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FV430 SERIES, VEHICLES, ALL MARKS

REPAIR INSTRUCTIONS

This publication contains information covering the requirement of categories 5.1 at information levels 2,3 and 4

BY COMMAND OF THE DEFENCE COUNCIL

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PRELIMINARY MATERIAL

REPAIR INSTRUCTIONS

PREFACE

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INTRODUCTION

1 Service users should forward any comments concerning this Publication through the channels prescribed in AESP 0100-P-011-013. An AESP Form 10 is provided at the end of this document; it should be photocopied and used for forwarding comments on this AESP.

2 AESPs are issued under Defence Council authority and where AESPs specify action to be taken, the AESP will itself be of sufficient authority for such action and also for the demanding of the necessary stores, subject to the provision of Para 3 below.

3 The subject matter of the Publication may be affected by Defence Council Instructions (DCIs). Standard Operating Procedures (SOPs) or by Local Regulations. When any such Instruction, Order, or regulation contradicts any portion of this Publication, they are to be taken as the overriding authority.

RELATED AND ASSOCIATED PUBLICATIONS

Related Publications

4 The Octad for the subject equipment consists of the Publications shown. All references are prefixed with the first eight digits of this Publication. The availability of the publications can be checked by reference to the relevant Group Index (refer to AESP 0100-A-001-013).

5 This publication has been produced in both hard copy and microfiche formats. Each page therefore carries a number page and a frame number.

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* Categories/Sub-categories not published

Associated Publications

Reference	Title
AESP 0200-A-221-013	Painting of service equipment
AESP 0200-A-220-013	Preservation, Identification and Packaging of assemblies
AESP 6140-H-100-013	Secondary batteries Lead-acid
EMER Gen O 331	Preparation for the repair of vehicle fuel tanks and other metal containers for flammable liquid
EMER Pwr M 106	Fuel injection equipment technical handbook – Preferred repair scheme
EMER Pwr M 112/3	Fuel injection equipment CAV fuel injection pumps, types N and NN technical handbook – Technical description
EMER Pwr M 114/3	CAV Fuel injection pumps, types N and NN technical handbook – Field and Base repairs
EMER Pwr M 132	Fuel Injection equipment, CAV Governors and stop assemblies, Technical Handbook – Technical Description
EMER Pwr M 134	Fuel Injection equipment, CAV Governors and stop assemblies, Technical Handbook – Field & Base Repairs
EMER Pwr P 154/11	Panel, Distribution, No 6 Mk 1 (FV 534891) Technical Handbook – Field & Base Repairs
EMER Pwr P 324/11	Starter, No 3 Mk 1 (FV546101) & Mk 2 (FV546165) Technical Handbook – Field & Base Repairs
EMER Pwr P 424/1	Pump, fuel pressurizing, No 2 Mk 1 (FV342593) Technical Handbook – Field & Base Repairs
EMER Pwr P 454/4	Firewire control box, No 1 Mk 1 (FV494568) Technical Handbook – Field & Base Repairs
EMER Pwr S 562/1	Engines, K60, No 4, Mk 4G, Technical Handbook – Technical Description
EMER Pwr S 567/1	Engine, Rolls Royce, K60, Multi fuel technical handbook – Modification Instructions 1-29
EMER T & M A 028 Ch 56	Material Quality Assessment – Principles and Practices in REME – Inspection and Testing of Mechanical Components
EMER T & M A 028 Ch 60	Material Quality Assessment – Principles and Practices in REME – Inspection and Examination of Ball and roller bearings
EMER T & M A 028 Ch 153	Tester, Radiator and Cooling Systems
EMER T & M B 021	Operators instructions for Avometer universal
EMER Pwr W 001	Vehicles equipped with Alternators / AC Generators
EMER Pwr W 104/12	Alternator, No 1 Mk 1
EMER Pwr W 114/2	Control Panel, alternator, No 1 Mk 1
EMER Pwr W 124/2	Rectifier unit, No 1 Mk 1, (FV342588) Technical Handbook – Field & Base Repairs
EMER Wksp G 300	The cleaning, de-rusting and phosphation of iron and steel

ABBREVIATIONS

6 Throughout this Publication any reference to right or left is as seen from the rear of the vehicle looking forward, unless otherwise stated. Where non-standard abbreviations are used, the full meaning is written out in full the first time the subject is mentioned in the text, followed by the abbreviation in brackets.

GENERAL

7 This Publication details unit level repairs applicable to FV430 Series, Vehicles, All Marks. Repairs are restricted to procedures that can be carried out by LADs or attached tradesmen, in eight hours or less, employing as many tradesmen as convenient to work on the task. In good conditions, no single task should exceed 16 man-hours.

8 Repairs at Level 2 are defined as follows:

8.1 Replacement of components or assemblies as detailed in relevant chapters.

8.2 Adjustment, as necessary.

8.3 Testing and inspection to confirm that repairs have been performed satisfactorily.

9 Details of any special tools required to effect repairs are given in the relevant chapters.

10 Jointing compounds and adhesives to be used are tabulated in relevant chapters.

11 For details of POL products refer to the latest edition of the Army Vocabulary of Petroleum, Oils and Lubricants

12 Unless otherwise specified in relevant chapters, details of fuel, oils, lubricants and allied products to be used are listed in Category 6 (Maintenance Schedule) of this Octad.

WORKSHOP SPECIAL TOOLS

13 Details of workshop special tools and locally manufactured tools will be found in relevant chapters. Where no such tools are referred to, the use of standard equipment is implied.

HAZARDOUS SUBSTANCES

14 Before using any hazardous substance or material, the user must be conversant with the safety precautions and first aid instructions:

14.1 On the label of the container it was supplied in.

14.2 On the material Safety Data Sheet.

14.3 In local Safety Orders and Regulations.

WARNINGS

(1) PERSONNEL HAZARD. ENSURE THAT ALL LOCAL STANDING OPERATING PROCEDURES AND ALL CURRENT HEALTH AND SAFETY REGULATIONS ARE COMPLIED WITH, WHEN CARRYING OUT ANY OF THE PROCEDURES DETAILED WITHIN THIS PUBLICATION.

(2) HEAVY WEIGHT. THE POWER PACK WEIGHS 1816 kg (4000 lb). DUE CONSIDERATION MUST BE GIVEN TO THE REGULATIONS GOVERNING THE LIFTING OF HEAVY WEIGHTS WHEN MOVING THIS EQUIPMENT.

(3) HEAVY WEIGHT. THE LOUVRE ASSEMBLY WEIGHS 254 kg (560 lb)). DUE CONSIDERATION MUST BE GIVEN TO THE REGULATIONS GOVERNING THE LIFTING OF HEAVY WEIGHTS WHEN MOVING THIS EQUIPMENT.

(4) SAFETY HAZARD. DO NOT WALK OR WORK UNDER A SUSPENDED POWER PACK.

(5) HEAVY WEIGHT. THE AIR CLEANER WEIGHS APPROX 40 kg (90 lb). DUE CONSIDERATION TO THE REGULATION GOVERNING THE LIFTING OF HEAVY WEIGHTS, SHOULD BE GIVEN.

(6) HEAVY WEIGHT. THE RADIATOR WEIGHS 72 kg (160 lb). DUE CONSIDERATION TO THE REGULATION GOVERNING THE LIFTING OF HEAVY WEIGHTS SHOULD BE GIVEN.

(7) HEAVY WEIGHT. THE HEAT EXCHANGER WEIGHS 46 kg (102 lb). DUE CONSIDERATION SHOULD BE GIVEN TO THE REGULATIONS GOVERNING THE LIFTING OF HEAVY WEIGHTS.

(8) HEAVY WEIGHT. EACH SPROCKET HUB, COMPLETE WITH RINGS, WEIGHS 86 KG (190 LB). DUE CONSIDERATION SHOULD BE GIVEN TO THE REGULATIONS GOVERNING THE HANDLING OF HEAVY WEIGHTS.

(9) HEAVY WEIGHT. THE COMMANDERS CUPOLA WEIGHS 109 kg (240 lb). DUE CONSIDERATION WARNING SHOULD BE GIVEN TO THE REGULATIONS GOVERNING THE LIFTING OF HEAVY WEIGHTS.

(10) HEAVY WEIGHT. THE ROTATING RING WEIGHS 76 kg (167 lb). DUE CONSIDERATION SHOULD BE GIVEN TO THE REGULATIONS GOVERNING THE LIFTING OF HEAVY WEIGHTS

(11) ASBESTOS. THE STEERING BRAKE BANDS USED ON THIS EQUIPMENT CONTAIN ASBESTOS. NO ATTEMPT IS TO BE MADE TO WORK WITH ASBESTOS MATERIALS WITHOUT CONFORMING TO DEPARTMENTAL/UNIT INSTRUCTIONS.

(12) HEAVY WEIGHT. THE HATCH COVER WEIGHS 100 kg (220 lb). DUE CONSIDERATION SHOULD BE GIVEN TO THE REGULATIONS GOVERNING THE LIFTING OF HEAVY WEIGHTS.

(13) HEAVY WEIGHT. THE OUTER FLAP WEIGHS 49 kg (108 lb). DUE CONSIDERATION SHOULD BE GIVEN TO THE REGULATIONS GOVERNING THE LIFTING OF HEAVY WEIGHTS.

(14) PERSONNEL HAZARD. 'DO NOT' ATTEMPT TO REMOVE STRIKER HEAD FROM BCF CYLINDERS.

(15) PERSONNEL HAZARD. UNDER NO CIRCUMSTANCES IS THE CYLINDER CLAMP TO BE REMOVED UNTIL BOTH CONTROL CABLES HAVE BEEN DISCONNECTED.

(16) PERSONNEL HAZARD. UNDER NO CIRCUMSTANCES IS WORK ON THE CONTROL CABLE TO BE UNDERTAKEN UNTIL SECURITY OF CYLINDERS HAS BEEN CONFIRMED.

(17) HEAVY WEIGHT. THE STEERING LEVERS WEIGH 23 kg (50 lb). DUE CONSIDERATION SHOULD BE GIVEN TO THE REGULATION GOVERNING THE LIFTING OF HEAVY WEIGHTS.

(18) LETHAL VOLTAGE. THE SUPPRESSION SYSTEM OF THE FAN MOTOR INCLUDES CAPACITORS RATED AT D.C. WORKING VOLTAGES OF 150 VOLTS. THE MOTOR MUST BE ISOLATED PRIOR TO INSULATION TESTS BEING CARRIED OUT ON THE REMAINDER OF THE SYSTEM. LIMITED INSULATION TESTS ON THE MOTOR MAY BE CARRIED OUT AT UNIT LEVEL ONLY IF A 100 MEGOHMMETER IS AVAILABLE.

(19) HEALTH HAZARD. ASBESTOS. THIS EQUIPMENT/ASSEMBLY CONTAINS ASBESTOS COMPONENTS. NO ATTEMPT IS TO BE MADE TO WORK WITH ASBESTOS MATERIALS WITHOUT CONFORMING TO APPROPRIATE DEPARTMENTAL/UNIT INSTRUCTIONS.

(20) SHORT CIRCUIT. BOTH VENTILATION AND VEHICLE BATTERIES ARE CHARGED FROM THE GEAR DRIVEN ALTERNATOR. IF THE VENTILATION BATTERIES, WHICH ARE LOCATED IN THE L.H. CORNER OF THE FLOOR OF THE PERSONNEL COMPARTMENT, ARE DISCONNECTED OR REMOVED, THE POSITIVE LEAD MUST BE SECURED TO THE INSULATED TERMINAL POST. THIS POST IS LOCATED ON THE L.H. WALL OF THE VEHICLE, JUST BESIDE THE BATTERIES. IT IS NOW POSSIBLE TO RUN THE ENGINE WITHOUT THE DANGER OF A SHORT CIRCUIT OCCURRING BETWEEN THE DISCONNECTED POSITIVE LEAD AND EARTH.

(21) HEAVY WEIGHT. EACH BATTERY WEIGHS 80LB. DUE CONSIDERATION MUST BE GIVEN TO THE REGULATIONS GOVERNING THE LIFTING OF HEAVY WEIGHTS WHEN MOVING EQUIPMENT.

(22) ACCIDENTAL GRENADE DISCHARGE. BEFORE CARRYING OUT ANY MAINTENANCE ON THE SMOKE GRENADE DISCHARGER SYSTEM, ENSURE EACH GRENADE TUBE IS UNLOADED.

(23) HEAVY WEIGHT. EACH ALTERNATOR WEIGHS 32 kg (70lb). DUE CONSIDERATION MUST BE GIVEN TO THE REGULATIONS GOVERNING THE LIFTING OF HEAVY WEIGHTS WHEN MOVING EQUIPMENT.

(24) PERSONNEL DANGER. SHOULD IT BE NECESSARY TO TURN THE ENGINE IN ORDER TO OBSERVE THE CHAMFERED TEETH OR DOWELS IN THE GEARBOX THE FUEL PIPES BETWEEN THE FUEL PUMP AND THE INJECTORS SHOULD BE SLACKENED OFF AND OPEN TO ATMOSPHERE. THIS WILL PREVENT THE ENGINE FROM BEING INADVERTENTLY STARTED.

(25) ACCIDENTAL GRENADE DISCHARGE. BEFORE CARRYING OUT ANY MAINTENANCE ON THE SMOKE GRENADE DISCHARGER SYSTEM, ENSURE EACH GRENADE TUBE IS UNLOADED

(26) PERSONNEL DANGER. SHOULD IT BE NECESSARY TO TURN THE ENGINE IN ORDER TO OBSERVE THE CHAMFERED TEETH OR DOWELS IN THE GEARBOX THE FUEL PIPES BETWEEN THE FUEL PUMP AND THE INJECTORS SHOULD BE SLACKENED OFF AND OPEN TO ATMOSPHERE. THIS WILL PREVENT THE ENGINE FROM BEING INADVERTENTLY STARTED.

(27) PERSONNEL HAZARD. BEFORE USING ANY HAZARDOUS SUBSTANCE OR MATERIAL, ENSURE THAT YOU KNOW THE SAFETY AND FIRST AID INSTRUCTIONS:

(27.1) ON THE LABEL OF THE CONTAINER IT WAS SUPPIED IN.

(27.2) ON THE MATERIAL SAFETY DATA SHEEET.

(27.3) IN THE LOCAL SAFETY ORDERS AND REGULATIONS.

CAUTIONS

(1) ELECTRICAL COMPONENT PROTECTION. Semi-conducting devices and capacitors, having a comparatively low d.c. working voltage, are included in some of the assemblies. The following precautions must therefore be taken when carrying out insulation tests with a test set, Megohmmeter. Harnesses both ends of interconnecting harnesses or cables must be disconnected. Any semi-conducting device or capacitor, which is included in the circuit of an assembly, must be isolated.

(2) FILTER PROTECTION. The fan unit of the ventilation and NBC system must NOT be run unless the paper element has been fitted to the filter unit, otherwise dust particles in incoming air can erode fan blades and reduce the efficiency of the equipment.

(3) ELECTRICAL PRECAUTION. Both the ventilation system and vehicle batteries are charged from the belt driven generator. If the former batteries are disconnected or removed, the positive lead MUST be secured to the insulated terminal post located on the left hand side of the hull wall in the vicinity of the batteries

(4) SEALING INSPECTION. All sealing throughout the vehicle MUST be maintained in a serviceable condition at all times. This is important, as efficient operation of NBC equipment will depend on good and sound sealing of the vehicle. Hull sealing should be inspected at regular intervals.

(5) OIL AND COOLANT TEMPERATURES. The maximum engine coolant temperature should not exceed 105 deg c (220 deg F). The maximum gearbox oil temperature should not exceed 122 deg C (250 deg F).

(6) EQUIPMENT DAMAGE. With the power pack removed, it is essential that the propeller shaft be removed from the gearbox output flange before running the engine. Failure to do so will result in considerable damage.

(7) EQUIPMENT DAMAGE. Before test running the power pack, check that all tools are removed, particularly from fan casing.

(8) EQUIPMENT DAMAGE. It is essential that engine coolant temperature is kept under constant observation during test running; the engine must be switched 'OFF' immediately when the coolant temperature reaches 100 deg C (212 deg F). A coolant temperature time graph, based on an ambient temperature of 18 deg C (65 deg F) with engine speed at 1500 rev/min under NO LOAD is shown in Fig 1 as a guide only.

(9) EQUIPMENT DAMAGE. The thermostat must NOT be removed from the engine for normal running, otherwise overheating, resulting in damage to the engine will occur.

(10) EQUIPMENT DAMAGE. Except in (11) below, vehicles should not be towed without first removing or disconnecting the gearbox coupling connecting main gearbox to steering unit.

(11) EQUIPMENT DAMAGE. In an emergency, vehicle may be towed up to half a mile without action as in (1) above.

(12) EQUIPMENT DAMAGE. In cases of defective steering unit where it is necessary to tow the vehicle, the drive shafts between the steering unit and final drives must be disconnected.

(13) EQUIPMENT DAMAGE. In the event of final drive failure, tracks must be removed.

(14) EQUIPMENT DAMAGE. An 'A' frame tow bar should be used and towing must not exceed 16 kph (10 mph).

(15) EQUIPMENT DAMAGE. Finger marks alone can cause the sealing surfaces to deteriorate. Avoid touching surfaces, except with clean tissue, at every stage in dismantling and assembling.

(16) EQUIPMENT DAMAGE. If this setting procedure is not adhered to either the engine will not shut down in the event of governor failure or the pump will be damaged possibly in the full speed condition.

(17) EQUIPMENT DAMAGE. The distribution panel is a sealed unit and should not be opened up at unit level. If frequent changing of the desiccator's element is found necessary the panel should be removed and sent to workshops for drying out, resealing and subsequent pressure testing.

(18) EQUIPMENT DAMAGE. Before insulation testing is carried out on the cable harness, the harness must be disconnected at each end, to prevent damage to the semi-conductor devices. Megohometer testing must not be used on any assemblies except the alternators.

(19) EQUIPMENT DAMAGE. Do not let cable ends touch or earth, feed to horn bypasses master switch, when test switch at firewire control box is operated.

(20) EQUIPMENT DAMAGE. Before insulation testing is carried out on the cable harness, the harness must be disconnected at each end, to prevent damage to the semi-conductor devices. Megohmeter testing must not be used on any assemblies except the alternators.

(21) EQUIPMENT DAMAGE. Do not disturb settings of other potentiometers in the control panel.

(22) EQUIPMENT DAMAGE. Do not let cable ends touch or earth, feed to horn bypasses master switch, when test switch at firewire control box is operated.

(23) EQUIPMENT DAMAGE. When running the power pack outside the vehicle, one man is to occupy the driver's seat to start the engine and observe the instruments; the second man is to control operations at the power pack.

(24) EQUIPMENT DAMAGE. All components must be thoroughly checked for correct functioning whilst test running the power pack. Particular attention should be given to all hose/pipe connections, since most of these will be inaccessible when the power pack is installed. Test run after any adjustments or rectifications have been made.

(25) EQUIPMENT DAMAGE. It is essential that the blower be blanked off with a clean cover plate when the air cleaner is removed. Failure to protect the blower assembly from dirt/foreign matter will result in severe damage to the blower assembly and/or engine. The cover plate, which may be of steel, wood, hardboard or any suitable material available, is to be manufactured to the required dimensions.

(26) EQUIPMENT DAMAGE. When the Pitot tube bolts have been slackened, the flange must NOT be turned, as this will cause damage to the rear governor housing and the pitot tubes. Hold flange firmly in one position with tool throughout removal procedure.

(27) EQUIPMENT DAMAGE. Personnel are to ensure that care is taken to prevent locking wire and nuts from falling inside steering unit.

(28) EQUIPMENT DAMAGE. DO NOT keep an axle arm jacked up for excessively long periods, as this will adversely affect the torsion bar.

(29) EQUIPMENT DAMAGE. The upper and lower mounting bolts are finished to close limits and are chrome surfaced on bearing diameters. Accurate alignment of holes before entering bolts is essential so as not to damage them. Additionally, smear bearing surfaces of bolts with jointing compound, H1/8030-99-220-2370 before entering them.

CHAPTER 1-0

POWER PACK ASSEMBLY – LIST OF CHAPTERS

CONTENTS

LIST OF CHAPTERS

1 This chapter is further sub-divided as follows:

CHAPTER 1-1

POWER PACK

CONTENTS

GENERAL

WARNING

HEAVY WEIGHT. THE POWER PACK WEIGHS 1816 kg (4000 lb). DUE CONSIDERATION MUST BE GIVEN TO THE REGULATIONS GOVERNING THE LIFTING OF HEAVY WEIGHTS WHEN MOVING THIS EQUIPMENT.

1 Unit repairs to the power pack are to consist of removing sub-assemblies/components for repair or replacement purposes, or to obtain access to repairable items. Some components are accessible with the power pack in position, and details of these are given in Paras 7 to 10. It can be assumed, however, that even with the greatest dexterity shown by the tradesmen employed, it is simpler to remove and refit the power pack when carrying out most repairs. Therefore, do not attempt to remove a component without first removing the power pack (except, of course, where accessibility is obviously possible), otherwise much time may be wasted, with the power pack having to be removed in the end.

WORKSHOP SPECIAL TOOLS

2 Table 1 lists the special tools required to carry out the operations detailed in this sub-chapter.

TABLE 1 WORKSHOP SPECIAL TOOLS

Serial (1)	NSN (2)	Designation (3)	FV No. (4)
1	9ACR/2590-99-867-0379	Sling, lifting power pack	559907
2	9ACR/4910-99-802-3190	Beam lifting power pack, universal	586352

DATA

3 Overall dimensions:

3.1 Length 1626 mm (5 ft 4 in.)

3.2 Width 1372 mm (4 ft 6 in.)

3.3 Height 1397 mm (4 ft 7 in.)

4 Minimum hook height to lift power pack clear 3581 mm (11 ft 9 in.)

5 Max governed speed 3750 rev/min (under full load)

6 Idling speed 780 to 800 rev/min

ACCESSIBILITY

7 Access can be obtained to carry out some repairs by:

7.1 Removing the roof louvres.

7.2 Removing the access plates between the driver/power pack compartments and the personnel/power pack compartments.

7.3 Opening the front access plate.

NOTE

The power pack is secured in five places. Details of access to these are given in Para 51, 56 and 62.

8 With the power pack in position, the following tasks can be carried out when roof louvres are raised:

8.1 Changing the air cleaner elements.

8.2 Removing the fans.

8.3 Removing the fire wire elements from the fan stator frame.

8.4 Removing the engine oil tank breather filter.

8.5 Checking the hydraulic oil level.

8.6 Resetting the air cleaner indicator.

9 With the power pack in position, the following tasks can be carried out when the driver/power pack compartment access cover plates are removed:

9.1 Changing the gearbox filter element.

9.2 Changing the fuel filter and the fuel pressure relief valve.

9.3 Adjusting the gearbox selector linkage.

9.4 Removing the fuel injection pump.

9.5 Removing the injectors.

9.6 Removing the front alternator.

9.7 Removing the oil pressure switch.

9.8 Removing the coolant thermostat.

9.9 Adjusting the fan control unit.

9.10 Tightening hydraulic and oil pipe unions.

10 With the power pack in position, the following tasks can be carried out when the front access plate is opened:

10.1 Removing the gearbox coupling/steering unit flange bolts.

10.2 Removing the left-hand final drive shaft.

10.3 Adjusting/replacing the steering unit brake bands.

10.4 Removing the exhaust expansion joint and refitting joint gaskets.

10.5 Removing the inlet crankshaft damper unit.

11 In addition to the above tasks, access to the bearing cover plates on the transfer gearbox is possible when the personnel/power pack access plate is removed.

Engine oil tank

12 The engine oil tank weighs 22.7 kg (50 lb) dry.

Removal

13 Remove power pack, Chap 1-1 refers.

14 Drain the oil tank; capacity 23 litres (5 gal) approx.

15 Release the four oil pipe unions from the top tank. (1.7/8 in., 1.5/8 in. A/F).

16 Remove the 12 x 1/4 UNF bolts holding rectifier unit to oil tank and lift assembly clear of tank. Place the rectifier unit in a suitable drip tray beside the power pack.

17 Release the two nuts from tank tie-bolts. Remove the bolts from the tie-bolt yokes within the power pack frame.

18 Remove the oil tank by easing forward.

Cleaning

19 Remove the 12 x 1/4 UNF setscrews securing the gauze filter plate fitted between the rectifier unit compartment and the tank.

20 Remove all the sludge/dirt from tank interior. If facilities are available, steam-clean the tank. Clean the filler pipe and breather. Examine the drain plug threads, union connections and tank seams.

Refitting

21 Assemble and refit the tank in reverse order to dismantling and removing. Note the following points.

21.1 Fit new gaskets to all joints/connections.

21.2 Ensure all union nuts are 'started' before tank is secured.

Engine oil filters

22 Unit repairs to twin oil filters are to consist of changing elements and gaskets or replacing the complete assembly. The by-pass valve fitted in the filter head is non-adjustable, should this valve become defective, the complete twin filter assembly must be replaced.

Removal

23 Remove power pack, para 31 refers.

24 Remove the top locking bridge from filter centre bolt.

25 Slacken the centre bolt cap nut, while supporting filter bowl. The filter bowl will, at all times, be full of oil.

26 Lower the bowl carefully and pour the oil into a suitable container.

27 Withdraw the element, cork seal, spring, copper washer and rubber washer from the centre bolt.

Cleaning

28 Clean the components thoroughly and inspect for serviceability.

29 Clean and inspect the filter head, by-pass valve, cap nut copper washer and rubber ring insert.

Refitting

30 Assemble the components (using replacement element) and refit in reverse order to removing. Fill the filter bowl with the correct grade of oil before refitting to the head.

REMOVING POWER PACK

31 The following sequence assumes that two men are working on the vehicle. Operations are grouped for convenience.

Preliminary operations

32 Position the vehicle on level ground.

33 Turn the battery master switch and the fuel tap to OFF position.

34 Open the front access plate by releasing the six quick release bolts.

Vehicle roof access

35 Close the driver's hatch cover.

36 Release the 13 quick-release bolts securing the intake and the outlet louvres. Loosen the centre clamping bolts (one per clamp) and turn both clamps through 90 deg.

WARNING

HEAVY WEIGHT. THE LOUVRE ASSEMBLY WEIGHS 254 kg (560 lb). DUE CONSIDERATION MUST BE GIVEN TO THE REGULATIONS GOVERNING THE LIFTING OF HEAVY WEIGHTS WHEN MOVING THIS EQUIPMENT.

37 Raise either end of the louvre assembly and secure with locking pin the through locating hole. Fit the sling (Table 1, Serial 1) around raised part of louvre and lift assembly clear of vehicle.

38 Remove the angle bracket fitted transversely across the top front of power pack compartment.

39 Remove the transverse strut fitted centrally across top of power pack compartment.

Inside driver's compartment

40 Loosen and turn the four centre clamps on the access cover plates; remove the upper and lower sections of the access cover plates (these are secured by quick-release bolts).

41 Remove the periscope washer container.

42 Disconnect the gear control linkage at the main gearbox.

43 Disconnect the neutral start cable secured to the inside of the bulkhead between the driver and the power pack compartments.

44 Remove the gear selector lever assembly complete with attached linkage.

45 Turn the engine oil filler-locking ring to release the filler pipe from the partition sill; remove the engine oil filler pipe from the engine oil tank.

46 Remove the upper forward section of the driver/power pack partition; all nuts are captive on a separate strip.

47 Remove the angle iron sill from the centre bulkhead.

48 Disconnect the accelerator linkage from the governor arm and from the louvre cross-shaft. Remove the bracket and upper cross-shaft (accelerator) complete from centre bulkhead.

49 Disconnect the driver's emergency stop control cable from the power pack frame mounted lever.

50 Remove the eight bolts securing the gearbox coupling to the steering unit, at the steering unit end.

51 Remove the right-hand rear bolt and the centre bolt securing the power pack.

Inside personnel compartment

52 Remove the radio batteries and case.

53 Remove the literature stowage bin from the bulkhead.

54 Remove the bottom access plate.

55 Remove the rear generator access plate.

56 Remove the left-hand rear bolt securing power pack.

Through front access

57 Disconnect all pipes, cables and fire wire connections at the junction panel secured to front top of the pack.

NOTE

The two fuel pipe connections at bottom left-hand side of the panel (as viewed facing panel) are colour marked for identification purposes. These two unions are identical; mark and identify each pipe for ease of correct reassembly.

58 Remove the clips securing cables and bring cables and fuel pipes through front access.

59 Disconnect from power pack the two flexible pipes of the fixed fire extinguisher system.

60 Disconnect at top unions (where flexible pipe is connected to steel pipe) from the steering unit to the heat exchanger oil pipes.

61 Release the exhaust expansion joint clips and remove the expansion joint.

62 Remove the two front bolts securing power pack.

Lifting out

WARNING

SAFETY HAZARD. DO NOT WALK OR WORK UNDER A SUSPENDED POWER PACK.

63 Secure the two longer lifting straps (Table 1, Serial 1) to the crossbeam (Table 1, Serial 2) at the points marked and the shorter lifting strap at the opposite end of the beam. Lift the beam and lower to the power pack. Secure the two longer straps to the front vertical members of the superstructure using the High Tensile Steel (HTS) bolts supplied with the lifting beam. Secure the shorter strap to lifting eye in fan stator casing.

64 Commence lifting slowly until the air cleaner is clear of the compartment; ease the pack to the left to allow the main gearbox to clear the compartment roof. Continue lifting carefully until the pack is clear of the roof.

65 Move the pack to the front of the vehicle; turn the pack through 180 deg so that, when lowered, the front of the pack is facing the front of the vehicle. The factor governing the position of the pack from the vehicle will be the available length of the cables and fuel hoses passing through the front access panel.

TEST RUNNING

NOTE

Although the power pack is designed to stand and to be test run on its own frame, it is advisable to use suitable skidding unless level hard standing is available.

WARNINGS

(1) PERSONNEL HAZARD. WHEN CABLES AND FUEL LINES ARE RECONNECTED, IT MUST NOT BE ASSUMED THAT, WITH THE POWER PACK REMOVED FROM THE HULL, THE ENGINE IS 'DEAD'. IT IS NOT SUFFICIENT TO RELY ON THE MASTER BATTERY SWITCHES BEING OFF, SINCE PERSONNEL WORKING ON THE VEHICLE MAY INADVERTENTLY CLOSE THESE. TO PREVENT ACCIDENTS, IF THE ENGINE HAS TO BE TURNED OVER, REMOVE ELECTRICAL CONNECTIONS TO FUEL CUT-OFF SOLENOID AND FUEL INJECTION PUMP.

(2) FIRE HAZARD. THE FIXED FIRE EXTINGUISHING SYSTEM WILL BE INOPERATIVE WHEN THE POWER PACK IS TEST RUN OUTSIDE THE HULL. PORTABLE HAND HELD FIRE EXTINGUISHERS MUST BE TO HAND DURING TEST RUN.

CAUTIONS

(1) EQUIPMENT DAMAGE. With the power pack removed, it is essential that the propeller shaft is removed from the gearbox output flange before running the engine. Failure to do so will result in considerable damage.

(2) EQUIPMENT DAMAGE. Before test running the power pack, check that all tools are removed, particularly from fan casing.

(3) EQUIPMENT DAMAGE. When running the power pack outside the vehicle, one man is to occupy the driver's seat to start the engine and observe the instruments; the second man is to control operations at the power pack.

(4) EQUIPMENT DAMAGE. It is essential that engine coolant temperature is kept under constant observation during test running; the engine must be switched 'OFF' immediately when the coolant temperature reaches 100 deg C (212 deg F). A coolant temperature time graph, based on an ambient temperature of 18 deg C (65 deg F) with engine speed at 1500 rev/min under NO LOAD is shown in Fig 1 as a guide only.

(5) EQUIPMENT DAMAGE. All components must be thoroughly checked for correct functioning whilst test running the power pack. Particular attention should be given to all hose/pipe connections, since most of these will be inaccessible when the power pack is installed. Test run after any adjustments or rectifications have been made.

66 Connect all electrical cables and fuel lines to the power pack junction panel. Reconnect and set the driver's emergency stop control cable to the power pack frame mounted lever (refer to Chap 3).

67 Temporarily assemble the gear range selector to the centre bulkhead; connect neutral position; this will close the micro-switch and allow the starter circuit to operate.

68 Ensure the main gearbox is in neutral position, by confirming the inner lever arm, to which gear selector control would normally be connected, is in the vertical position.

69 Ensure the engine disconnector is in the ENGAGED position.

70 Turn the fuel tap ON.

71 Set the master switch and the engine switch to ON. If repairs have been carried out to fuel system, allow one minute for the fuel lines to pressurise.

72 Start the engine and run for two minutes at 1000 rev/min, then switch OFF. Check the engine and hydraulic system oil levels coolant level. Top up as necessary.

73 Restart the engine and run at 1500 rev/min until the coolant temperature gauge registers 72 deg C (160 deg F); reduce speed to 1000 rev/min and check the gearbox oil level in accordance with AESP 2350-T-250-201. Top up the gearbox, if necessary, but do not overfill.

74 When the gearbox has been checked, check the fan speeds, which should be as follows:

74.1 Fans should idle at engine temperatures below 38 deg C (100 deg F) and should progressively increase in speed as the engine temperature is raised.

74.2 When the operating temperature of between 88 deg C (190 deg F) and 94 deg C (200 deg F) is reached, the fan control unit thermostat is fully open, permitting full flow of hydraulic fluid to drive the fans at full speed.

NOTE

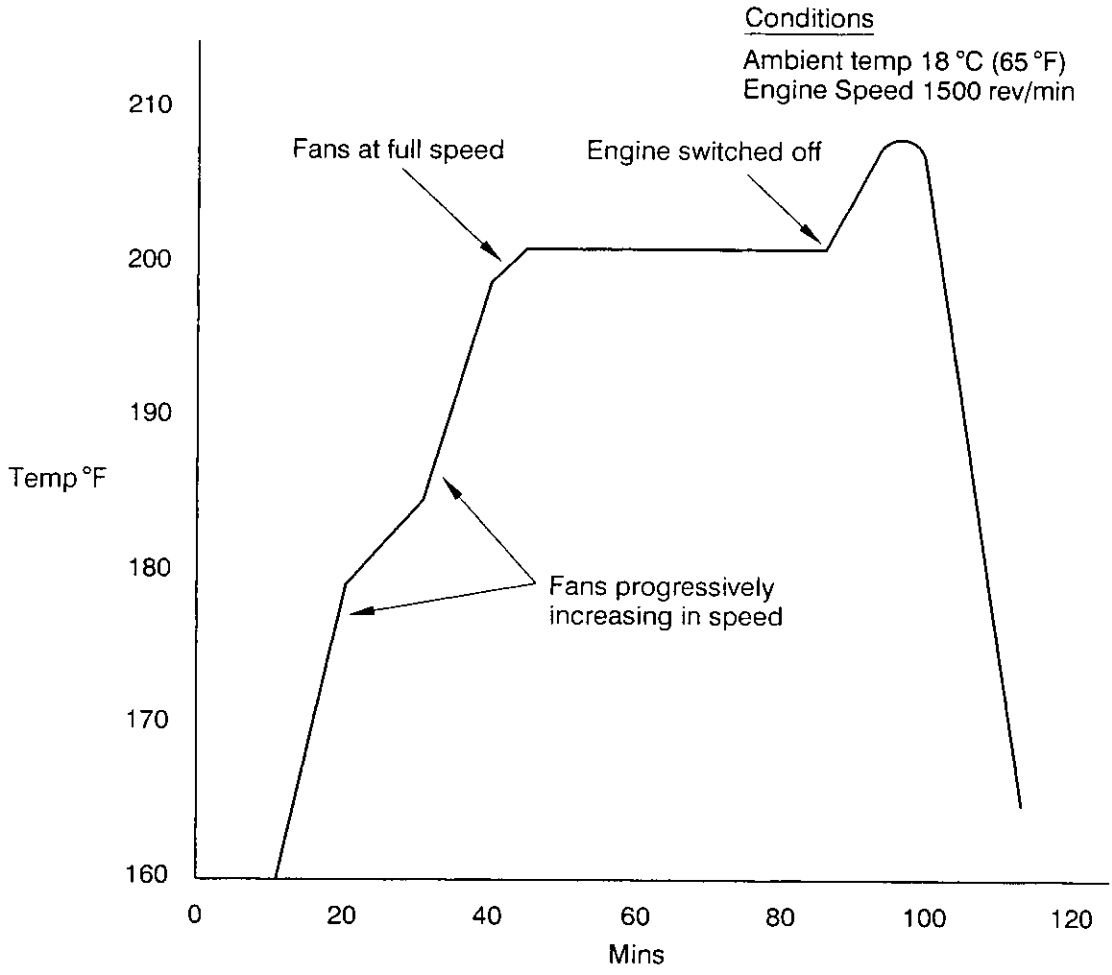
Adjustments to the fan control unit for fan idling/cutting in speeds are detailed in Chap 1-4.

REFITTING THE POWER PACK

75 Before refitting, thoroughly clean out the power pack compartment. Inspect and repair hull sealing as necessary.

76 Recheck the power pack, ensuring all unions are correctly wire locked.

77 Refit the propeller shaft to the gearbox flange; torque tighten securing bolts to 47 Nm (35 lbf ft)



(When test run outside of vehicle without shroud or load at 1500 rev/min)

432/144

Fig 1 Coolant temperature characteristics

78 Refit the power pack in reverse procedure to removal, ensuring the following:

78.1 The steering unit oil pipes are fitted to the correct unions.

78.2 Ensure the threads of all power pack securing bolts are engaged before releasing weight of the power pack.

78.3 Torque tighten the propeller shaft to steering unit flange bolts to 47 Nm (35 lbf ft)

78.4 Ensure electrical cables and fuel pipes are clipped clear of the left hand final drive shaft.

78.5 Check the fire-extinguishing system, Chap 3 refers.

SUPERSTRUCTURE

79 The superstructure of the power pack need not be removed to carry out unit repairs.

CHAPTER 1-2

ENGINE

CONTENTS

GENERAL

1 The following paragraphs detail the repair procedures for the engine, but they do NOT include those components contained in the fuel and cooling systems. Although many of the sub assemblies/ components for these systems are fitted to the engine, repair procedures covering engine's, No. 4 Mk 4F and 6 F, are grouped into three chapters for convenience. For example, removing and timing procedures for the fuel injection pump are described in Chap 1-3, Fuel system and removing and dismantling coolant pump is described in Chap 1-4, Cooling system. To avoid cross-referencing, this Chap must be read in conjunction with Chap 1-3 and 1-4.

WORKSHOP SPECIAL TOOLS

2 Table 1 lists the workshop special tools required to carry out the procedures described within this chapter.

TABLE 1 WORKSHOP SPECIAL TOOLS

Serial (1)	NSN (2)	Designation (3)	FV No. (4)
1	5120-99-865-5053	Spanner adjusting tappets	FV143185
2	5120-99-865-5054	Spanner adjusting tappets	FV143186
3	5120-99-865-5062	Spanner adjusting tappets	FV147625
4	5120-99-865-3022	Compressor valve spring	FV143889
5	5120-99-254-2890	Compressor valve spring	W6513
6	5120-99-812-3882	Tool valve holding	RRZ/2997
7	5120-99-811-2501	Engine turnover spanner	FV668398
8	5180-99-800-8920	Spanner injection pump	FV453200
9	5180-99-800-8921	Extractor injection pump	FV453319

NOTE

The tool detailed at Table 1, Serial 7, is designed for turning over the K60 engine and is an aid for fuel injection pump timing. It can be used with the power pack either installed or removed from the vehicle. To use, remove one of the centre bearing covers from the transfer gearbox and insert tool into hollow splined shaft of intermediate gearbox.

DATA

3 The power unit is either a Rolls Royce K60, No. 4 Mk 4 F, or a K60, Mk 6 F engine.

3.1	Firing order	1-5-3-4-2-6.
3.2	FIP timing inner dead centre.	40 deg before inlet (upper) crankshaft inner crankshaft
3.3	Governed speed	3750 rev/min output shaft 2386 rev/min crankshaft speed.
3.4	Idling speed	780 to 800 rev/min.
3.5	Oil pressure warning light operates at	0.56 to 0.84 kg/cm^2 (8 to 12 lb/in^2).

NOTE

There is no engine oil pressure gauge. A 'PRESS TO TEST' type button switch indicates safe working pressure.

3.6	Maximum permissible coolant temperature	105 deg C (220 deg F).

LUBRICATION SYSTEM

4 A pressurised system based on the dry sump principle is employed for the engine, including transfer gearbox lubrication. Oil is supplied to the main galleries and ancillaries by a pressure pump and returned to the engine oil tank via the heat exchanger from the bottom cover (sump) by two scavenge pumps.

5 The built up pressure in the pump relieves at 4.9 kg cm^2 (70 lb in.^{2}) and excess oil is drained. A restrictor valve located between the pressure and the main filters reduces supply pressure to 4.2 kg cm^2 (60 lb in.^{2}). This pressure differential is specifically designed to ensure positive circulation to the oil-cooled alternators, oil supply to alternators being at 4.9 kg cm^2 (70 lb in.^{2}) with return to 4.2 kg cm^2 (60 lb in.^{2}) pressure side of system.

6 The pumps and pressure relief valve are located inside engine casing and will not be repaired at unit level.

OIL PRESSURE SWITCH, NO. 1, MK 3

7 This unit is located below the front alternator and adjacent to the No. 6 injector. For electrical tests of the unit, refer to Chap 5.

Removing and refitting

8 Switch the battery master switch to OFF.

9 Remove the access plate's driver's/power pack compartment, Chap 1-1 refers.

10 Remove the locking wire off the pressure switch knurled cap and unscrew the cap.

11 Disconnect the electrical leads

12 Release the nut securing the screened lead cover, and ease leads clear.

13 Remove the six No. 2 BA screws securing the unit to junction (11/32 in. A/F).

14 Refit the unit in reverse order to removing, ensuring that the lead connections are in the 11 o'clock position, as viewed from the front of the unit.

EXHAUST SYSTEM

15 An exhaust manifold is fitted to each side of the engine casing. Each manifold is in two parts, these being joined by a sleeve to form a gas tight metal-to-metal joint. A connecting pipe routed across the front of the engine is flanged to each manifold. The expansion joint, fitted between the connecting pipe and the exhaust outlet pipe through side of hull, forms the 'break' point when removing power pack.

Removing and refitting manifolds

WARNING

HEALTH HAZARD. ASBESTOS. THIS EQUIPMENT/ASSEMBLY CONTAINS ASBESTOS COMPONENTS. NO ATTEMPT IS TO BE MADE TO WORK WITH ASBESTOS MATERIALS WITHOUT CONFORMING TO APPROPRIATE DEPARTMENTAL/UNIT INSTRUCTIONS.

LH manifold

16 Remove power pack, Chap 1-1 refers.

17 Remove the starter motor and the starter motor securing strap.

18 Remove the four 3/8 in. UNF bolts securing exhaust connecting pipe to manifold. Remove the manifold securing bolts; part manifold at the centre joint and remove. Collect the copper asbestos gasket fitted to the manifold/connecting pipe flange and the steel gaskets fitted to the engine casing exhaust ports.

19 Refit the LH manifold in reverse order to removing.

RH manifold

20 This manifold CANNOT be removed with the main gearbox in 'situ' and will not be attempted as a unit repair.

VISCOUS DAMPERS

21 Viscous dampers are fitted to the front end of each crankshaft. These components are sealed units and are NOT to be dismantled at unit level. The upper (air) crankshaft damper is a single unit engraved with timing marks on both front and reverse faces. The lower (exhaust) crankshaft damper is, in effect, two single units positioned with front faces together and secured to the end of the crankshaft.

Removing and refitting

22 Remove power pack, Chap 1-1 refers.

23 Remove the ten screws on the face side of the damper unit; remove the locking plate and withdraw the damper unit(s). Note that the securing holes are NOT equally spaced and the unit can only be fitted one way.

24 To refit, position the damper unit to align securing holes, refit the locking plate and screws.

TACHO-GENERATOR AND DRIVE

25 The tacho-generator and drive unit for the engine rev counter is located at the rear of the engine casing, below left hand fan motor.

Removing and refitting

26 Remove power pack, Chap 1-1 refers.

27 Remove the three screws securing the generator unit to the intermediate drive casing and withdraw the generator.

28 Remove the three screws securing the intermediate casing to the take-off drive from the blower and remove the casing complete with spur gear drive.

29 Refit the units in reverse order to removing, ensuring all O-rings are serviceable.

GENERATOR DRIVE SHAFT (FV 452158)

Removing and refitting

30 Remove power pack, Chap 1-1 refers.

31 Remove both generators, Chap 5 refers.

32 Remove the power pack superstructure Chap 1-1 refers.

33 Remove the hydraulic pump.

34 Disconnect the oil return pipe (generator casing to wheel case) at the union above the flange face of the mechanical drive casing. Release the oil feed pipe to the alternator housing.

35 Unscrew the 5/16 in. UNF screws securing the front cover to the rear housing and carefully ease the cover clear. Collect the oil transfer sleeve (bobbin) with O-rings fitted between the faces of cover and the housing.

36 Remove the hydraulic pump drive (quill shaft) from the end of the upper crankshaft. This is pulled straight out, taking care not to damage the seal behind it.

37 Remove the generator drive gear. The drive shaft will come out with this, leaving broken stub of shaft.

38 Using the spanner (Table 1, Serial 8) remove the serrated nut securing the FIP drive shaft to gear.

39 Remove the FIP drive shaft using the extractor (Table 1, Serial 9 (FV453319)) examine the drive shaft for signs of cracking or blueing.

NOTE

If it is necessary to remove the broken generator shaft, use the pump drive extractor tool. This is a locally manufactured item and drawings are available from LASS IPT, DLO Andover, Portway, Monxton Road, Andover, Hants, SP11 8HT.

40 Carefully refit the FIP drive shaft, (to avoid disturbing the FIP timing), and tighten the serrated nut.

41 Fit the new generator drive shaft.

42 Refit the components in reverse order to removing.

43 Check the FIP timing before starting the engine.

CHAPTER 1-3

FUEL SYSTEM

CONTENTS

Table — Page

Fig

INTRODUCTION

1 This chapter covers the repair of the fuel system of the FV432, FV436 and the FV439 and some common FV434 components. Further information relevant to FV434 fuel system can be found in AESP 2350-T-252-523.

LOCALLY MANUFACTURED TOOLS

2 Table 1 lists the locally manufactured tools required to carry out the procedures detailed in this chapter.

TABLE 1 LOCALLY MANUFACTURED TOOLS

Serial (1)	Designation (2)	Drawing No. (3)
1	K60 Injector removal tool	V7100/2
2	Blanking plate for air cleaner/blower flange	V7100/3

3 Table 2 lists the adhesives, sealants and lubricants required to carry out the procedures detailed in this chapter.

TABLE 2 ADHESIVES, SEALANTS AND LUBRICANTS

Serial (1)	NSN/FV (2)	Mfr ID (3)	Description (4)
1	8040-99-225-0098	EC 1099	Adhesive, 1 litre

WARNINGS

(1) FIRE HAZARD. A DANGER OF FIRE ALWAYS EXISTS WHEN WORKING ON FUEL SYSTEMS WITHIN THE VEHICLE. MASTER SWITCHES ARE TO BE TURNED OFF, HATCHES OPENED TO DISPERSE FUMES, VEHICLE EARTHED TO DISCHARGE ANY STATIC ELECTRICITY, AND A SUPPLY OF COTTON WASTE AVAILABLE TO 'MOP UP' ANY SPILT FUEL.

(2) FIRE HAZARD. FIRE EXTINGUISHING EQUIPMENT MUST BE AVAILABLE AT ALL TIMES. THE FIXED FIRE EXTINGUISHING EQUIPMENT IS INOPERATIVE WHEN THE POWER PACK IS REMOVED.

GENERAL

4 The main fuel tanks are located in compartments in the LH and RH rear of the personnel compartment. Both tanks are connected via a two-way fuel tap to a collecting tank fitted underneath the floor plates between the two tanks. To prevent the accumulation of debris, a fuel filter is fitted between the fuel filler neck and the collector/filter. The supply from both main tanks are gravity fed to a collecting tank, only one fuel gauge is necessary, this being fitted to the RH tank.

5 A fuel pressurising pump is fitted to the collecting tank, the pump end of the assembly being submerged inside the tank with the fully enclosed motor fitted externally. The fuel injection pump is base mounted on the RH side of the engine casing and is driven from the upper crankshaft by spur gearing to the pump coupling.

MAIN FUEL TANKS

NOTE

Before commencing the removal of fuel tanks ensure a container of a suitable size and material is available to drain the fuel into.

Removing

6 Turn the fuel tap ON and drain fuel through the drain valve, which is located at the bottom of the collector tank.

7 Remove the filler cap to increase the draining speed.

8 Remove the rear two sections of the ventilation ducting to gain access to the four bolts at the upper edge of the tank. The ducting is removed as follows:

8.1 Remove the two self-tapping screws securing the rear sections to the front section.

8.2 Commencing from the rear, remove screws securing the alternate ball diffusers to the ducting, and then gently prise out each ball-diffuser.

8.3 Remove the nuts and washers from the mounting studs inside the ducting.

8.4 Lift the ducting clear and lay to one side where it cannot be damaged, otherwise difficulty will be experienced when refitting.

Right hand fuel tank

9 If the RH tank is being removed, disconnect the lead from the fuel gauge unit by uncoupling the plug from the cable socket in the sidewall.

10 Remove the appropriate fuel vent pipe completely, by disconnecting at the tank and vent valve.

11 Remove the bolts and lift away the tank cover plate complete with thermal sheeting.

12 Raise the filler cap armoured cover and remove the tank filler cap, complete with the securing chain and the neck filler (prise out the spring ring to which the cap securing chain is anchored).

13 Remove the bellows-type spill cap from tank neck. If the spill cap is undamaged, mark the seal, the metal flange and the hull to ensure the cap is refitted in the correct position to take up its original set.

14 Disconnect the fuel outlet pipes at the T-junction adjacent to the tank and at the tank outlets.

Left hand fuel tank

15 If the LH tank is being removed, disconnect the spill return pipes at the tank unions.

16 Remove the appropriate fuel vent pipe completely, by disconnecting at the tank and vent valve.

17 Loosen the tank strap nuts and remove the two strap nut brackets.

18 Before the tanks can be removed from the recess, the following electrical units must be removed as they impede the outward movement of the tanks:

18.1 Disconnect the cables, tannoy speaker, and antenna trimming unit complete with the supporting bracket.

18.2 Remove the limit switch/contact switch from the rear door.

18.3 The tank may now be removed from the recess by pulling inward and tipping downward. Ensure that the tank does not foul the hull thermal sheeting. (Weight of tank 46.31 kg (102 lb)).

Maintenance

19 Check the exterior of tank for signs of damage. Inspect seams and cover plates for signs of leaking. Renew the cover plate gasket, if necessary. Repairs involving the welding of seams or external fittings will NOT be carried out as a unit repair but back loaded to the supporting workshop.

20 Clean the filler neck filter.

21 Inspect the securing clamp and cables.

22 For removal of the fuel gauge unit refer to Para 25 to 27.

23 For electrical tests of the fuel gauge unit refer to Chap 5.

Refitting

24 Refit the tank in reverse order to removing, noting the following:

24.1 The felt supports, fitted in the recess, must be in good condition. The felts that have become detached must be properly secured with adhesive (Table 2, Serial 1).

24.2 The tank recess must be thoroughly cleaned.

24.3 Ensure the fuel pipe unions are correctly tightened.

24.4 The securing straps must hold the tank firmly in position: DO NOT over tighten the strap-securing nuts.

GAUGE UNIT

Removing

25 Remove the screws securing the flange of the unit to the tank.

26 Ease the unit free of the tank, then manipulate the unit to guide the float arm with the float through the tank aperture.

27 If it is necessary to remove the terminal block of unit, remove six screws securing the block; carefully ease the terminal block including rheostat from unit, noting that:

27.1 An actuating pin, operated by the float arm gearing, fits into a slot in the rheostat arm.

27.2 The terminal block is located onto the flange of the unit by a dowel.

Refitting

28 Before refitting in the reverse order to removing, inspect the float arm and float; the latter item is finished with a cellulose coat, which, if damaged or broken, will result in the cork float being soaked in fuel. Points to note in refitting of the tank gauge unit are:

28.1 The flange of the unit is located to the tank by a master bolt.

28.2 Ensure the tank gauge unit flange gasket is in good condition. Tighten the flange bolts evenly.

PRESSURISING PUMP, NO. 2, MK 2 (FV 342593)

Removing

NOTE

Unit repairs to the fuel pressurising pump are limited to cleaning the coarse filter and refitting the complete assembly.

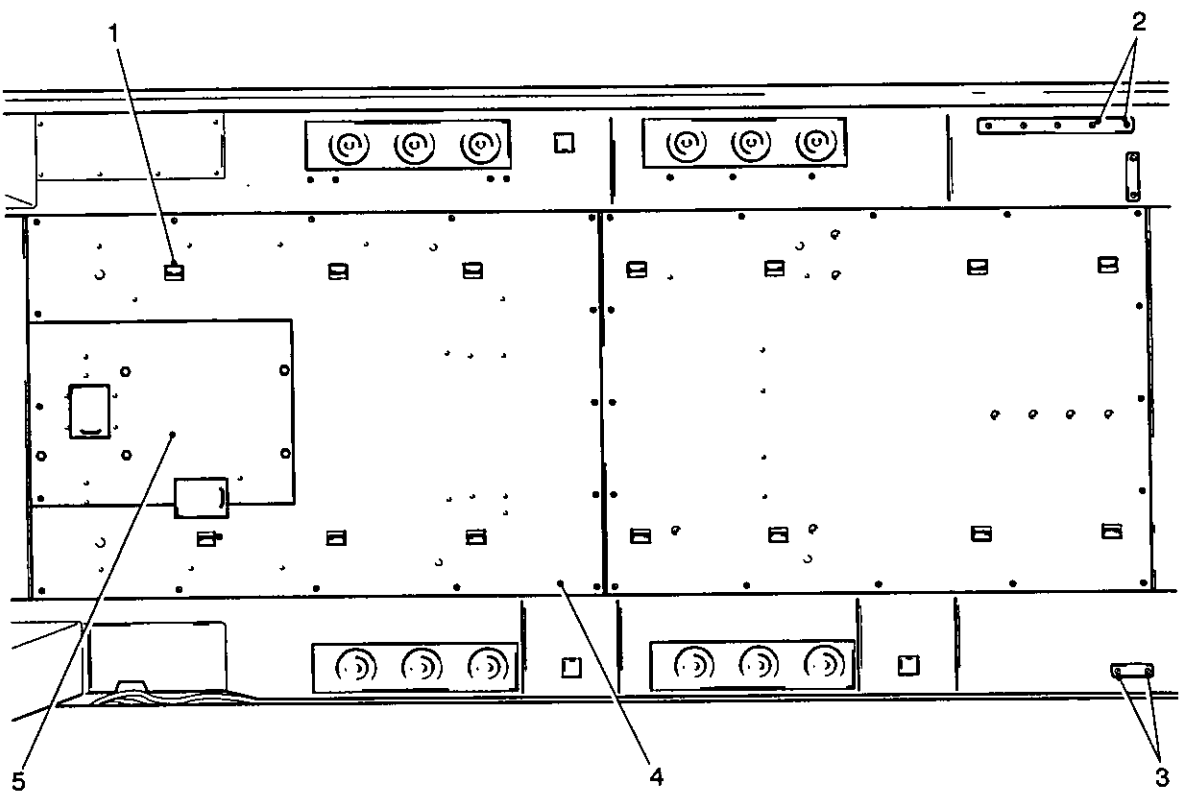
29 Turn the fuel stop valve to OFF.

30 Open the drain valve to drain the fuel from the collecting tank.

NOTE

Before commencing with the removal of the pressurising pump ensure a container of a suitable size and material is available to drain the fuel into.

31 Remove the collector tank access plate (Fig 1 (5)) located in the rear floor plate (4).



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1 Lower stretcher anchor strap attachments
2 Left pedestal holes
3 Right pedestal holes
4 Rear floor plate
5 Collector tank access plate

Fig 1 Floor plate

32 Remove the union nuts from:

32.1 The outlet side of fuel valve.

32.2 The outlet side of fuel pump.

33 Remove the four bolts securing the collector tank and move the tank to right until the Thorn socket on the rear of the pump can be unscrewed.

34 Lift the tank and the pump from the vehicle.

35 Remove the drain valve assembly from the base of the tank.

NOTE

Before the pump can be removed from the tank, the coarse filter must be pulled clear of the centre pipe. Access to the filter is through the drain valve aperture.

36 Remove the pump flange bolts and ease the pump away from tank.

37 For electrical tests to the pressurising pump refer to Chap 5.

Refitting

38 Refit the pump in the reverse order to removing, noting the following:

38.1 Ensure the filter is clean.

38.2 Ensure the gaskets are in good condition.

38.3 Ensure the pump outlet union faces rearward.

38.4 Ensure the flange bolts are tightened evenly and the pipe connections are correctly tightened.

38.5 Ensure air is bled through the bleed valve on the collecting tank before the floor plates are refitted. Turn fuel stop to 'ON' and refit access plate (5).

INJECTION PUMP (TYPE NNL WITH HYDRAULIC GOVERNOR)

General

39 The fuel injection pump is an in-line, six-element type, fitted with a hydraulic governor and a fuel cut-off solenoid. The solenoid operates the control rod only when de-energised and is therefore a 'FAIL-SAFE' device, with the control rod returning to the stop ('NO FUEL') position should an electrical fault develop. When the solenoid is energised the stop lever moves away from the stop plate but the control rod remains in the 'NO FUEL' position until the pump camshaft is rotated. Hydraulic pressure then moves the servo piston, which in turn moves the swing link, internal governor lever and the control rod to the fuelling position.

NOTE

To avoid fouling the FIP fuel stop control, the injector leak off pipe is re-routed on power packs fitted with a two-piece injector leak off pipe. This does not apply to early variants fitted with a one-piece flexible hose. Details of pipe bending details are illustrated in Fig.2.

Removing (with power pack in situ)

40 Remove the access plates between the driver and the power pack compartments, as detailed in Chap 1-1.

41 Remove the engine oil breather pipe; cap or seal off union on oil tank.

42 Disconnect the leads from the fuel cut-off solenoid.

43 Remove the six pressure pipes, pump to injectors.

44 Disconnect the two banjo unions on top of the pump body. Collect the copper washers, two per union. Disconnect the flexible pipe (filter to pump) at top of the pump.

45 Disconnect the small-bore pipe, governor to valve actuator on main gearbox.

46 Disconnect and remove the oil feed and return pipes to and from the pump and engine. Disconnect the driver's emergency stop control cable from the injection pump and the power pack frame.

NOTE

The instructions for setting this cable are in Chap 3.

47 Remove the four screws securing the pump coupling. These are identified as those nearest the pump body. DO NOT remove the screws securing the flexible coupling.

48 Remove the four screws securing the base of the pump to the mounting plate.

NOTE

The sleeves are fitted between the bases of the pump and the mounting plate for the front two screws and the rear screws, i.e. those nearest the engine casing are longer.

49 A timing mark is etched/stamped on the edge face of the pump coupling. Before removing the pump, check and identify the timing mark. If in doubt as to where the mark is and the same pump is being refitted, mark the coupling to ensure correct refitting in accordance with the instructions detailed in Para 49

50 When the pump is removed, extend the timing mark by carefully scribing on the faces of the pump coupling.

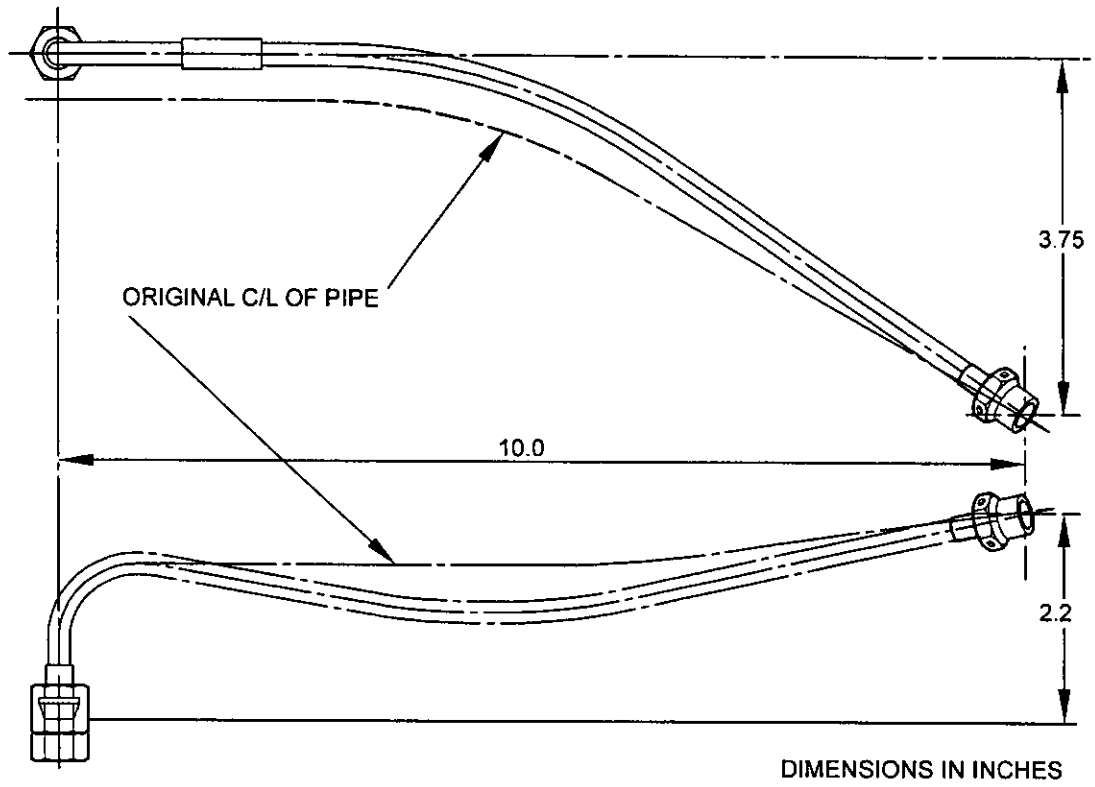


Fig 2 Pipe bending details

Refitting and timing

51 Refitting and timing is carried out in reverse order to removing. Points to note:

51.1 Fit the sleeves to the two front holes for securing screws in the base of the pump before positioning pump to mounting flange.

51.2 The two longer screws securing the base of pump are fitted on the engine casing side.

51.3 Before connecting the leads to fuel cut-off solenoid, ensure the master battery switches are OFF.

52 Before connecting the pump coupling, with reference to Fig 2, time as follows:

NOTE

Before commencing timing procedure, consult the engine modification certificate to ascertain whether FVRDE approval No. 27049 (EMER Pwr S 567/1 Mod Instr No. 4) has been included. If it has been included, the engine is fitted with an Automatic Timing Device (ATD).

52.1 To time an engine fitted with ATD, turn the engine until the 30 deg mark on the upper crankshaft damper is coincident with its pointer.

52.2 To time an engine NOT fitted with ATD, turn the engine until the 40 deg mark on the upper crankshaft is coincident with its pointer.

NOTE

The upper damper has timing marks etched on the front and rear faces, each with its own pointer; either set of marks may be used, whichever are convenient.

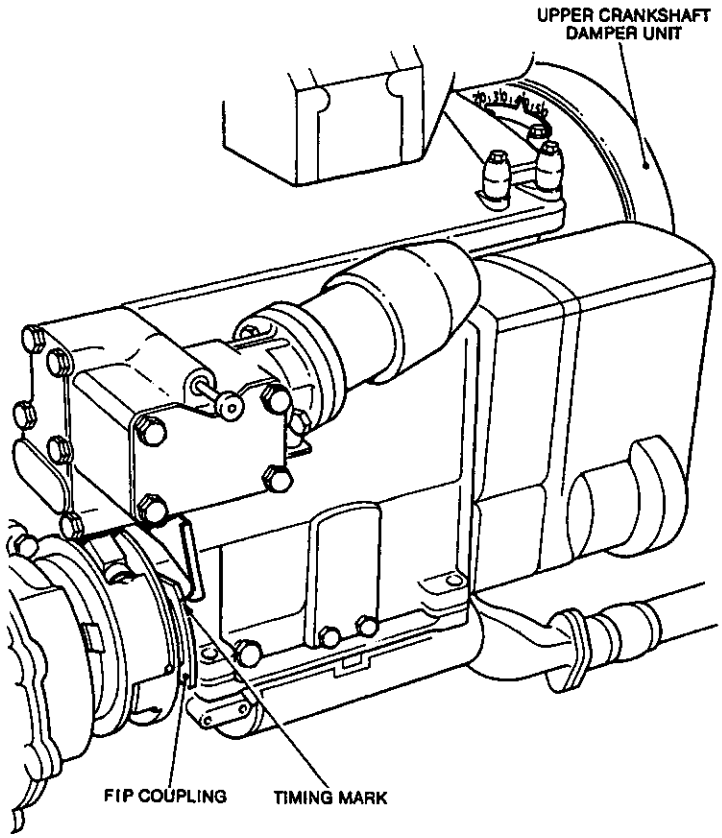


Fig 3 Timing marks on engine and fuel injection pump

53 Rotate the pump anti-clockwise as viewed from the governor end of the pump and line up the timing mark with the pointer on the pump body.

NOTE

The pump timing mark is a single line stamped on the periphery of the flange. DO NOT use the equi-spaced marks on the periphery about 180 deg from single timing mark.

54 Fit the pump coupling securing screws.

55 Immediately after fitting and timing the pump, run the engine until normal operating temperature is reached. Reset the pump external stop so that the idling speed (engine output shaft) is 780 to 800 rev/min. It is important that the idling speed is set to the stated limits. At lower than 780 rev/min, gear fluctuations in the transfer gearbox can damage the engine coupling, whilst above 800 rev/min 'CREEP' commences in the transmission gearbox.

Renewal of disposable governor breather

56 The procedure for renewing the disposable governor breather, is as follows:

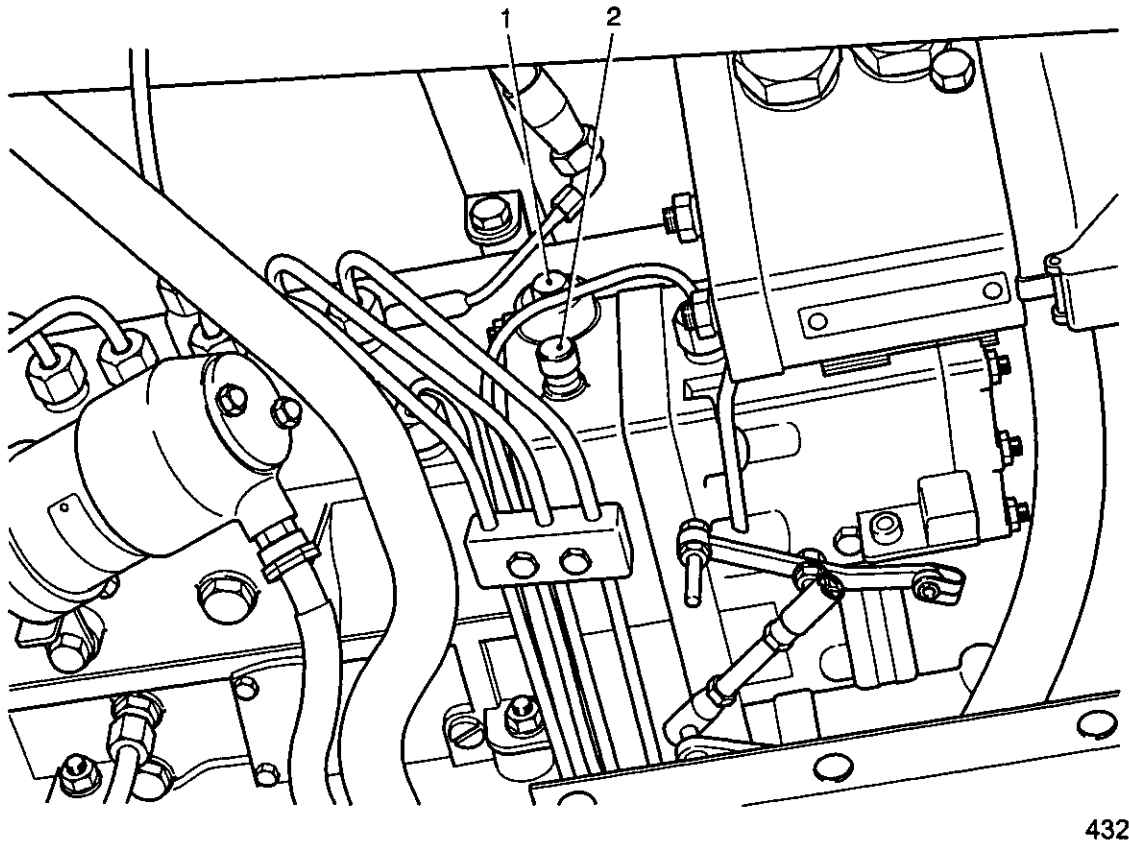
56.1 Remove the power pack access plate

56.2 Clean the surrounding area of the breather (Fig 4(1)).

56.3 Remove and dispose of, in accordance with local instructions, the governor breather using a spanner on the hexagon head of the breather.

56.4 Fit a new governor breather.

56.5 Refit the power pack access plate.



1 Breather , governor 2 Dipstick, governor

Fig 4 Injection pump governor

INJECTORS

General

57 All injectors are accessible with the power pack in situ. For general instructions covering inspection and testing of injectors, see Power M 310. When adjusting used injectors, the opening pressures are to be set at; Mk 4F engine 160 bar, Mk 6F engine 175 bar - these being the normal operating settings. New or base overhauled injectors are set to open at; Mk 4F engine 175 bar, Mk 6F engine 190 bar to allow for settling down of the valve spring. No adjustment is required before fitting.

Removing

58 Remove the access plates between the driver and the power pack compartments, as detailed in Chap 1-1.

59 Remove the screws securing the spill pipe banjo unions to the injectors.

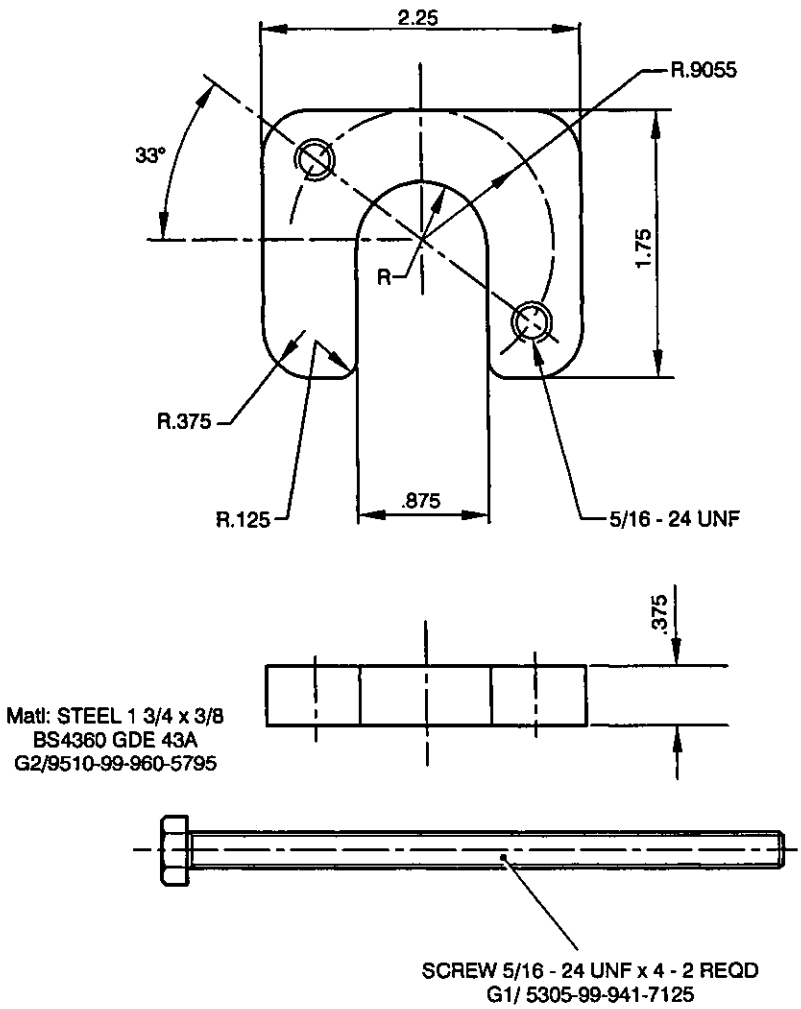
60 Remove the pressure pipes, pump to injectors if necessary, mark pipes to assist refitting.

61 For the No. 6 injector, remove the oil pressure switch in accordance with instructions detailed in Chap 1-2.

62 Manufacture the extractor (Fig 5). Remove the injector flange securing screws, fit the extractor and jack out the injectors ensuring equal pressure is applied to the extractor screws.

Refitting

63 Refit the injectors in reverse order to removing. Ensure the injector housing is free of carbon; tighten the injectors evenly.



Dimensions in inches

Fig 5 K60 Injector removal tool

AIR CLEANER

Removing

WARNING

HEAVY WEIGHT. THE AIR CLEANER WEIGHS APPROX 40 kg (90 lb). DUE CONSIDERATION TO THE REGULATION GOVERNING THE LIFTING OF HEAVY WEIGHTS SHOULD BE GIVEN.

CAUTION

EQUIPMENT DAMAGE. It is essential that the blower be blanked off with a clean cover plate when the air cleaner is removed. Failure to protect the blower assembly from dirt/foreign matter will result in severe damage to the blower assembly and/or engine. The cover plate, which may be of steel, wood, hardboard or any suitable material available, is to be manufactured to the dimensions shown in Fig 6.

64 Release the clip securing the flexible hose, fitted to the bottom front of the air cleaner assembly. Ease hose clear of the assembly.

65 Remove the indicator pipe from the cleaner input flange and the fan stator casing.

66 Remove the nuts from the flange securing the moulded rubber joint to the blower flange.

67 Take the weight of the assembly with a rope sling passed through the lifting eyes.

68 Remove bolts holding the assembly to the power pack superstructure.

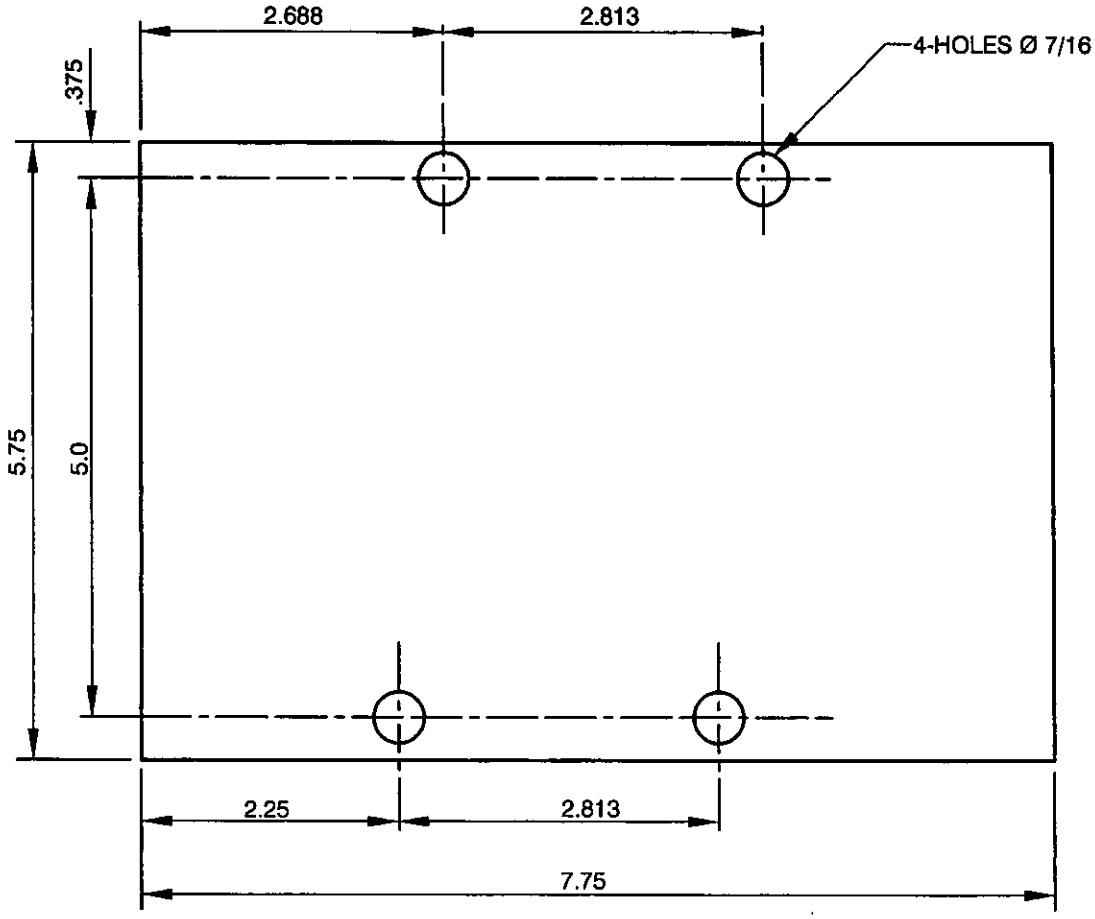
69 Lift the cleaner assembly clear. Fit the cover plate to the blower flange, also cover the open end of the air cleaner with a suitable material.

Servicing maintenance

70 Servicing the air cleaner, including replacing the second stage elements is described in AESP 2350-T-250-201 Chap 2-3. The indicator unit, located in the fan stator cowling, is not repairable and is to be renewed if damaged or defective.

Refitting

71 Before refitting the cleaner assembly in reverse order to removing, ensure that the rubber joint fitted between the cleaner assembly and the blower is undamaged. This item must form an airtight joint between the cleaner and blower. Extreme care must be used when positioning the cleaner to blower so that the dirt or foreign matter does not drop or become dislodged into the blower assembly.



432/147

Dimensions in inches. Suggested material 1 mm steel plate.

Fig 6 Blanking plate for air cleaner/blower flange

AIR CLEANER

Removing

WARNING

HEAVY WEIGHT. THE AIR CLEANER WEIGHS APPROX 40 kg (90 lb). DUE CONSIDERATION TO THE REGULATION GOVERNING THE LIFTING OF HEAVY WEIGHTS SHOULD BE GIVEN.

CAUTION

EQUIPMENT DAMAGE. It is essential that the blower be blanked off with a clean cover plate when the air cleaner is removed. Failure to protect the blower assembly from dirt/foreign matter will result in severe damage to the blower assembly and/or engine. The cover plate, which may be of steel, wood, hardboard or any suitable material available, is to be manufactured to the dimensions shown in Fig 4.

65 Release the clip securing the flexible hose, fitted to the bottom front of the air cleaner assembly. Ease hose clear of the assembly.

66 Remove the indicator pipe from the cleaner input flange and the fan stator casing.

67 Remove the nuts from the flange securing the moulded rubber joint to the blower flange.

68 Take the weight of the assembly with a rope sling passed through the lifting eyes.

69 Remove bolts holding the assembly to the power pack superstructure.

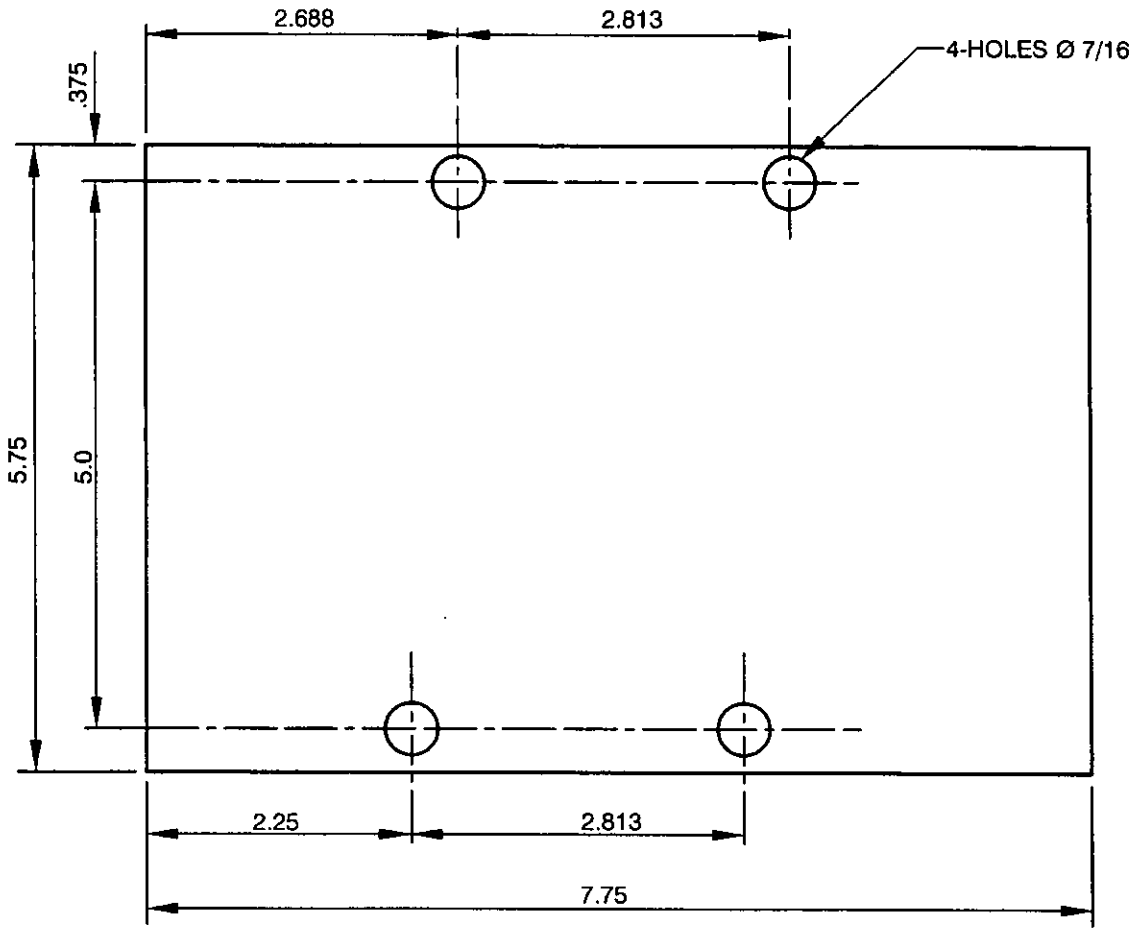
70 Lift the cleaner assembly clear. Fit the cover plate to the blower flange, also cover the open end of the air cleaner with a suitable material.

Servicing maintenance

71 Servicing the air cleaner, including replacing the second stage elements is described in AESP 2350-T-250-201 Chap 2-3. The indicator unit, located in the fan stator cowling, is not repairable and is to be renewed if damaged or defective.

Refitting

72 Before refitting the cleaner assembly in reverse order to removing, ensure that the rubber joint fitted between the cleaner assembly and the blower is undamaged. This item must form an airtight joint between the cleaner and blower. Extreme care must be used when positioning the cleaner to blower so that the dirt or foreign matter does not drop or become dislodged into the blower assembly.



Dimensions in inches. Suggested material 1 mm steel plate.

Fig 7 Blanking plate for air cleaner/blower flange

CHAPTER 1-4

COOLING SYSTEM

CONTENTS

(continued)

CONTENTS (continued)

WORKSHOP SPECIAL TOOLS

1 Table 1 lists the workshop special tools required to carry out the procedures detailed in this chapter.

TABLE 1 WORKSHOP SPECIAL TOOLS

Serial (1)	NSN (2)	Designation (3)
1	6MT2/4910-99-822-3959	Tester, radiator and cooling system (or approved equivalent)
2	W2/6689-99-942-0507	Gauge pressure 0 to 210 kgf/cm^2 (0 to 3000 lbf/in^2) (or approved equivalent)

LOCALLY MANUFACTURED TOOLS

2 Table 2 lists the locally manufactured tools required to carry out the procedures detailed in this chapter.

TABLE 2 LOCALLY MANUFACTURED TOOLS

Serial (1)	Drawing No. (2)	Designation (3)
1	V7115/1	Extractor tool for coolant pump impellor

NOTE

Drawings for the tools detailed in Table 2 may be demanded from LASS IPT, DLO Andover, Portway, Monxton Road, Andover, Hants, SP11 8HT.

ADHESIVES, SEALANTS AND ADHESIVES

3 Table 3 lists the adhesives, sealants and lubricants required to carry the procedures detailed in this chapter.

TABLE 3 ADHESIVES, SEALANTS AND LUBRICANTS

Serial (1)	NSN (2)	Mfr ID (3)	Designation (4)
1	8040-99-225-0098	EC 1099	Adhesive, 1 litre
2	8030-99-220-2370	Hylomar PL32M	Sealing compound

GENERAL

4 The Roll Royce K60 type engine is primarily cooled by a pressurised liquid system. Circulation is effected by a pump assisted, thermo-syphon action.

5 Cooling is effected by the hydraulically driven fans positioned above and to the rear of the engine. Warm air is extracted from the power pack compartment through the rear exhaust louvres. Cool air is induced through the front inlet louvres, to form an airflow passing through the radiator and around the engine, gearbox and power pack ancillaries. The coolant is circulated through a fan control unit so that the speed of the fans is controlled by coolant temperature.

6 The cooling system also incorporates a heat exchanger to maintain a balanced temperature between the coolant and the engine, gearbox fan and steering unit oil systems.

RADIATOR

Removing

WARNING

HEAVY WEIGHT. THE RADIATOR WEIGHS 72 kg (160 lb). DUE CONSIDERATION SHOULD BE GIVEN TO THE REGULATIONS GOVERNING THE LIFTING OF HEAVY WEIGHTS.

7 Remove power pack, Chap 1-1 refers.

8 Drain the coolant into a clean container for further use.

9 Release the hose clips on the pipe connections at the radiator to the fan control unit, radiator to heat exchanger and radiator to coolant pump.

10 Release the coolant pump bypass at the union under the rear of the radiator.

11 Remove the eight securing bolts, lift the radiator clear.

Testing

12 Radiators are tested to 1.4 kg/cm^2 (20 lbf/in^2) during manufacture. After repairs to the radiator, it should be submerged and tested to that pressure. To affect this, suitable 'bungs' must be made to fit the outlet, inlet and relief tube apertures. Additionally, the pressure relief valve must be removed and a blanking plate fitted, with a gasket of rubber or similar material, over the aperture (use the flange of the pressure relief valve as a template for making the blanking plate). Pressure in the tank during the test must not be allowed to rise above 1.4 kg/cm^2 (20 lbf/in.^{2}) use tester, radiator and cooling system (Table 1, Serial 1).

Refitting

13 Renew any hose or associated part that is worn or damaged, refer to Para 19.

14 Refit the radiator in reverse order to removing.

PRESSURE AND VACUUM RELIEF VALVE

NOTE

Relief valve should open between 0.67 and 0.74 kg/cm^2 (9.5 and 10.5 lbf/in^2). The vacuum valve should open at 0.07 kg/cm^2 (1 lbf/in.^{2}). An unserviceable valve cannot be repaired and must be replaced.

Removing and refitting

15 Remove the setscrews securing the valve to the header tank, lift out valve. Replace with a new gasket, tightening the setscrews evenly.

Pressure testing cooling system and relief valve.

16 After any repair or replacements to the cooling system, the system must be pressure tested using the appropriate tester (Table 1, Serial 1).

Testing

17 Refer to T&M A 028 Chap 153 for the operation of Tester, Radiator and Cooling Systems.

18 The pressure should operate at between 0.67and 0.74 kg/cm^2 (9.5 and 10.5 lbf/in^2)

COOLANT HOSES

19 The correct grade of hose for use in the cooling system is identified by having two, half inch wide yellow stripes, marked along the length of the hose. Alternatively, the hose might have a British Standards number moulded into the hose, i.e. BS 2952. This hose has no form of colour identification. It should be noted that on Mk 2 vehicles, to obviate fire risk from coolant glycol residue igniting on exhaust manifold a hose (Fig 1(14)) is fitted on the PRV to lead coolant away. AESP 2350-T-250-811, Mod Instr No 1/53 refers.

COOLANT PUMP

Removing

20 Remove power pack, Chap 1-1 refers.

21 Drain the coolant into a clean container.

22 Remove the union nut at top of the pump body. Disconnect the hose connections; pump to heat exchanger, at pump end.

23 Remove the screws securing the pump drive flange. Remove the screws securing the pump mounting face to the engine casing (note that the top two screws are shorter than the lower two). Collect the O-rings fitted to ports.

Dismantling

NOTE

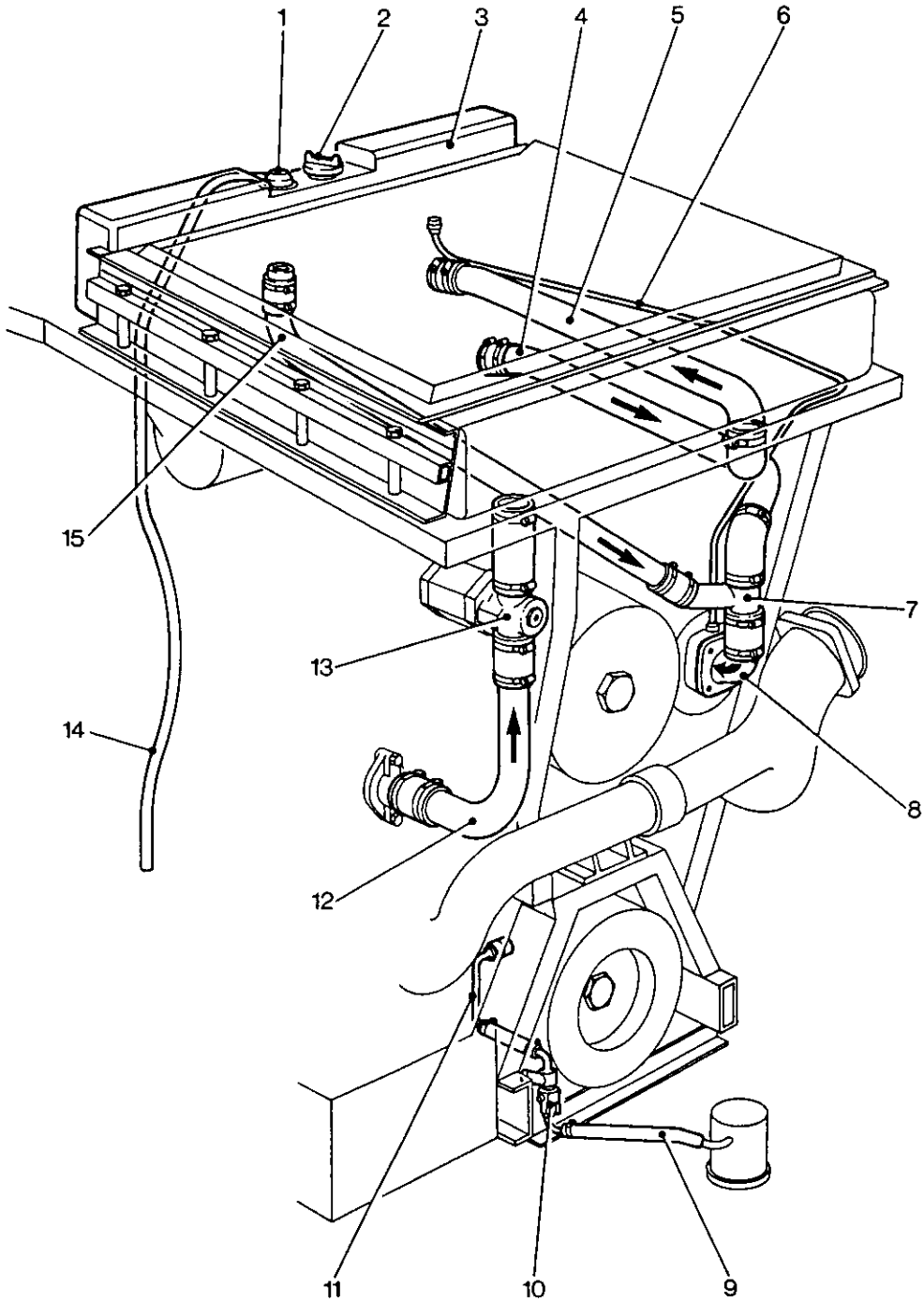
The procedure detailed below is based on complete dismantling of the pump and fitting replacement seals. To obtain access to the circlips retaining the drive shaft it will be necessary to remove either the seal at the coupling end or the sealing gland at the impellor end. These seals will almost certainly be damaged whilst removing. Before dismantling, ensure that the fault is diagnosed and that replacement parts are available.

24 Remove the screws securing the cover to the pump body.

25 Manufacture extractor tool (Table 2, Serial 1) and extract the impellor and coupling from the drive shaft.

26 Remove the seal from the housing. Remove the circlip retaining the pump drive shaft. Pull the drive shaft (from the impellor end) clear of the pump body.

27 Remove the sealing gland complete with the cover from the housing.



1	Pressure/vacuum relief valve	9	Connecting pipe to hull drain plug
2	Radiator filler cap	10	Drain cock
3	Radiator header tank	11	Cylinder block drain pipe
4	Coolant outlet, heat exchanger to pump	12	Engine thermostat controlled outlet to radiator
5	Coolant inlet, from radiator to heat exchanger	13	Fan controller connection
6	Vent tube, pump to radiator header tank	14	Relief valve vent pipe extension
7	Branch connection	15	Coolant pipe, header tank to pump
8	Coolant pump connection		

Fig 1 Coolant connections

Assembling

NOTE

Before assembling, inspect the drive shaft bearing for wear or corrosion and renew if necessary. The shaft and the bearing are supplied as an assembly. Renew all seals if a new sealing gland is fitted.

28 Fit drive shaft and the bearing assembly into housing, then fit the circlips against each end of the shaft bearing.

29 Fit the seal, with the sealing lip trailing. Smear the outer diameter of the seal with jointing compound (Table 3, Serial 2).

30 Press the coupling to the shaft until its outer face is flush with the end of the shaft. The coupling bore is an interference fit with the shaft and a fly-press, capable of applying a force of about 3.5 kN (800 lbf), is used.

31 Smear the periphery of the sealing gland cover with jointing compound (Table 3, Serial 2) before fitting gland with cover into housing. Note that when home, the rear face of the cover is flush with the face of the housing.

32 Press the impellor onto the shaft so that, with the drive shaft hard against the circlip adjacent to the coupling, a clearance of 0.254 to 0.914 mm (0.010 to 0.036 in.) is obtained between the rear face of the impellor and the face of the casing.

33 Refit the cover to the pump body.

Refitting

34 Refit the coolant pump in reverse order to removing. Ensure that the O-rings fitted in ports on the mounting faces are serviceable and correctly located. Tighten the screws securing the pump mounting face to the engine casing evenly and securely.

HEAT EXCHANGER

35 The function of the assembly is the exchange of heat between the oil and coolant systems. The coolant is circulated through a series of tubes positioned longitudinally through the assembly whilst the oil systems are directed under pressure to and from the various sections of the assembly. The sections are secured by through bolts. Each section is a separate unit in respect of oil but common to the assembly in respect of coolant. The engine and main gearbox sections are designed with a relief valve to relieve and by-pass oil to the outlet connection should the section be choked or blocked.

Removing

WARNING

HEAVY WEIGHT. THE HEAT EXCHANGER WEIGHS 46 kg (102 lb). DUE CONSIDERATION SHOULD BE GIVEN TO THE REGULATIONS GOVERNING THE LIFTING OF HEAVY WEIGHTS.

36 Remove power pack, Chap 1-1 refers.

37 Remove the radiator; refer to Para 7 to 11.

38 Remove the two coolant pipes from heat exchanger.

39 Remove the engine oil tank breather pipe.

40 Release the engine steering unit and hydraulic oil pipes from the front section of the heat exchanger and main gearbox oil pipes from rear section of the heat exchanger.

NOTES

(1) Use a suitable drip tray to collect oil and coolant spillage.

(2) If in doubt, tie identification tags on all the connecting pipes to assist when refitting.

(3) Union nuts are 1.5/16 in. and 1.7/8 in. A/F.

41 Lift the electrical cables from ducting at the rear of generator.

42 Release the heat exchanger hinged clamps and secure them clear of the heat exchanger.

43 Lift the heat exchanger assembly clear and place in a suitable tray to drain.

Refitting

44 Before refitting the heat exchanger in reverse order to dismantling, carry out a simple test by positioning the assembly and completely filling the water section. Allow to stand for approx 15 minutes to ensure that there are no leaks, then drain off. When the assembly is fitted to the power pack, ensure all the hose connections are securely tightened, wire-lock all union nuts after test running.

THERMOSTAT

CAUTION

EQUIPMENT DAMAGE. The thermostat must NOT be removed from the engine for normal running, otherwise overheating will occur, resulting in damage to the engine.

45 The engine coolant thermostat is located in front of the coolant jacket, which forms the base for the FIP. The thermostat must NOT be removed from its housing for normal running of the engine, otherwise overheating, resulting in damage to the engine, will occur.

Removing

46 Remove power pack, Chap 1-1 refers.

47 Drain the coolant into a suitable clean container for re-use.

48 Release the hose clip below the fan control unit and remove the two flange bolts on the thermostat housing. Remove the coolant pipe.

49 Remove the setscrews securing the front flange of the elbow connection to the engine casing and setscrews securing the thermostat housing to the coolant jacket. Remove the unit and withdraw the thermostat.

NOTE

If the thermostat is difficult to withdraw, place in warm water for approx two minutes.

Testing and refitting

50 Immerse the thermostat in clean water in a suitable container.

51 Insert a suitable thermometer, graduated to 100 deg C (212 deg F).

52 Apply heat to raise the water temperature.

53 Observe the thermostat opening and fully open temperatures, these should be 70-75 deg C (158-167 deg F) and 90 deg C (194 deg F) respectively.

54 A variation of ± 10% on opening and fully open temperatures is permissible. Thermostats not within these limits are to be discarded.

55 Refit in reverse order to removing, ensuring all seals are in good condition.

COOLANT SENDER UNIT

56 The coolant sender unit is located in the coolant jacket below the FIP. Electrical tests are contained in Chap 5.

HYDRAULIC FAN SYSTEM

Cleaning magnetic filters

57 Unscrew each filter from the tank, covering the holes immediately with clean paper and tape to prevent the ingress of dirt.

58 Clamp the filter flange lightly in vice.

59 Remove the nut and washer at base of the filter and withdraw the filter cage.

60 Wash the cage in clean kerosene.

61 Wipe the bar magnet with a lint free clean cloth, ensuring that all particles are removed.

62 Reassemble the cage on to the bar magnet and secure with the nut and washer.

63 Refit the filter into the tank, ensuring that the sealing washer is fitted beneath the head.

NOTE

Care must be taken to prevent the magnet from being knocked, dropped or allowed to come into contact with iron or steel objects.

Draining and refilling reservoir

64 Remove power pack, Chap 1-1 refers.

65 Arrange a suitable container to receive the oil to be drained from the reservoir.

66 Remove the drain plug from the base of the tank unit and allow oil to drain into the container.

NOTE

Slackening the drain plug will only drain the lower tank of the tank unit.

67 Check that the joint washers are serviceable and refit the drain plugs to the tank.

68 Filter replacement oil through a 74-micron mesh gauze filter into the reservoir until the MAX level on the dipstick is reached.

69 After the engine has run for a few minutes, recheck the oil level and top up as necessary. Check the drain plug for leakages.

Removing RH fan motor

70 Remove power pack, Chap 1-1 refers.

71 Drain the hydraulic fluid reservoir into a clean container and preserve for re-use.

72 Remove the screws and withdraw the firewire from the fan stator bore.

73 Remove retaining nut form end of fan drive shaft and pull off fan complete with hub. Ensure the key is collected from the shaft.

NOTE

If the hub is a tight fit on the shaft, turn back the lockwasher tab, and remove the bolts securing the fan blade assembly to the hub. Remove the fan blade assembly and draw the hub off the shaft with a puller. Ensure that the hub flange is not distorted when using the puller.

74 Remove the pipe from between the four-way junction at the LH of the LH fan motor and the RH fan motor.

75 Remove the pipe from between the four-way junction at the RH of the LH fan motor and the RH fan.

76 Disconnect the leak-off pipe from the RH fan motor body.

77 Remove the fuel line between the inner connector on the fuel filter and the union located at the bracket on the underside of the fan stator frame.

78 Disconnect the outer fuel pipe from the fuel filter and secure clear of the fan motor.

79 Slacken the bolts holding the motor to the fan stator casing, support the motor, remove the bolts and withdraw the motor from the power pack.

Refitting RH fan motor

80 Refit the fan motor in reverse order to removing, ensuring that the bolts securing the fan to the hub are locked with lockwasher tabs and the hub-retaining nut is securely locked.

81 Ensure that a clearance of 0.381 mm (0.015 in.) exists between tips of the fan blades and the fan stator casing.

82 Ensure that nuts securing pipes to unions on the hydraulic motor are wire-locked.

83 Ensure that the firewire is securely clipped into position clear of the fan blades.

84 Ensure that the hydraulic reservoir is filled to the correct level before refitting the power pack.

Removing LH fan motor

85 Remove power pack, Chap 1-1 refers.

86 Drain the hydraulic fluid reservoir into a clean container and preserve for re-use.

87 Remove the screws and withdraw the firewire from the fan stator bore.

88 Remove the retaining nut from the end of the fan drive shaft and pull off the fan complete with hub. Ensure the key is collected from the shaft.

NOTE

If the hub is a tight fit on the shaft, turn back the lockwasher tab, and remove the bolts securing the fan blade assembly to the hub. Remove the fan blade assembly and draw the hub off the shaft with a puller. Ensure that the hub flange is not distorted when using the puller.

89 Remove the leak-off pipe from between the body of the fan motor and the leak off test point.

90 Remove the pipe from between the RH fan motor and the four-way connection at the RH of the LH fan motor.

91 Disconnect the pipe at the joint located behind the RH fan motor. DO NOT remove the pipe from the four-way connector.

92 Remove the pipe from between the four-way connector at the LH of the LH and RH fan motor.

93 Remove the pipe from between the four-way junction at the LH of the LH fan motor and the controller at the connector behind the RH fan. Disconnect the retaining clip and withdraw the pipe.

94 Slacken the bolts holding the motor to the fan stator casing, support the motor, remove the bolts and withdraw the motor from power pack.

Refitting LH fan motor

95 Refit the fan motor in reverse order to removing, ensuring that the bolts securing the fan to the hub are locked with the lockwasher tabs and the hub retaining nut is securely locked.

96 Ensure that a clearance of 0.381 mm (0.015 in.) exists between tips of the fan blades and the fan stator casing.

97 Ensure that the nuts securing the pipes to the unions on the hydraulic motor are wire-locked.

98 Ensure that the firewire is securely clipped into position clear, of the fan blades.

99 Ensure that the hydraulic reservoir is filled to the correct level before refitting the power pack.

Removing hydraulic pump

100 Remove power pack, Chap 1-1 refers.

101 Drain the hydraulic fluid reservoir into a clean container and preserve for re-use.

102 Disconnect the inlet, outlet and body drain hoses from the pump.

103 Remove the bolts securing the two cable clips at the RH of the pump and push cables away from the vicinity of the pump.

104 Remove the bolts and washers securing the pump mounting flange to the engine, collect three the bushes from the flange as the pump is withdrawn.

105 Withdraw the drive shaft extension if remaining in the alternator drive casing and detach the sealing ring from the case or nose of the pump.

Refitting hydraulic pump

106 Inspect and, if necessary, renew the sealing ring on nose of the pump.

107 Refit the pump in reverse order to removing, ensuring that all unions are wire-locked.

108 Ensure that the hydraulic reservoir is filled to the correct level before refitting the power pack.

109 Ensure that the cables are clipped back into position and checked for possible chafing points.

Removing hydraulic reservoir

110 Remove power pack, Chap 1-1 refers.

111 Drain the reservoir.

112 Slacken the clips and disconnect the filler tube from the hose at the lower end, pushing the tube through the stator tray.

113 Disconnect the hose from the coupling on the underside of reservoir.

114 Slacken back the union nut connecting the leak-off test point, junction block to reservoir.

115 Disconnect the pipe between the reservoir and the heat exchanger at the reservoir end.

116 Remove the bolts securing the reservoir brackets to the power pack frame and filter bracket and withdraw the reservoir.

Refitting hydraulic reservoir

117 Refit the hydraulic reservoir in reverse order to removing, ensuring that the hose between the heat exchanger and the reservoir is connected lightly in position prior to securing the reservoir to the power pack and that the connection is tightened securely after final location of the reservoir.

Removing control unit

NOTES

(1) The unit controls the speed at which the fans run and is mounted on the power pack. As the coolant temperature rises the thermostat in the control unit extends and shuts off the hydraulic fluid by-pass, thereby directing full fluid flow from the pump to the fan motors. The control temperature stamped on the nameplate of the control unit is that at which the by-pass is finally shut. This temperature is set by the manufacturers and must only be altered if tests show that the by-pass shuts at a different temperature from that shown on the nameplate.

(2) The temperature setting of the controller does not normally change with time. If the temperature characteristics of a controller which has been in service for some time appears to have altered, the thermometer must be considered as suspect before any adjustment is carried out to the control unit. Some readjustment may be necessary if the vehicle is moved from an extreme hot to an extreme cold climate or vice versa, even in these conditions, the change in control temperature is unlikely to exceed 3 deg C (37 deg F).

118 Remove power pack, Chap 1-1 refers.

119 Drain the hydraulic fluid reservoir into a clean container and preserve for re-use.

120 Drain the coolant from the power pack and preserve for re-use.

121 Disconnect the inlet and the outlet hydraulic unions from the uppermost side of controller.

122 Slacken the clips securing the coolant hose connection to the lower side of the controller coolant manifold and slide the connecting hose down the pipe away from the controller. If necessary slacken the hose clips at the connection, at the bottom of the pipe to assist in the removal of the controller.

123 Slacken the hose clips securing the connections on the upper side of the controller coolant manifold.

124 Remove the bolts securing the electrical junction panel to the upper cross member of the power pack frame and nut and bolt securing the firewire support stay to the junction panel. Lower the panel for access to the rear of the controller.

125 Remove the nuts and washers securing the controller to the mounting bracket on the power pack. Withdraw the controller downward and outward from the upper coolant pipe connection.

Dismantling control unit to replace thermostat element

126 Screw the hand control fully in.

127 Remove the cap from bottom of the carrier.

128 Remove the four bolts securing the carrier to the upper section of the controller.

129 Remove the nut and washer, and withdraw the thermostat element.

130 Withdraw the copper sealing washer, collar and spacing washers from the element.

Assembling control unit

131 Fit the spacing washers, collar and a new copper sealing washer to the thermostat element.

132 Insert the thermostat assembly into the carrier and secure with a washer and nut. Ensure that the thermostat element is centralized in the bore prior to tightening the retaining nut. Ensure the push rod is inserted into the thermostat element with the groove inside the hole.

133 Adjustment of the controller for variation of temperature at which the fans begin to operate is carried out by addition or removal of spacing washers. Insertion of one washer will raise the temperature by 1 deg C (33.8 deg F); removal of one washer will lower temperature by the same amount. It is therefore important that the same number of washers should be refitted under the collar as removed on stripping and, if necessary, adjusted after a functional test of the system on the vehicle. If it is found that the control temperature cannot be altered by the above procedure, the thermostat element must be replaced.

134 Refit the carrier assembly to the upper section of the controller.

Refitting control unit

135 Refit the control unit to the power pack in reverse order to removing ensuring:

135.1 Hydraulic and cooling system connections are fully tightened, the clips for the upper coolant connection being fitted in position prior to locating the controller in position.

135.2 Firewire system at rear of the electrical junction panel is free from kinks or damage.

135.3 Coolant and hydraulic systems are refilled to the correct level as detailed in AESP 2350-T-250-601.

135.4 Engine is run and the operation of the thermostat is checked by observing the temperature at which the fans commence to run at full speed, as stamped on the nameplate of the control unit.

135.5 On completion of the test, all coolant and hydraulic pipe joints are inspected for leakage and, if necessary, the hydraulic unions are wire locked.

Maintenance of relief valve

136 The relief valve is an integral part of the controller and cannot be adjusted unless the controller is completely dismantled. The valve will be trouble free unless water or an excessive amount of dirt gets into the hydraulic oil. Should this happen, severe corrosion of the valve will take place and oil will by-pass the fan motors, causing the fan to run slowly.

137 The relief valve spring may also settle with age and will result in the relief valve opening at a lower pressure. If problems are experienced with the relief valve, the complete control unit must be replaced.

FUNCTIONAL TESTS

General

138 Remove power pack, Chap 1-1 refers.

139 Check that the hydraulic reservoir is filled to the correct level with oil as detailed in AESP 2350-T-250-601.

140 Run the engine for five minutes at idling speed.

141 Stop the engine, recheck the oil level in the hydraulic reservoir, top up if necessary. (the system is self bleeding)

142 Carry out leak tests on components as follows.

Hydraulic Pump

143 Fit the pressure gauge (Table 1, Serial 2) to the test point at the hydraulic pump outlet.

144 Run the engine at 2300 rev/min as registered on vehicle tachometer and screw in the manual over-ride screw on the controller until 99.75 kg/cm^2 (1425 lbf/in.^{2}) is registered on the pressure gauge. Continue running the engine until the hydraulic oil has reached a temperature of 50 deg C (122 deg F), as ascertained by stopping the engine, remove the magnetic filter and insert a thermometer through the filter aperture in the reservoir. Restart and continue running the engine if the temperature is below 50 deg C (122 deg F).

145 When the correct test temperature is reached, disconnect the leakage line from the pump at the three-way junction capping off the union on the junction with the cap screw attached by a chain to the junction box.

146 With the engine running at 2300 rev/min and 99.75 kg/cm^2 (1425 lbf/in.^{2}) registered on the pressure gauge, collect the leakage oil from the pump for a period of one minute. If leakage from the pump exceeds 975 cc in one minute, the pump is faulty and a replacement unit must be fitted. Ensure that the leak test is carried out with the hydraulic oil maintained at 50 deg C (122 deg F) as, with a 10 deg C (50 deg F) increase, the leakage rate is approx 50% higher than the rate specified at 50 deg C (122 deg F). Conversely, leakage will be less at a lower temperature.

147 On completion of the test, remove the cap screw and refit the pump leakage pipe to the three-way junction, remove the pressure gauge from the test point.

NOTE

The correct standard test speed for the pump is 1480 rev/min shaft speed. As the tachometer is geared to the output shaft, which rotates at 1.56 times crankshaft speed (pump is driven by crankshaft), it is necessary to set engine speed to 2300 rev/min as registered on the tachometer.

Fan motors

148 Fit the pressure gauge (Table 1, Serial 2) to the test point at the hydraulic pump outlet.

149 Run the engine at 2300 rev/min as registered on the vehicle tachometer and screw in the manual over-ride screw on the controller until 99.75 kg/cm^2 (1425 lbf/in^2) is registered on the pressure gauge. Continue running the engine until the hydraulic oil has reached a temperature of 50 deg C (122 deg F), as ascertained by stopping the engine, removing the magnetic filter and inserting a thermometer through the filter aperture in the reservoir. Restart and continue running the engine if temperature is below 50 deg C (122 deg F).

150 When the correct test temperature is reached, disconnect the leakage line from the pump at the three-way junction capping off the union on the junction with the cap screw attached by a chain to the junction box.

151 With the engine running at 2300 rev/min and 99.75 kg/cm^2 (1425 lbf/in^2) registered on the pressure gauge, collect leakage oil from the pump for a period of one minute. If the leakage from the pump exceeds 600 cc in one minute, the pump is faulty and a replacement unit must be fitted.

152 On completion of the test, remove the cap screw and refit the pump leakage pipe to the three-way junction, remove the pressure gauge from the test point.

Controller and complete installation test

153 Check that the hydraulic reservoir is filled to the correct level with oil detailed in AESP 2350-T-250-601.

154 Run the engine at 2300 rev/min.

155 Release the locknut and screw in the controller override screw until the fans are rotating slowly. There is some lost motion on the screw, which must be taken up before the fans will start to rotate. If the coolant has reached a temperature sufficient to open the controller thermostat, the fans will rotate without the override screw being moved.

156 Fully retract the override screw and top up the tank with oil.

157 Screw in the override screw to the limit of travel. This will cause the fans to rotate at full speed. Leave the system running at this speed while inspecting entire circuit for leaks. DO NOT let the coolant temperature rise above 100 deg C (212 deg F).

158 Retract the override screw until the fans have slowed down to between 30 and 100 rev/min (to achieve this, the engine coolant must be allowed to cool down to below 82 deg C (180 deg F). It is necessary for the fans to turn slowly for ventilating the engine compartment.

159 Stop the engine.

160 Remove, clean, and refit the magnetic filter units.

HYDRAULIC FAN DRIVE SYSTEM – FAILURE DIAGNOSIS

161 Table 4 enables a fault in the hydraulic fan drive system to be identified. It is assumed that the initial symptom is that the fan speeds are unsatisfactory.

TABLE 4 HYDRAULIC FAN DRIVE SYSTEM - FAILURE DIAGNOSIS

Serial (1)	Action (3)	Correct result/Action (4)	Incorrect result/Action (5)
1	Check oil level.	Oil level correct. Go to 3.	Oil level low. Go to 2.
2	Check for oil leaks, top up oil.	Fan speed correct. End of test.	Fan speed incorrect. Go to 3.
3	Run engine at 3000 rev/min. Screw down over ride screw. Check fan speeds with tachometer.	Both fans above 3500. End of test.	Both fans below 3500 rev/min, go to 8. One fan below 3500 rev/min. Go to 4.
4	Check slow fan for mechanical stiffness.	Fan free. Go to 5.	Fan stiff, replace motor.
5	Check leakage rate on slow motor.	Leakage rate below limit. Go to 6.	Leakage rate above limit, replace motor.
6	Carry out visual check on fans and radiator.	Visually satisfactory. Go to 7.	Damage or blockage apparent. Replace or repair as required.
7	Check for blockage in oil supply or return line to slower motor.	Line clear. Go to 9.	Line blocked. Clear blockage.
8	Check pump outlet pressure.	Pressure correct, end of test.	Pressure over 150 psi, oil cooler or return pipe to tank blocked, change or clean. Pressure below 150 psi go to 9.
9	Check hydraulic pump leakage.	Leakage rate within limits. Go to 10.	Leakage rate above rate, change pump.
10	Check motors for leakage.	Both motors within limit. Go to 11.	Either or both motors above limit change motor(s).
11	Check line from tank to pump for blockage.	If clear, got to 12.	If blocked, clear blockage.
12	Check operation of controller.	Operation correct, end of test.	Operation incorrect, change controller (suspect relief valve or spring).

CHAPTER 1-5

TRANSMISSION

CONTENTS

WORKSHOP SPECIAL TOOLS

1 Table 1 lists the workshop special tools required to carry out the procedures detailed in this chapter.

TABLE 1 WORKSHOP SPECIAL TOOLS

Serial (1)	NSN (2)	Designation (3)
1	9ACR/5120-99-867-0382	Wrench, crowfoot, 1-5/16 in. A/F, bihex, 1/2 in. sq drive
2	9ACR/5120-99-867-0381	Wrench, crowfoot, 1-5/8 in. A/F, bihex, 1/2 in. sq drive
3	9ACR/5120-99-867-0374	Crowfoot attachment

LOCALLY MANUFACTURED TOOLS

2 Table 2 lists the locally manufactured tools required to carry out the procedures detailed in this chapter.

TABLE 2 LOCALLY MANUFACTURED TOOLS

Serial (1)	Drawing No. (2)	Designation (3)
1	V 7023/1	Removal tool, gearbox output flange
2	V 7023/2	Extractor for gearbox output flange seal
3	V 7023/5	Gauge checking pin protrusion steering brake adjustment

NOTE

These tools are the same as those nominated in previous publications. Drawings may be demanded from LASS IPT, DLO Andover, Portway, Monxton Road, Andover, Hants, SP11 8HT.

ADHESIVES, SEALANTS AND LUBRICANTS

3 Table 3 lists the adhesives, sealants and lubricants required to carry out the procedures detailed in this chapter.

TABLE 3 ADHESIVES, SEALANTS AND LUBRICANTS

Serial (1)	NSN (2)	Mfr ID (3)	Designation (4)
1	8030-99-220-2370	Hylomar PL32M	Sealing compound
2	9150-99-220-2418	XG 279	Grease, automotive and artillery, 3 kg

GM-ALLISON TX200 AUTOMATIC GEARBOX – FAILURE DIAGNOSIS

4 Table 4 enables a fault to be traced in the gearbox.

NOTES

(1) This table lists only those faults that can be rectified by REME personnel carrying out unit repairs.

(2) All other faults will originate from internal defects that will require the gearbox to be replaced. Gearbox replacement is a field repair.

TABLE 4 GM–ALLISON TX 200 AUTOMATIC GEARBOX - FAILURE DIAGNOSIS

Serial (1)	Symptoms (2)	Probable causes (3)	Action (4)
1	Engine operating effectively but no drive with range selector in any position.	Oil level low.	Fill to correct level.
		Oil filter clogged.	Replace filter element.
		Range selector and TV control linkage out of adjustment.	Adjust linkage.
		Engine coupling disengaged.	Engage disconnector.
2	Engine operating effectively but vehicle loses power with range selector in any position.	Incorrect grade of oil.	Drain system and replenish with correct grade of oil.
		Incorrect adjustment of steering brakes.	Adjust brakes.
		Range selector and TV control linkage out of adjustment.	Adjust linkage.
		Oil level low.	Fill to correct level.
3	No drive in any range.	Oil level low.	Fill to correct level.
		Oil filter clogged.	Replace filter element.
		Range selector linkage out of adjustment.	Adjust linkage.
		Throttle valve out of adjustment.	Adjust control linkage.
4	Vehicle moves forwards or backwards in neutral.	Range selector linkage out of adjustment.	Adjust linkage.
5	Excessive creep in any range except neutral.	Engine idling speed too high.	Adjust to correct idling speed (780 rev/min).
		Governor Oil level low.	Fill to correct level.
6	All gears change speeds too low at full throttle.	Throttle valve out of adjustment.	Adjust control linkage.
7	All gear change speeds too high except lock up-end and 1st to 2nd range at part throttle.	Rear pitot tube loose.	Tighten rear pitot tube mounting bolts.
		Throttle valve control out of adjustment.	Adjust control linkage.

(continued)

TABLE 4 GM–ALLISON TX 200 AUTOMATIC GEARBOX – FAILURE DIAGNOSIS (continued)

Serial (1)	Symptoms (2)	Probable causes (3)	Action (4)
8	No change to 2nd gear and lock-up gear. Change speeds high.	Oil level low.	Fill to correct level.
		Oil filter clogged.	Change filter element.
9	1st to 2nd gear range and all lock-up gear change speeds high.	Oil level low. Oil filter clogged.	Fill to correct level. Replace filter element.
10	Erratic gear changes.	Range selector linkage out of adjustment	Adjust linkage.
		Throttle valve linkage out of adjustment.	Adjust control linkage.
		Governor oil level low.	Fill to correct level.
11	Down change speed too low, misses 2nd gear.	Driver changes manually at too low a vehicle speed.	Correct driving practice.
12	Gear change misses 4th gear.	Rear pitot tube loose.	Tighten rear pitot tube mounting bolts.
13	Gear slip in all gears.	Oil level low. Oil filter clogged, causing low clutch pressure.	Fill to correct level. Replace filter element.
14	Intermittent buzzing noise.	Oil filter clogged. Oil level low.	Replace filter element. Fill to correct level.
15	Oil leak at output shaft.	Output flange seal leaking.	Replace flange seal or retaining bolt sealing ring.
16	Oil leak at rear bearing retainer.	Loose bearing retainer bolts.	Tighten down bolts evenly.
17	Oil thrown from gearbox filler tube.	Dipstick loose.	Secure or replace as necessary.
		Oil level too high.	Drain to correct level.
		Breather pipe blocked or disconnected.	Connect, clean or replace pipe.

(continued)

TABLE 4 GM–ALLISON TX 200 AUTOMATIC GEARBOX – FAILURE DIAGNOSIS (continued)

Serial (1)	Symptoms (2)	Probable causes (3)	Action (4)
18	Gearbox overheating in all ranges.	Oil level low.	Fill to correct level.
		Oil level too high.	Drain to correct level.
		Defective temperature thermo-bulb.	Replace thermo-bulb.
		Power pack airflow restricted.	Clear restriction.
		Defective engine cooling system.	Check and rectify.
		Oil pipes to and from heat exchanger restricted.	Clean or replace oil pipes.
		Oil cooler section of heat exchanger restricted.	Clean or replace oil cooler section.
		Incorrect driving practice.	Do not slip transmission on incline.
19	Dirty oil.	Failure to change at specified interval.	Change oil and replace oil filter element.
		Oil filter element faulty.	Change oil and replace oil filter element.
		Gearbox overheating.	Refer to Serial 18.
20	Vehicle will not tow start (also refer to Serials 1 and 3).	Defective engine.	Check and rectify.
		Defective transmission.	Check and rectify.
		Oil level low in gearbox.	Fill to correct level.

TRANSFER GEARBOX

CAUTIONS

(1) Vehicles should not be towed without first removing or disconnecting the gearbox coupling connecting the main gearbox to the steering unit.

(2) In an emergency, the vehicle may be towed up to half a mile without first removing or disconnecting the gearbox coupling connecting the main gearbox to the steering unit.

(3) In cases of a defective steering unit where it is necessary to tow the vehicle, the drive shafts between the steering unit and final drives must be disconnected.

(4) In the event of final drive failure, the tracks must be removed.

(5) An 'A' frame tow bar should be used and towing must not exceed 16 kph (10 mph).

Outer bearing end caps

5 Unit repairs to the transfer gearbox are to be limited to removing outer bearing end caps, rectifying oil leaks, and repairs to oil pipes. Proceed as follows:

5.1 Remove the bearing end cap. Tap lightly with a hammer shaft to loosen the cap.

NOTE

In the case of the LH cap, it will be necessary to remove the disconnector lever.

5.2 Remove traces of any old jointing compound from the gearbox casing and bearing cap.

5.3 Check the bearing cap for distortion, using a suitable straight edge.

6 To refit, apply the jointing compound (Table 3, Serial 1) to both faces, refit bolts and tighten evenly.

Oil pipes

7 Repairs to, or replacement of, oil pipes to the transfer gearbox may be undertaken as necessary.

NOTE

The gearbox oil filter may be removed with the power pack installed (removing the oil filter with the power pack removed from the vehicle presents no difficulties).

Removing oil filter

8 Remove the access plug from beneath the hull and drain the oil into a clean receptacle. 11 litres (19 pints (approx)) will be drained.

9 Remove the two nuts and bolts from the rear of driver's seat base frame. Fold the seat backrest rearwards, lift the seat and tilt it fully forward.

10 Switch the radio battery master switch to OFF.

11 Slacken the two nuts securing the battery clamp bar. Disconnect the cable from the negative terminal of the battery. Carefully lift the rubber cover from the positive terminal to obtain access to the connector and then disconnect. Similarly disconnect the battery inter-connector from one of the terminals.

12 Withdraw the flexible vent tubes from the batteries and carefully lay the tube assembly to one side. Lift out the batteries and then remove the glass fibre container.

13 Unscrew the four bolts and remove the access plate to expose the filter and cover. Release and remove the filter element end cover securing strap. DO NOT remove the nut from bolt.

14 Remove the end cover plate with gasket. Remove the retainer plate and withdraw the element complete with end gaskets.

Refitting oil filter

15 Clean the gasket surface on the gearbox oil pan and parts that have been removed. Fit a new element complete with new end gaskets and cover the gasket.

16 Insert the new element complete with gaskets into the oil pan aperture, ensuring that the inner end is located and seated correctly.

17 Holding the element, fit retainer plate (dished side towards element) and then refit end cover and gasket. Refit and tighten the end cover securing strap.

18 Refit the access plate, battery container, batteries and the driver's seat in reverse order to removing.

19 Refill the gearbox to the correct level with oil, refer to AESP 2350-T-250-601. Refill the hull access plug.

Gearbox output flange seal

20 In the event of a heavy oil leak from the gearbox output flange, the flange bolt sealing ring and oil seal must be renewed. Obtain tools (Table 2, Serials 1 and 2) before undertaking the removal of flange.

Removing

21 Remove the power pack from vehicle Chap 1-1 refers. Remove the gearbox coupling.

22 Knock back the tab washer against the flange retaining washer.

23 Fit the tool (Table 2, Serial 1) to the output flange, securing firmly with two nuts and bolts. The larger hole between the mounting holes is to allow the use of a 3/4 in. A/F socket spanner.

CAUTION

EQUIPMENT DAMAGE. When the Pitot tube bolts have been slackened, the flange must NOT be turned, as this will cause damage to the rear governor housing and the pitot tubes. Hold flange firmly in one position with tool throughout removal procedure.

24 Slacken the two rear pitot tube mounting bolts at least 1.6 mm (1/16 in.)

25 Holding the flange stationary, use a 3/4 in. A/F socket to unscrew flange bolt. Remove the tab lockwasher and flange bolt sealing ring.

26 Remove the tool from the flange without allowing the flange to turn (chalk marks aligned on flange and housing will assist in seeing that the flange is kept stationary).

27 Reverse the tool and bolt up to flange again. Screw in forcing the bolt to draw the flange off the spines.

28 Using the tool (Table 2, Serial 2) withdraw the seal from the housing. Ensure that the lugs on withdrawal arms are aligned before turning the withdrawal nuts.

Refitting

29 Clean the seal housing with a lint free cloth. Clean off any preservative from the seal itself.

30 Offer up the seal squarely to the seal housing with lip facing towards the gearbox. Using a suitable disc, tap the seal until the outer edge stands 0.8 to 1.2 mm (1/32 in. to 3/64 in.) proud of the housing.

31 Install the output flange coupling, then tap it until it seats against the rear bearing. Hold flange stationary and fit the retaining washer, new seal ring, tabwasher and coupling bolt.

32 Fit holding the tool to the flange and tighten the flange bolt to a torque tightness of 113 Nm to 136 Nm (83 lb/ft to 100 lb/ft).

33 Remove the tool. Stake the tab washer into the recess in the retaining washer then flatten the tab of the washer squarely against a flat on the bolt head.

34 Tighten the Pitot tube bolts to a torque tightness of 14 to 16 Nm (10 to 12 lb/ft). Refit the gearbox coupling.

35 Check the oil level and top up as necessary in accordance with AESP 2350-T-250-601.

GEARBOX OIL TEMPERATURE BULB

36 The gearbox oil temperature bulb sender unit is mounted in the pipe conveying gearbox oil to the heat exchanger. The sender unit is a nickel wire resistance bulb, connected to the temperature gauge on the instrument panel with the connection being made through the power pack junction panel. If the gearbox oil temperature gauge fails to register, locate and rectify the fault as soon as possible.

ROAD TEST

37 At full throttle with the gear selector lever in ranges 1-2, 3-4, 3-5, 6-5, the upward change should occur between 3500/3700 rev/min and the downward change between 2000/2500 rev/min.

38 The gear engagement should be stable, with no hunting occurring between the gears when driving conditions remain steady.

39 Gearbox oil temperature should not exceed 105 deg C (220 deg F) (vehicle gauge reading).

40 If the gear changes occur outside the figures given in Para 37, adjust the gearbox throttle valve control and check the driver's gear range selector linkage adjustment, Chap 3 refers.

GEARBOX COUPLING AND UNIVERSAL JOINTS

Removing

41 Remove the front sealing panel and the rear detachable cover from the power pack compartment.

42 Remove the bolts at the steering unit connecting the flange.

NOTE

It may be necessary to move the vehicle slightly to position the bolts for ease of access.

43 Disengage the dis-connector to enable the coupling to be turned at the gearbox. Remove the flange bolts, and then lift out coupling.

Dismantling

44 Remove one of the bearing end cap covers. Remove any paint from yoke holes, which may impede removal of bearing cap.

45 Hold the joint in one hand, tap lightly with a hide face hammer on the radius of the lug of the yoke. The needle bearing will gradually emerge and can finally be withdrawn.

46 If the bearing proves excessively tight, it can be removed by tapping it up from the underside of the yoke, taking care not to damage it. This operation will destroy the cork seal and necessitate new parts being fitted upon assembly.

47 Repeat the operation for the opposite bearing and then remove yoke. Rest the two exposed trunnions on wood or lead blocks and tap case of flange yoke to remove remaining needle bearings.

Maintenance

48 Clean all parts thoroughly.

49 Inspect the coupling yokes and flanges for signs of cracking. Check the flange boltholes for signs of elongation.

50 Inspect the needle roller bearing cups for wear and tear. Check the fit of cups in yoke holes. Inspect the needle rollers for flattened areas and wear.

51 Inspect the trunnions for wear and indentation. Check that the lubricant drillings are clear.

52 Inspect the cork seal retainers for damage. Renew the flange drive bolts if stretched or damaged.

Assembling

53 Assemble the needle rollers in the bearing cups, smearing the cup walls with grease to retain rollers. Using new cork seals, fit the seals and retainers on the spider journal, using a tubular drift.

54 Insert the spider journal into the flange yoke holes, and then tap the bearing into position using a soft round drift smaller in diameter than the yoke hole. Repeat the operation for the remaining three bearings.

55 If, when assembled, the joint tends to bind, tap lightly with a wooden mallet this will relieve pressure of bearings on end of the trunnions.

56 Assemble the other universal joint by repeating this procedure. Apply a grease gun and charge the universal joints with grease (Table 3, Serial 2).

Refitting

57 Refit the gearbox coupling on vehicle. Tighten the nuts to 47 Nm (35 lbf/ft).

STEERING UNIT

WARNING

ASBESTOS. THIS STEERING BRAKE BANDS USED ON THIS EQUIPMENT CONTAINS ASBESTOS. NO ATTEMPT IS TO BE MADE TO WORK WITH ASBESTOS MATERIALS WITHOUT CONFORMING TO DEPARTMENTAL/UNIT INSTRUCTIONS.

NOTE

Instances have occurred of nuts securing rear-mounting bracket to steering unit working loose. Nuts should be retightened to a torque of 81 to 88 Nm (60 to 65 lbf/ft).

Steering brake adjustment

58 Referring to Fig 1, open the steering unit access cover on vehicle front plate. Adjust each brake as follows:

58.1 Remove the top cover (5) and gasket (4) from the steering unit. Examine the gasket and renew if unserviceable. DO NOT refit the gasket on the steering unit until the cover is to be fitted.

58.2 Adjust the steering linkage, if necessary, at the vertical rod until, with steering lever in OFF position against the stop on bracket, protruding face of operating pin (7) is 7 mm (0.280 in.) proud of housing and roller (8) is in contact with the pin (use gauge Table 2, Serial 3).

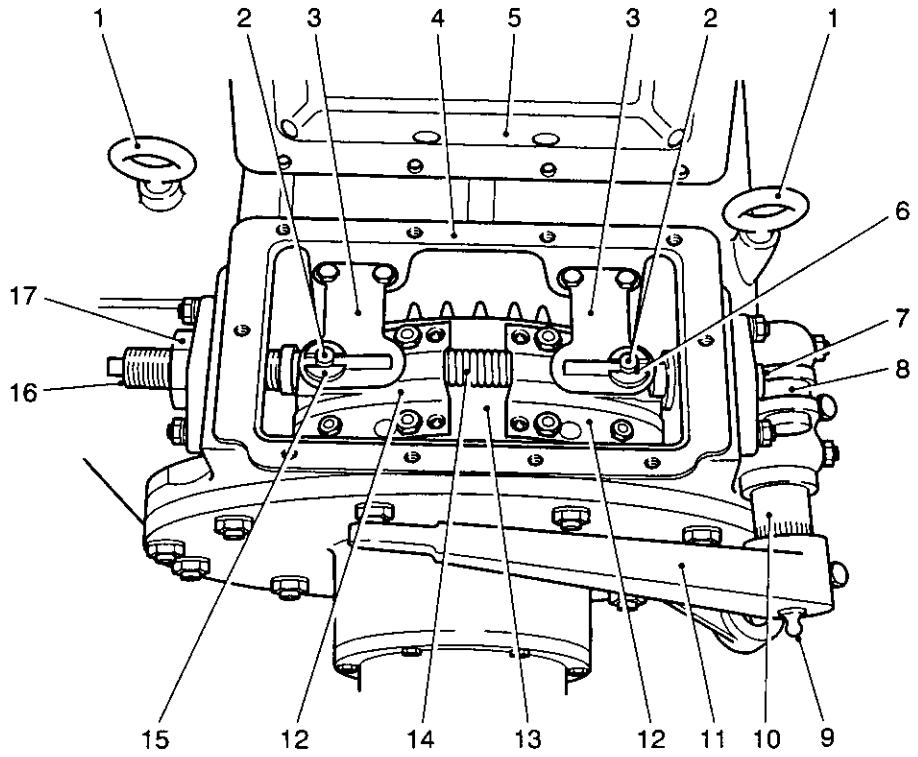
58.3 Release the locknut (17). Screw in the adjustable pin (16) until the brake band (12) is contacting the drum (13). Unscrew the pin (16) two turns and tighten the locknut.

58.4 Slacken the band suspension nuts (6) and push the studs (2) hard down.

58.5 Tighten the lower nut until the slider (15) is just held on slide plate (3). Tighten a further one and a half turns and lock.

58.6 Measure the total lever free travel at the top of each lever. Using two fingers around steering levers there should be a total of 152 mm (6 in.) of travel from fully OFF to ON position (when resistance is felt).

58.7 When correctly adjusted, refit the top cover and gaskets then close the access cover.



1	Lifting eye	10	Operating shaft
2	Suspension on stud	11	Operating lever
3	Guide plate	12	Brake band
4	Gasket	13	Brake drum
5	Top cover	14	Return spring
6	Locknut, suspension stud	15	Slider
7	Operating pin	16	Adjusting screw
8	Roller	17	Locknut, adjustable pin
9	Lubricating nipple		

Fig 1 Steering brake adjustment

Removing steering brake band

59 Referring to Fig 1, chock the road wheels to prevent movement of the vehicle. Ensure that the steering levers are in the OFF position and open the steering unit access cover on the vehicle front plate.

60 Remove the top cover (5) and gasket (4) from the steering unit casing.

61 Release the locknut (17) and screw out the adjusting screw (16) until the end of the pin is flush with the screw housing on the inside of the casing.

62 Disconnect the brake-band operating lever (11) from the vertical rod, by removing the clevis pin.

63 Remove the band suspension nuts from the two saddle studs (2). Remove the sliders (15) from the studs (2).

64 Remove the two guide plates (3) by removing the bolt-securing plates.

CAUTION

EQUIPMENT DAMAGE. Personnel are to ensure that care is taken to prevent locking wire and nuts from falling inside steering unit.

65 Remove the locking wire and nuts securing the two saddle assemblies. Remove the saddle assemblies together with the coiled return spring.

66 Remove the brake band (12) through access by sliding it around the drum.

NOTE

Turning the input shaft of steering unit slowly and revolving brake drum can assist operation of brake band removal. To do this, it will be necessary to disconnect the gearbox coupling and both half shafts from steering unit.

67 Repeat for the brake band on the other side.

Refitting

68 Refit in the reverse order to removing, ensuring:

68.1 The points of the chevrons formed by the grooved pattern in the band lining are pointing in the opposite direction to normal rotation of brake drum (brake drums rotate backwards in a forward gear).

68.2 Check the free length of the coiled return spring before refitting. This should be seven inches approx when new.

68.3 Check that the clearance between each slider and guide plate slot is within 0.6 mm (0.025 in.) and 1 mm (0.040 in.).

68.4 Adjust the brakes. See Para 58. Renew the cover gasket if necessary.

Steering unit oil tank

NOTE

The steering unit oil tank cannot be removed unless the power pack is removed from the vehicle.

Removing

69 Drain the steering unit oil tank, preferably while the steering unit is still warm. Use a suitable a container to accept 20 litres (35 pints) approx (system capacity 23 litres (40 pints)).

70 Slacken the hose clip at the tank filler hose connection to the pipe stub on tank. Twist the filler cap assembly anti-clockwise, bearing on the two vertical lugs; then lift out filler cap complete with the filler hose and the dipstick.

71 Disconnect the feed pipe to the steering unit at the pipe union on the steering unit. Disconnect the flexible pipe from the heat exchanger, at the oil tank.

72 Disconnect the breather assembly from its connections on the oil tank and the steering unit. Remove the nuts securing the steady bracket and remove the breather assembly complete. Temporarily refit the steady bracket nuts.

73 Remove the tank strap nuts, then lift the tank to clear straps. Secure the seating pads as the tank comes clear.

Servicing

74 Remove the tank aperture cover plate to clean the interior. Remove the tank outlet pipe. Remove the pipe adaptor, withdrawing the outlet pipe strainer with it.

75 Clean the tank interior, using steam if available. Remove all sludge from the tank and de-frothing tray. Check that the internal baffle plate is secure.

76 Clean the gauze strainer (8 mesh), renew the strainer and the pipe adaptor if damaged (note condition and content of any sludge trapped on the strainer exterior).

Refitting

77 Refit all of the components in reverse order to removing. Use new gaskets where necessary.

HALF SHAFTS

Removing LH half shaft

78 Open the steering unit access cover.

79 Bend back the tab washers securing the bolts on the inner sides of the coupling rings, i.e. those nearest to the centre of the half shaft. Remove the bolts and the semi-circular retaining plates beneath them.

80 Slide the coupling rings off the driving teeth towards the shaft centre. Secure the spring clip and the O-ring seal on each side as coupling ring displaces them from their mounting shoulder on the shaft.

Refitting LH half shaft

81 Lubricate the coupling ring teeth (Table 3, Serial 2).

82 Offer up the shaft to driving and driven flanges. Engage the coupling rings. Slide the O-ring into the annular gap between each coupling ring and shaft shoulder, followed by the spring ring.

83 Renew tab washers before fitting the retaining plates and bolts. Tighten the 1/4 in. x 3/4 in.'T' steel set screws to 11 Nm (8 lb/ft), and secure with tab washers.

Removing RH half shaft

84 Disconnect the accelerator linkage at the pedal connection.

85 Remove the driver's floor plate.

86 Remove the nuts and bolts securing the two halves of the half shaft cowling, lift off the cowling and accelerator pedal assembly.

87 Repeat the removal procedure as detailed in Para 78 to 80.

Refitting RH half shaft

88 Refit as detailed in Para 81 to 83. Refit the half shaft cowling floor plate and connect the accelerator pedal linkage.

NOTE

When fitting replacement O-rings, the O-ring has to be stretched to pass over the teeth of the flange. This must be done carefully to avoid tearing the O-ring wall. A piece of brass shim, wrapped over the teeth, will protect the O-ring when fitting.

CHAPTER 2-0

FINAL DRIVE, SUSPENSION AND TRACKS – LIST OF CHAPTERS

CONTENTS

LIST OF CHAPTERS

1 This chapter is further sub-divided as follows:

CHAPTER 2-1

FINAL DRIVE

CONTENTS

WORKSHOP SPECIAL TOOLS

1 Table 1 lists the workshop special tools required to carry out the procedures detailed in this chapter.

TABLE 1 WORKSHOP SPECIAL TOOLS

Serial (1)	NSN (2)	Designation (3)
1	9ACR 5120-99-823-3286	Wrench main drive shaft
2	9ACR 5120-99-866-9593	Spanner, brake band, adjustable pin locknut
3	9ACR 5120-99-867-0383	Wrench, crowfoot, 1-1/8 in. A/F, bihex, 1/2 in. sq drive
4	TBA	Wrench, crowfoot, 1-5/16 in. A/F, bihex, 1/2 in. sq drive

LOCALLY MANUFACTURED TOOLS

2 Table 2 lists the locally manufactured tools required to carry out the procedures detailed in this chapter.

TABLE 2 LOCALLY MANUFACTURED TOOLS

Serial (1)	Illustration No. (2)	Designation (3)
1	V 7023/1	Removal tool, gearbox output flange
2	V 7023/2	Extractor for gearbox output flange seal
3	V 7023/3	Gauge measuring end float, final drive main shaft
4	V 7023/4	Gauge measuring end float, final drive pinion shaft
5	V 7023/5	Gauge checking pin protrusion steering brake adjustment

NOTE

Drawings may be demanded from LASS IPT, DLO Andover, Portway, Monxton Road, Andover, Hants, SP11 8HT.

ADHESIVES, SEALANTS AND LUBRICANTS

3 Table 3 lists the adhesives, sealants and lubricants required to carry out the procedures detailed in this chapter.

TABLE 3 ADHESIVES, SEALANTS AND LUBRICANTS

Serial (1)	NSN (2)	Mfr ID (3)	Designation (4)
1	9150-99-220-2418	XG 279	Grease, automotive and artillery

SPROCKETS

4 Sprockets are rings fitted with recessed faces on lugs facing away from the sprocket hub so that the lip of the recess holds a flat on the bolt head. One lug of each flange of the hub has a dowel and one lug of each sprocket ring has a dowel hole, to ensure the correct location of rings.

Removing sprocket rings

5 Break the track and pull the top run clear of the sprocket (AESP 2350-T-250-201 refers).

NOTE

Whenever a track is broken to service the sprocket rings, pull the sprocket outwards to test for excessive end float. To adjust the end float, refer to Para 31.

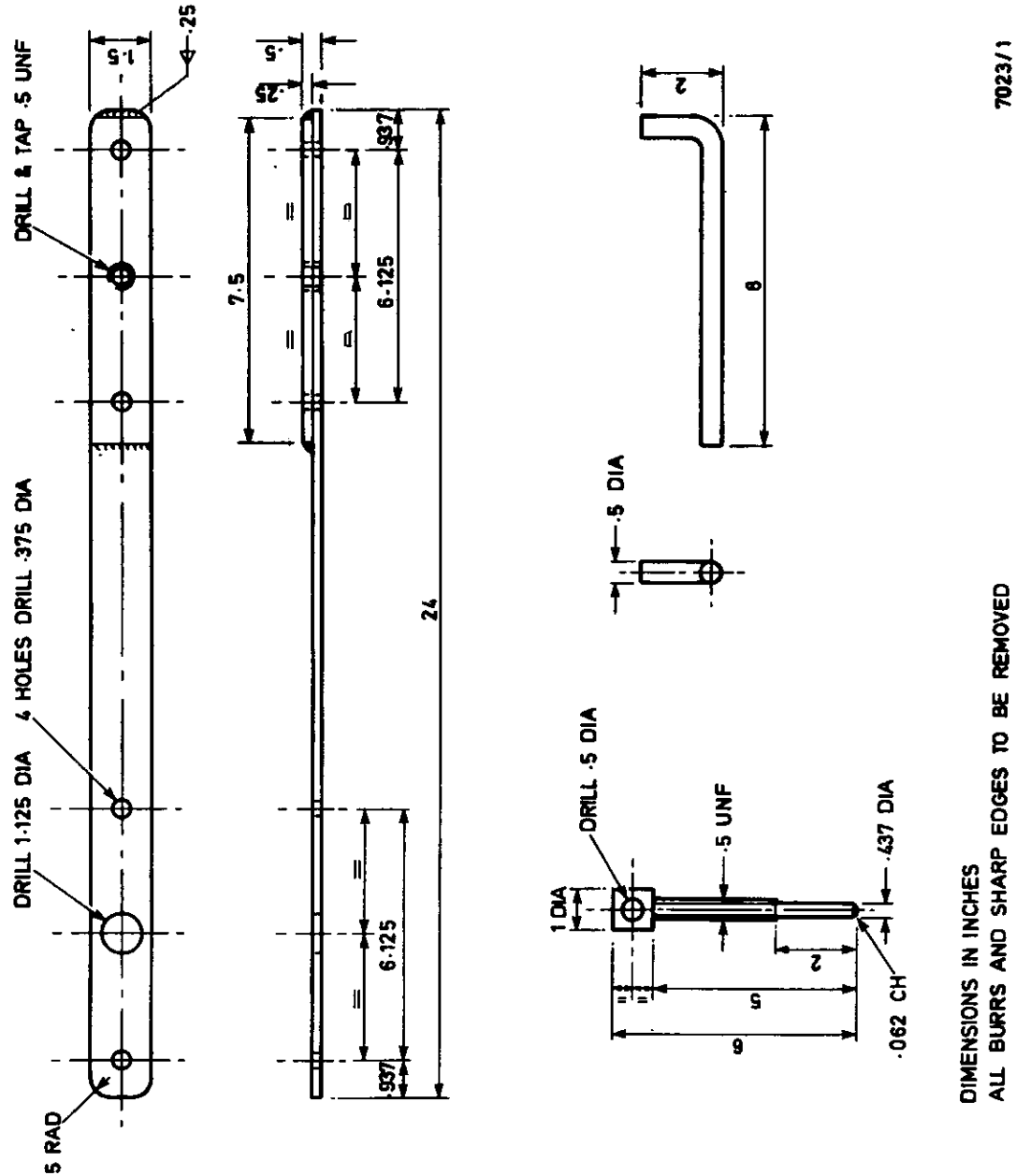
6 Remove the bolts securing the outer ring, remove the ring from the hub.

7 Remove the bolts securing the inner ring. Remove the ring by turning it to allow the lugs to pass between bolting lugs on the hub.

8 Renew any bolts, nuts or spring washers that are damaged.

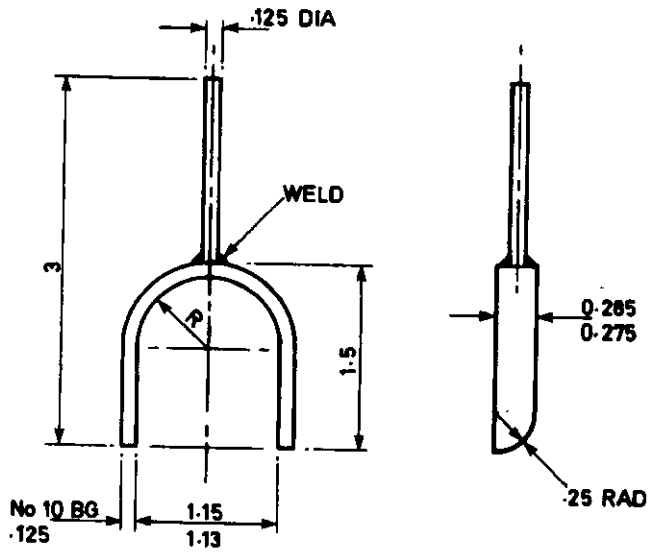
Refitting sprocket rings

9 Inspect the sprocket rings for wear before refitting and consider whether sprocket ring reversal is justified.



TITLE FIG 1 REMOVAL TOOL, GEARBOX OUTPUT FLANGE	VEHICLES & WEAPONS BRANCH REME	
	PROJ NO 70911	DRG NO V7023/1

A3



MATERIAL : MILD STEEL
DIMENSIONS IN INCHES

7023/5

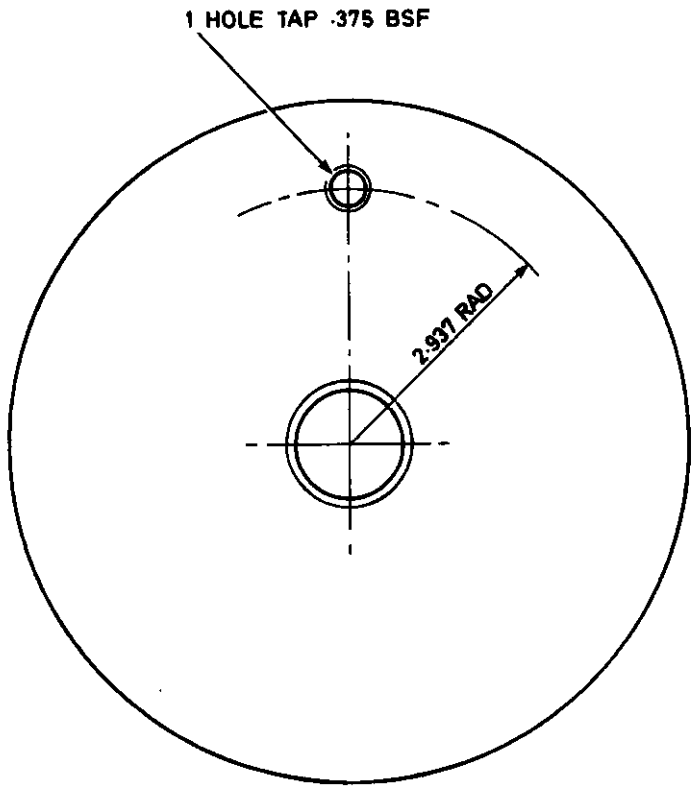
TITLE FIG 5
GAUGE CHECKING PIN PROTRUSION
STEERING BRAKE ADJUSTMENT

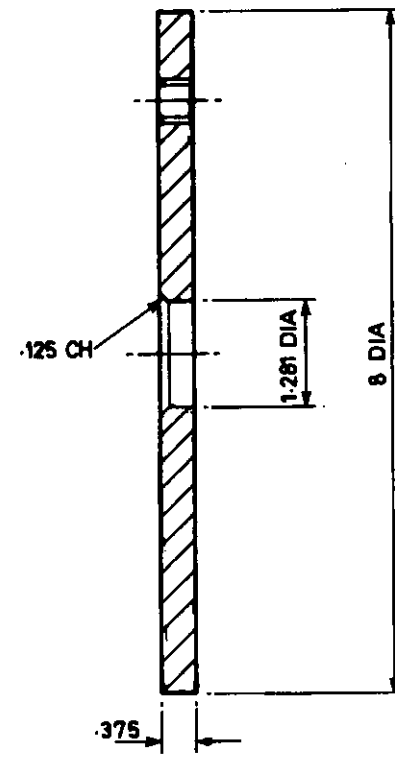
VEHICLES & WEAPONS BRANCH REME

PROJ NO 7091

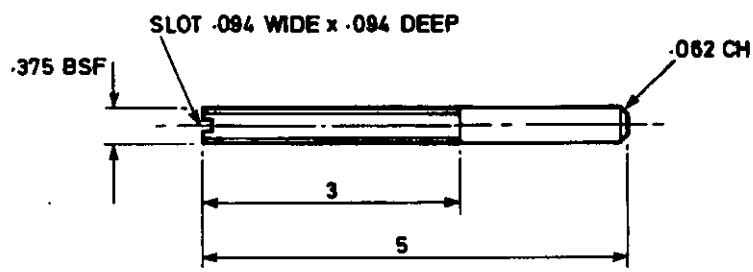
DRG NO V7023/5

A3





MATERIAL : MILD STEEL 1 - OFF
SUPPORT PLATE



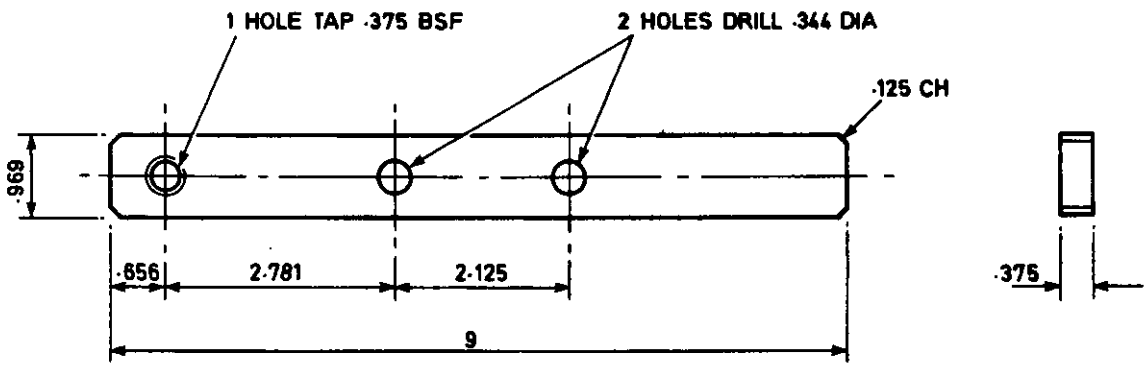
MATERIAL : MILD STEEL 1 - OFF
INDICATOR PIN

DIMENSIONS IN INCHES

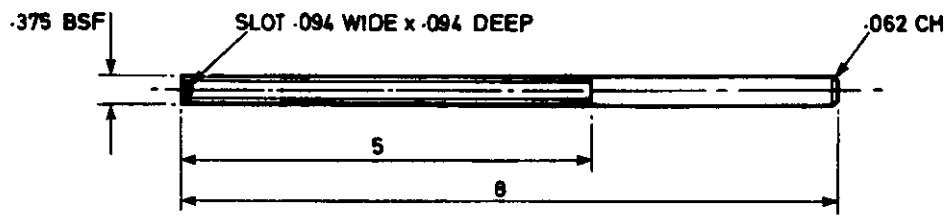
7023/4

TITLE	FIG 4 GAUGE, MEASURING ENDFLOAT, FINAL DRIVE PINION SHAFT
	VEHICLES & WEAPONS BRANCH REME
PROJ NO 70911	
DRG NO V7023/4	

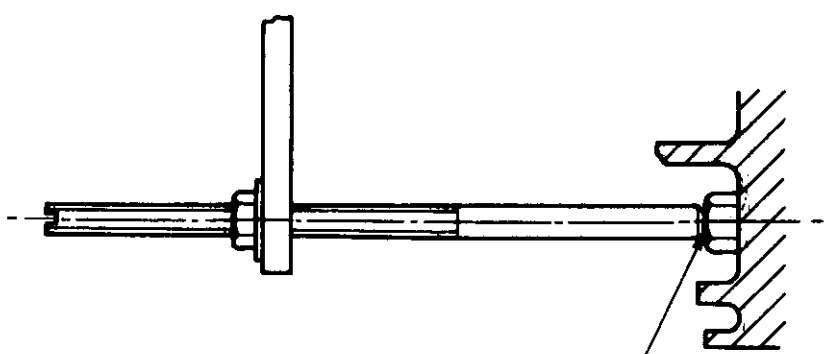
A3



MATERIAL : MILD STEEL 1 - OFF
SUPPORT BAR



MATERIAL : MILD STEEL 1 - OFF
INDICATOR PIN



WITH SHAFT PUSHED INWARDS SET ·002 CLEARANCE USING FEELER GAUGE
PULL SHAFT OUTWARDS AND MEASURE INCREASED CLEARANCE

DIMENSIONS IN INCHES

7023/3

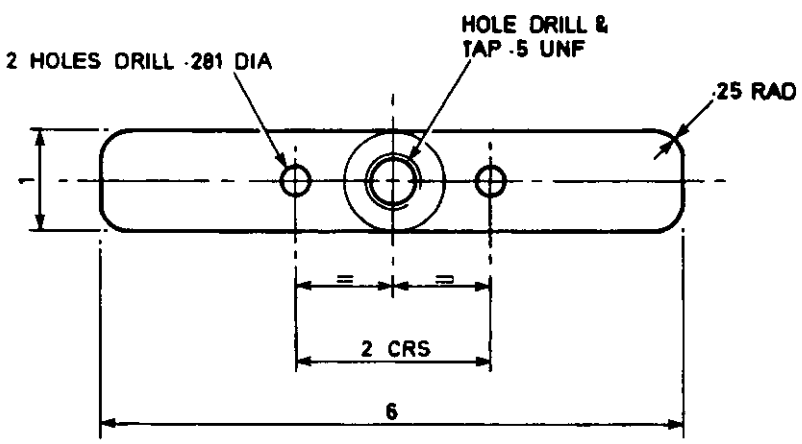
TITLE
FIG 3 GAUGE, MEASURING ENDFLOAT, FINAL DRIVE MAINSHAFT

VEHICLES & WEAPONS BRANCH REME

PROJ NO 7091

DRG NO V7023/3

A3



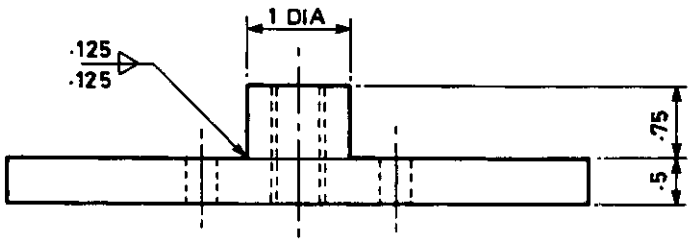
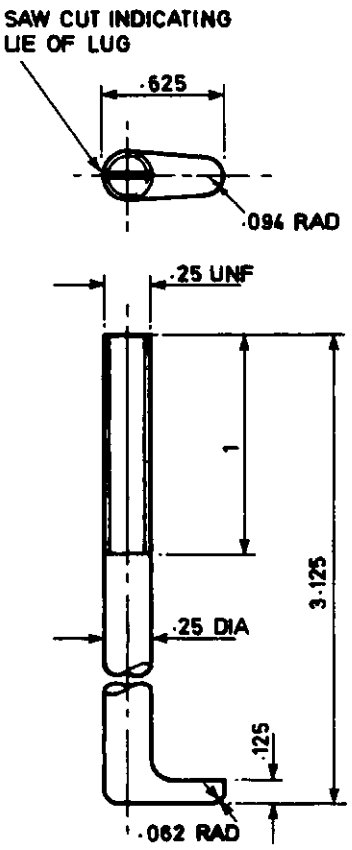


PLATE 1 - OFF
MATERIAL : MILD STEEL



HOOK 2 - OFF
MATERIAL : MILD STEEL

ALL BURRS AND SHARP EDGES TO BE REMOVED
DIMENSIONS IN INCHES

7023/2

TITLE
FIG 2 EXTRACTOR FOR GEARBOX OUTPUT FLANGE SEAL

VEHICLES & WEAPONS BRANCH REME

PROJ NO 70911

DRG NO V7023/2

A3

2350-T-250-522

10 Fit the inner ring first, locating ring on dowel. Fit the securing bolts from the outside so the lip of the sprocket recess holds one flat on each bolt ensure girder section lock washers are used.

11 Tighten the nuts to a torque tightness of 41 Nm (30 lbf/ft). Re-join the track and adjust the track tension. The sprocket ringbolts must be tested for tightness daily for three days after reversal or renewal of the sprocket rings.

Removing sprocket hub

WARNING

HEAVY WEIGHT. EACH SPROCKET HUB, COMPLETE WITH RINGS, WEIGHS 86 KG (190 LB). DUE CONSIDERATION SHOULD BE GIVEN TO THE REGULATIONS GOVERNING THE HANDLING OF HEAVY WEIGHTS.

12 Chock the vehicle to prevent movement. Remove the forward section of the track guard. Remove the sand shield. Break the track and pull top run clear of the sprocket (AESP 2350-T-250-201 refers).

13 Remove the locking wire, two bolts and locking plate. Remove the sprocket locknut, using the wrench main drive shaft (Table 1, Serials 1 or 4).

14 If not already marked, lightly centre punch the shaft and sprocket hub to ensure mating the splines when refitting.

15 Draw the sprocket off the main shaft splines.

NOTE

Two shims, 12 SWG. and 18 SWG, are fitted on the main shaft and bear against the inner track of the taper roller race. Ensure that these shims are not accidentally withdrawn with the sprocket hub and damaged or lost, or steering drift will occur due to misalignment of sprocket hub.

Refitting sprocket hub

16 Before refitting the sprocket assembly, smear the labyrinth recess liberally with grease (Table 3, Serial 1).

17 Offer up the sprocket to the output shaft, aligning the punch marks referred to in Para 14. Fit the hub locknut and tighten fully with ring spanner. Ensure that the locknut butts firmly against hub shoulder.

NOTE

During initial servicing and vehicle inspection periods, the hub locknut must be checked for tightness.

18 Fit the locknut locking plate and the two securing bolts. Wire the bolts securely.

19 Connect the track and adjust the track tension. Lubricate the hub with a grease gun, until clean grease (Table 3 Ser 1) exudes from the hub inner end.

20 Fit the sand shield and the track guard section.

MAIN SHAFT OIL SEAL

Removing

21 Drain the oil from final drive casing.

22 Remove the sprocket hub; refer to Para 12 to 15.

23 Remove the ring of bolts on the oil seal housing. Using the two jacking bolts in the holes provided remove the seal housing. Secure the shims located under seal housing.

24 Press out the back-to-back oil seals from the housing, using a suitable disc.

Refitting

25 Fit the replacement seals in the housing, with the lip of inner seal facing inwards (towards hull),and the outer seal lip facing outwards. Use a suitable disc to enter the seals squarely in housing.

26 Ensure that there are no burrs or nicks on the oil seal sleeve, as these will damage the seal. Carefully dress any imperfections with a carborundum slip or a well chalked dead smooth file. The surface of the seal sleeve is highly polished during manufacture and this finish must be maintained to ensure good sealing.

27 Refit the shims originally removed, renewing any that are damaged (these shims are supplied in thicknesses of 0.13 mm, 0.18 mm and 0.51 mm (0.005 in., 0.007 in., and 0.020 in.).

28 Fit the oil seal housing, pulling down the bolts evenly around housing. At this point check the main shaft end float. See Para 31.

29 With the end float at the correct figure, refit the sprocket hub refer to Para 16 to 20.

30 Fill the final drive with oil to the correct level AESP-2350-T-250-601 refers. Ensure that the filler cap and the drain plug gaskets are in good condition.

Main shaft end float

31 Shims fitted under the oil seal housing maintain the main shaft end float at 0.1 mm (0.004 in.) to 0.15 mm (0.006 in.). Wear in the main shaft bearings will cause the end float to increase.

32 If, when the track has been broken, pulling outwards on the sprocket reveals that excessive end float is present the sprocket hub and the seal housing must be removed to adjust shim thickness.

33 To measure end float, referring to Fig 1, carry out the following:

33.1 Obtain tool (Table 2, Serial 3).

33.2 Remove the oil seal housing, bolt from the 12 o'clock position on the housing. File or machine bolt the head to remove any embossed characters and leave the head perfectly flat, reducing the bolt head thickness as little as possible. Refit the prepared bolt.

33.3 Bolt the support bar to the locking plate recess, adjusting the indicator pin so that it is well clear of the machined bolt head but aligned with it.

33.4 With a block of wood, bump the end of main shaft to take up all end float.

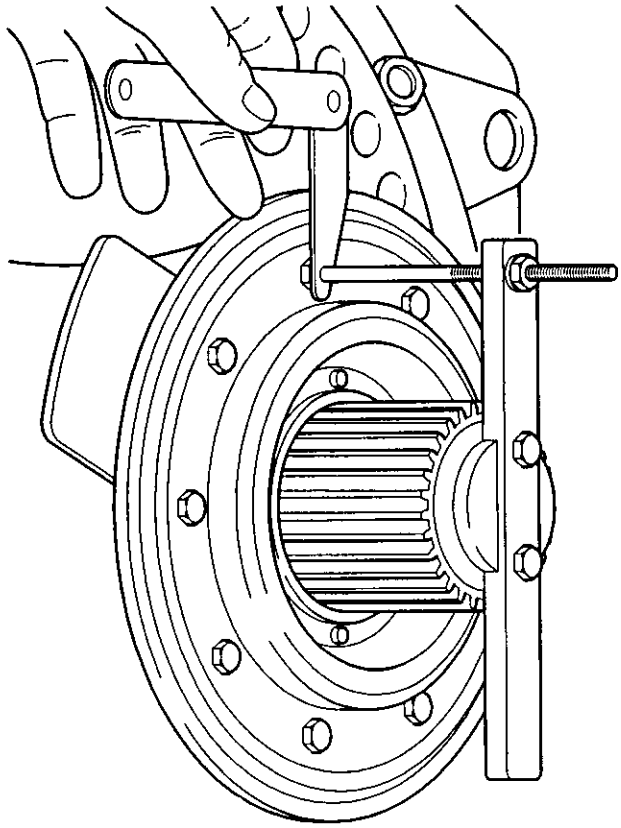


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Fig 1 Checking final drive main shaft end float

33.5 With a feeler gauge, carefully set the end of the indicator pin so that it is 0.05mm (0.002 in) from the machined bolt head (Fig 1). Steady the pin by locking the locknut. Check the set clearance after tightening.

33.6 Pull squarely on the support bar to pull out the main shaft to limit of the end float. Measure the now increased clearance between the bolt head and the indicator pin this should be between 0.16 mm (0.006 in) and 0.2 mm (0.008 in) allowing for the initial 0.05 mm (0.002 in) setting.

33.7 Remove the tool and adjust the shim thickness as necessary. Recheck after adjustment until satisfactory.

33.8 Refit all parts removed.

INPUT PINION SHAFT OIL SEAL

Removing

34 Disconnect and remove the appropriate half shaft, Chap 1-5 refers.

35 Remove the split pin, castellated nut and flat washer securing pinion shaft driving flange. Withdraw the driving flange from the pinion shaft.

NOTE

Use 1-7/8 in. A/F spanner.

36 Remove the ring of bolts around the oil seal housing. Remove the seal housing, tapping slightly with a hammer shaft to loosen. Secure the shims located under the seal housing.

37 Press out the oil seal from the housing using a suitable disc.

Refitting

38 Ensure that the seal housing is clean. Clean off any preservative from the new seal. Ensure there are no nicks or burrs on the seal facing of the driving flange. Carefully dress any such imperfections with a carborundum slip or a well chalked dead smooth file.

39 Fit the replacement oil seal in the housing with the lip of the seal facing inwards (towards the roller bearing). Use a suitable disc to enter seal squarely in the housing.

40 Refit the shims originally removed renewing any that are damaged (these shims are supplied in thicknesses of 0.13 mm (0.005 in) and 0.18mm (0.007 in)).

41 Fit the oil seal housing but at this stage DO NOT tighten down the bolts.

42 Fit the driving flange to the pinion shaft to centralise the seal housing. At this point remove the flange and check the pinion shaft end float, refer to Para 45 to 54.

43 With the end float at the correct figure refit the driving flange, flat washer and nut. Tighten the nut and fit split pin.

44 Refit the half shaft Chap 1-5 refers.

PINION SHAFT END FLOAT

45 The shims fitted under the oil seal housing maintain the pinion shaft end float at 0.1 mm (0.004 in) to 0.16 mm (0.006 in). Wear in the pinion shaft will cause the end float to increase.

46 If, when the half shaft has been removed, pulling outwards on driving flange reveals that excessive end float is present the driving flange and oil seal housing must be removed (refer to Para 34 to 37) to adjust shim thickness.

Measuring end float

47 Obtain tool (Table 2, Serial 4).

48 Remove the oil seal housing bolt from the 6 o'clock position on the housing. File or machine bolt head to remove any embossed characters and leave the head perfectly flat, reducing bolt head thickness as little as possible. Refit the prepared bolt.

49 Bolt the support bar to the locking plate recess, adjusting indicator pin so that it is well clear of machined bolt head but aligned with it.

50 With a block of wood, bump the end of the main shaft to take up the entire end float.

51 With a feeler gauge carefully set the end of the indicator pin so that it is 0.05 mm (0.002 in) from machined bolt head. Steady the pin by locking locknut. Check the set clearance after tightening.

52 Pull squarely on the support bar to pull out main shaft to limit of end float. Measure the now increased clearance between the bolt head and indicator pin, this should be between 0.15 mm (0.006 in) and 0.2 mm (0.008 in) allowing for the initial 0.05 mm (0.002 in) setting.

53 Remove the tool and adjust shim thickness as necessary. Recheck after adjustment until satisfactory

54 Refit all parts removed.

CHAPTER 2-2

SUSPENSION AND TRACKS

CONTENTS

(continued)

CONTENTS (continued)

WORKSHOP SPECIAL TOOLS

1 Table 1 lists the workshop special tools required to carry out the procedures detailed in this chapter.

TABLE 1 WORKSHOP SPECIAL TOOLS

Serial (1)	NSN (2)	FV No. (4)	Designation (3)
1	9ACR/5120-99-866-9582	300731	Guide pin torsion bar
2	9ACR/5120-99-866-9595	559795	Gauge, axle arm setting
3	9ACR5120-99-801-3874	585704	Rod straight headless
4	9ACR/5120-99-866-9590	538376	Puller mechanical
5	9ACR/5120-99-866-9591	538377	Sleeve, bearing, puller
6	9ACR/5120-99-866-9592	559551	Tool, assembling, wheel hub
7	9ACR/5120-99-804-7599	585703	Jacking mandrel

ADHESIVES, SEALANTS AND LUBRICANTS

2 Table 2 lists the adhesives, sealants and lubricants required to carry out the procedures detailed in this chapter.

TABLE 2 ADHESIVES, SEALANTS AND LUBRICANTS

Serial (1)	NSN (2)	Mfr ID (3)	Designation (4)
1	9150-99-991-1124	OMD 90	Lubricating oil, engine
2	9150-99-220-2418	XG 279	Grease, automotive and artillery
3	8030-99-224-8707	Loctite 270	Locking sealant
4	8030-99-220-2370	Hylomar PL32M	Sealing compound
5	8030-99-225-0098	EC 1099	Adhesive

WEIGHTS OF MAJOR COMPONENTS

3

3-1	Road wheel (single)	33 kg (73 lb).
3-2	Wheel hub	25 kg (56 lb).
3-3	Axle arm	37 kg (80 lb).
3-4	Torsion bar	19 kg (42 lb).
3-5	Shock absorber	13 kg (29 lb).
3-6	Guide roller (less bracket)	16 kg (36 lb).
3-7	Guide roller bracket	12 kg (27 lb).

ROAD WHEELS AND TRACK ADJUSTING WHEELS

4 The wheels are interchangeable. To overcome the loosening of the wheel bolts, a load spreader ring is fitted under the heads of the bolts.

WHEEL HUB BEARINGS

5 With all other components serviceable and secure, renew the bearings when rim rock (measured at wheel periphery) exceeds 4.8 mm (3/16 in.). Checking for road wheel hub play

5.1 The road wheel hub bearings are not adjustable but up to 4.7 mm (3/16 in.) rocking movement at the rim of the wheel is permissible. Rim rock in excess of this amount must be reported.

5.2 Raise the axle arm until the wheel is clear of the track (see Paras 19 to 26).

5.3 Check that the wheel moves freely without snagging or tight spots.

5.4 Grasp the top of the outer tyre with both hands and test for rock by pushing and pulling on the wheel. Repeat this with the wheel rotated in quarter turns.

5.5 If the rocking movement at the rim exceeds the limit given or if the wheel does not rotate freely, report the condition.

5.6 Lower the wheel.

5.7 Repeat the procedure for each of the other road wheels.

Removing hub

CAUTION

EQUIPMENT DAMAGE. DO NOT keep an axle arm jacked up for excessively long periods, as this will adversely affect the torsion bar.

6 Slacken the road wheel nuts (8 off) on the hubs affected.

7 Jack up the axle arm until it is clear of the track horn using the jacking mandrel (Table 1 item 7) and remove the road wheels (AESP 2350T-250-201). The wheels are a close fit on the hub and removal of the studs makes the wheel easier to remove.

8 Rotate the hub so that the oil filler plug is at the 6 o'clock position. Remove the plug and allow the oil to drain into a suitable container.

9 Remove the bolts securing the hubcap. Remove the hubcap and paper washer.

10 Knock up the tab washer on the stub axle nut. Slacken and remove the nut, tab washer and thick distance washer.

11 Using the puller bearing (Table 1, Serial 4), pull off the hub complete with bearings and the seal housing.

NOTES

(1) If the apparent condition of oil seal does not warrant dismantling, it is advisable to leave the oil seal housing intact on the stub axle as the hub is removed. Taking the seal housing off with the hub splits the oil seal into two parts and increases the possibility of damaging the seal faces and Torus rings and of collecting dirt as it is reassembled. Therefore, where it is desired to leave the oil seal intact, remove the six bolts from the oil seal housing before applying bearing puller to the hub. Then fit bearing puller and commence removing the hub. Ensure to stop the seal housing from leaving the labyrinth and so parting the seal (renewal of the paper gasket between the seal housing and hub must not be forgotten when refitting hub).

(2) To remove the hubs on stations 1 and 5, first slacken off the track adjustment fully. Additionally, support the appropriate hull corner with blocks or skidding. When the track adjusting wheel has to be removed, to clear the wheel, break the track under the track adjusting wheel and pull the top run of the track forward. Chock the road wheels to prevent the vehicle from rolling.

Dismantling hub (removed complete with seal housing)

12 Remove the bolts securing the seal housing to the hub. Remove the housing and paper washer. Keep the seal housing away from dirt and accidental damage. Use protective tape over seal face and groove.

13 Place protective tape over the half of the seal remaining in the labyrinth groove. Protect completely.

14 Remove the inner track and rollers of the roller bearing. Pull the distance piece out of hub.

15 Using a suitable drift, tap out the ball race and the outer track of the roller race.

Assembling hub

16 Ensure that the hub interior is clean (pay particular attention to bearing recesses).

17 If replacement bearings are to be fitted, clean and remove all traces of preservative. Smear the ball race with oil (Table 2, Serial 1) to aid in fitting. Carefully enter the bearing in the recess, using a hide hammer, then tap home carefully.

18 Clean, examine and refit the distance piece in the hub.

19 Insert the roller bearing inner track. Clean the mating faces seal the housing to the hub. Use a new paper gasket between faces. Tighten the bolts evenly.

20 Observe precautions regarding the fitting of the oil seal halves (refer to Para 34). Clean the groove in the labyrinth and test the condition of the groove, all round with fingertip.

21 Fit the seal halves in the hub and labyrinth and protect against dirt until the moment of mating the seal faces.

Refitting assembled hub

22 Clean the stub axle surfaces and ensure that the bearing diameters are smooth and are without any burrs or scratches. Carefully dress out any such blemishes with a carborundum slip.

23 Offer the unassembled hub to stub axle. Assemble the tool assembly wheel hub (Table 1, Serial 6) to the hub and press hub fully home.

24 Fit thick spacer washer, tab washer (check for serviceability) and axle nut. Fit the road wheels and tighten the wheel nuts sufficiently to remove all shake from the wheels.

Hub bearing-pull off test

NOTE

If the pull off test is carried out with the road wheel fitted ensure that the wheel rims do not foul track horns when the wheel is rotating.

25 The axle nut is to be tightened up fully. Rotate the hub a few times. Fit the road wheel and using a spring balance hooked onto a hole on the wheel rim, a tangential pull of 1.8 to 2.2 kg (4 to 5 lb) should rotate the wheel on initial assembly. After road test, recheck the hub adjustment tighten the axle nut if necessary. A tangential pull of 0.9 to 1.3 kg (2 to 3 lb) should rotate the wheel.

26 Check rim rock. There should be no perceptible rim rock and the wheel should spin freely with no dragging. In this condition seals are correctly preloaded.

27 Bend down the tab washer accurately to a flat on nut. Fit the hubcap using new paper gasket. When refitting the hubcap ensure that a gap of 0.508 mm and 1.525 mm (0.020 in and 0.060 in.) between the button and seal is maintained. Smear the face of the hub and hubcap with jointing compound (Table 2, Serial 4).

28 Turn the hub so that embossed arrow points to 12 o'clock. This will position the filler plug for filling to correct level with oil (Table 2, Serial 1).

29 Refit the filler plug and renew copper washer as necessary.

30 Lower the wheels and remove jack. Tighten the road wheel nuts securely in a diagonal sequence, using spanner supplied. An extension bar must not be used to increase leverage. The designed torque tightness is 163 Nm (120 lb/ft) max.

NOTE

If new studs and nuts are fitted, check for tightness AESP 2350-T-250-201 Chap 2-4 refers).

HUB OIL SEALS

General

31 Oil seals fitted to the road wheel and track adjusting wheel hubs are identical. The type of seal is known as a 'floating ring' seal. Arrangement of the seal is shown in Fig 1.

32 The object of the seal is to retain lubricant within the hub and to exclude dirt. The highly finished surfaces of the floating ring, (Fig 1 (2)) are held in contact by pressure exerted by rubber Torus seals. These Torus seals distort slightly when fitted into their mounting recesses. The inner floating ring seal, with its Torus seal, is stationary as the Torus seal fits into the groove of the hub labyrinth. The outer floating ring seal rotates with the hub as its Torus seal locates in a recess of the hub oil seal housing.

33 Efficiency of the seal depends entirely upon the mating faces of the floating ring seals. These faces have a high degree of surface finish that must be preserved. Ensure that surfaces are not scratched or nicked.

Fitting

CAUTION

EQUIPMENT DAMAGE. Finger marks alone can cause the sealing surfaces to deteriorate. Avoid touching surfaces, except with clean tissue, at every stage in dismantling and assembling.

34 To ensure satisfactory seal life, the following instructions must be rigidly observed:

34.1 Whenever a seal is dismantled completely, new Torus ring seals MUST be fitted to BOTH halves of the floating ring seal.

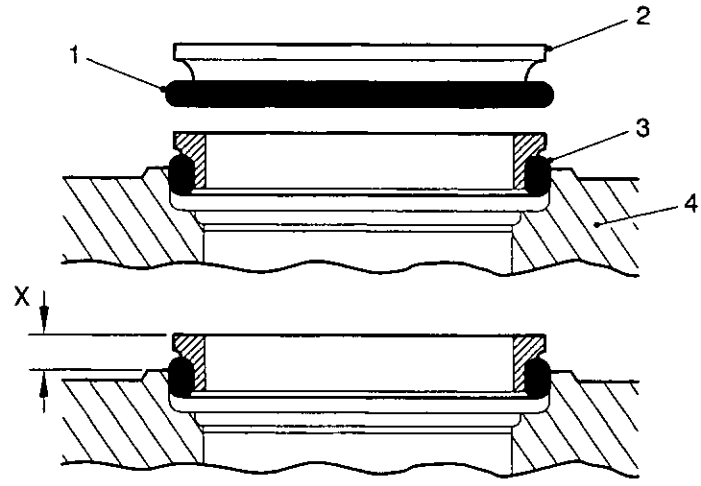
34.2 A floating ring seal that has been in use must NOT be mated with a new floating ring seal or with another used floating ring seal. If more than one seal housing is dismantled at a time DO NOT mix the floating ring seals. Once run together they must remain mated until they are scrapped.

34.3 The utmost care must be taken to keep dirt and dust away from the finely finished surfaces. If the seal is assembled with dirt between the faces the seal will rapidly be destroyed.

34.4 Recesses into which a Torus seal fits must be free of dirt, rust and grease or any obstruction that will prevent accurate bedding of the Torus seal. Torus seals must NOT be twisted or strained and must be absolutely dry.

34.5 Fig 1 shows the method of entering the seal into the housing. Finger pressure only may be used to enter the seal into its groove. When the seal has entered, (dimension 'X', shown in Fig 1), it must be checked at several points on the periphery of the floating ring seal to ensure that the seal is squarely set in relation to the groove.

34.6 Before mating the finished surfaces a thin smear of oil (Table 2, Serial 1) must be applied with a clean paper tissue (DO NOT allow this protective film of oil to come into contact with the Torus ring seal). Mate surfaces instantly to avoid contracting airborne dust.



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1	Rubber Torus seal	3	Finger pressure point when fitting
2	Metal floating ring seal	4	Housing

Fig 1 Hub oil seal

TORSION BARS

General

35 Each axle arm is splined to a torsion bar, which in turn is splined to a torsion bar anchorage on the opposite side of the hull. As road shocks move the axle arm upwards the torsion bar twists. The torsion bar resists the twisting force and produces a springing action that absorbs the shock of axle arm deflection. This keeps the road wheel in contact with the track.

Checking for broken torsion bar

36 When the vehicle sags to one side on a hard and level surface use a crowbar to lift each wheel on the low side of the vehicle. If a wheel can be lifted easily with the crowbar its torsion bar is broken and must be replaced. Another indication of a broken torsion bar or of incorrect settings is that the road wheel tyre does NOT bulge at the point of track contact.

Removing torsion bar

NOTES

(1) If removing the front or rear torsion bars, place a suitable jack and packing at appropriate hull corner. Disconnect the shock absorber from axle arm.

(2) If affected torsion arm is on the RH side it will be necessary to remove the corresponding road wheels from the LH side and lower the axle arm. This will give access to the torsion bar anchorage.

Preliminary operations

37 Slacken off the tracks on both sides if necessary; refer to Para 36 note (1).

38 Slacken the road wheel nuts and remove road wheels (AESP 2350-T-250-201 refers).

39 Lower the axle arm to relieve the stress on the torsion bar. Support the hub with a block. Remove the jack.

40 Slacken the locknut and locking sleeve clamping bolt at the axle arm end of the torsion bar. Unscrew the locking sleeve from the axle arm. Secure the small aluminium plug that bears on the locking sleeve knurled portion.

41 Remove the nut at the end of the torsion bar. Remove the bearing washer and shims from beneath the nut. Tie the shims together for correct replacement.

NOTE

Make sure that all shims have been removed before removing the torsion bar.

42 Remove the upper and lower sealing plates and O-rings from the anchor block end.

43 Remove the brass blanking plug and washer from the anchor block. Tap out the two anchor pins.

44 Screw the guide pin taper tool (Table 1, Serial 1) into the anchored end of the torsion bar. Tap the anchored end out of anchor block. Withdraw the torsion bar fully from axle end. Take care not to damage the rubberised protective coating of the torsion bar as it is withdrawn from the hull. Dry-clean the torsion bar. DO NOT use cleaning solvents on the rubberised protection.

Broken torsion bars

45 When a torsion bar is seen to be broken withdrawal from the hull can be assisted through inspection covers in the hull floor, in the case of stations 4 and 5. Stations 1, 2 and 3 present more difficulties as the inspection covers are beneath the power pack and drivers compartment. To avoid lifting out the power pack, to replace a broken torsion bar, the following procedure is advised:

45.1 Obtain a length of 19 mm (3/4 in.) or 16 mm (5/8 in.) dia bar, 1.83 m (6 ft) in length. Thread 3/8 in. UNF for a length of 19 mm (3/4 in.), for insertion into the anchored end of the broken torsion bar. Screw in firmly and then tap the broken end clear of the anchor block and push the broken end through to the axle arm end.

Torsion bar handing

46 Torsion bars are preset during manufacture and are NOT interchangeable between sides of the vehicle. An arrow mark is stamped on the axle arm end of the bar showing the direction of its presetting. It is very important, therefore, that torsion bars are fitted to the correct side. The RH torsion bars (RH axle arms) have Part No. FV434553 and the arrow points clockwise. The LH torsion bars (LH axle arms) have Part No. FV434554 and the arrow points anti-clockwise.

47 If the bar is inserted so that the arrow is on top the arrowhead will point towards the front of the vehicle. Bars fitted to the wrong sides will fail prematurely.

48 Old type bars have a protective coating of self-vulcanising synthetic rubber, the depth of which is not less than 0.4 mm (0.015 in). This protective coating must be undamaged otherwise the bar will corrode and early failure will result. As an interim measure, a wrapping of polythene over the rubber coating, to provide additional protection, was added. The later type of torsion bar is preserved by an epoxy paint system, which gives a hard black finish.

Resetting torsion bar

49 With reference to Fig 2, position rod straight headless (Table 1, Serial 3). Prepare to jack up the axle arm. Place the axle arm setting gauge (Table 1, Serial 2) on the rod at an appropriate position and support it as the axle arm is jacked up. Cease jacking up when the setting gauge is firmly in contact with base of the hull without excessive force being applied. The axis of the rod is the reference point for axle arm setting measurement. The gauge settings for torsion bars, with ± 3.18 mm (1/8 in.) tolerance, are:

49.1	No. 1 and 2 stations	171 mm (6.3/4 in.)
49.2	No. 3 and 4 stations	162 mm (6.3/8 in.)
49.3	No. 5 station	154 mm (6 in.)

NOTE

FV434 and FV439 variants require individual Axle Arm Setting Gauges, these are detailed with the relevant variant Cat 522, Chap 2-2.

50 Lubricate the torsion bar splines with grease (Table 2, Serial 2). Assemble the tapered guide pin (Table 1, Serial 1) to the anchored end of the torsion bar. Offer up the bar from axle arm end.

51 Pass the torsion bar across the hull until the guide pin protrudes through the anchor housing. Manipulate the torsion bar with the guide pin until the torsion bar enters splines at each end (there are 44 splines at axle arm end and 42 at anchor end). This has the effect of a vernier adjustment and enables the torsion bar to be fitted with the axle arm at the correct height for presetting.

52 Fit two pins to the anchor block. A light tap of the torsion bar may be necessary to locate the anchor pin groove satisfactorily.

53 Refit the O-rings and sealing plates (fit new O-rings if there are signs of deterioration).

54 Remove the taper guide pin. Refit the brass end plug washer. Smear the threads of the end plug with sealing compound (Table 2, Serial 3).

55 Remove the setting gauge. Fit the shims, bearing washer and locknut (chamfered face of bearing washer faces the shims). Tighten the locknut. Smear the threads of the locking sleeve with sealing compound (Table 2, Serial 3) before fitting.

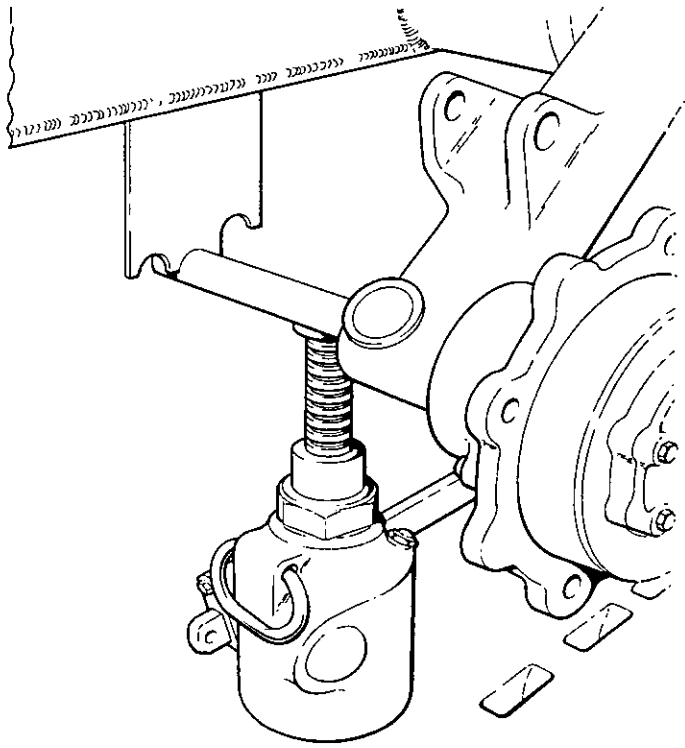

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Fig 2 Use of axle arm setting gauge and rod straight headless

Axle arm end float

56 Check the axle arm end float before fitting locking sleeve, as follows:

56.1 With the locknut fully tightened and using a suitable wooden block, bump the axle arm fully home into its housing. Check the tightness of locknut.

56.2 Prise the axle arm away from the housing with a short crowbar. Check the gap between the face of the axle arm housing and the seal face of the axle arm tube. This should not be less than 2 mm (0.08 in.).

56.3 Where this measurement is incorrect, adding or removing shims between the bearing washer and the torsion bar shoulder effects adjustment.

NOTE

This clearance allows for expansion and contraction of the torsion bar. Shims are provided in thicknesses of 0.13 mm (0.005 in.), 0.39 mm (0.015 in.), and 0.77mm (0.03 in.).

56.4 With the axle arm end float satisfactory, fit locking sleeve and tighten fully. Insert small aluminium plug squarely in locking bolthole. Tighten the locking bolt to engage aluminium plug. Tighten the locking nut.

57 Refit the road wheels.

Anchor block

Removing

58 Remove the torsion bar see Para 37.

59 Remove the locking bolt and plug. Ensure the copper washer is secure.

60 With a suitable drift tap out the anchor block.

Refitting

61 Refit in reverse order to removing and using a new aluminium locking plug.

62 Ensure that the locking plug is engaged squarely in the recess at bottom of the anchor block.

AXLE ARMS

63 Axle arms are NOT interchangeable from side to side.

64 The front and rear arms are interchangeable with each other. These have shock absorber lugs and a recess is ground in the arm to provide bump clearance for the drive sprocket.

65 Intermediate axle arms are interchangeable on their appropriate side. In an emergency a front or rear axle arm may be fitted to an intermediate station on the appropriate side. Shock absorber lugs being superfluous.

Removing

66 Remove the components from the axle arm as detailed in Para 39 and 40. Remove the torsion bar leaving the anchor block in position.

67 Remove the axle arm retaining plate secured by two bolts.

68 Commence to withdraw the arm from the hull. As the arm clears the hull ensure that the inner portion of the arm does not damage the seal in the hull, by levering on the end of the removing tool.

69 With the arm removed from the hull ensure to protect the machined surface from damage by abrasion.

Axle arm seals and bushes

70 Bushes are replaced in field workshops. Renewal of the outer axle arm bush seal may be undertaken (if it appears to be unserviceable). This seal acts primarily as a dust excluder and should be in good condition. The inner bush seals are accessible when the bushes are removed, therefore, the inner seal can only be replaced at field workshop level.

Refitting

71 Clean the axle arm tube-bushing diameter.

72 When renewing the axle arm dust excluder seal, the lip must face outward (towards axle arm).

73 Offer up the axle arm to the hull and enter the axle arm tube into the housing. Push the axle arm home and fit retaining plate.

74 Reset the axle arm height; insert the torsion bar see Para 49.

75 Check the axle arm end float (see Para 56).

SHOCK ABSORBERS

NOTE

(1) There are two types of shock absorber mountings that may be fitted, on replacement of shock absorber change the fittings to suit.

(2) There are two types of shock absorber in service, friction and hydraulic. On failure of a friction type shock absorber all four 4 must be replaced with hydraulic type shock absorbers in accordance with 2350-T-250-821 Gen Instr No 7.

Removing front shock absorbers

76 Remove the front section of the track guard.

77 Locate the jacking mandrel (Table 1, Serial 7) in the axle arm and jack up the front road wheel. Support the corner of hull with blocks or skidding.

78 Remove the road wheel and then lower the axle arm to remove tension from the shock absorber spring.

79 Slacken off the clamping bolt on the top-mounting bracket. Remove the top-mounting bolt. Secure the mounting bolt locking collar.

80 Remove the lower mounting bolt and nut and remove the shock absorber from the vehicle.

Refitting front shock absorber

81 Refit in the reverse order to removing.

82 Attach the shock absorber to the lower mounting bolt. Jack up the axle arm to enter the top-mounting bolt. Tighten clamping bolt securely. Smear the faces of mounting bolts with jointing compound (Table 2, Serial 4) and threads of lower mounting bolt with sealing compound (Table 2, Serial 3).

Removing rear shock absorbers

83 Remove the rear section track guard.

84 Slacken off the track adjustment fully.

85 Lever the top run of the slackened track clear of guide roller, remove the guide roller see Para 111.

86 Locate the jacking mandrel (Table 1, Serial 7) in the axle arm and jack up the rear road wheel. Support corner of hull with blocks or skidding.

87 Remove the road wheel. Lower the axle arm to remove the tension from the shock absorber spring.

88 Remove the top and bottom mounting bolts and nuts from their respective mounting brackets on the guide roller bracket and axle arm.

89 Remove the rear shock absorber assembly.

Refitting the rear shock absorbers

90 Refit in the reverse order to removing.

91 Attach the shock absorber to the lower mounting bolt. Jack up the axle arm to enter top mounting bolt.

92 Smear the threads of bolts with sealing compound (Table 2, Serial 3).

CAUTION

EQUIPMENT DAMAGE. The upper and lower mounting bolts are finished to close limits and are chrome surfaced on bearing diameters. Accurate alignment of holes before entering bolts is essential so as not to damage them. Additionally, smear bearing surfaces of bolts with jointing compound, (Table 2, Serial 4) before inserting them.

Removing and Refitting Shock absorber bushes

93 'Silentblock' rubber bushes can be renewed when worn or collapsed by pressing out the old bush with a suitable dolly, manufactured locally. DO NOT use a lubricant when fitting new bushes. A dusting of French chalk, if available, will assist entry of new bush, otherwise press in dry. Press bush fully home making sure that the outer sleeve of the bush protrudes by an equal amount on each side of the eye. Unequal positioning of the bush in the eye will result in difficulty when offering up the shock absorber to the mounting brackets.

HYDRAULIC TRACK ADJUSTER

Removing hydraulic adjuster

94 Remove the track from track tensioner wheel.

95 Pivot, the cranked axle with the stub axle away from the piston end of the adjuster.

96 Unscrew the setscrews securing the trunnion mounting plate. Remove the plate and lift cylinder, with the piston, clear of the adjuster bracket.

NOTES

(1) If the hydraulic action of adjuster is still effective there is no need to remove track in order to remove adjuster. Fully tension track and 'pack' in between:

(1-1) Top of track tensioner wheel and rear guide roller.

(1-2) Bottom of the track tensioner wheel and the rear road wheel.

(2) The adjuster bracket should NOT be removed as a unit repair. The adhesive (Table 2, Ser 5) used between the bracket and hull surfaces must not be disturbed.

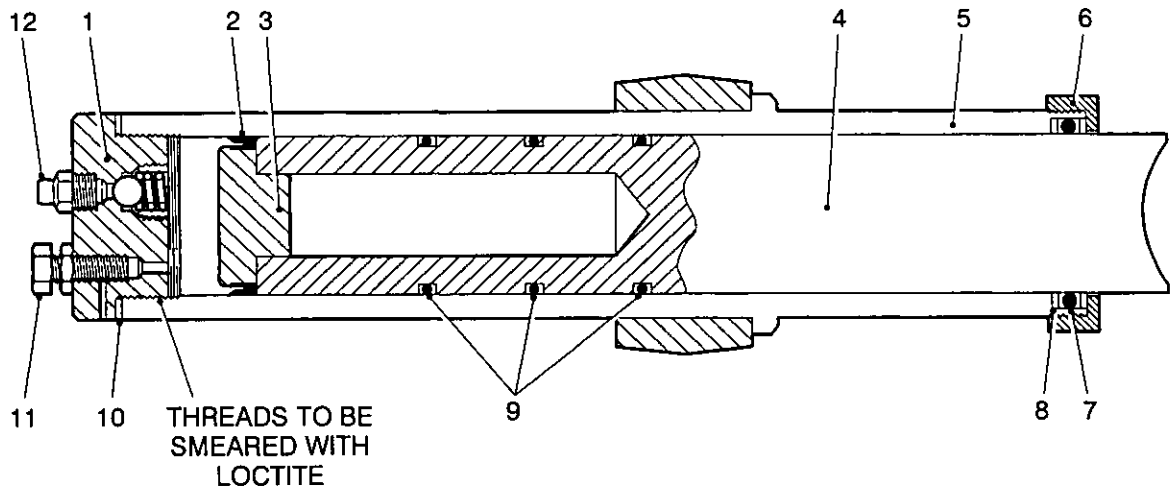
Dismantling cylinder assembly

97 With reference to Fig 3, unscrew the end cap (1). Tap the piston (4) at radius end into the cylinder until clear of seal cap (6) and fluid seal (7). Unscrew the seal cap and remove the fluid seal with anti-extrusion ring (8).

98 Tap the piston from plug (3) end clear of cylinder.

99 The three O-rings (9) are easily removable over the piston. The distributor seal (2) is removable over the plug diameter but this seal should not be removed unless replacement is necessary.

100 Remove the pressure release screw (11) and nipple (12) from the end cap. The threaded plug which houses the spring and ball valve is centre punch locked in position and should not be removed unless the spring is obviously broken or the ball valve is defective.



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1	End cap	7	Fluid seal
2	Distribution seal	8	Anti-extrusion ring
3	Piston plug	9	O-rings
4	Piston	10	Copper washer
5	Cylinder	11	Pressure relief valve
6	Seal cap	12	Nipple

Fig 3 Section of track adjuster cylinder and ram

Assembling cylinder assembly

101 Clean and examine the piston. Light scoring may be stoned down to obtain a smooth profile providing plating surface is still intact.

102 Refit the O-rings and, if necessary, distribution seal. Note the position of seal (Fig 3, (2)).

103 Lightly grease the piston and seals. Line up the piston so that, when assembled in cylinder, the radius will align with the stub axle axis. Ensure that the seal is seated squarely and tap piston into cylinder from seal cap end.

104 When the radius end of the piston is 30 mm (1.2 in.) from end of cylinder, fit the fluid seal and anti extrusion ring. Enter the seal carefully into the recessed end of the cylinder, if necessary use a suitable length of tubing to ease the seal squarely into position. Fit and tighten the seal cap.

105 Examine the end cap and check that the pressure relief drilling is clear. Anneal the copper washer before refitting and apply sealing compound (Table 2, Serial 3) to threads.

106 Screw the end cap to cylinder. Ensure that the pressure release screw is located towards the bottom of the assembly when refitted.

Refitting adjuster

107 Clean and lightly grease the trunnion bearings.

108 Refit the cylinder assembly in reverse order to removing. Fit and tighten the trunnion mounting plate and screws.

109 Functionally test by pumping the grease into the cylinder and tensioning the track.

GUIDE ROLLERS

General

110 Bearings must be renewed when the amount of end float exceeds 2.4 mm (3/32 in). When refitting the guide roller wheels, torque the wheel nuts to 54 Nm (40 lbf ft).

Removing

111 Remove the track guard and slacken the track tension.

112 Remove or raise the top run of the track to clear the guide rollers.

113 Remove the bolts securing the hubcap. Remove the split pin and the nut from the bearing shaft. Secure the flat washer from beneath the nut.

114 Pull the top roller off its shaft complete with oil seal housing and dust shield. The rear distance piece, which forms the stationary member of the labyrinth, will be left on the bearing shaft. The outer ball bearing and distance piece may remain in the roller hub.

115 Where only renewal of tyred rollers is required, remove these after removing the hub nuts. Fit new tyred rollers with shallower dishing fitted towards roller hub centre.

116 To dismantle the roller completely, remove the bolts securing the oil seal housing and the dust shield, to the roller hub (note that the oil seal is fitted as a dust excluder, i.e. lip towards hull).

117 Tap out outer ball bearing, if it has remained in the hub, by striking the hubcap mounting studs against a block of wood. Remove bearing distance piece.

118 Tap out seal bearing with a suitable soft drift. Roller hub is now completely dismantled.

Refitting

119 If new bearings are to be fitted, ensure that hub interior is clean, particularly bearing recesses. Remove preservative from new bearings and pack with grease (Table 2, Serial 2). Fit inner bearing and tap squarely home.

120 Fit the oil seal housing and dust shield having first ascertained that the seal is in good condition. If a new seal has to be fitted, ensure that the lip faces the hull when fitted in the housing.

121 Examine the stationary member of labyrinth (rear distance piece), which is a press fit on the bearing shaft.

122 Examine the outer distance piece for damage.

123 With the roller hub fitted, fit the distance piece, outer bearing, plain washer nut and split pin. The bearing nut should be tightened fully to eliminate end float. The roller must spin freely.

124 Apply a smear of jointing compound (Table 2, Serial 4) to the face of the hubcap, refit and bolt up cap. Apply a grease gun to the nipple in the cap and pack the hub with grease (Table 2, Serial 2).

GUIDE ROLLER MOUNTING BRACKETS

Removing

125 Two guide roller mounting brackets each side are bolted to the hull using six bolts, four bolts entering captive nuts on the inner face of the hull and two being retained by a welded block with tapped holes. Removal of the front bracket is straightforward but removing the rear bracket involves removing the rear road wheel and disconnecting the shock absorber upper mounting see Para 6 to 11 and 83 to 89.

126 The roller spindle is located in the bracket by a hardened Mills pin, which protrudes 25 mm (1 in.) from the bracket after entering the spindle. The Mills pin is a drive fit in a bracket and spindle and must remain tight in the bracket. The Mills pin protrusion provides a convenient anchorage for the track support rail when the track has been broken for maintenance operations.

127 If the Mills pin is loose in the bracket, with relative movement between the spindle and bracket due to wear, exceeding 19 mm (0.7352 in.), the bracket assembly must be replaced.

Refitting or replacing

128 When refitting or replacing a bracket, the mounting bolts must be smeared with jointing compound (Table 2, Serial 4) to seal the hull boltholes and threads. The bracket is assembled dry to the hull.

BUMP STOPS

129 Upward movement of each axle arm is limited by a bump stop at each station. A bump stop consists of steel discs and rubber pads bonded together and are not repairable. To remove a bump stop, remove self locking nut from mounting bolt and knock stop away from bracket.

TRACKS

130 A new track consists of 90 links. Track assemblies which have been reduced to the minimum (86) number of track links will be sentenced BLR and returned. An exception to this will be when at least 10% of the links in an assembly fail the limits of wear stated in Para 132, in which case the track assembly is to be sentenced Beyond Economical Repair (BER) by a REME tradesman.

131 The following limits of wear are intended to prevent rebushing of useless track links but at the same time to ensure maximum life is obtained from each link with resultant lowering of maintenance costs. It is not intended that links be gauged with precision instruments, at the most two steel rules will be used. Track links are to be inspected prior to removal of bushes and those individual links, which fail these limits in any one respect, are to be scrapped. Limits of wear or deformation:

131.1 Guide horns, side face: 3.2 mm (1/8 in.) on either face.

131.2 Forward driving lugs of sprocket apertures: 4.8 mm (3/16 in.)

131.3 Track pad well: remaining depth 7 mm (5/8 in.) minimum.

131.4 Inspect links for cracks; especially in bush bore areas and side faces of guide horns.

131.5 Check bush bores for elongation and other malformation.

132 When new rubber pads or new tracks are fitted, the pad securing nuts should be checked frequently for tightness during the first 80 km (50 miles) and thereafter during normal routine inspections. Correct torque tightness is 95 Nm (70 lb/ft) dry. Pads should be replaced before the rubber is worn down to the level of metal spud or link, or if the rubber has broken away to the extent that only 60% of the pad remains in contact with the ground. The polyurethane washer should be re-used on the same track link when repadding (unless it is cracked or broken).

133 Track tension must be maintained to give 25 mm (1 in.) to 38 mm (1 1/2 in.) sag midway between top rollers, with no slack under the rear sprocket or rear idler.

134 New tracks must not be run with worn sprocket rings. Rings should be reversed or renewed as necessary.

MEASUREMENT AND RECTIFICATION OF DRIFT

135 Measure drift as detailed in Test and Measurement A 028.

136 If deviation exceeds 305 mm (1 ft), proceed as follows:

137 Remove the tracks (AESP 2350-T-250-201 refers) and check as at Paras 130 to 134.

138 Check that there is no uneven drag on the steering brakes by either chalk marking both sprockets, running the engine with gear engaged and seeing that both sprockets rotate at the same speed or by pulling on each sprocket rim with a spring balance, (normal pull 356-445 N (80-100 lb f)). Adjust as necessary, Chap 1-5 refers. If after adjustment, sprockets continue to rotate at different speeds, it is possible that different ratio final drive gears have been fitted, (Ratio on FV432 is 4.15:1. On FV434 and FV439 it is 4.58:1). Check the vehicle repair history to ascertain if a final drive assembly has been recently replaced.

139 Check the final drive sprockets relative to vehicle centre line using gauge at Fig 4. If variation from datum is more than 0.8 mm (1/32 in) remove the hub and check for correct shimming, refer to Chap 1-5.

NOTE

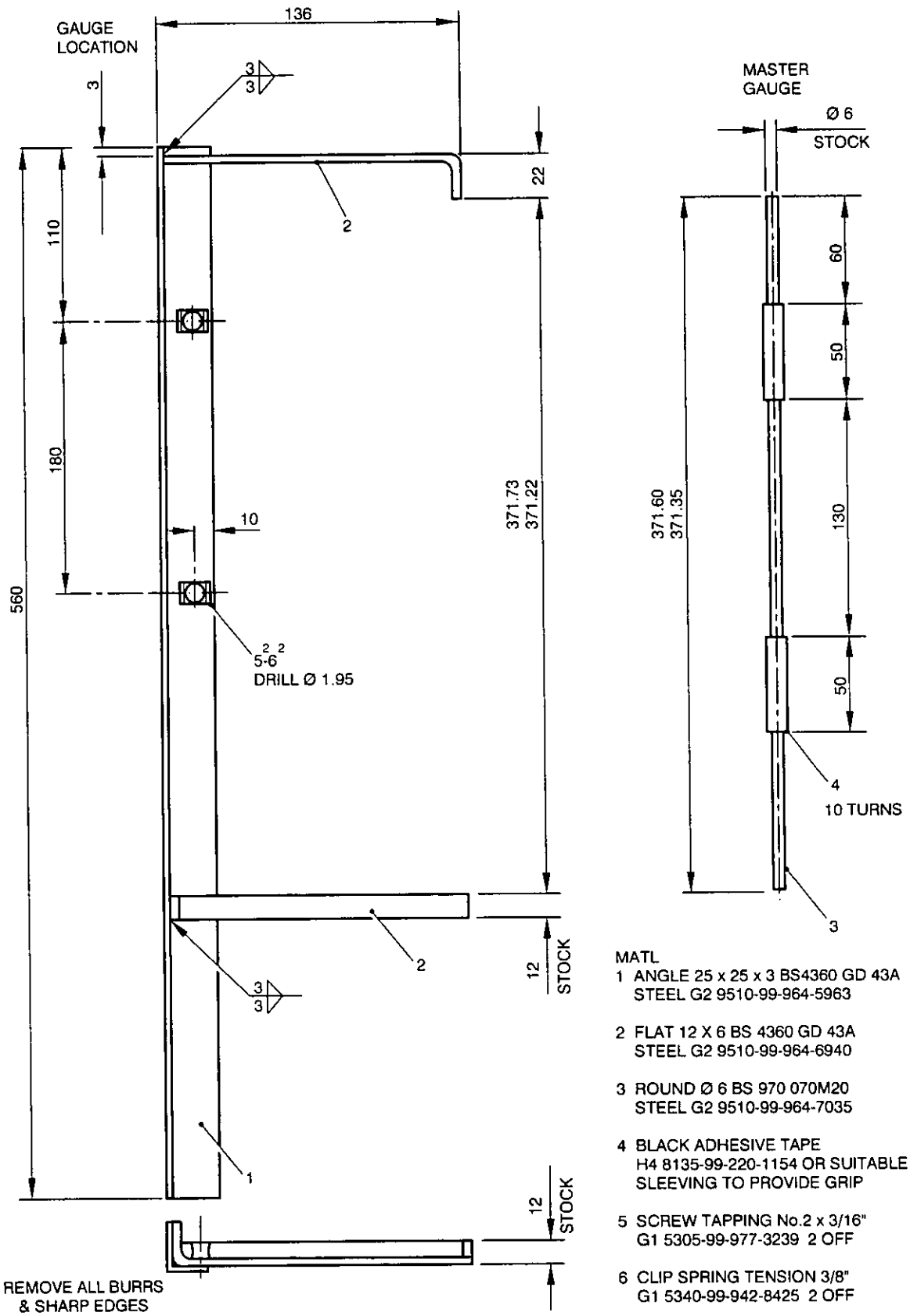
. This gauge can also be used as a quick check before the tracks are removed.

140 Set up parallel wires along both sides of the vehicle at road wheel centre height. Measure alignment of each wheel to wire and record dimensions. If toe-in or toe-out is found on any one wheel, suspect bent axle arm.

NOTE

Badly damaged wheel rims should be changed before measuring. If any one-wheel station differs more than 0.8 mm (1/32 in.) from the others, adjust shimming accordingly.

141 Refit the tracks, recheck the drift and, if still unacceptable, transfer one 12 or 18 SWG shim, depending on amount of drift, from one sprocket hub to the other as appropriate, i.e. if drift to right, remove shim from right and fit to left side. If this procedure fails to rectify drift, the vehicle should be back loaded.



MATL

1 ANGLE 25 x 25 x 3 BS4360 GD 43A
STEEL G2 9510-99-964-5963

2 FLAT 12 X 6 BS 4360 GD 43A
STEEL G2 9510-99-964-6940

3 ROUND Ø 6 BS 970 070M20
STEEL G2 9510-99-964-7035

4 BLACK ADHESIVE TAPE
H4 8135-99-220-1154 OR SUITABLE
SLEEVING TO PROVIDE GRIP

5 SCREW TAPPING No.2 x 3/16"
G1 5305-99-977-3239 2 OFF

6 CLIP SPRING TENSION 3/8"
G1 5340-99-942-8425 2 OFF

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(All dimensions in mm)

Fig 4 Gauge location final drive spacer

CHAPTER 3

HULL, FITTINGS AND CONTROLS

CONTENTS

(continued)

CONTENTS (continued)

ADHESIVES, SEALANTS AND LUBRICANTS

1 Table 1 lists the adhesives, sealants and lubricants required to carry out the procedures detailed in this chapter

TABLE 1 ADHESIVES, SEALANTS AND LUBRICANTS

Serial (1)	NSN (2)	Mfr ID (3)	Description (4)
1	8030-99-220-2370	Hylomar PL32M	Sealing compound
2	8040-99-225-0098	EC 1099	Adhesive, 1 litre
3	9150-99-220-2418	XG 279	Grease, automotive and artillery
4	8030-99-220-1024	Loctite	Adhesive 10 cc

GENERAL

2 All sealing throughout the vehicle MUST be maintained in a serviceable condition at all times. This is important, as the efficient operation of the Environmental Control System equipment and power pack cooling will depend on good and sound sealing of the vehicle. Hull sealing should be inspected at frequent intervals.

3 Special instructions are not necessary for the removal and refitting of the driver's and commander's hatch covers, rear door, access covers and seat frames. The method for removing will be obvious upon inspection. For fitting rubber seal, head and side pads to driver's hatch and rubber seal to the rear door and access covers, refer to Para 33.

NOTE

The commander's hatch equilibrate mountings are fitted with lengthened screws and lock nuts to prevent loosening of screws during service.

COMMANDER'S CUPOLA

WARNING

HEAVY WEIGHT. THE COMMANDERS CUPOLA WEIGHS 109 kg (240 lb). DUE CONSIDERATION SHOULD BE GIVEN TO THE REGULATIONS GOVERNING THE LIFTING OF HEAVY WEIGHTS.

Removing

4 Remove the periscopes and store in a safe place to prevent them from being damaged.

5 Remove the ring of bolts securing the fixed ring to the hull roof.

6 Using a cordage sling, lift off the cupola assembly. Lower the assembly onto wooden blocks of sufficient depth to obviate the fouling of parts hanging below.

Maintenance

7 Inspect the head and brow pads and the cover plate sealing ring for serviceability.

8 Refer to Para 33 for method of fitting the pads and sealing ring. Smear the face of the mounting flange with sealing compound (Table 1, Serial 1) prior to refitting assembly.

Refitting

9 Refit in the reverse order to removing. The centring rollers will require adjustment, refer to Para 20.

ROTATING RING

WARNING

HEAVY WEIGHT. THE ROTATING RING WEIGHS 76 kg (167 lb). DUE CONSIDERATION SHOULD BE GIVEN TO THE REGULATIONS GOVERNING THE LIFTING OF HEAVY WEIGHTS.

Removing

10 Remove the plug from the underside of each of the three traversing rollers. Secure the spring and ball as each plug is removed.

11 Using a flat lever, slightly raise the rotating ring and remove each traversing roller in turn.

12 Lift the rotating ring away from the fixed ring and place on wooden blocks.

Inspection

13 Inspect the sealing ring fitted between the rotating and fixed ring. When fitting a new sealing ring, refer to Para 33.

14 Inspect the traversing and centring rollers for wear.

Refitting

15 Refit in reverse order to removing. Adjust centring rollers, refer to Para 20.

TRAVERSING ROLLERS

Dismantling

16 Remove the traversing roller from the cupola refer to Para 10 and 11.

17 Remove the circlip from end of the eccentric shaft. Press out the shaft from the block and secure the needle bearing and roller.

18 If necessary, the locking handle can be removed from the shaft by driving out the Mills pin.

Assembling

19 Assemble in reverse order to dismantling. Renew worn or damaged needle bearings and rollers.

Adjusting centring rollers

20 Using a 3/8 in. A/F Allen key, rotate in turn each roller eccentric until roller bears against face of cupola sufficiently to allow easy rotation without excessive play.

MORTAR HATCH

Removing main (outer) hinges

21 Fold back the inner flap and open and hold the hatch cover at 10 deg to the vertical.

22 Remove the bolts and lift off the anchor block plate at the centre of the hinge tube.

23 Remove the end plugs from the hinge tubes by removing the retaining screw and plate and levering off the end plugs.

24 Tap out the torsion spring from the tubes (the torsion spring consists of a number of laminated sleeves). Lower the hatch cover.

WARNING

HEAVY WEIGHT. THE HATCH COVER WEIGHS 100 kg (220 lb). DUE CONSIDERATION SHOULD BE GIVEN TO THE REGULATIONS GOVERNING THE LIFTING OF HEAVY WEIGHTS.

25 If it is necessary to remove the hatch covers, remove the bolts securing the tube flanges to the anchor block and remove the tubes. Fit a sling and lift off the hatch cover

Inspection

26 Inspect the torsion spring and renew if damaged or broken.

27 Inspect the head pads and sealing rings. Para 33 refers to method of fitting new pads and sealing rings.

Refitting

28 Refit in reverse order to removing, ensuring that the hatch cover is held at 10 deg to the vertical when assembling.

Removing inner hinges

WARNING

HEAVY WEIGHT. THE OUTER FLAP WEIGHS 49 kg (108 lb). DUE CONSIDERATION SHOULD BE GIVEN TO THE REGULATIONS GOVERNING THE LIFTING OF HEAVY WEIGHTS.

29 Open and hold the inner flap at 10 deg to the vertical. Remove the hinges from the outer flap cover to part the inner flap from the outer flap.

30 Remove the square headed end plug and tap out the torsion spring from the opposite end of the tube (torsion spring consists of a number of laminated sleeves).

Refitting

31 Renew the torsion spring if damaged or broken.

32 Refit in reverse order to removing, ensuring that the hatch cover is held at 10 deg to the vertical when assembling.

SEALING

Insulation lining and hull sealing rings

33 The interior of the vehicle is lined throughout with a plastic covered foam insulation lining. Insulation lining, head pads and rubber seals used throughout the vehicle are to be fitted in the following manner:

33.1 Adhesive (Table 1, Serial 2 or approved equivalent) is to be used.

33.2 When fitting insulation lining, padding or rubber seals, surfaces to be bonded must be clean and free from paint, oil or grease film. Apply a thin even coat of adhesive to both mating surfaces. Allow adhesive to dry to an aggressively tacky stage where it will adhere, but not transfer to the finger when touched lightly. Press or roll the surfaces firmly together to ensure a good contact at all points.

Lining of power pack compartment

WARNING

HEALTH HAZARD. ASBESTOS. THIS EQUIPMENT/ASSEMBLY CONTAINS ASBESTOS COMPONENTS. NO ATTEMPT IS TO BE MADE TO WORK WITH ASBESTOS MATERIALS WITHOUT CONFORMING TO APPROPRIATE DEPARTMENTAL/UNIT INSTRUCTIONS.

34 The rear wall, longitudinal bulkhead and detachable covers are lined with 3 mm (1/8 in.) asbestos. If the asbestos has to be renewed, it is to be secured to the walls of the compartment with adhesive (Table 1, Serial 2), refer to sub Para 33.1.

Fire Fighting Equipment

WARNING

PERSONNEL HAZARD. DO NOT ATTEMPT TO REMOVE STRIKER HEAD FROM BCF CYLINDERS.

General

35 The fire fighting equipment consists of two BCF cylinders mounted in the personnel compartment on the personnel/power pack bulkhead. The cylinders are clamped to a delivery head from which outlet pipes are routed to the power pack compartment.

36 The fire fighting equipment can be actuated by remote cables from the driver's compartment or from the LH and RH side of the vehicle exterior. The cables are routed into a junction box where they are paired to a single cable routed to each cylinder. The cylinders can also be actuated from the personnel compartment by finger controls fitted to the striker head.

37 The cylinders are pre-charged and are fitted with test buttons in their base. Unit repairs will consist of removing and replacing complete cylinders.

Removing cylinders

WARNINGS

(1) PERSONNEL HAZARD. UNDER NO CIRCUMSTANCES IS THE CYLINDER CLAMP TO BE REMOVED UNTIL BOTH CONTROL CABLES HAVE BEEN DISCONNECTED AND PLUGS FITTED.

(2) PERSONNEL HAZARD. UNDER NO CIRCUMSTANCES IS WORK ON THE CONTROL CABLE TO BE UNDERTAKEN UNTIL SECURITY OF CYLINDERS HAS BEEN CONFIRMED.

38 To prevent the possibility of a charged cylinder being accidentally discharged, it is essential that the following procedure be strictly adhered to:

38.1 Ensure the cylinder clamp is secure.

38.2 Disconnect the remote control cables at both cylinders.

38.3 Remove the two nuts securing the cylinder clamp (Fig 1(10)).

38.4 Lift bottle clear of manifold (12) and fit plastic plug (14) to discharge head.

38.5 Only when Para's 38.1 to 38.5 have been completed disconnect the safety cable (11) by opening its clip (15).

38.6 Lift both cylinders clear.

Replacing cylinders

38 Replace in reverse order to removing, ensuring the delivery head washer is serviceable.

GUN MOUNT 7.62 mm (L7A1 GPMG) No. 3, Mk 1

General

39 Unit repairs to the mount should consist of repairs by welding and checking movement between the machine gun and cradle and between cradle and saddle. If movement is in excess of figures detailed in Para 41, the mount should be back loaded to supporting workshop and a replacement mount fitted.

Inspection

40 Details of clearances and action to be adopted as follows:

41.1 Side clearance between machine gun and cradle, front end, 0.4 mm (0.015 in.).

41.2 Lift on front pin, 0.4 mm (0.015 in.).

41.3 Lift on rear pin, 0.4 mm (0.015 in.).

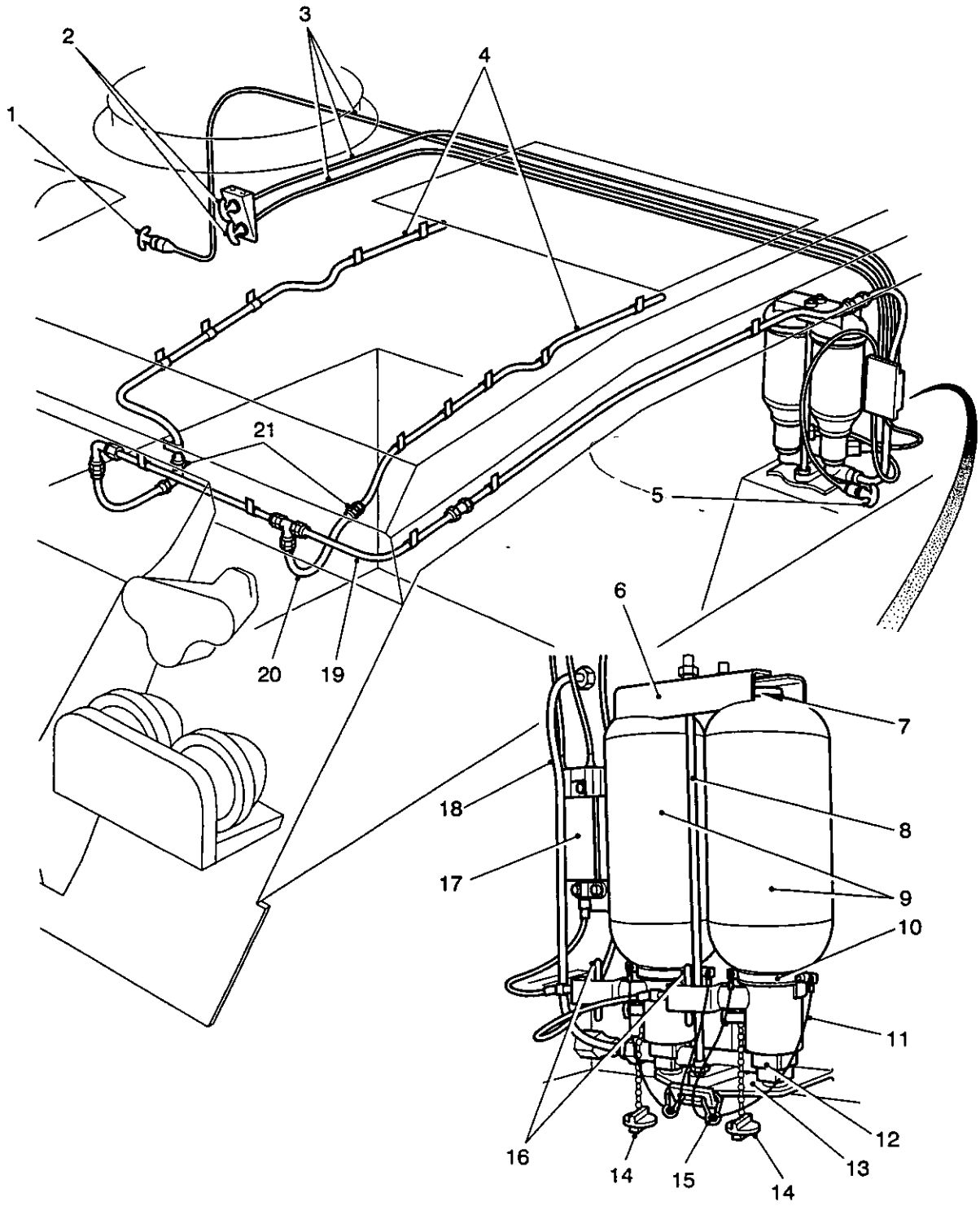
41.4 Lift on cradle to saddle pivot pin, 0.4 mm (0.015 in.).

41.5 Maximum clearance between cradle and saddle at pivot point, 1.5 mm (0.060 in.).

41.6 Ensure that front and rear sight clamping screws operate correctly, i.e. sights can be clamped anywhere on its length of travel.

41.7 Ensure that the travel-locking arm, fits between the cradle and cupola.

41.8 Apply grease (Table 1, Serial 3) to all untreated surfaces.



1	Right external turn and pull handle	7	Test diaphragm	15	Clip
2	Driver's turn and pull handles	8	Tie bar	16	Finger bars
3	Bowden cable	9	BCF cylinders	17	Cables junction box
4	Spray pipes	10	Clamp	18	Copper tubing
5	Left external turn and pull handle	11	Safety Cable	19	Tubing
6	Securing plate	12	Manifold	20	Flexible hoses
		13	Bracket	21	Disconnect points
		14	Plastic plug		

Fig 1 Fixed fire fighting equipment

GEAR RANGE SELECTOR

NOTE

The following adjustment can be carried out with the power pack installed or removed. If the power pack is 'in situ' remove rear detachable cover of longitudinal bulkhead between driver and power pack compartment.

Linkage adjustment

42 Disconnect the selector rod from the gear control lever at the gearbox. Slacken the locknut securing the yoke.

43 Position the driver's range selector lever in NEUTRAL.

44 Position the gear control lever in the vertical position, i.e. turn lever fully clockwise, then move the lever anti-clockwise one 'click'. The gearbox is now in neutral

45 Adjust the selector rod by turning the yoke until a 'free-pin' fit is affected at the gear control lever. Refit the pin.

46 Check all positions in the range to ensure that the positive 'clicks' of the gear control lever are felt at each detent, as the driver's' lever is moved through the gear positions in the gate.

47 When assembling the gear range selector, apply Loctite (Table1, Ser4) to the pivot pin (Fig 2(1)) before fitting the lever (2). Secure the lever to the pivot using a Roll Pin.

MICROSWITCH

Tests

48 Before faulting the switch, which will require the removal of the gear range selector assembly in order to replace the switch, carry out the following tests:

48.1 Remove the rear detachable cover from the longitudinal bulkhead (between the driver and power pack compartments.

48.2 Disconnect the gearbox interlock switch cable at bulkhead.

48.3 Place the driver's gear range selector lever in the NEUTRAL position.

48.4 With a multimeter set to dc ohms range, carry out continuity tests at the disconnected cable plug on the bulkhead.

NOTE

The engine switch need not be switched ON.

48.5 Check between plug pins A and B; a reading of zero Ohms should be indicated.

48.6 Check between plug pins C and D; a reading of infinity (open circuit) should be indicated.

48.7 Place range selector in one of the forward range positions.

48.8 Check between plug pins C and D; a zero Ohms reading should be indicated.

48.9 Check between plug pins C and D; a reading of infinity (open circuit) should be indicated.

49 If the readings are unsatisfactory, this will indicate that the switch is faulty and must be replaced.

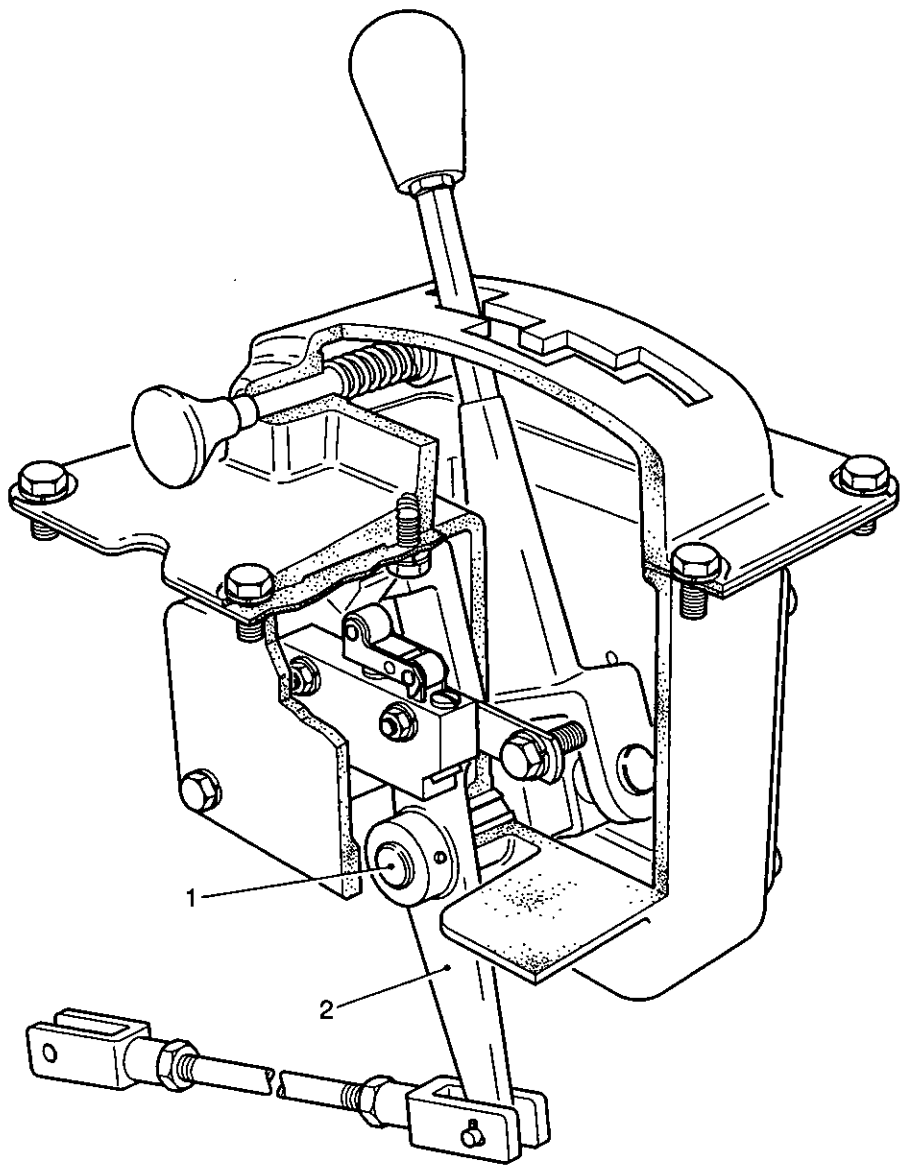
Removing and refitting

50 Close the fuel tap. Turn the master switch to OFF.

51 Remove the rear detachable cover from the longitudinal bullhead (quick release bolts).

52 Disconnect the gear selector linkage at the control rod.

53 Disconnect the gearbox interlock switch cable at the longitudinal bulkhead.



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1 Pivot pin 2 Lever

Fig 2 Gear range selector assembly

54 Remove the gear range selector assembly from the longitudinal bulkhead.

55 Remove the RH cover plate from the selector assembly by removing the four bolts.

56 Disconnect the leads at the switch. Remove the switch assembly by removing the two mounting bolts.

57 Refit in the reverse order to removing.

THROTTLE VALVE CONTROL

General

58 The function of the throttle valve control is to transpose pressure generated in the fuel injection pump governor into linear movement of the gearbox control lever. The control is a hydraulic cylinder (pressurised by the governor) with the piston connected by an adjustable linkage to the gear control lever. Pressure, and thus movement of the hydraulic piston, is proportional to the engine speed. As the engine speed increases, the piston is moved downwards to affect movement of the control lever. As the engine speed decreases, governor pressure falls and the hydraulic piston is returned under spring pressure.

59 Unit repairs to the throttle control valve are limited to adjusting the linkage or replacing the assembly.

Removing and refitting

60 Remove power pack, Chap 1-1 refers.

61 Release the union nut at the top of the control.

62 Remove the clevis pin from the gear control lever.

63 Remove two 1/4 in. UNF screws securing the control to the bracket (fitted to main gearbox).

64 Refit the assembly in reverse order to removing.

Adjusting

65 Remove power pack, Chap 1-1 refers.

66 Obtain setting gauge V6913/1 and pointer V6913/2.

NOTE

If this gauge is required it can be locally manufactured, (drawings available from LASS IPT,DLO Andover, Portway, Monxton Road, Andover, Hants, SP11 8HT) or obtained from the vehicle ETS.

67 With reference to Fig 3, secure the gauge to the gearbox inspection plate and refit the control lever pin with the pointer.

68 With the engine stationary the pointer should be on the 'S' mark on the setting gauge. To adjust, slacken the locknut and using a spanner on the nut secured to the rod, adjust the length of the rod to move the pointer to the correct position. Tighten the locknut.

69 Start the engine and run at idling speed (780 to 800 rev/min). The pointer should now be on 'I' mark.

70 Remove the gauge and pointer. Refit the control lever pin and split pin.

ACCELERATOR PEDAL AND LINKAGE

Removing

71 Disconnect the rod from the pedal to the cross shaft by disconnecting ball joint at pedal.

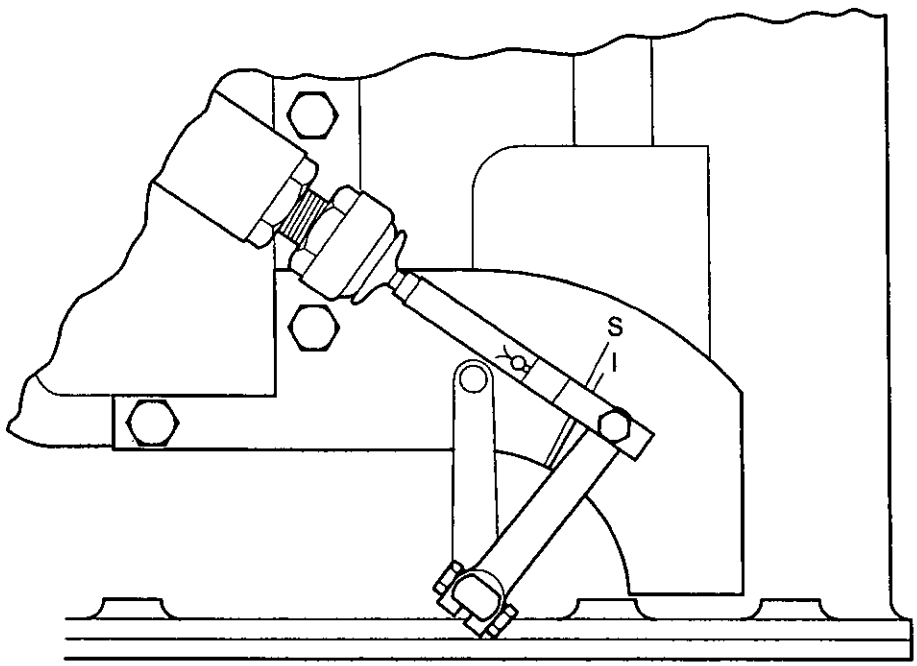
72 Remove the bolt securing the RH half shaft assembly and cowling. Lift off cowling complete with accelerator assembly.

Pedal stop adjustment

73 Before refitting the pedal stop assembly and cowling. Adjust the pedal heel stop as follows:

73.1 Set the top bolt so that the measurement from the upper face, of the flange, of the half shaft cowling to the upper bolt head is exactly 51 mm (2 in.).

73.2 Lock the locknut on the stop bolt. Recheck the adjustment.



S = Start
I = Idle

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Fig 3 Gauge, setting, gearbox throttle valve control, positioned on vehicle

Refitting

74 Refit in reverse order to removing. Ensure that the forward ball joint is not adjusted too tightly.

Adjusting accelerator linkage

75 Remove power pack/driver compartment access plates Chap1-1 refers.

76 Disconnect the linkage at the governor control arm (ensure hand throttle control is fully slackened).

77 Procure a block of wood or metal 3.2 mm (1/8 in.) thick. Place this on the accelerator pedal stop and depress the accelerator pedal so that the pedal traps the block. This is the fully open position of the accelerator.

78 With the governor control held in the fully open position and the accelerator pedal fully depressed, adjust the linkage so that the ball joint is a free fit in the governor control arm.

79 Release the accelerator pedal and remove the block.

80 Start and warm up the engine. Adjust the hand throttle to give an idling speed of 780-800 rev/min. Lock hand throttle.

81 With the engine running, depress the accelerator pedal slowly; if there is excessive movement before engine speed increases, adjust the pedal heel stop, Para 73 refers.

82 Refit power pack/driver compartment access plates.

STEERING LEVERS

WARNING

HEAVY WEIGHT. THE STEERING LEVERS WEIGH 23 kg (50 lb). DUE CONSIDERATION SHOULD BE GIVEN TO THE REGULATIONS GOVERNING THE LIFTING OF HEAVY WEIGHTS.

Removing

83 Remove the false floor plate in front of the driver's seat.

84 Remove the lubrication pipes from the steering lever unit.

85 Disconnect the short longitudinal rod from the composite lever on the cross shaft by removing the clevis pin (DO NOT disturb stop light adjustment nuts).

86 Disconnect the leads from both stop light switches by removing the cover plates, disconnecting the lead terminal nuts, unscrewing the knurled nut securing the loom and withdrawing the leads.

87 Remove the six bolts securing the assembly base to the hull floor bracket. Lift the assembly out of the hull.

Dismantling

88 Remove the fulcrum pin locking plate at the LH side of the steering lever base.

89 With a suitable drift drive out the fulcrum pin from the lever cross shaft.

90 Remove short rods from steering levers.

91 Remove the two long bolts that pass through the ratchets. Secure the two sleeves located between the ratchets. Secure the battery plate supporting the lubricating nipples.

92 Remove the ratchets through the slots in the levers.

93 Lift the two levers out of the bracket assembly.

94 Remove the pinch bolt securing the short relay lever and prise off the short lever.

95 Separate the two levers by pulling the LH lever off the RH lever shaft extension.

PARKING BRAKE RATCHET AND PAWL

96 Renewal of the ratchet and pawl may be undertaken if the teeth are worn. DO NOT dress out any damaged teeth on the ratchet and pawl. Replace worn parts.

Removing pawl

97 Unscrew the circular milled nut at top of the steering lever. Remove the nut and unscrew the thumb button.

98 Take off the nut exposed when the thumb button is removed and lift out pawl spring. Push the pawl rod downwards to cause pawl to clear the guide block.

99 Spring pawl clear of lever without bending pawl rod. Unscrew the locknut above pawl, then remove pawl from the rod.

Replacing pawl

100 Fit the replacement pawl to the rod, ensuring that the designed clearance of 4 mm (0.15 in.) between the teeth of the pawl and the quadrant. Ensure that the teeth of the pawl, when fitted to the rod, point towards the front or open side of the lever.

101 Lock the locknut above pawl, aligning the nut so that a flat lies at each edge of pawl to enable it to pass the guide blocks.

102 Push the pawl rod upwards, pushing the pawl into the guide blocks and upper end of the rod through the guide at the top end of cover.

103 Fit the spring and washer. Fit the thumb button screwing it fully home. Fit the milled nut. The thumb button should project 7.6 mm (0.30 in.) from the milled nut when released.

Replacing lever brushes

104 Tap out both sets of bushes.

105 Insert the new bushes so that the outer edge of the bush is flush with the outside edge of the shaft (deeper insertion will make future removal difficult).

Stop lamp lever contacts

106 Before refitting the steering levers check the setting of the contact bolts. These should be adjusted so that the total length, measured from the flat on boss unit beneath the locknut, to the top face of the bolt head, is exactly 16.5 mm (0.65in.).

107 Ensure the locknut is securely tightened.

Assembling

108 Assemble the steering levers in reverse order to dismantling.

109 When refitting the ratchet quadrants ensure that the teeth face the correct direction. A quick check is to observe the untoothed portions of the quadrant. The longest untoothed portion goes towards the front of the assembly.

110 After refitting the assembly in the hull and connecting up to the brake linkage, check the brake adjustment, Chap 1-5 refers.

111 In the event of the steering lever rods having been inadvertently disturbed their set lengths are given below, (Measured between the yoke centres).

111.1	Short rods	373 mm (14.70 in.).
111.2	Long rods	635 mm (25.00 in.).

DRIVER'S EMERGENCY STOP CONTROL

General

112 This is a foot pedal control fitted at the LH side of the accelerator pedal and coupled to the engine governor to stop the engine in the event of governor failure.

113 It is essential that the operating lever on the back of the fuel injection pump move to the limit of its travel. If its movement is reduced, the engine may stop from idling but not from high speed light load condition, (the run-away condition).

Initial setting

CAUTION

EQUIPMENT DAMAGE. If this setting procedure is not adhered to either the engine will not shut down in the event of governor failure, or the pump will be damaged possibly in the full speed condition.

114 Ensure that the clevis is secured to each end of the cable and 9.5 mm (3/8 in.) of thread is engaged.

115 With the cable disconnected from the lever on the fuel pump scribe two lines on the engine block. One indicating the fully rearward position of the lever and the other the fully forward position.

116 Connect one end of the cable to the lever on the fuel pump and the other end to the foot control pedal.

117 With the pedal depressed so that the lever is in the fully forward position, adjust the pedal stop that is in front of and below the pedal, so that no further strain is placed on the cable.

118 With no pressure on the pedal ensure that the lever returns to its fully rearward position.

119 Recheck with the pedal fully depressed against the stop and readjust as necessary.

120 Start the engine and check for satisfactory and correct functioning of emergency stop control throughout full range of engine speeds.

CHAPTER 4

VENTILATION CONTROL SYSTEM

CONTENTS

GENERAL

1 This chapter details the Level 2 repairs to the ventilation control system.

Sealants, solvents and lubricants

2 Table 1 lists the sealants, solvents and lubricants required to carry out the procedures described within this chapter.

TABLE 1 SEALANTS, SOLVENTS AND LUBRICANTS

Serial (1)	NSN/FV No. (2)	Designation (3)
1	9160-99-665-3053	Petroleum jelly

Special tools and test equipment

3 Table 2 lists the special tools and test equipment required to carry out the procedures described within this chapter.

TABLE 2 SPECIAL TOOLS AND TEST EQUIPMENT

Serial (1)	NSN/FV No. (2)	Designation (3)
1	Z4/6625-99-102-5387	100 megohmmeter
2	Z4/6625-99-252-3606	Multimeter set, general purpose, hand held

VENTILATION CONTROL SYSTEM Mk 2 VEHICLES

General

WARNING

LETHAL VOLTAGE. VOLTAGES ON SOME EQUIPMENT IN THIS VEHICLE SUCH AS RADIOS CAN BE LETHAL. DO NOT ATTEMPT ANY REPAIR OR ADJUSTMENT TO THESE EQUIPMENTS UNLESS ALL BATTERY MASTER SWITCHES ARE OFF.

4 The ventilation control system consists of the following assemblies (shown in Figs 1, 2 and 3) and is initially controlled by fan switch S1 in the accessories control box.

4.1 Fan unit No. 1, Mk 1. - S23

4.2 Filter housing No. 1, Mk 1.

4.3 Fan controller No. 1, Mk 2.

4.4 Pressure/suction gauge No. 1, Mk 3.

4.5 Pressure gauge valve No. 1, Mk 1.

4.6 Vehicle pressure relief valve No. 1, Mk 1.

4.7 Ventilation batteries

Pressure test

5 Ensure that a filter is fitted to the filter unit.

6 Close all doors and hatches.

7 Close fan switch at Distribution panel, No 6, Mk 1.

8 Operate fan controller, mounted at back of pressure/suction gauge, to minimum speed position that will enable pressure inside vehicle to build up to at least 3 in. SWG (standard water gauge) as indicated on the pressure (+) scale of the gauge. At this reading, vehicle pressure relief valve (situated in the roof of vehicle on the off side of drivers compartment) should open sufficiently to cause a bleed, which will maintain the pressure at 3 in. SWG.

9 If pressure fails to reach the required 3 in. SWG, it will be due to:

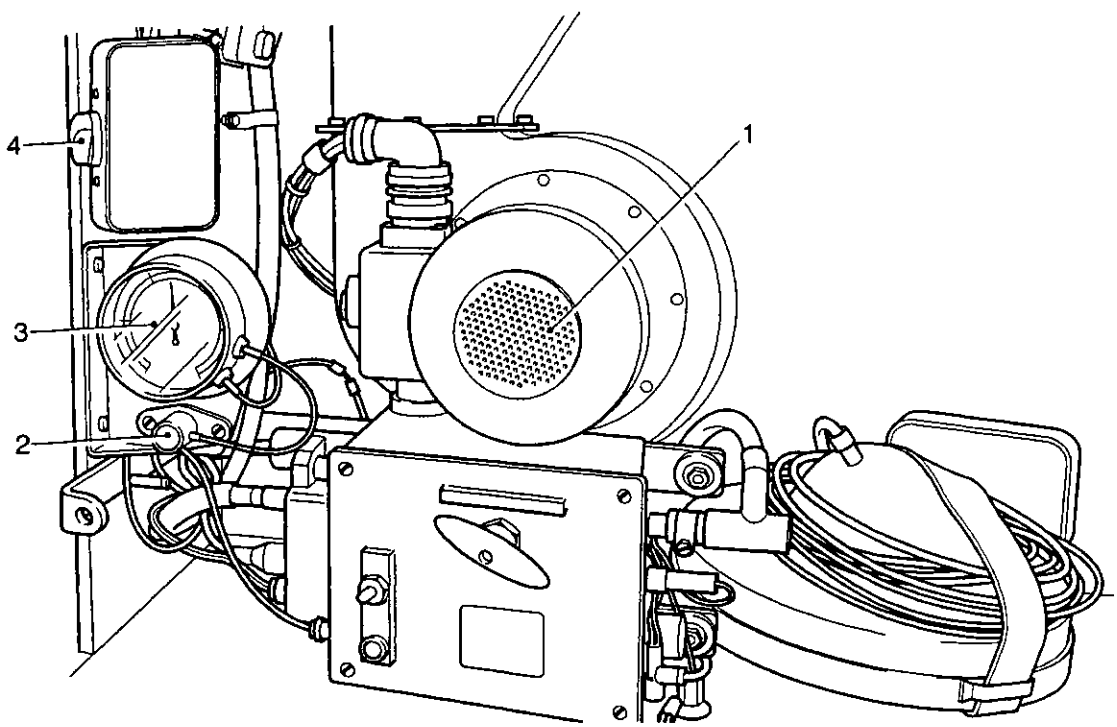
9.1 Clogged filters.

9.2 A Leak in vehicle sealing. Cause can be ascertained by operating the test button below pressure/suction gauge and noting the reading on the suction (-) scale. A reading of less than -1 in. SWG will prove that the filters are clean, indicating that there is a leak in the vehicle sealing. If, however, a reading of 5 in. SWG or more is observed, which will indicate that the system is overloaded due to clogged or dirty filters.

10 If pressure fails to reach the required 3 inches SWG it will be due to:

10.1 Clogged filters.

10.2 A leak in the vehicle sealing. The cause can be verified by operating the test button (2) located below the pressure/suction gauge and noting the reading on the suction (-) scale. A reading of less than 1 inch SWG will prove that the filters are clean but there is a leak in the vehicle sealing. If a reading of - 5 inches SWG or more is observed this will indicate that the system is overloaded due to clogged or dirty filters. Filter replacement is detailed at Para 14.



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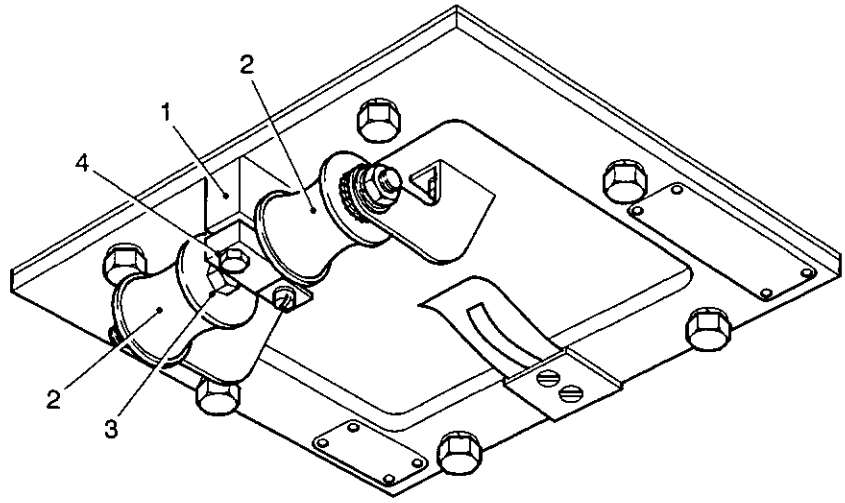
1	Fan pressurising unit, No. 1, Mk 1	3	Pressure/suction gauge, No. 1, Mk 3
2	Pressure gauge valve, No. 1, Mk 1(test button)	4	Fan controller, No. 1, Mk 2

Fig 1 Location of fan and controls



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1	Centre pillar	3	Torsion spindle
2	Rubber torsion springs	4	Locking screw

Fig 2 Vehicle pressure relief valve, No. 1, Mk 1

Vehicle pressure relief valve No. 1, Mk 1 (FV 481771)

11 If the pressure relief valve fails to operate correctly (see Para 5), adjustment to the valve torsion springs as follows:

11.1 Slacken the No. 2BA locking screw (Fig 2 (4)) at centre pillar (1).

11.2 Apply a spanner to the hexagonal section of the torsion spindle (3) and preset by twisting the spindle until the valve flap begins to open when the vehicle internal air pressure reaches 3 inches SWG.

11.3 Tighten the spindle locking screw and recheck operation of the valve.

Filter housing No. 1, Mk 1 (FV 481893)

Removal

12 The filter housing (Fig 3) with flexible connection is protected by an armoured cover and is located on the outside R.H. wall of the vehicle. The filter housing can be removed, independent of the fan unit, as follows:

12.1 Ensure the fan is switched OFF at the accessories control box.

12.2 Remove the armoured cover.

12.3 Support the weight of the filter housing, unscrew the bolts (3) securing the flexible connection (4) to inlet mounting plate (1) and remove the housing.

Refitting

13 The procedure for refitting the filter housing is the reverse of removal.

Replacing filter elements

CAUTION

FILTER PROTECTION. The fan unit of the Ventilation Control System must NOT be run unless the paper particulate element has been fitted to the filter unit, otherwise dust particles in incoming air can erode fan blades and reduce the efficiency of the equipment.

14 To replace the filter elements, proceed as follows:

14.1 Ensure the fan is switched OFF at the accessories control box.

14.2 Open the doors of the armoured cover.

14.3 Unscrew the bolts (Fig 3 (5)) at the centre of the filter holders (6) and remove the holders.

14.4 Lift out the paper filter elements (7).

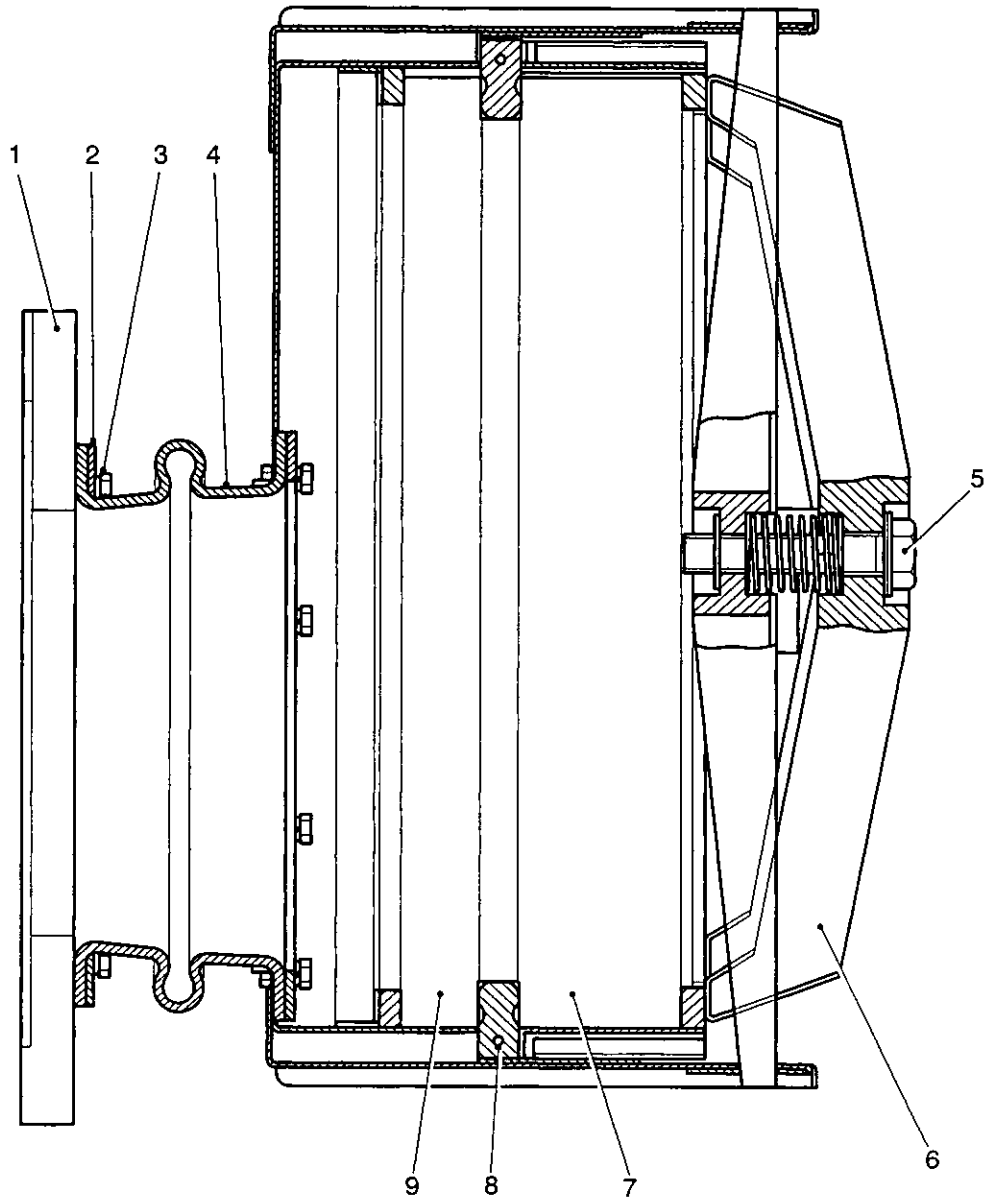
14.5 Remove the rubber seals (8).

14.6 Lift out the charcoal filter anti vapour elements (9).

14.7 Renew filter elements and assemble in reverse order.

NOTE

Filters can only be fitted one way due to the lugs on each side of the filter frame fitting into the corresponding slots in the filter unit.



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1	Inlet mounting plate	6	Filter holders
2	Ring	7	Filter particulate, No.1, Mk1
3	Bolts securing connection	8	Rubber seals
4	Flexible connection	9	Filter anti-vapour
5	Bolts securing element		

Fig 3 Filter housing, No. 1, Mk 1

Fan unit No. 1, Mk 1 (FV 481818)

WARNINGS

(1) LETHAL VOLTAGE. THE SUPPRESSION SYSTEM OF THE FAN MOTOR INCLUDES CAPACITORS RATED AT D.C. WORKING VOLTAGES OF 150 VOLTS. THE MOTOR MUST BE ISOLATED PRIOR TO INSULATION TESTS BEING CARRIED OUT ON THE REMAINDER OF THE SYSTEM. LIMITED INSULATION TESTS ON THE MOTOR MAY BE CARRIED OUT AT UNIT LEVEL ONLY IF A 100 MEGOHMMETER IS AVAILABLE.

(2) SHORT CIRCUIT. BOTH VENTILATION AND VEHICLE BATTERIES ARE CHARGED FROM THE GEAR DRIVEN ALTENATOR. IF THE VENTILATION BATTERIES, WHICH ARE LOCATED IN THE L.H. CORNER OF THE FLOOR OF THE PERSONNEL COMPARTMENT, ARE DISCONNECTED OR REMOVED, THE POSITIVE LEAD MUST BE SECURED TO THE INSULATED TERMINAL POST. THIS POST IS LOCATED ON THE L.H. WALL OF THE VEHICLE, JUST BESIDE THE BATTERIES. IT IS NOW POSSIBLE TO RUN THE ENGINE WITHOUT THE DANGER OF A SHORT CIRCUIT OCCURRING BETWEEN THE DISCONNECTED POSITIVE LEAD AND EARTH.

Carbon brush renewal

15 Unit repairs are to be confined to replacing carbon brushes or replacing the assembly. Brushes are to be replaced if they are damaged or of they are less than 0.25 in. in length. With normal vehicle interior arrangements, brushes may be replaced with the assembly in position, as follows:

15.1 Open the fan switch located in the accessories control box and ensure fan controller is in the off position.

15.2 Remove the CE fan cover (Fig 4 (1)) secured by eight retaining screws.

15.3 Remove the commutator cover pin, fan cover mounting posts (7) and commutator cover (2).

15.4 Remove the brush spring and back plate assemblies (3).

15.5 Fit the new brushes (8) and reassemble in reverse order.

Removal

16 The procedure to remove the No. 1 Mk 1 fan unit is as follows:

16.1 Ensure the fan switch, on the accessories control box and the fan controller are in the 'OFF' position.

16.2 Disconnect the lead from the plug (Fig 4 (4)) mounted on the motor terminal box.

16.3 Disconnect the vertical ducting, which is secured with self-tapping screws, from the transverse ducting.

16.4 Disconnect the suction pipe from the inlet mounting plate.

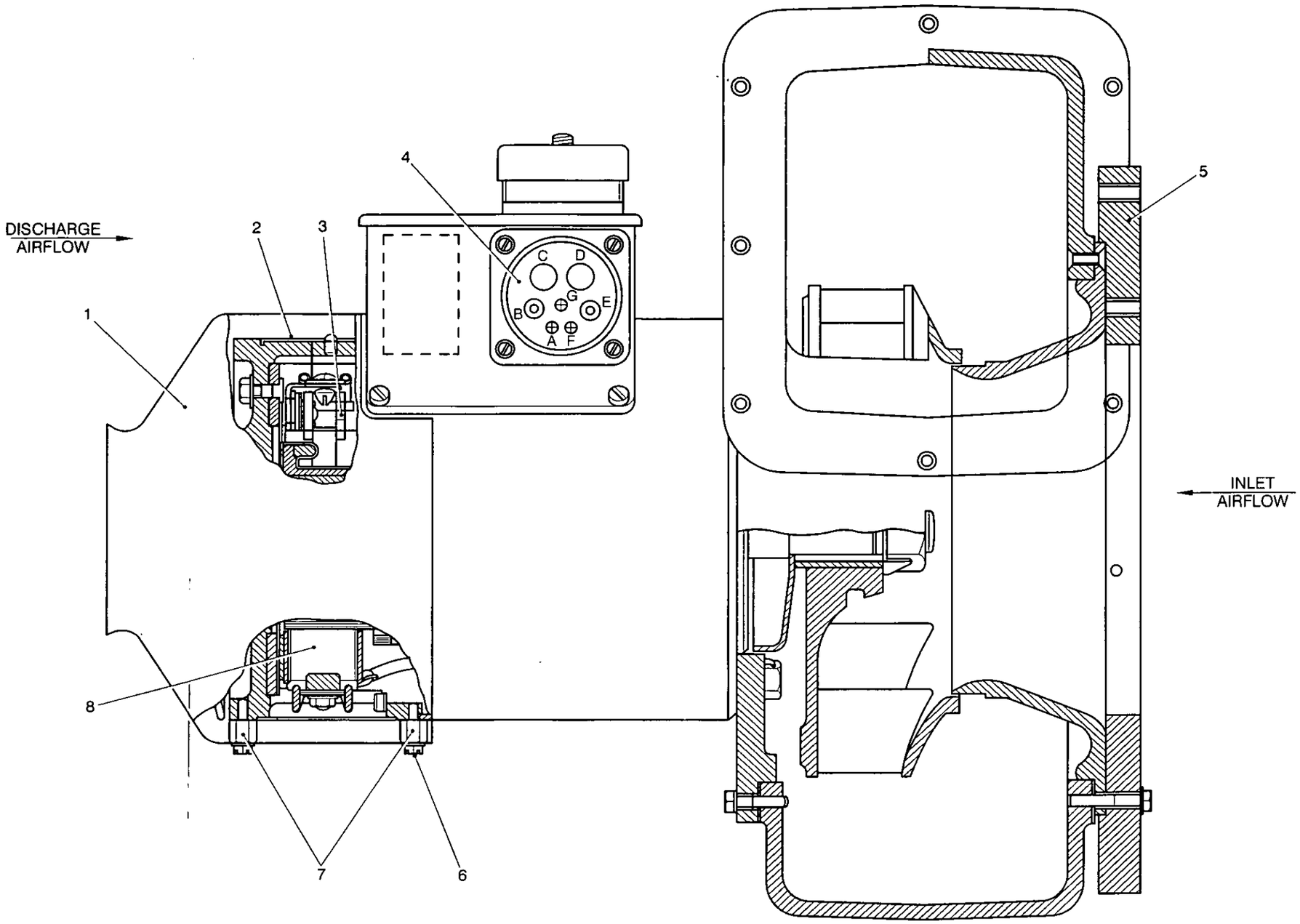
16.5 Remove the filter unit assembly, secured to the fan inlet plate by eight bolts, refer to Para 8. Finally, remove the eight bolts securing the fan inlet mounting plate to the wall of the vehicle. Ensure that the weight of the assembly is taken whilst removing the bolts.

Refitting

17 Refit in reverse order to removing, ensuring that the fan switch is open during the operation.

NOTE

If any earth bonding lead has to be reconnected, the connection must be cleaned and after assembly, coated with petroleum jelly (Table 1, Serial 1).



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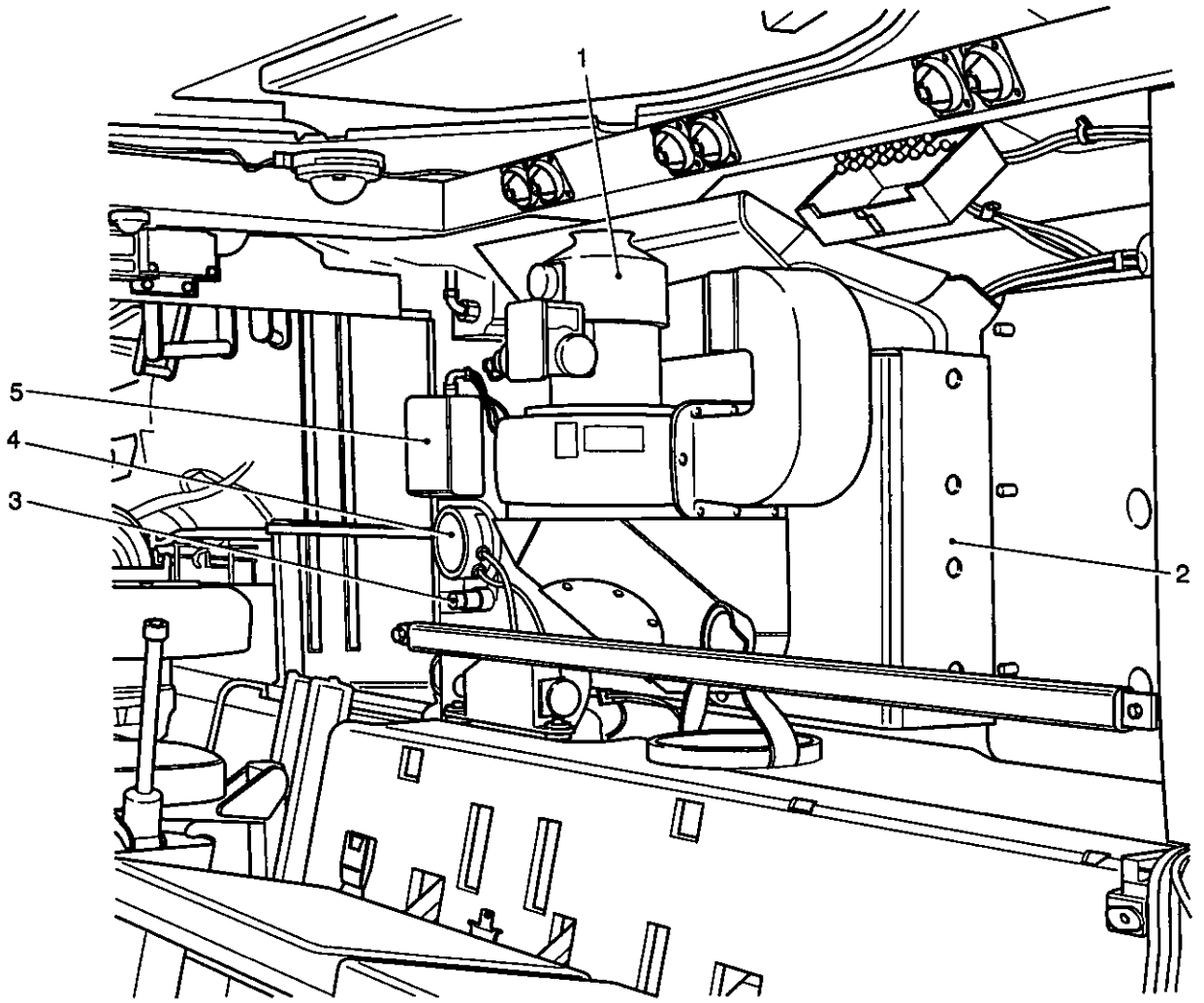
1	CE fan cover	3	Brush spring and backplate assemblies	5	Inlet mounting plate	7	Fan cover mounting post
2	Commutator cover	4	Terminal box plug	6	Screw, securing, CE fan cover	8	Brush

Fig 4 Fan pressurising unit, No.1, Mk1

VENTILATION CONTROL SYSTEM Mk 2/1 VEHICLES

General

18 To obtain a more efficient ventilation control system, which eliminates the external filter box to improve filter life and degree of protection, the projecting filter housing on the side of the vehicle has been moved inboard to the pannier space and a new 7 in. fan fitted. Vehicles may be fitted with either the 7 in. fan or the 5.1 in., depending on modification status. The hull has been modified to accept the new ventilation system.



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1	Fan unit	4	Pressure/suction gauge, No. 1, Mk 3
2	Filter housing	5	Fan controller
3	Pressure gauge valve, No. 1, Mk 1(test button)		

Fig 5 Location of fan and controls

19 The 7 in. fan is designated fan unit, No. 1, Mk 2, FV 564270 and is electrically similar to fan unit, No. 1, Mk 1, FV 451818 that it replaces.

20 The 5.1 in. fan is designated fan unit No. 4, Mk 1, FV 482416. This unit is controlled by a controller, fan, No. 2, Mk 1, FV 546143.

Components of improved ventilation control system

21 The introduction of the improved ventilation systems involves changes of filter and heater unit (when fitted). The changes are detailed in Table 3.

TABLE 3 COMPONENTS OF IMPROVED VENTILATION CONTROL SYSTEM

Fan unit (1)	Controller fan (2)	Filter (3)	Housing filter (4)	Heater, vehicle, multi-fuel (Fitted in cold theatres only) (5)
No. 1, Mk 1 FV 481818	No. 1, Mk 2 FV 342536	Particulate No. 1, Mk 1 FV 481850	No. 1, Mk 1 FV 481893	FV 524571 No. 1, Mk 1 FV 534560 No. 2, Mk 1
No. 1, Mk 2 FV 564270	No. 1, Mk 2 FV 342536	Particulate No. 1, Mk 1 FV 481850 or Anti-vapour, No. 1, Mk 1, FV 481851	No. 6, Mk1 FV482434	FV 597480 No. 8, Mk 1 FV597481 No. 9, Mk 1
No. 4, Mk 1 FV 482416	No. 2, Mk 1 FV546143	Anti-vapour No. 1, Mk 1, FV594540	No. 6, Mk 1 FV482434	FV 597482 No. 10, Mk 1 FV597483 No. 11, Mk 1

22 On certain Fan units, No. 1, Mk 2, FV 564270 (7 in. fan) the Motor, driving, No. 8, Mk 1, FV 342567 or Motor, driving, No. 8, Mk 2, FV 342568 may be fitted with a diode (CV7316) across the shunt field coils to prevent damage to the motor relay by back electromotive force from the motor field when the motor is switched off. This will be denoted by the removal of figure 3 on the motor modification record plate.

23 On certain Fan units, No. 4, Mk 1, FV 482416 (5.I in. fan) the Motor, driving, No. 9, Mk I, FV 546142 may also be fitted with a diode across the shunt field coils as described in Para 22. This will be denoted by the removal of figure 1 on the motor modification record plate.

24 When the vehicle is to be used in a cold theatre, provision is made for a multi-fuel heater to be fitted.

Pressure test

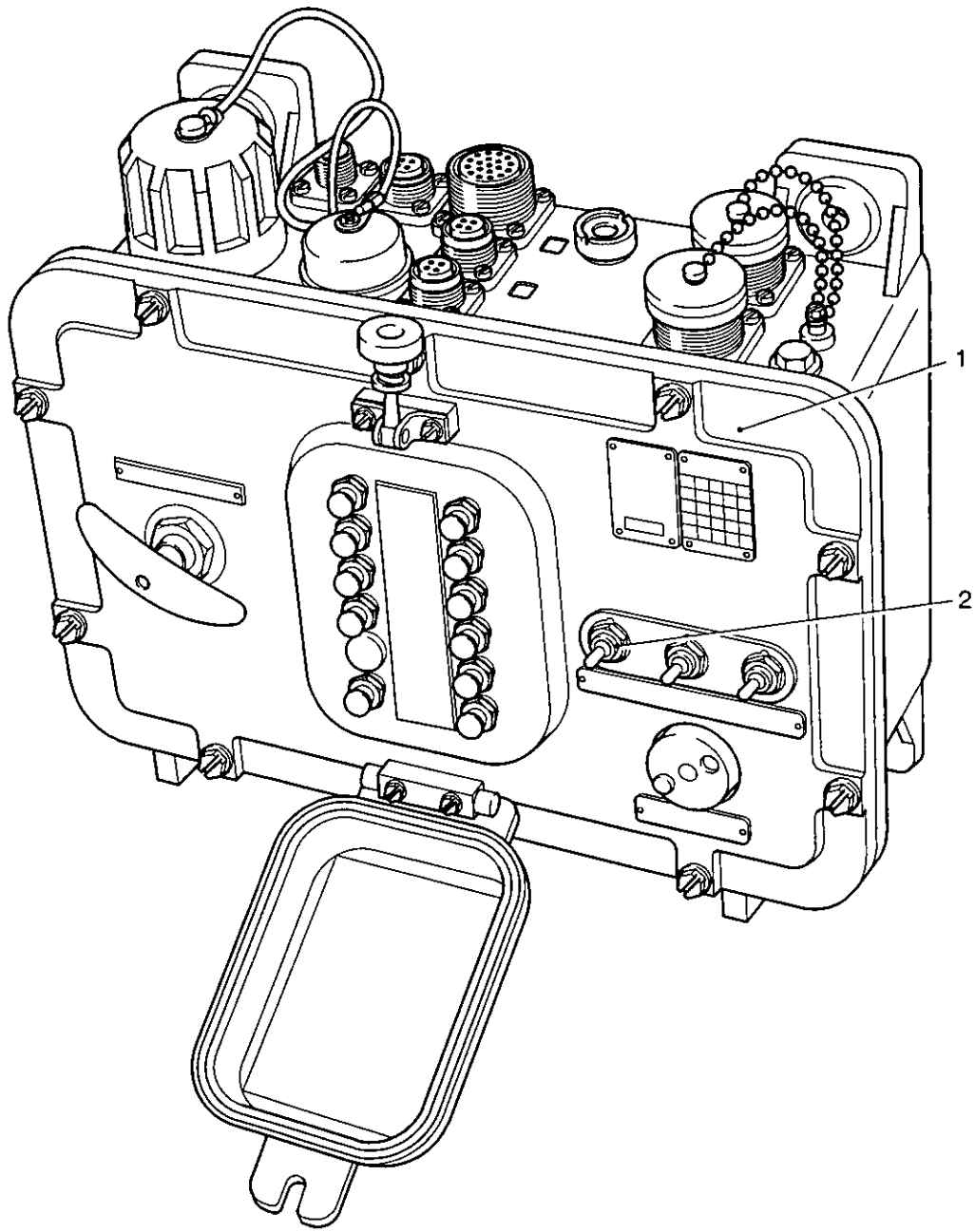
25 To pressure test the system, proceed as follows:

25.1 Ensure the correct filter is fitted to the filter unit.

25.2 Ensure all doors and hatches are closed.

25.3 Ensure the CBR switch (Fig 6 (2)) on the distribution panel, No. 6, Mk 1, is set to ON.

25.4 Operate the fan controller, mounted on the right-hand bulkhead at the rear of the commanders seat, to the minimum speed position, that will enable the pressure inside the vehicle to build up to at least 3 inches Standard Water Gauge (SWG) as indicated on the pressure (+) scale of the gauge. At this reading, the vehicle pressure relief valve (situated in the roof of vehicle on the left-hand side in front of rear door) should open sufficiently to cause a bleed, which will maintain the pressure at 3 inches SWG.



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1 Distribution panel, No. 6, Mk 1

2 CBR switch

Fig 6 Location of ventilation fan switch

26 If pressure fails to reach the required 3 inches SWG it will be due to:

26.1 Clogged filters.

26.2 Leaks in vehicle sealing

27 The cause can be ascertained by operating the test button below pressure/suction gauge and noting the reading on the suction (-) scale. A reading of less than 1 inch SWG will prove that the filters are clean, indicating that there is a leak in the vehicle sealing. If, however, a reading of - 5 inches SWG or more is observed. This will indicate that the system is overloaded due to clogged or dirty filters.

FAN, UNIT, No. 4, Mk 1 (FV 482416)

WARNINGS

(1) LETHAL VOLTAGE. THE SUPPRESSION SYSTEM OF THE FAN MOTOR INCLUDES CAPACITORS RATED AT D.C. WORKING VOLTAGES OF 150 VOLTS. THE MOTOR MUST BE ISOLATED PRIOR TO INSULATION TESTS BEING CARRIED OUT ON THE REMAINDER OF THE SYSTEM. LIMITED INSULATION TESTS ON THE MOTOR MAY BE CARRIED OUT AT UNIT LEVEL ONLY IF A 100 MEGOHMMETER IS AVAILABLE.

(2) SHORT CIRCUIT. BOTH VENTILATION AND VEHICLE BATTERIES ARE CHARGED FROM THE GEAR DRIVEN ALTERNATOR. IF THE VENTILATION BATTERIES, WHICH ARE LOCATED IN THE L.H. CORNER OF THE FLOOR OF THE PERSONNEL COMPARTMENT, ARE DISCONNECTED OR REMOVED THE POSITIVE LEAD MUST BE SECURED TO THE INSULATED TERMINAL POST. THIS POST IS LOCATED ON THE L.H. WALL OF THE VEHICLE, JUST BESIDE THE BATTERIES. IT IS NOW POSSIBLE TO RUN THE ENGINE WITHOUT THE DANGER OF A SHORT CIRCUIT OCCURRING BETWEEN THE DISCONNECTED POSITIVE LEAD AND EARTH.

Removal

28 The procedure to remove the No. 4 Mk 1 fan unit is as follows:

28.1 Ensure the fan switch and the fan controller, are in the OFF position.

External operations

28.2 Open the external hatch.

28.3 Remove the filters.

28.4 Remove the eight screws securing the rubber air duct.

Internal operations

28.5 Remove the 'U' shaped air duct, six screws.

28.6 Disconnect the plug.

28.7 Remove the pipe to the pressure/suction gauge.

28.8 Remove the ten mounting screws and lift out the fan unit.

Refitting

29 Refit in reverse order to removing.

NOTE

If any earth bonding lead has to be reconnected, the connection must be cleaned and after assembly, coated with petroleum jelly (Table 1, Serial 1).

Failure diagnosis

Failure diagnosis tables

30 Failure diagnosis procedures are presented in the form of tables, each table consisting of six columns as follows:

30.1 Column 1 (Serial) details the sequence to be followed during the test. Tests should be carried out in the order stated in column 1 or 6.

30.2 Column 2 (Action) details the action to be taken to perform that step.

30.3 Column 3 (Test points) defines the test points that are applicable to that step.

30.4 Column 4 (Correct result) details the expected result that should be obtained for correct operation. Use the multimeter (Table 2, Serial 2) set for voltage measurement or for continuity testing use range setting 0-100 ohms.

30.5 Column 5 (Action if correct) details the action to be taken if the expected result is correct.

30.6 Column 6 (Action if not correct) details the action to be taken if the expected result is incorrect.

Initial conditions

31 When carrying out failure diagnosis, the following initial conditions are assumed to be met:

31.1 All user maintenance and fault finding has been successfully carried out.

31.2 The engine is not running, unless otherwise stated.

31.3 No circuit breaker is tripped.

31.4 Diagnostic equipment is serviceable and correctly calibrated.

Fan motor failure

WARNINGS

(1) LETHAL VOLTAGE. THE SUPPRESSION SYSTEM OF THE FAN MOTOR INCLUDES CAPACITORS RATED AT D.C. WORKING VOLTAGES OF 150 VOLTS. THE MOTOR MUST BE ISOLATED PRIOR TO INSULATION TESTS BEING CARRIED OUT ON THE REMAINDER OF THE SYSTEM. LIMITED INSULATION TESTS ON THE MOTOR MAY BE CARRIED OUT AT UNIT LEVEL ONLY IF A 100 MEGHOMMETER IS AVAILABLE.

(2) SHORT CIRCUIT. BOTH VENTILATION AND VEHICLE BATTERIES ARE CHARGED FROM THE GEAR DRIVEN ALTERNATOR. IF THE VENTILATION BATTERIES, WHICH ARE LOCATED IN THE L.H. CORNER OF THE FLOOR OF THE PERSONNEL COMPARTMENT, ARE DISCONNECTED OR REMOVED THE POSITIVE LEAD MUST BE SECURED TO THE INSULATED TERMINAL POST. THIS POST IS LOCATED ON THE L.H. WALL OF THE VEHICLE, JUST BESIDE THE BATTERIES. IT IS NOW POSSIBLE TO RUN THE ENGINE WITHOUT THE DANGER OF A SHORT CIRCUIT OCCURRING BETWEEN THE DISCONNECTED POSITIVE LEAD AND EARTH.

32 Vehicles fitted with Fan unit, No. 4, Mk 1 Controller, fan, No. 2, Mk 1 and Distribution panel, No. 6, Mk 1, carry out the following procedure:

Fan motor circuit – failure diagnosis

33 If the fan motor fails to operate, partially or completely, ensure the carbon brush gear is serviceable (Para 15 refers) then proceed to test the system. Carry out actions as detailed in Table 4 to enable a fault to be identified in the fan motor circuit, with reference to Fig 7.

TABLE 4 FAN MOTOR CIRCUIT - FAILURE DIAGNOSIS

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
1	Disconnect plug from SK1 of the fan controller, set battery master switch ON. Carry out dc voltage test.	SK1 insert D to E.	24V nominal.	Go to 3	Go to 2
2	Disconnect plug PL2 of the fan controller Carry out dc voltage test.	PL2 insert A to C	24V nominal	Go to 3	Refer to Chap 5.
3	Set controller switch to OFF. Carry out continuity test of controller.	PL2 A to SK1 E	continuity	Go to 4	Renew controller.
4	Set controller switch to OFF. Carry out continuity test.	PL2 C to SK1 D	continuity	Go to 5	Renew controller.
5	Set controller switch to MIN. Carry out continuity test.	PL2 A to SK1 E and A	continuity	Go to 6	Renew controller.
6	Set controller switch to MIN. Carry out continuity test.	PL2 C to SK1 D	continuity	Go to 7	Renew controller.
7	Set controller switch to MIN. Carry out continuity test.	SK1 B to C	continuity	Go to 8	Renew controller.
8	Set controller switch to MAX. Carry out continuity test.	PL2 A to SK1 B and D	continuity	Go to 9	Renew controller.
9	Set controller switch to MAX. Carry out continuity test.	PL2 C to SK1 A,C and E	continuity	Go to 10	Renew controller.

(continued)

TABLE 4 FAN MOTOR CIRCUIT - FAILURE DIAGNOSIS (continued)

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
10	Carry out resistance test.	PL2 A to SK1 A Step controller Select low range Switch position: MIN 1 2 3 4 5 PL2 A to SK1 A Step controller Select high range Switch position: 5 6 7 8 9 MAX	 0Ω 2Ω 5Ω 8.5Ω 14Ω 30Ω 0Ω 2Ω 3.6Ω 5.2Ω 6.8Ω 8.7Ω	Renew fan unit.	Renew controller.

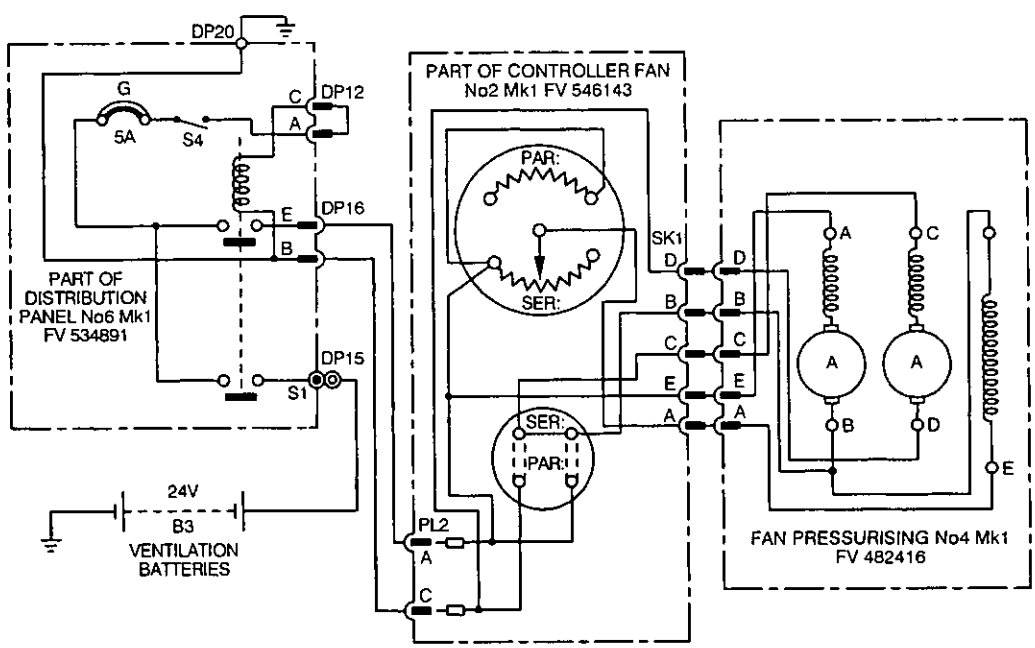

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Fig 7 Circuit diagram, ventilation control system

CHAPTER 5

ELECTRICAL SYSTEM

CONTENTS

(continued)

CONTENTS (continued)

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CONTENTS (continued)

(continued)

CONTENTS (continued)

GENERAL

1 This chapter details the Level 2 repairs to the electrical system.

Sealants, solvents and lubricants

2 Table 1 lists the sealants, solvents and lubricants required to carry out the procedures described within this chapter.

TABLE 1 SEALANTS, SOLVENTS AND LUBRICANTS

Serial (1)	NSN/FV No. (2)	Designation (3)
1	9160-99-665-3053	Petroleum jelly
2	H1/6810-99-210-3048	Butanone, reagent (formerly M.E.K.)

Special tools and test equipment

3 Table 2 lists the special tools and test equipment required to carry out the procedures described within this chapter.

TABLE 2 SPECIAL TOOLS AND TEST EQUIPMENT

Serial (1)	NSN/FV No. (2)	Designation (3)
1	Z4/6625-99-102-5387	500V Megohmmeter
2	Z4/6625-99-252-3606	Multimeter set, general purpose, hand held
3	1VSM/2590-99-811-6800	Tester flame switch
4	Z4/6625-99-102-2589	Indicator phase sequence and continuity
5	9ACR/2590-99-867-0380	Interconnecting box
6	5120-99-811-2501	Engine turn over spanner

NOTE

EMER Pwr W 001 should be studied before commencing any servicing on this vehicle.

4 The electrical system contains voltage sensitive elements (semi-conductors, diodes, and capacitors) and the following instructions must therefore be strictly observed when conducting megohmmeter tests.

4.1 Assemblies. Capacitors and semi-conductors in an assembly circuit must be isolated before testing. Where a specified voltage megohmmeter is detailed for a particular assembly, on no account must a higher voltage be used.

4.2 Harnesses Both ends of inter-connecting harnesses must be disconnected.

Insulation resistance testing

5 The 'cold' insulation resistance of all assemblies, other than rotating machines, are not to be less than 5MΩ when measured with a 500V megohmmeter (subject to the conditions detailed in Para 4).

6 The 'cold' resistance of all rotating machines must be tested with a 500V megohmmeter and are not to be less than 1MΩ when all windings are paralleled (subject to the conditions detailed in Para 4).

Electrical testing

7 Before commencing any of the electrical tests detailed in this chapter, carry out the following:

7.1 Inspect for mechanical damage.

7.2 Ensure that all connections are clean and tight.

7.3 Service the batteries as detailed in AESP 6140-H-100-013

7.4 On successful completion of electrical testing all electrical connections must be remade.

8 If the power pack is removed to replace an electrical assembly, it should be run before refitting to ensure that the replacement electrical assembly functions correctly.

9 All continuity and resistance tests should be with the systems made 'dead' by switching OFF battery master switches. Multimeter set (Table 2, Serial 2) must be used for these tests and set to the resistance range, unless the megohmmeter is specifically detailed for a test.

10 Where a test details a voltage measurement, the multimeter must be used and set to a suitable dc or ac voltage range, as appropriate.

Failure diagnosis

Failure diagnosis tables

11 Failure diagnosis procedures are presented in the form of tables, each table consisting of six columns as follows:

11.1 Column 1 (Serial) details the sequence to be followed during the test. Tests should be carried out in the order stated in column 1 or 6.

11.2 Column 2 (Action) details the action to be taken to perform that step.

11.3 Column 3 (Test points) defines the test points that are applicable to that step.

11.4 Column 4 (Correct result) details the expected result that should be obtained for correct operation. Use the multimeter (Table 2, Serial 2) set for voltage measurement or for continuity testing use the resistance range.

11.5 Column 5 (Action if correct) details the action to be taken if the expected result is correct.

11.6 Column 6 (Action if not correct) details the action to be taken if the expected result is incorrect.

Initial conditions

12 When carrying out failure diagnosis, the following initial conditions are assumed to be met:

12.1 All user maintenance and fault finding has been successfully carried out.

12.2 The engine is not running, unless otherwise stated.

12.3 No Circuit Breaker (CB) is tripped and all fuses are serviceable. The location of all CBs and fuses is detailed in AESP 2350-T-250-201.

12.4 Diagnostic equipment is serviceable and correctly calibrated.

BATTERIES

NOTES

(1) For manufacturing details of the battery-lifting tool, refer to Para 17.

(2) Ensure that battery filler plugs (if used) are fitted before moving batteries.

General

13 The vehicle is equipped with six batteries, mounted in three sets, hull batteries, radio batteries, and ventilation batteries. All the batteries are mounted as pairs in containers, Fig 1 shows the arrangement for the ventilation batteries. An alternative location for the positioning of the ventilation batteries can be seen in Fig 1B. AESP 2350-T-250-811 Mod Instr No 1/116 refers.

Removal

WARNING

HEAVY WEIGHT. EACH BATTERY WEIGHS 36.3 kg (80 LB). DUE CONSIDERATION MUST BE GIVEN TO THE REGULATIONS GOVERNING THE LIFTING OF HEAVY WEIGHTS WHEN MOVING EQUIPMENT.

14 The procedure to remove any of the batteries is as follows:

14.1 Switch all battery master switches to OFF.

14.2 For the radio batteries, remove the driver's seat assembly.

14.3 Release the nuts (Fig 1A(4)) holding clamp (8) and the remove clamp.

14.4 Remove the ventilation tube (1) and the T-connection.

14.5 Remove the battery negative connection (7).

14.6 Remove the battery positive connection (3) and connecting strap (5).

14.7 For the hull batteries, remove battery container securing strip and slide container with batteries onto driver's seat.

14.8 For the radio batteries, lift commander's seat foot platform to vertical position.

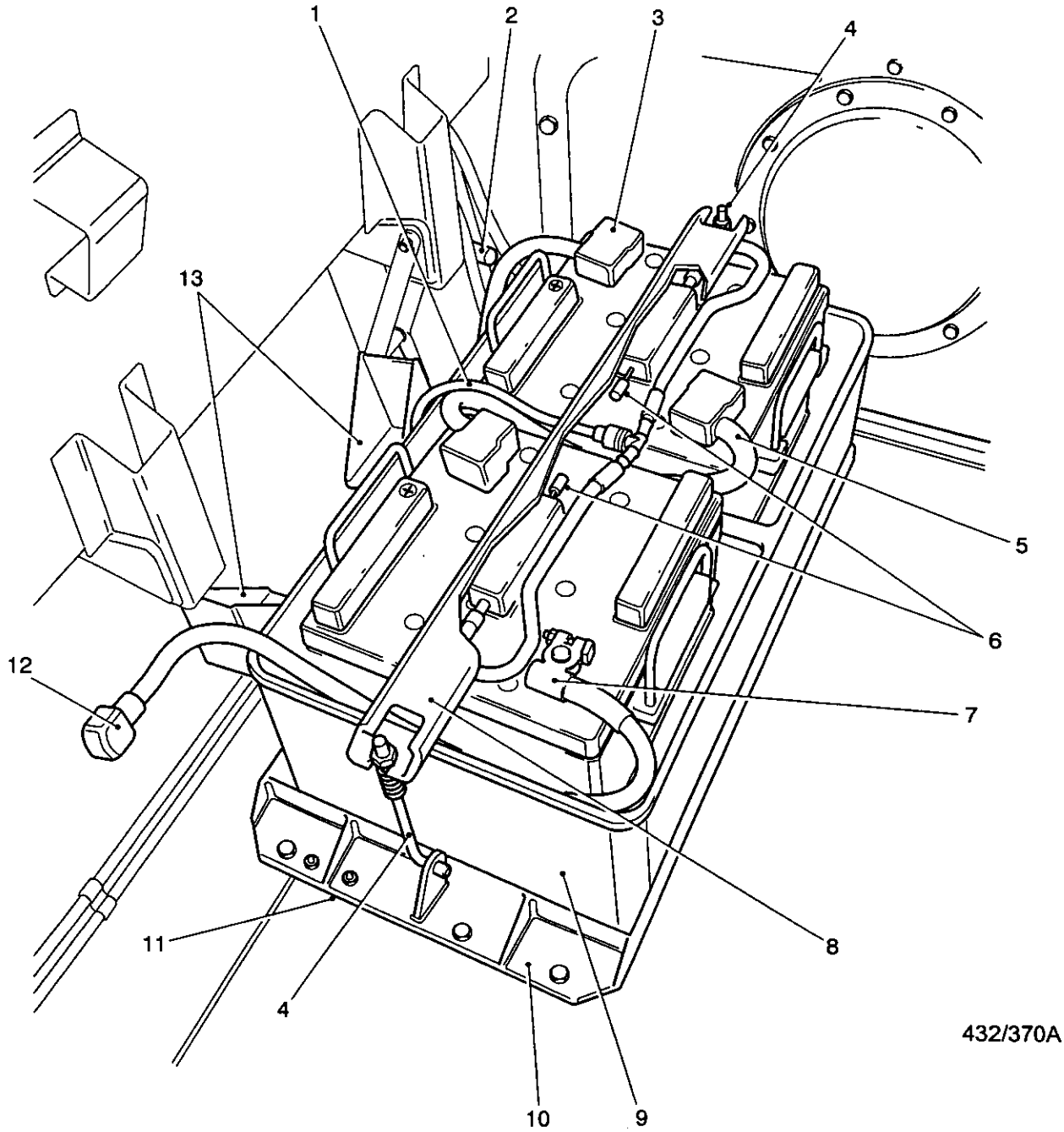
14.9 Using the special battery lifting tool, detailed at Para 17, move batteries from the vehicle individually out through the driver's hatch or back through the crew compartment.

Refitting

15 Refit in reverse order to removing.

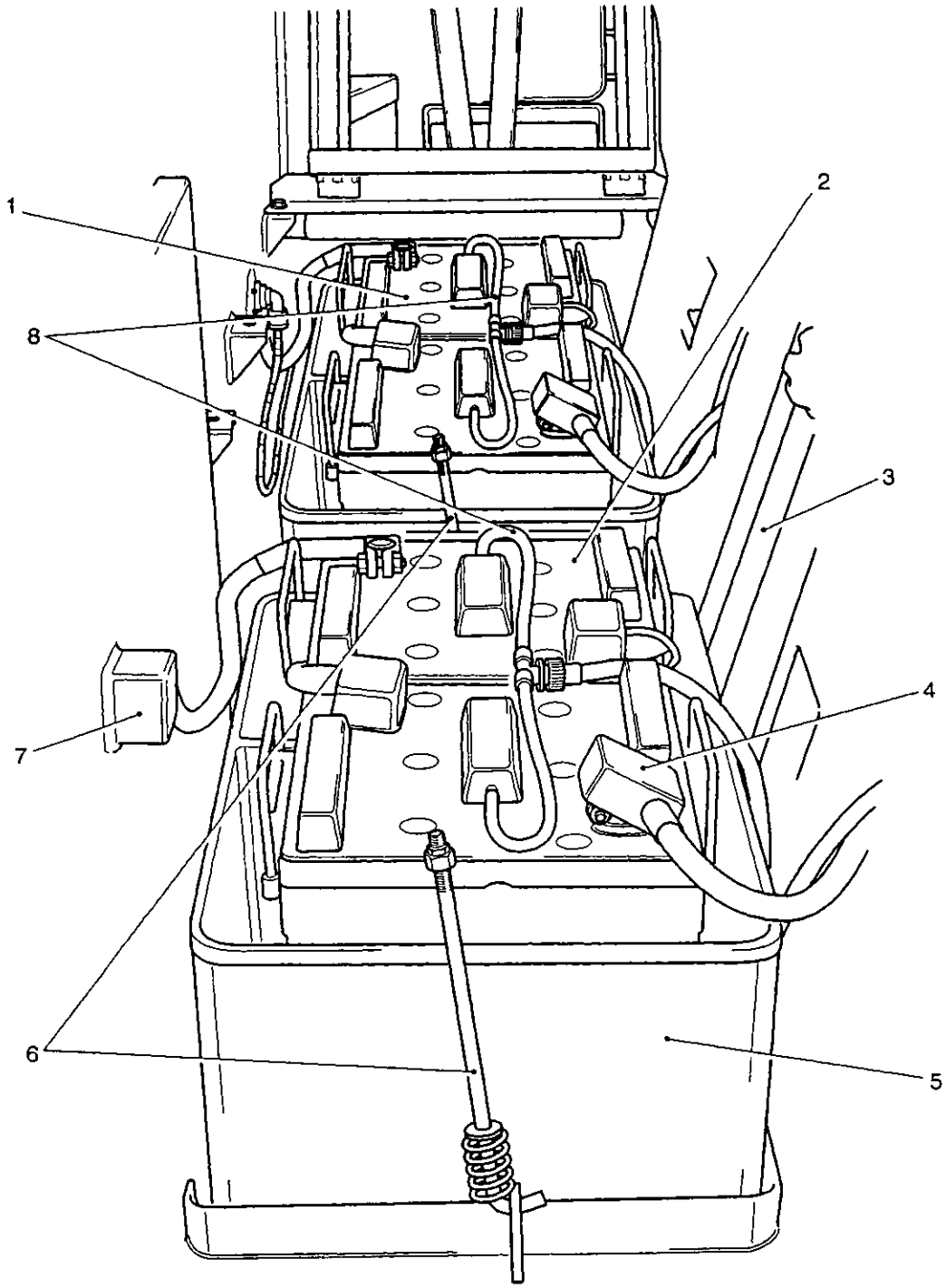
Testing

16 Depending on which set of batteries have been replaced, carry out functional test on corresponding system: hull - ensure engine starts; radio – ensure radio operates under all conditions; ventilation – ensure fan operates.



1	Vent pipe assembly	9	Battery housing container
2	Insulated stowage terminal	10	Mounting bracket
3	Positive terminal	11	Packing strip
4	Clamp bolts	12	Hull neg connection
5	Connecting strap	13	Commanders periscope stowage brackets
6	Seal caps		
7	Negative terminal		
8	Clamp bar		

Fig 1A Battery mounting (ventilation batteries)



1	Radio batteries	5	Battery housing container
2	Ventilation batteries	6	Clamp bolts
3	Commanders seat support slide	7	Negative terminal
4	Positive terminal	8	Battery vent pipe assembly

Fig 1B Alternative positioning of ventilation batteries

Battery lifting tool

17 To facilitate the removing and refitting of batteries, a special tool may be manufactured locally. For manufacturing details see Fig 2.

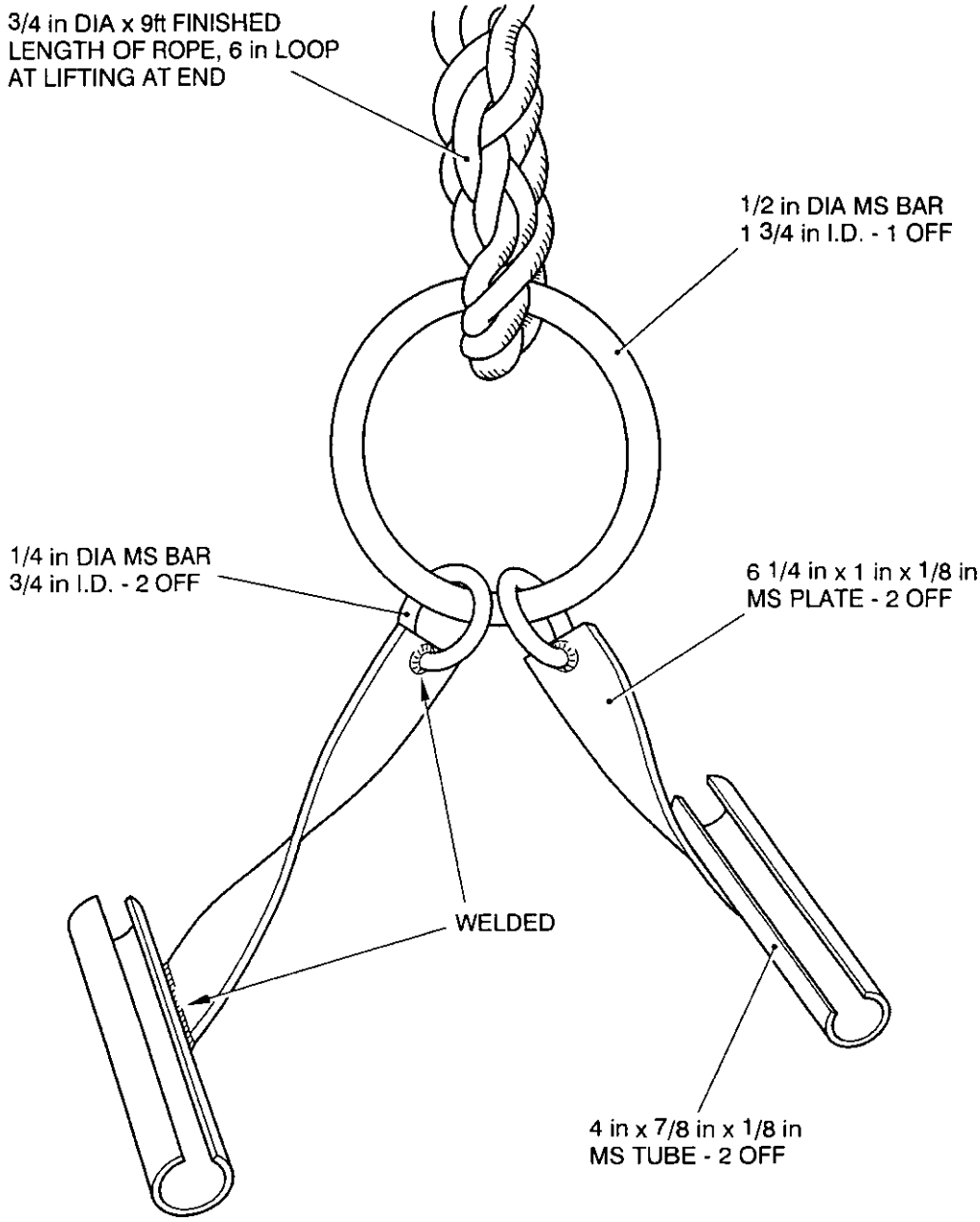


Fig 2 Battery lifting tool

RADIO DISTRIBUTION BOX No 1 Mk 3

Failure diagnosis

18 Check the fuse carrier for corrosion and renew the radio distribution panel if corrosion is present.

19 Table 3 with reference to Fig 3 enables a fault in the radio distribution box No 1 Mk 3 to be identified.

TABLE 3 RADIO DISTRIBUTION BOX No 1 Mk 3 - FAILURE DIAGNOSIS

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
1	Set radio battery master switch S1 to OFF. Disconnect all external plugs and sockets. Carry out continuity test.	RDP5 to RDP2B RDP5 to RDP3B RDP5 to RDP6C RDP5 to NEG	continuity	Go to 2.	Renew radio distribution box.
2	Set radio battery master switch S1 to ON. Carry out continuity test.	RDP1 to RDP7 RDP1 to RDP8 RDP7 to RDP8 RDP1 to RDP3A RDP1 to RDP2A	continuity	Go to 3.	Renew radio distribution box.
3	Carry out resistance test.	RDP9B to RDP2A RDP9B to RDP3A	160Ω 160Ω	Go to 4.	Renew radio distribution box.
4	Set external charge switch S2 to ON. Carry out resistance test.	Multimeter -ve lead on RDP6D, +ve lead on RDP9B	350Ω	Go to 5.	Renew radio distribution box.
5	Carry out resistance test.	Multimeter +ve lead on RDP6D, -ve lead on RDP9B	10000Ω or greater	Go to 6.	Renew radio distribution box.
6	Energize the generator only. From 24Vdc supply apply +ve to RDP6D and -ve to RDP9B, switch S2 to ON. Carry out continuity test.	RDP1 to RDP6A	continuity	Go to 7.	Renew radio distribution box.
7	Carry out resistance test.	RDP9B to RDP6C	160Ω	End of test.	Renew radio distribution box.

Removal

20 Remove the radio distribution box as follows:

20.1 Switch 'OFF' the radio battery master switch (Fig 4 (4)).

20.2 Disconnect the radio battery.

20.3 Remove plugs RDP1, RDP2, RDP3, RDP7 and RDP9.

20.4 Disconnect the earth strap (Fig 4(3)) at the hull.

20.5 Remove the four bolts (2) securing the panel to the mounting bracket (1) and remove the box.

Refitting

21 Refit in reverse order to removing, ensuring that the contact areas between the vehicle hull and the earth strap are clean and free from grease. After assembly apply a coat of petroleum jelly (Table 1, Ser 1).

Testing

22 Ensure the correct operation of vehicle radios and the external charging circuit.

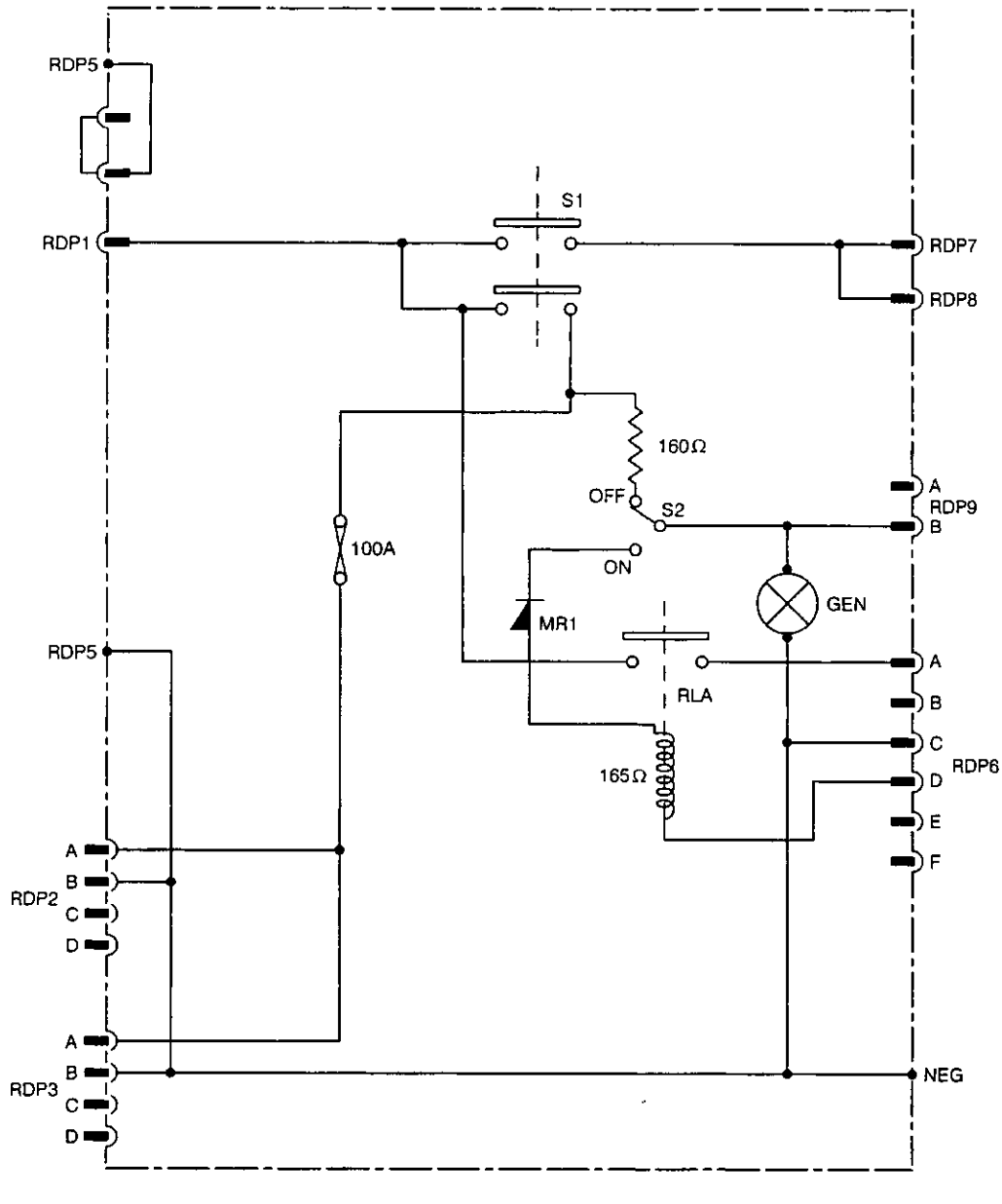
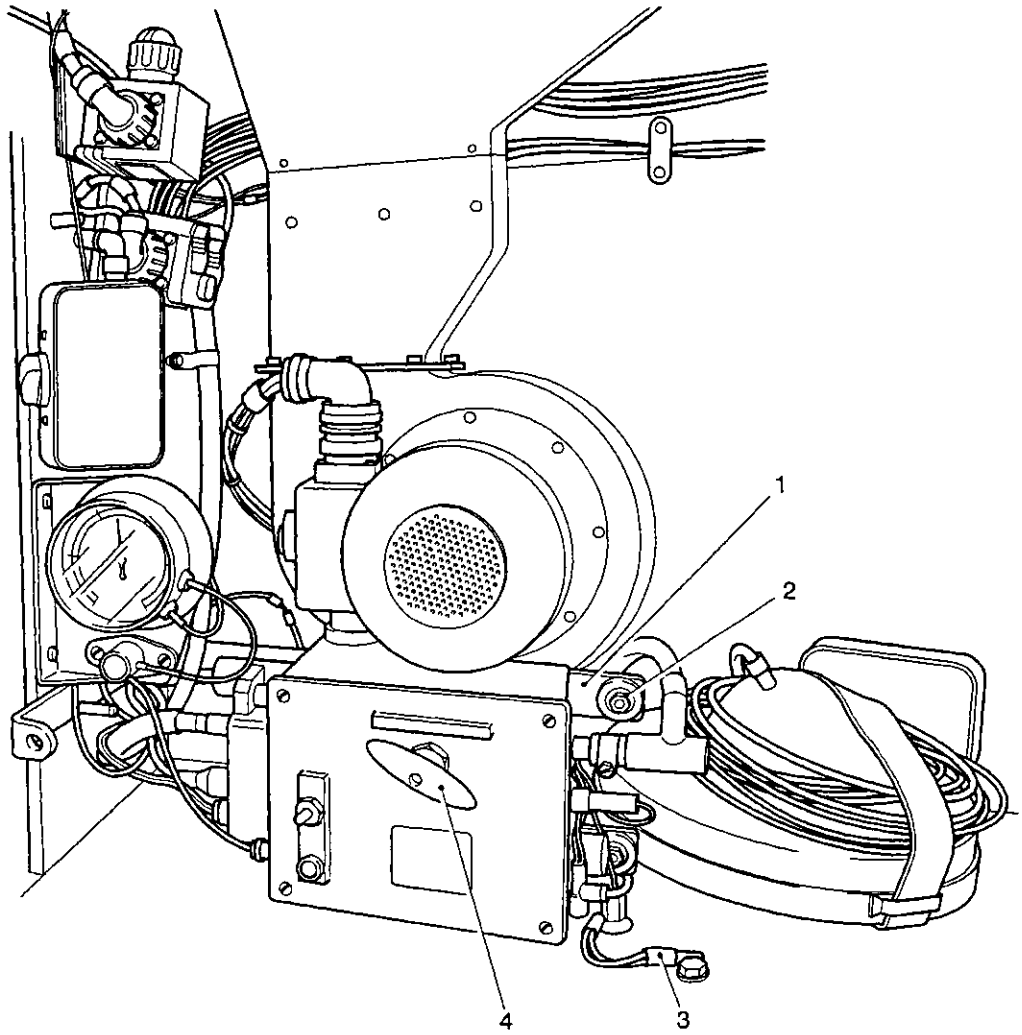


Fig 3 Wiring diagram, radio distribution box No1 Mk3



1	Mounting bracket	3	Earth strap
2	Bolt (4 off)	4	Radio battery master switch

Fig 4 Radio distribution box No1 Mk3

GENERATING SYSTEM

Failure diagnosis

General

CAUTION

EQUIPMENT DAMAGE. Before insulation testing is carried out on the cable harness, the harness must be disconnected at each end, to prevent damage to the semi-conductor devices. Megohmmeter testing must not be used on any assemblies except the alternators.

23 No detailed repairs to alternators or control panels must be carried out at unit level. When necessary, a replacement assembly should be fitted.

Power supply faults

24 Table 6, in conjunction with Figs 5 A,B,C,D, details the more common faults within the power supply circuit and directs the technician to the most probable cause of those faults with a suggested remedial action.

TABLE 4 POWER SUPPLY FAULTS

Serial (1)	Symptoms (2)	Probable causes (3)	Action (4)
1	Batteries discharged.	Incorrect line voltage.	Carry out dc voltage check Para 41 refers. Adjust if necessary.
2	Overheating of batteries.	Incorrect line voltage.	Carry out dc voltage check Para 41 refers. Adjust if necessary.
3	No or low ammeter reading.	Failure of generating circuit.	Connect the rear control panel to the front alternator. If the fault is rectified, the front control panel is defective and should be replaced. Connect the front control panel to the rear alternator. If the fault is rectified, the rear control panel is defective and should be replaced. If the fault is not rectified check harness to alternator. If this is satisfactory replace the relevant alternator.
4	Ammeter registers zero and the generator failure lamp is not extinguished when the engine speed has reached 400 rev/min.	Failure of generating circuit.	Stop engine; switch 'OFF' battery master switch and check fuse D on the distribution panel. Disconnect the front alternator at DLB13. Disconnect front alternator control panel at socket. Switch 'ON' hull battery master switch and run the engine. If the failure lamp is now extinguished, check harness for a short circuit between phase lines. If action above is satisfactory, move the access plates in the driver's compartment. Test the harness from the power pack junction to the alternator. If the action above is satisfactory then replace the front alternator. If actions above fail to produce a satisfactory result reconnect the front alternator and control panel. Disconnect rear alternator at DLB14 and repeat actions for the rear alternator.

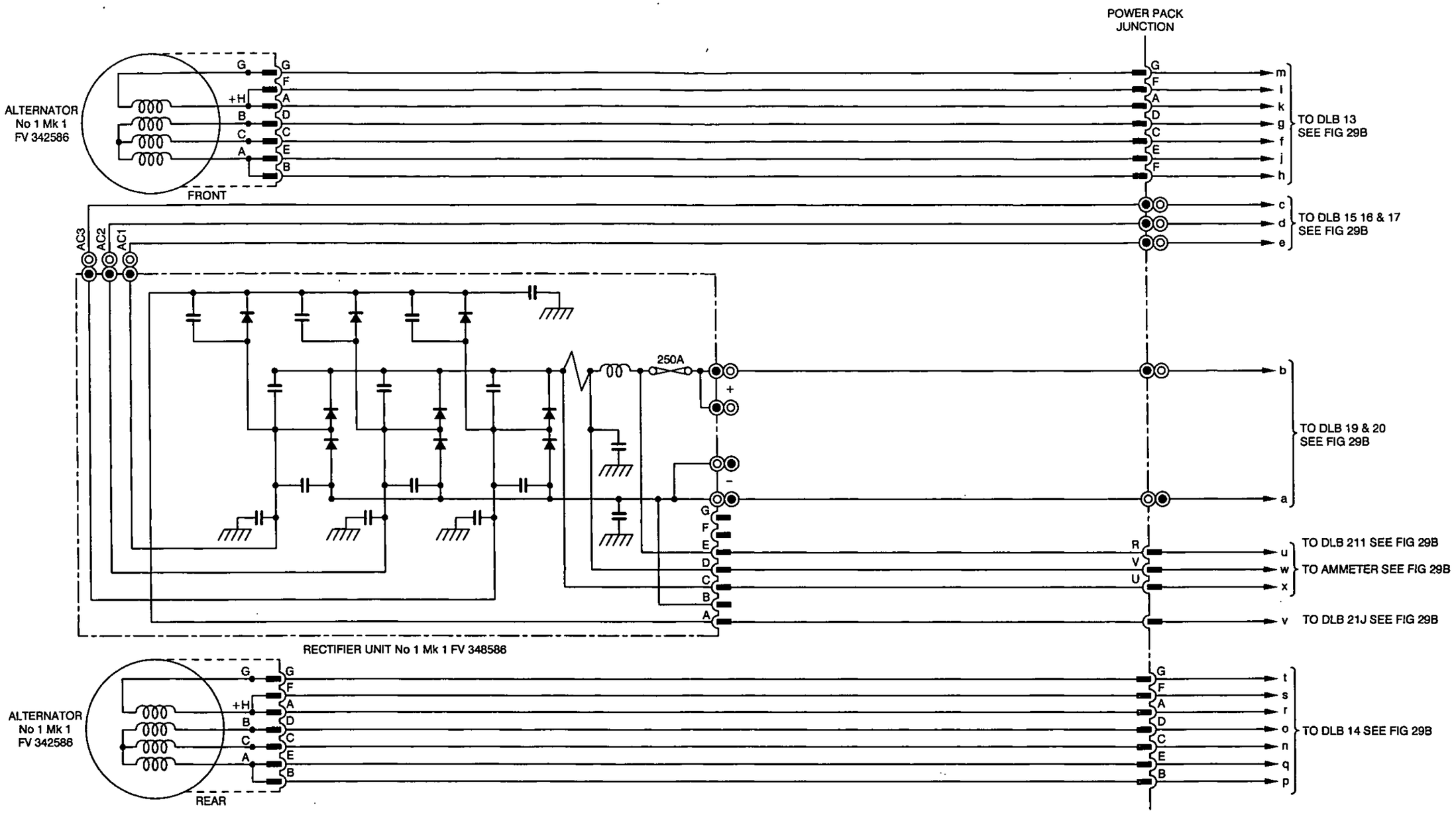


Fig 5A Generating system, incorporating distribution panel No 6 Mk1 (part view)

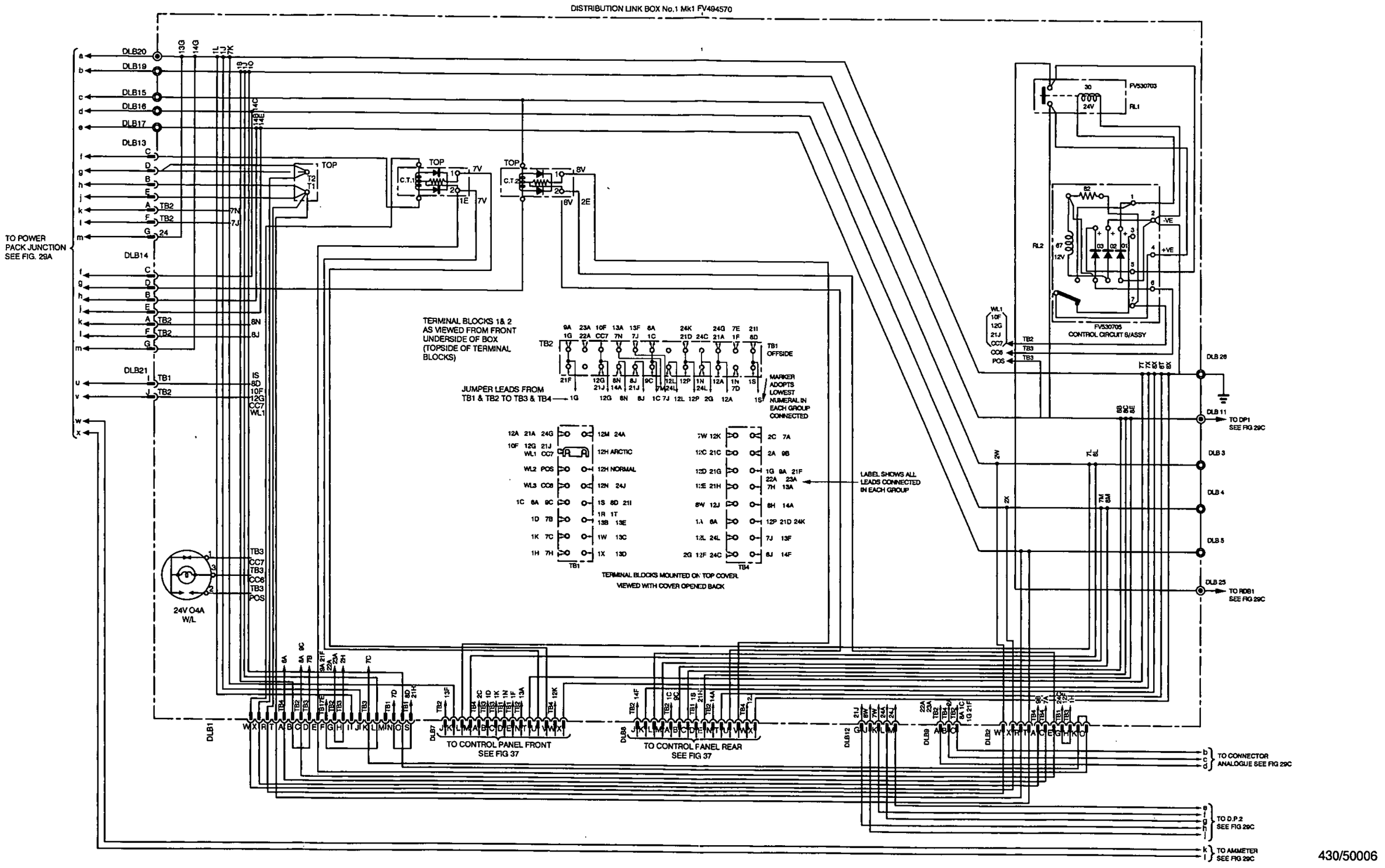


Fig 5B Generating system, incorporating distribution panel No 6 Mk1 (part view)

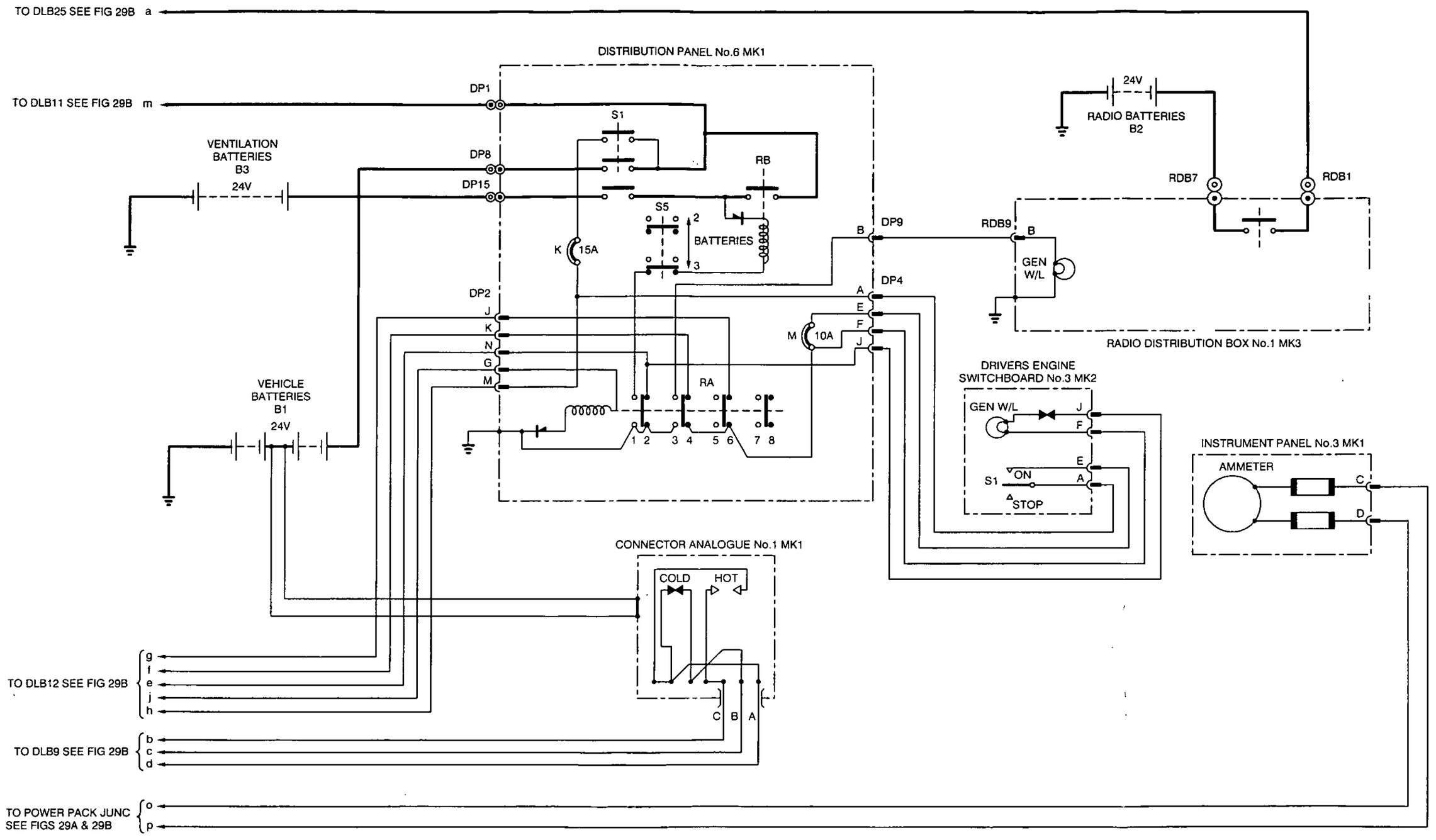


Fig 5C Generating system, incorporating distribution panel No 6 Mk1 (part view)

NOTE:
FRONT AND REAR
CONTROL PANELS
ARE IDENTICAL

CONTROL PANEL ALTERNATOR No.1 MK1

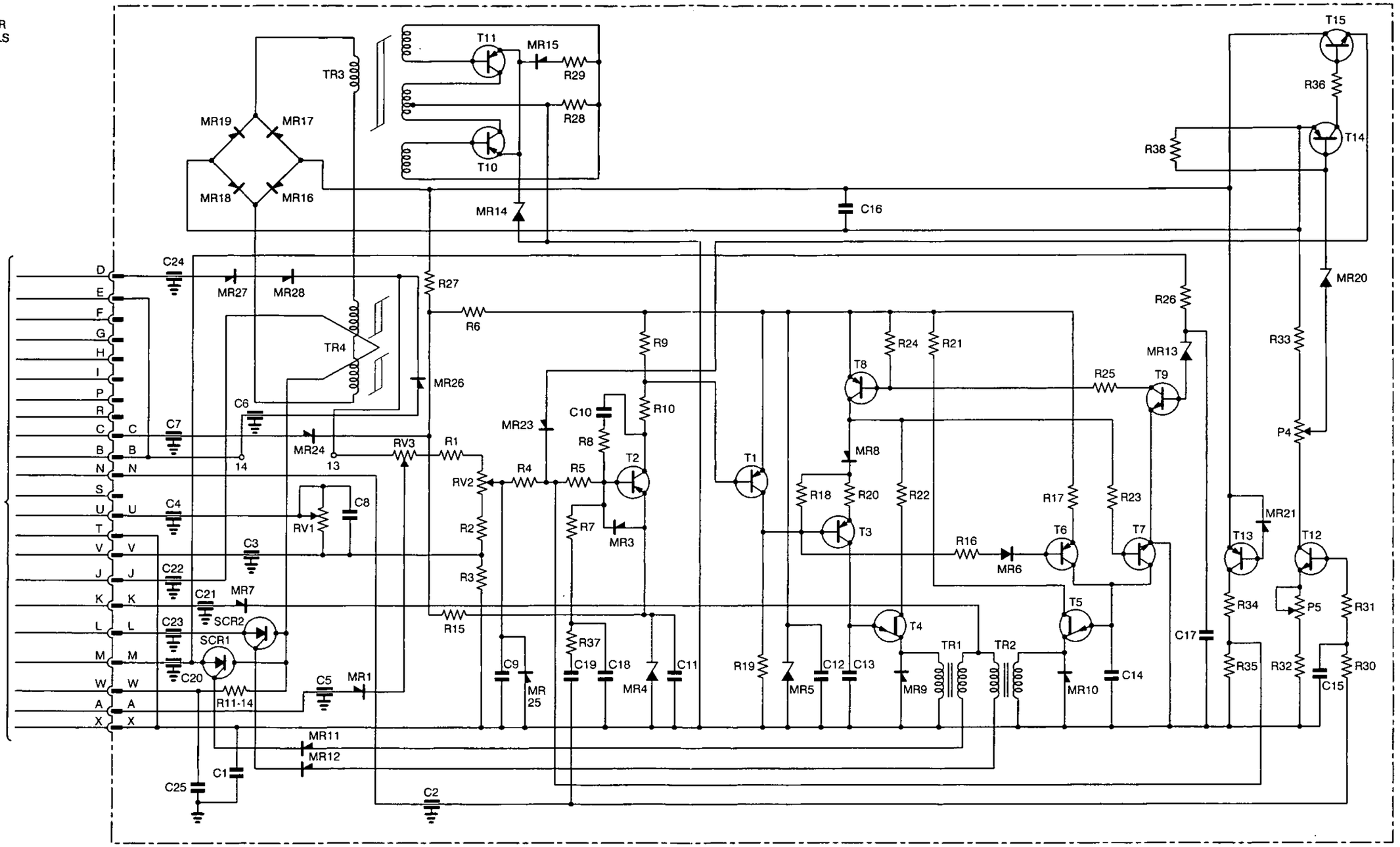


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Fig 5D Generating system, incorporating distribution panel No 6 Mk1 (part view)

Failure diagnosis of generator only line circuit

25 Facilities are provided for monitoring the charging circuit at terminal strips TB3 and TB4, mounted inside the cover of the distribution link box (DLB). To gain access to the terminal strips, remove the driver's lower instrument panel from its mounting, remove the distribution link box cover plate screws and fold cover plate back.

26 Table 4 and Fig 6 enables a fault in the generator only line circuit to be identified.

TABLE 5 GENERATOR ONLY LINE CIRCUIT - FAILURE DIAGNOSIS

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
1	Set engine speed to 750 rev/min. Carry out voltage test.	Distribution link box TB3, terminal 21J to earth and terminal12G to earth.	16V dc approx.	End of test.	Go to 2.
2	Set hull battery master switch to OFF. Disconnect 12G and 12N from TB3 and dc -ve at power pack junction Carry out resistance test.	Multimeter -ve lead on 12G +ve lead to earth.	160Ω	Go to 7.	Go to 3.
3	Carry out resistance test.	Multimeter +ve lead on 12G -ve lead to earth.	10000Ω or greater	Go to 7.	Go to 4.
4	Disconnect DP2 and DLB12. Carry out continuity test.	DP2 to DLB12.	continuity	Go to 5.	Repair/renew harness.
5	Carry out resistance test.	Multimeter -ve lead on G of harness plug +ve lead to earth.	270Ω	Go to 6	Remove and test distribution panel.
6	Carry out resistance test.	Multimeter +ve lead on G of harness plug -ve lead to earth.	10000Ω or greater	Go to 7	Remove and test distribution panel.
7	Reconnect DP2 and DLB12. Disconnect from distribution link box and from power pack junction. Carry out continuity test.	Test continuity of each wire in harness.	continuity	Go to 8.	Repair/renew harness.

(continued)

TABLE 5 GENERATOR ONLY LINE CIRCUIT - FAILURE DIAGNOSIS (continued)

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
8	Reconnect power pack junction. Disconnect DLB21, remove caps from DLB3, 4 and 5. Carry out resistance test.	Multimeter +ve lead on pin J at DLB harness plug and -ve lead on DLB3, 4 and 5 in turn.	40Ω	Go to 9.	Carry out continuity check of wiring from power pack junction to rectifier unit.
9	Carry out resistance test.	Multimeter -ve lead on pin J at DLB harness plug and +ve lead on DLB3, 4 and 5 in turn.	10000Ω or greater	Go to 10.	Carry out continuity check of wiring from power pack junction to rectifier unit.
10	Disconnect all plugs and connectors from rectifier unit. Carry out resistance test.	Multimeter +ve lead on pin A and -ve lead on AC1, 2 and 3 in turn.	40Ω	Go to 11.	Renew rectifier unit.
11	Carry out resistance test.	Multimeter -ve lead on pin A and +ve lead on AC1, 2 and 3 in turn.	10000Ω or greater	Remove and test distribution link box. Para 50 refers.	Renew rectifier unit.

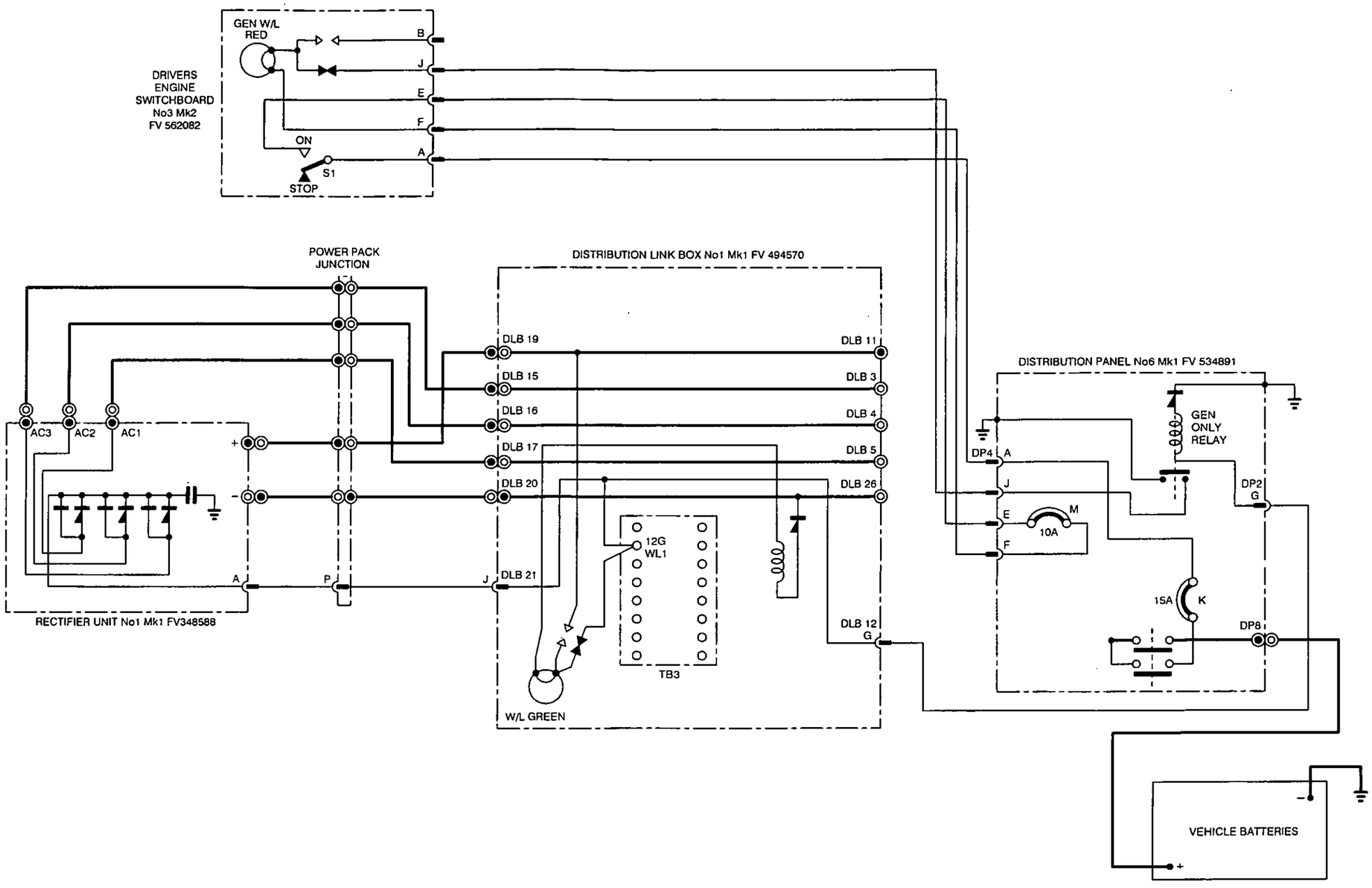

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Fig 6 Generator only line and warning light circuits

Failure diagnosis of armature field excitation circuit

27 Table 5 and Fig 7 enables a fault in the armature field excitation circuit to be identified.

28 Facilities are provided for monitoring the charging circuit at terminal strips TB3 and TB4, mounted inside the cover of the distribution link box (DLB). To gain access to the terminal strips, remove the driver's lower instrument panel from its mounting, remove the distribution link box cover plate screws and fold cover plate back.

TABLE 6 ARMATURE FIELD EXCITATION CIRCUIT - FAILURE DIAGNOSIS

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
1	Set hull battery master switch and engine switch to ON. Carry out voltage test.	Multimeter +ve lead on DLB TB4 8W and -ve lead on earth.	24V dc	Go to 2.	Go to 5.
2	Carry out voltage test.	Multimeter +ve lead on DLB TB4 12J and -ve lead on earth.	24V dc	Go to 3.	Go to 5.
3	Carry out voltage test.	Multimeter +ve lead on DLB TB4 12K and -ve lead on earth.	24V dc	Go to 4.	Go to 5.
4	Carry out voltage test.	Multimeter +ve lead on DLB TB4 7W and -ve lead on earth.	24V dc	Go to 12.	Go to 5.
5	Set hull battery master switch and engine switch to OFF. Disconnect DP2 and DLB12. Carry out continuity test of harness.	DP2 to DLB12	continuity	Go to 6.	Repair/renew harness.
6	Set hull battery master switch and engine switch to ON. Carry out voltage test.	DP2K to earth DP2J to earth	24V dc	Repair or renew distribution link box.	Go to 7.
7	Disconnect plug DP4. Carry out voltage test.	DP4A to earth DP4E to earth	24V dc		Go to 8.
8	Disconnect plug DP8. Carry out voltage test.	DP8 to earth	24V dc	Renew distribution panel.	Go to 9.

(continued)

TABLE 6 ARMATURE FIELD EXCITATION CIRCUIT - FAILURE DIAGNOSIS (continued)

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
9	Disconnect harness DP8 from batteries. Carry out continuity test of harness.	Each end of harness DP8	continuity	Go to 10.	Repair/renew harness.
10	Carry out voltage test.	Test batteries and battery earth.	24V dc	Go to 11.	Renew batteries.
11	Disconnect harness DP4 from driver's engine switchboard. Carry out continuity test of harness.	Each end of harness DP8.	continuity	Renew driver's engine switchboard.	Repair/renew harness.
12	Carry out resistance test.	DLB TB4 8J and earth.	0.035Ω	Go to 13.	Go to 14.
13	Carry out resistance test.	DLB TB4 7J and earth.	0.035Ω	Go to 14.	Go to 14.
14	Disconnect DLB13 and DLB14 from distribution link box. Carry out resistance test.	DLB 13 G to F of harness.	0.035Ω	Go to 15.	Repair or renew distribution link box.
15	Carry out resistance test.	DLB 14 G to F of harness.	0.035Ω	Go to 16.	Repair or renew distribution link box.
16	Disconnect harness DLB13 and DLB14 from power pack junction. Carry out resistance test.	Terminal F to G for each alternator at power pack junction.	0.035Ω	Go to 17.	Repair/renew harness power pack junction to distribution link box.
17	Remove power pack access plates. Remove access plate to each alternator. Remove harness plugs at alternators. Carry out continuity test.	Power pack junction and harness plugs.	continuity	Go to 18.	Repair/renew harness power pack junction to alternator.
18	Carry out resistance test of each alternator.	Pin G to F	0.035Ω	Go to 19.	Renew relevant alternator.

(continued)

TABLE 6 ARMATURE FIELD EXCITATION CIRCUIT - FAILURE DIAGNOSIS (continued)

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
18	Carry out resistance test of each alternator.	Pin G to F	0.035Ω	Go to 19.	Renew relevant alternator.
19	Ensure DP2 disconnected. Carry out resistance test.	Multimeter +ve lead on DLB TB4 8W and -ve lead on DLB TB4 8J.	0.035Ω	Go to 20.	Go to 21.
20	Carry out resistance test.	Multimeter +ve lead on DLB TB4 7W and -ve lead on DLB TB4 7J	0.035Ω	Go to 21.	Go to 21.
21	Disconnect harness DLB7 and DLB8 from distribution link box and alternator control panels. Carry out continuity test.	Each end of both harnesses.	continuity	Repair/renew harness distribution link box to alternator control panels.	Renew relevant alternator control panel.

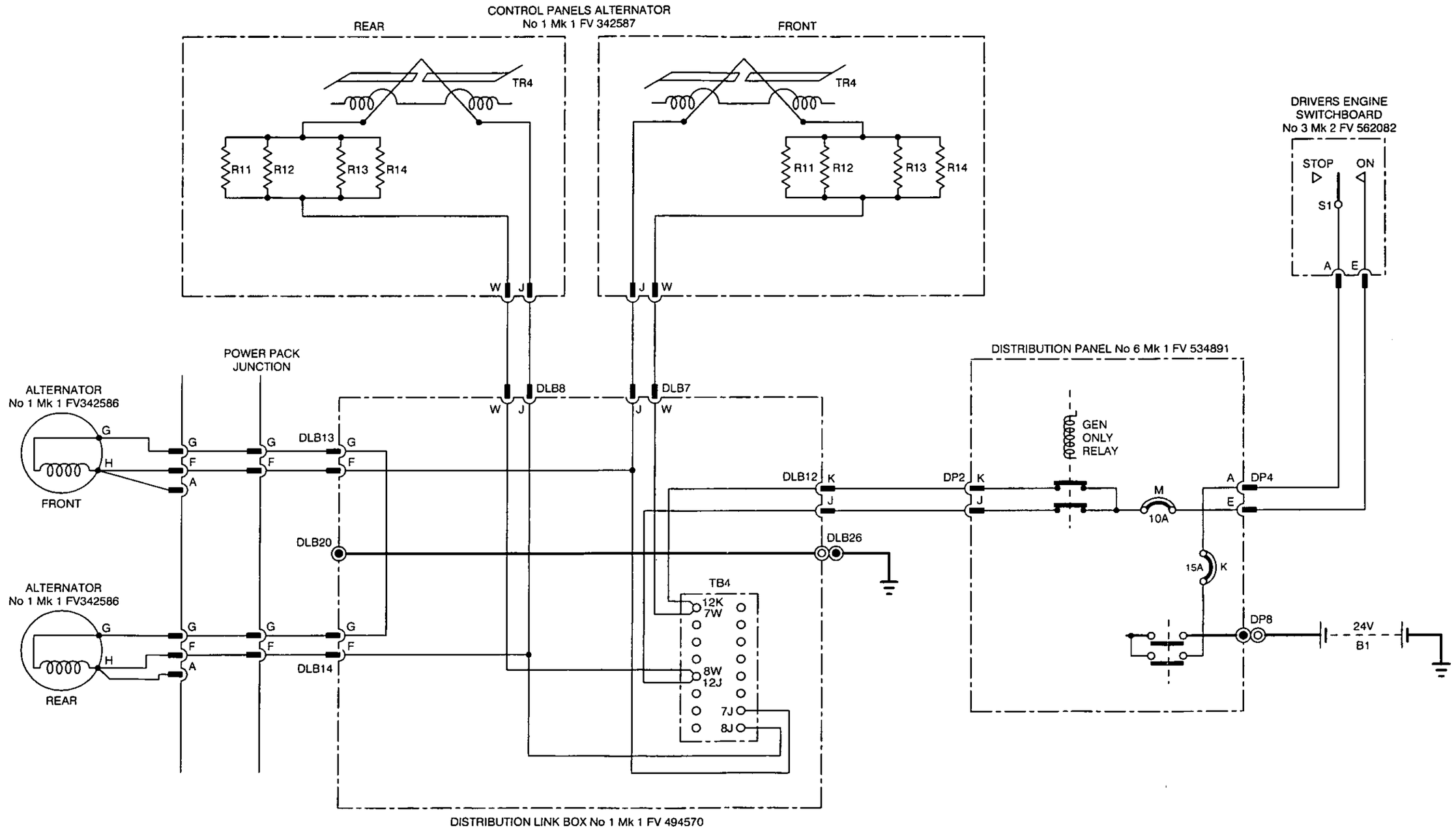

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Fig 7 Alternator field excitation circuit

Front alternator control panel removal

29 The procedure to remove a front alternator control panel is as follows:

29.1 Switch 'OFF' the hull battery master switch.

29.2 Release the four bolts retaining the driver's switchboard, lower and suitably support the switchboard.

29.3 Disconnect DLB15, DLB16, DLB17, DLB19, DLB20, DLB13, DLB14 AND DLB21.

29.4 Remove the harness DLB7 to the control panel.

29.5 Remove the connection at the control panel.

29.6 Remove the two nuts securing the control panel to the rear bracket.

29.7 Remove the two nuts on the securing bracket and remove bracket.

29.8 Release the two nuts securing the front bracket at the front of the control panel complete with bracket towards the front of the vehicle.

29.9 Lift the control panel clear of mounting.

29.10 Remove the two nuts securing the control panel to the bracket and remove the bracket.

Front alternator control panel refitting

30 The procedure to refit a front alternator control panel is as follows:

30.1 Refit the bracket to the control panel

30.2 Remove the nuts from the mounting studs and refit the control panel and bracket to the mounting.

30.3 Secure with the two nuts.

30.4 Complete refitting in the reverse order of removal.

Testing

31 Ensure voltage across hull batteries is 28.5V ± 0.5V dc with the engine running at 2000 rev/min.

Rear alternator control panel removal

32 The procedure to remove a rear alternator control panel is as follows:

32.1 Switch 'OFF' the hull battery master switch.

32.2 Remove the hull batteries, see Para 14.

32.3 Remove the harness DLB8 from the control panel.

32.4 Remove the earth connection at the control panel.

32.5 Disconnect DLB7, DLB12, DLB25, DLB22, DLB11 AND DLB26.

32.6 Support the DLB and remove the two mounting bolts from the supporting bracket.

32.7 Release the three nuts securing the supporting bracket to the hull.

32.8 For access to the control panel securing nuts, tilt the bracket towards rear of the vehicle.

32.9 Remove the four securing nuts, bring DLB supporting bracket to upright position.

32.10 Remove the control panel clear of the mounting.

Rear alternator control panel refitting

33 Refit in reverse order of removal.

Testing

34 Ensure voltage across hull batteries is 28.5V ± 0.5V dc with the engine running at 2000rev/min.

Alternators No 1 Mk 1

General

NOTES

(1) Alternators may be removed with the power pack fitted.

(2) When both alternators are removed phasing will be facilitated if the front alternator is refitted first.

(3) If the power pack has been removed, ignore all vehicle disconnections or reconnections, detailed in the following instructions for the removal and refitting of alternators.

Rear alternator removal

WARNING

HEAVY WEIGHT. EACH ALTERNATOR WEIGHS 32 kg (70lb). DUE CONSIDERATION MUST BE GIVEN TO THE REGULATIONS GOVERNING THE LIFTING OF HEAVY WEIGHTS WHEN MOVING EQUIPMENT.

35 The procedure to remove a rear alternator is as follows:

35.1 Switch 'OFF' the hull battery master switch.

35.2 Remove the power pack access plates in the driver's compartment.

35.3 Remove the upper and lower access plates on the bulkhead at the rear of power pack.

35.4 Disconnect the alternator harness plug.

35.5 Disconnect the oil coolant drainpipe.

35.6 Support the alternator.

35.7 Remove the securing ring towards the rear of alternator.

35.8 Withdraw the alternator.

Rear alternator refitting

36 The procedure to refit a rear alternator is as follows:

36.1 Check that the alternator end plate O-ring is serviceable. Remove the gearbox inspection port (Fig 8 (2)).

WARNING

PERSONNEL DANGER. SHOULD IT BE NECESSARY TO TURN THE ENGINE IN ORDER TO OBSERVE THE CHAMFERED TEETH OR DOWELS IN THE GEARBOX THE FUEL PIPES BETWEEN THE FUEL PUMP AND THE INJECTORS SHOULD BE SLACKENED OFF AND OPEN TO ATMOSPHERE. THIS WILL PREVENT THE ENGINE FROM BEING INADVERTENTLY STARTED.

36.2 Using spanner (Table 2, Serial 6), turn the engine until the dowels or the chamfered teeth (Fig 9 (2 and 6)) on the front of the alternator drive gear, are visible at the top, viewed through the gearbox inspection port.

NOTE

Refitting will be facilitated if both oil pipes (Fig 8(4)) are located in the drive housing before proceeding to refit the alternator.

36.3 Check that the O-rings are serviceable and properly located on the oil pipes (4).

36.4 Offer up the alternator to the drive gear housing and support the weight to prevent damage to the oil drainpipe.

36.5 Turn the alternator drive gear until the dowels or the chamfered teeth align with those on the front alternator.

36.6 Move the alternator into mesh with the drive gear. Recheck alignment of the dowels or the chamfered teeth.

36.7 Ensure that the assembly lines (Fig 8 (1)) or 'vees' (Fig 9 (1)) marked at the top of the alternator align with the assembly lines marked at the top of the gearbox.

36.8 Refit the securing ring. Ensure that the clamps locate properly.

36.9 Reconnect the oil drainpipe.

36.10 Reconnect the harness plug.

36.11 Refit the gearbox inspection port covers.

36.12 Remove the special engine turning tool and refit the transmission endplate.

36.13 Run the power pack. Check correct operation of generating system.

36.14 Refit the upper and lower access plates on the bulkhead at the rear of the power pack and the access plates in the driver's compartment.

Testing

37 Ensure voltage across hull batteries is 28.5V ± 0.5V dc with the engine running at 2000 rev/min.

Front alternator removal

WARNING

HEAVY WEIGHT. EACH ALTERNATOR WEIGHS 31.8 kg (70LB). DUE CONSIDERATION MUST BE GIVEN TO THE REGULATIONS GOVERNING THE LIFTING OF HEAVY WEIGHTS WHEN MOVING EQUIPMENT.

38 The procedure to remove a front alternator is as follows:

38.1 Switch 'OFF' the hull battery master switch.

38.2 Remove the power pack access plates in the driver's compartment.

38.3 Remove the upper and lower access plates on the bulkhead at the rear of power pack.

38.4 Disconnect the alternator harness plug.

38.5 Disconnect the oil coolant drainpipe.

38.6 Remove the cable securing clips from the cable channel and remove the cables.

38.7 Remove the cable channel.

38.8 Support the alternator.

38.9 Remove the securing bolts from the front alternator bracket.

38.10 Remove the securing ring towards the alternator drive.

38.11 Withdraw the alternator, taking care to prevent the alternator fouling on the fuel injection pump drive housing.

NOTE

On withdrawal check that the oil pipes (Fig 8 (4)) are located in the drive housing of the alternator.

Front alternator refitting

39 The procedure to refit front alternator is as follows:

39.1 Check that the alternator end plate O-ring is serviceable. Remove the gearbox inspection port cover (Fig 8 (2)).

WARNING

PERSONNEL DANGER. SHOULD IT BE NECESSARY TO TURN THE ENGINE IN ORDER TO OBSERVE THE CHAMFERED TEETH OR DOWELS IN THE GEARBOX THE FUEL PIPES BETWEEN THE FUEL PUMP AND THE INJECTORS SHOULD BE SLACKENED OFF AND OPEN TO ATMOSPHERE. THIS WILL PREVENT THE ENGINE FROM BEING INADVERTENTLY STARTED.

39.2 Using spanner (Table 2, Serial 6), turn the engine until the dowels or the chamfered teeth (Fig 9 (2 and 6)) on the front of the alternator drive gear, are visible at the top, viewed through the gearbox inspection port.

NOTE

Refitting will be facilitated if both oil pipes (Fig 8(4)) are located in the drive housing before proceeding to refit the alternator.

39.3 Check that the O-rings are serviceable and properly located on the oil pipes.

39.4 Offer up the alternator to the drive gear housing and support the weight to prevent damage to the oil drainpipe.

39.5 Turn the alternator drive gear until the dowels or the chamfered teeth align with those on the front alternator.

39.6 Move the alternator into mesh with the drive gear. Recheck alignment of the dowels or the chamfered teeth.

39.7 Ensure that the assembly lines (Fig 8 (1)) or 'vees' (Fig 9 (1)) marked at the top of the alternator align with the assembly lines marked at the top of the gearbox.

39.8 Refit the securing ring. Ensure that the clamps locate properly.

39.9 Reconnect the oil drainpipe.

39.10 Reconnect the harness plug.

39.11 Refit the gearbox inspection port covers.

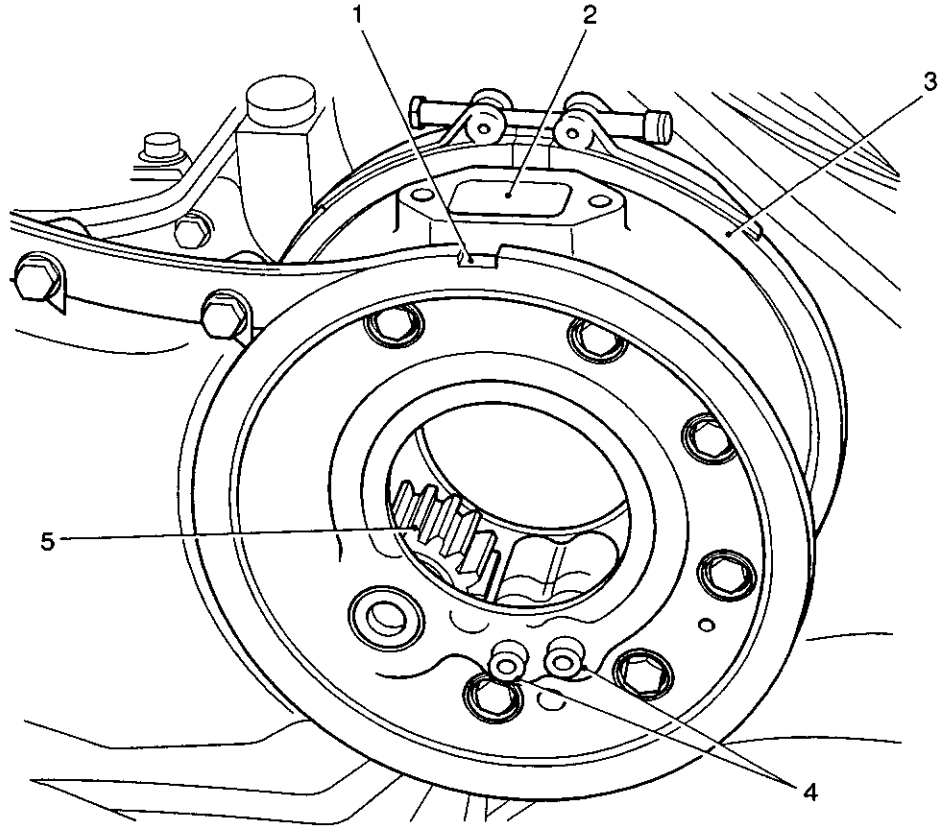
39.12 Remove the special engine turning tool and refit the transmission endplate.

39.13 Run the power pack. Check the correct operation of the generating system.

39.14 Refit the upper and lower access plates on the bulkhead at the rear of the power pack and the access plates in the driver's compartment.

Testing

40 Ensure voltage across hull batteries is 28.5V ± 0.5V dc with the engine running at 2000 rev/min.



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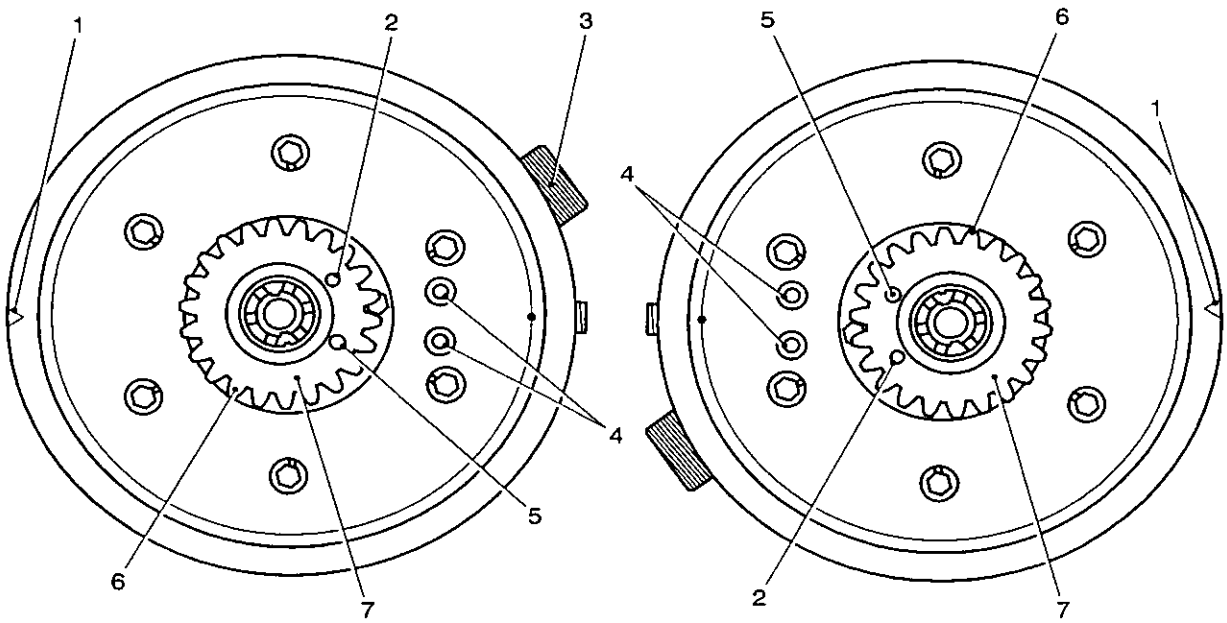
1 Assembly lines
2 Gearbox inspection port
3 Securing ring
4 Oil pipes
5 Driving gear wheel

Fig 8 Alternator gear drive



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1 Lining up 'vee'
2 Dowel pins
3 Electrical connection socket
4 Oil ports
5 Dowel hole
6 Chamfered teeth
7 Drive gear

Fig 9 End view of alternators

Controlled dc voltage check

41 To check the dc line voltage, each alternator and control panel must be checked separately proceed as follows:

41.1 Stop the engine, switch 'OFF' hull battery master switch, disconnect the rear alternator at DLB14 and the control panel at the socket, both detailed in Fig 7

41.2 Switch 'ON' the hull battery master switch, run the engine at 2000 rev/min, measure the voltage at the hull battery terminals. This must be 28·5 ± 0·5V. Adjust as detailed in Para 42, if necessary.

41.3 Stop the engine, Switch 'OFF' the hull battery master switch, lower the driver's engine switchboard, remove DLB13 and the control panel harness plug at the socket. Refit the switchboard, the harness plug DLB14 and the rear control panel. Test as in Sub Para 41.2 above.

Adjusting dc controlled voltage

42 To adjust the dc controlled voltage proceed as follows:

42.1 Stop the engine, Switch 'OFF' the hull battery master switch, select the appropriate control panel and remove its cover.

CAUTION

EQUIPMENT DAMAGE. Do not disturb settings of other potentiometers in the control panel.

42.2 Switch 'ON' the hull battery master switch, run the engine at 2000 rev/min, turn P2 (RV2) (Fig 10) until voltage is 28·5 ± 0·5V, measured at hull battery terminals.

NOTES

(1) Turn P2 clockwise to increase the voltage and anti-clockwise to reduce the voltage. This adjustment is very fine and great care must be taken.

(2) To gain access to P2 in the rear control panel, remove battery securing clamp and securing strip, move batteries in container towards power pack to full extent of positive and negative battery leads.

42.3 If the correct voltage setting cannot be obtained, replace the control panel.

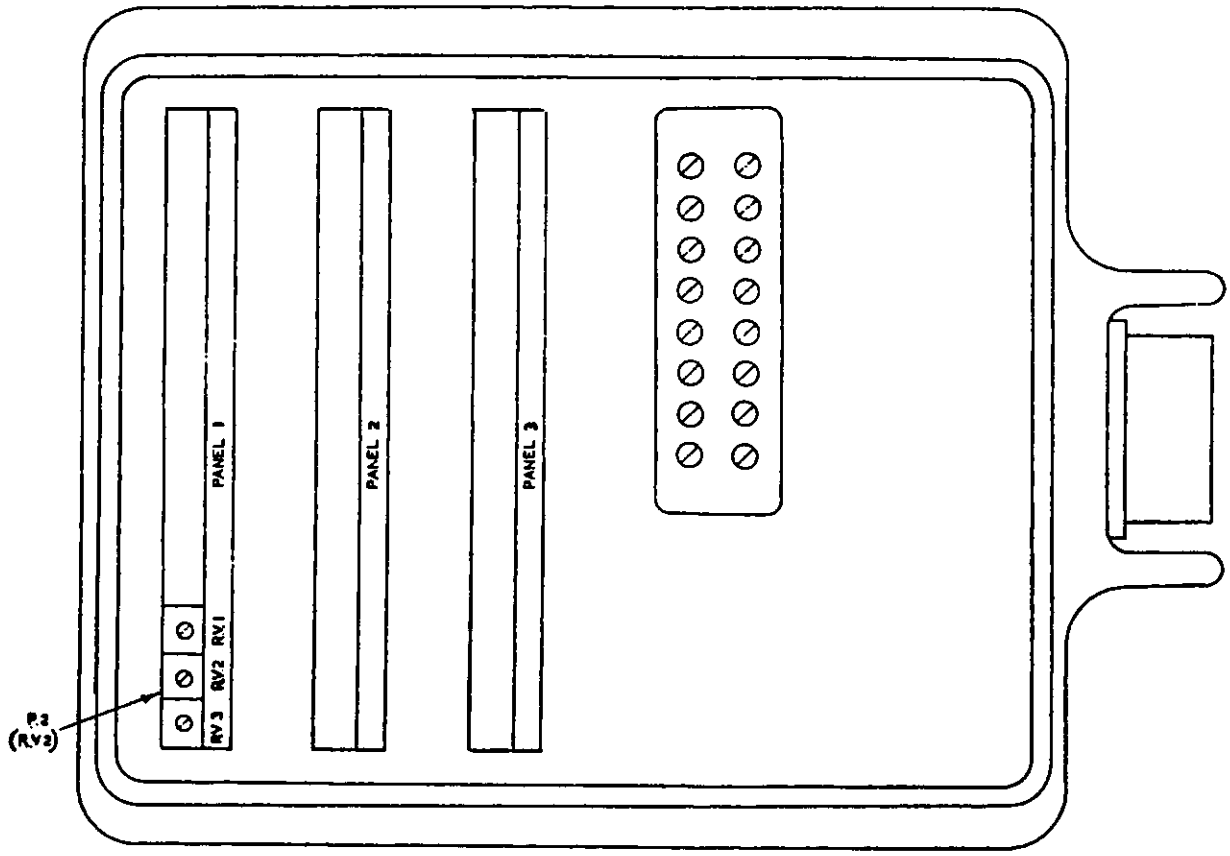

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Fig 10 Location of voltage adjustment

Rectifier unit No 1 Mk 1

Failure diagnosis

43 Table 7 and Fig 11 enables a fault in the rectifier unit circuit to be identified.

TABLE 7 RECTIFIER UNIT CIRCUIT - FAILURE DIAGNOSIS

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
1	Set hull battery master switch to OFF. Lower driver's switchboard. Disconnect DLB15, DLB16, DLB17, DLB 19 and DLB20. Carry out resistance test.	Multimeter +ve lead on DLB20 harness socket and -ve lead on DLB19 harness plug.	10000Ω or greater.	Go to 2.	Go to 16.
2	Carry out resistance test of plugs and sockets of harnesses.	Multimeter +ve lead on DLB19 and -ve lead on DLB20.	90Ω	Go to 3.	Go to 16.
3	Carry out resistance test.	Multimeter +ve lead on DLB19and -ve lead on DLB17.	27Ω	Go to 4.	Go to 16.
4	Carry out resistance test.	Multimeter +ve lead on DLB19and -ve lead on DLB17.	27Ω	Go to 5.	Go to 16.
5	Carry out resistance test.	Multimeter +ve lead on DLB17and -ve lead on DLB20.	27Ω	Go to 6.	Go to 16.
6	Carry out resistance test.	Multimeter +ve lead on DLB19and -ve lead on DLB16.	27Ω	Go to 7.	Go to 16.
7	Carry out resistance test.	Multimeter +ve lead on DLB16and -ve lead on DLB20.	27Ω	Go to 8.	Go to 16.
8	Carry out resistance test.	Multimeter +ve lead on DLB19and -ve lead on DLB15.	27Ω	Go to 9.	Go to 16.
9	Carry out resistance test.	Multimeter +ve lead on DLB15and -ve lead on DLB20.	27Ω	Go to 10.	Go to 16.
10	Carry out resistance test.	Multimeter +ve lead on DLB17and -ve lead on DLB19.	10000Ω or greater	Go to 11.	Go to 16.

(continued)

TABLE 7 RECTIFIER UNIT CIRCUIT - FAILURE DIAGNOSIS (continued)

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
11	Carry out resistance test.	Multimeter +ve lead on DLB20and -ve lead on DLB17.	10000Ω or greater	Go to 12.	Go to 16.
12	Carry out resistance test.	Multimeter +ve lead on DLB16and -ve lead on DLB19.	10000Ω or greater	Go to 13.	Go to 16.
13	Carry out resistance test.	Multimeter +ve lead on DLB20and -ve lead on DLB16.	10000Ω or greater	Go to 14.	Go to 16.
14	Carry out resistance test.	Multimeter +ve lead on DLB15and -ve lead on DLB19.	10000Ω or greater	Go to 15.	Go to 16.
15	Carry out resistance test.	Multimeter +ve lead on DLB20and -ve lead on DLB15.	10000Ω or greater	Go to 16.	Go to 16.
16	Disconnect harness at power pack junction. Carry out resistance test at power pack junction.	Multimeter +ve lead on dc -ve and -ve lead on dc +ve.	10000Ω or greater	Go to 17.	Go to 30.
17	Carry out resistance test.	Multimeter +ve lead on dc +ve and -ve lead on dc –ve.	90Ω	Go to 18.	Go to 30.
18	Carry out resistance test.	Multimeter +ve lead on dc +ve and -ve lead on AC1.	27Ω	Go to 19.	Go to 30.
19	Carry out resistance test.	Multimeter +ve lead on AC1 and -ve lead on dc –ve.	27Ω	Go to 20.	Go to 30.
20	Carry out resistance test.	Multimeter +ve lead on dc +ve and -ve lead on AC2.	27Ω	Go to 21.	Go to 30.
21	Carry out resistance test.	Multimeter +ve lead on AC2 and -ve lead on dc –ve.	27Ω	Go to 22.	Go to 30.
22	Carry out resistance test.	Multimeter +ve lead on dc +ve and -ve lead on AC3.	27Ω	Go to 23.	Go to 30.

(continued)

TABLE 7 RECTIFIER UNIT CIRCUIT - FAILURE DIAGNOSIS (continued)

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
23	Carry out resistance test.	Multimeter +ve lead on AC3 and -ve lead on dc –ve.	27Ω	Go to 24.	Go to 30.
24	Carry out resistance test.	Multimeter +ve lead on AC1 and -ve lead on dc +ve.	10000Ω or greater	Go to 25.	Go to 30.
25	Carry out resistance test.	Multimeter +ve lead on dc -ve and -ve lead on AC1.	10000Ω or greater	Go to 26.	Go to 30.
26	Carry out resistance test.	Multimeter +ve lead on AC2 and -ve lead on dc +ve.	10000Ω or greater	Go to 27.	Go to 30.
27	Carry out resistance test.	Multimeter +ve lead on dc -ve and -ve lead on AC2.	10000Ω or greater	Go to 28.	Go to 30.
28	Carry out resistance test.	Multimeter +ve lead on AC3 and -ve lead on dc +ve.	10000Ω or greater	Go to 29.	Go to 30.
29	Carry out resistance test.	Multimeter +ve lead on dc -ve and -ve lead on AC3.	10000Ω or greater	Go to 30.	Go to 30.
30	Remove the engine lower front sealing panel. Disconnect harness from rectifier unit. Carry out resistance test.	As serials 16 to 30.	As serials 16 to 30.	Renew or repair harness rectifier unit to power pack junction.	Renew rectifier unit.

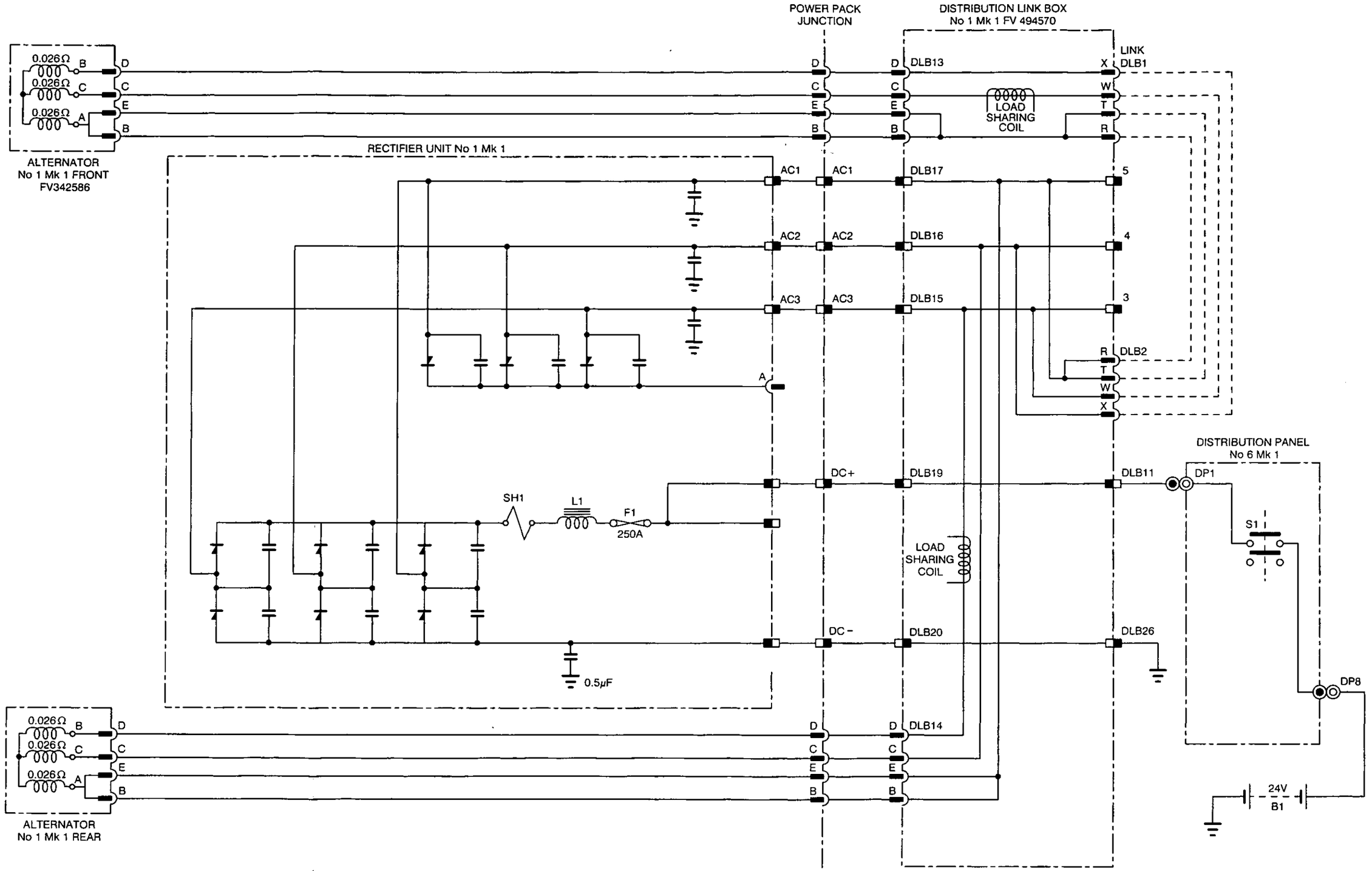

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Fig 11 Rectifier unit circuit

Removal of rectifier unit with power pack fitted

44 The procedure to remove a rectifier unit with the power pack fitted is as follows:

44.1 Switch OFF the hull battery master switch.

44.2 Remove the power pack access covers, Chapter 1-1 refers.

44.3 Remove the gearbox steering unit drive shaft, Chapter 1-1 refers.

44.4 Disconnect the cables from the rectifier unit.

44.5 Disconnect the flexible oil pipe at the rectifier unit, move the pipe towards the gearbox and secure clear of the rectifier unit.

44.6 Remove the 12 bolts securing the rectifier unit to the oil reservoir.

44.7 Lift the rectifier clear of the oil reservoir and place in a drip tray to allow the surplus oil to drain.

Refitting of rectifier unit with power pack fitted

45 Refit in reverse order to removing.

Testing

46 Ensure voltage across hull batteries is 28.5V ± 0.5V dc with the engine running at 2000rev/min.

Removal of rectifier unit with power pack removed

47 The procedure to remove a rectifier unit with the power pack removed is as follows:

47.1 Remove the pipe between the crankcase scavenge return pipe and the oil reservoir breather pipe.

47.2 Disconnect the crankcase scavenge return pipe.

47.3 Disconnect the oil rectifier connections.

47.4 Remove the 12 bolts securing the rectifier in the oil reservoir.

47.5 Place a suitable container near the rectifier unit, remove the rectifier from the oil reservoir, place in a container and allow the oil to drain off.

Refitting of rectifier unit with power pack removed

48 Refit in reverse order to removing.

Testing

49 Ensure, when the power pack is refitted, the voltage across hull batteries is 28.5V ± 0.5V dc with the engine running at 2000 rev/min.

Distribution link box No 1 Mk 1

Failure diagnosis

50 Remove the lid and visually examine for loose connections and broken or burnt wiring or components.

51 Table 8 and Fig 12 enables a fault in the distribution link box circuit to be identified.

TABLE 8 DISTRIBUTION LINK BOX CIRCUIT - FAILURE DIAGNOSIS

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
1	Set hull battery master switch to OFF. Disconnect all plugs and connectors. Carry out continuity test.	DLB13A to DLB7N DLB13F to DLB7J DLB14A to DLB8N DLB14F to DLB8J DLB21A to DLB12A and DLB24G DLB21C to DLB12C DLB21D to DLB12P and DLB24K DLB21F to DLB1G and DLB9A and DLB22A and DLB23A DLB21G to DLB12D DLB21H to DLB12E DLB21J to DLB10F and DLB12G DLB24A to DLB12M DLB24C to DLB2G and DLB12F DLB24E to DLB24F DLB24J to DLB12N DLB24L to DLB12L DLB1A to DLB6A DLB1C to DLB8A and DLB9C DLB1H to DLB2H DLB1K to DLB7C DLB7A to DLB2C DLB7B to DLB1D DLB7W to DLB12K DLB8W to DLB12J DLB2A to DLB9B DLB7N to TB4 DLB7J toTB4 DLB13C to TB3 DLB13D to TB3 DLB13B to TB3 DLB8J to TB4 DLB2G to TB4 DLB8A to TB3	continuity continuity	Go to 2.	Renew distribution link box unit.

(continued)

TABLE 8 DISTRIBUTION LINK BOX CIRCUIT - FAILURE DIAGNOSIS (continued)

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
1 (cont)	Continue continuity test.	DLB21J to TB3 DLB21A to TB3 DLB21D to TB4 DLB23A to TB4 DLB12L to TB4 DLB12H to TB3 DLB12M to TB3 DLB7E to DLB1F DLB7D to DLB1N DLB8D to DLB1S and DLB21 I E pin to case E pin to lid DLB8N to TB4	continuity continuity continuity continuity continuity continuity continuity continuity continuity continuity continuity continuity continuity	Go to 2.	Renew distribution link box unit.
2	Apply 19V dc	+ve to DLB10F -ve to DLB 20	Relay RL2 operates	Go to 3.	Renew distribution link box unit.
3	Apply 19V dc	-ve to DLB10F +ve to DLB 20	Relay RL2 does not operate.	Go to 4	Renew distribution link box unit.
4	Apply 19V dc.	+ve to DLB19 -ve to DLB 20	Relays RL1 and RL2 operates.	Go to 4.	Renew distribution link box unit.
5	Apply 19V dc.	-ve to DLB19 +ve to DLB 20	Relays RL1 and RL2 do not operate.	Go to 6.	Renew distribution link box unit.
6	Apply 24V dc with a 24V 18W lamp, wired in series and apply to the following points on FV530705 control circuit sub assembly.	(a) 7+ve 2-ve (b) 2+ve 7-ve (c) 7+ve 5-ve (d) 5+ve 7-ve (e) 1+ve 2-ve (f) 2+ve 1-ve	Relay operates. Relay does not operate. Lamp lights brightly. Lamp not lit. Contactor RL1 operates. Lamp lights dimly. Contactor RL1 must not operate. Lamp lights brightly.	Go to 6b. Go to 6c. Go to 6d. Go to 6e. Go to 6f. Go to 7a.	Renew distribution link box unit.

(continued)

TABLE 8 DISTRIBUTION LINK BOX CIRCUIT - FAILURE DIAGNOSIS (continued)

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
7	Apply 24V dc	(a) +ve to DLB11 and DLB12G -ve to DLB26	RL2 and contactor RL1 must energize. Press to test lampholder at half brilliance.	Go to 7b.	Renew distribution link box unit.
		(b) PRESS press to test lampholder.	RL2 and contactor RL1 must remain energized. Press to test lampholder at half brilliance.	Go to 7c.	Renew distribution link box unit.
		(c) Remove +ve from DLB12G.	RL2 and contactor RL1 de-energized. Press to test lampholder extinguished.	Go to 7d.	Renew distribution link box unit.
		(d) PRESS press to test lampholder.	Press to test lampholder at full brilliance.	End of test.	Renew distribution link box unit.

NOTE

In some instances the contacts in the 'press to test' lampholder will make before breaking at the mid position when the holder is pressed. When this occurs the sequences in Table 8, Serial 7c and 7d will differ in so far as the relay and contactor will energise at the mid point only.

Explanatory notes for distribution link box wiring diagram

NOTES

(1) Small wiring omitted for clarity.

(2) Leads omitted are shown at plug pins with reference number of first terminal block and final destination.

(3) Junction of three or more connector leads is made at TB1 and TB2.

(4) Junction of U 24 leads is also made at TB 1 and TB 2.

(5) Jumper leads are connected from TB1 and TB2 to monitoring points at TB3 and TB4 mounted on top cover.

(6) Jumper leads are connected for monitoring power tools voltage at TB3.

(7) All other junctions of two connector leads are made at TB3 and TB4 (except 1F, 7E, 12L, 24L, 1N and 7D, which are treated as NOTE 3),

(8) Size of cable shown as: 100 50 24 6 Unipren.

(9) All unmarked cables to be Unipren 12.

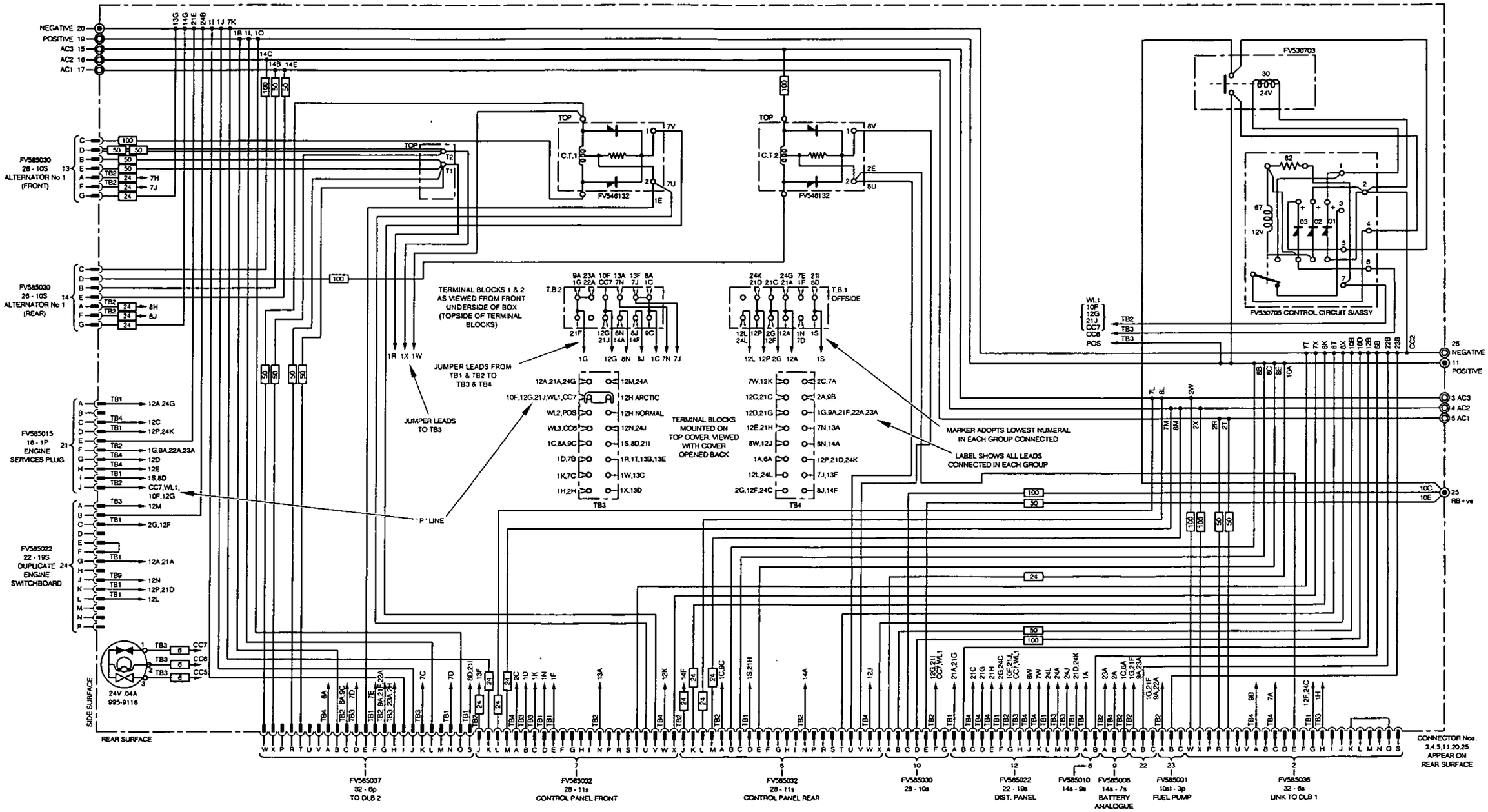

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Fig 12 Distribution link box No 1 Mk 1 - wiring diagram

Removal

52 The procedure to remove the distribution link box is as follows:

52.1 Switch OFF the hull battery master switch.

52.2 Remove the hull batteries Para 14 refers.

52.3 Release the three nuts (Fig 21(1)) retaining the instrument panel, disconnect the earth strap (2) at the L.H. instrument panel bracket, and lower the instrument panel.

52.4 Remove IP1, IP2 and IP3 and the speedometer cable.

52.5 Remove the instrument panel.

52.6 Release the four bolts retaining the driver's switchboard, lower and suitably support the switchboard.

52.7 Disconnect DLB15, DLB16, DLB17, DLB19, DLB20, DLB 13, DLB14 and DLB21.

52.8 Remove the harness power tool transformer to DLB1, from the hull mounting.

52.9 Remove the link DLB1 to DLB2.

52.10 Disconnect DLB7 and DLB8 then disconnect the control panels.

52.11 Disconnect DLB12, DLB25, DLB22, DLB11 and DLB 26.

52.12 Remove the two DLB mounting bolts from the supporting bracket (rear alternator control panel is attached).

52.13 Release the remaining two bolts (captive nuts).

52.14 Slide the DLB towards the rear of the vehicle, to clear hull mounted supporting bracket.

52.15 When accessible, remove the DLB earth connection (hull side of DLB).

52.16 Lift the DLB clear of mounting and remove.

Refitting

53 Refit in reverse order to removing.

NOTE

This distribution box can be used for normal or arctic conditions. Fitting a link from 12H NORMAL to 12H ARCTIC changes the condition. If a new distribution box is being fitted the position of the link must be checked; the link will either be a separate item with the box or fitted in the ARCTIC condition. When fitting a serviceable distribution box to a vehicle, it is advisable to check the position of the link for whatever conditions are required.

Testing

54 Ensure voltage across hull batteries is 28.5V ± 0.5V dc with the engine running at 2000rev/min.

Ammeter circuit

Failure diagnosis

55 Switch OFF the hull battery master switch.

56 Lower the instrument panel and check the ammeter for mechanical damage or signs of burning.

57 Table 9 and Fig 13 enables a fault in the ammeter circuit to be identified.

TABLE 9 AMMETER CIRCUIT - FAILURE DIAGNOSIS

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
1	Disconnect IP2. Carry out resistance test.	IP2C to IP2D.	2Ω	Go to 2.	Ammeter unserviceable, renew /repair instrument panel.
2	Disconnect harness at power pack junction.	IP2C to PPJU and IP2D to PPJV.	Open circuit.	Go to 3.	Renew/repair harness.
3	Disconnect harness at harness plug at rectifier.	PPJU to C and PPJV to D.	Open circuit.	Renew rectifier unit.	Renew/repair harness.

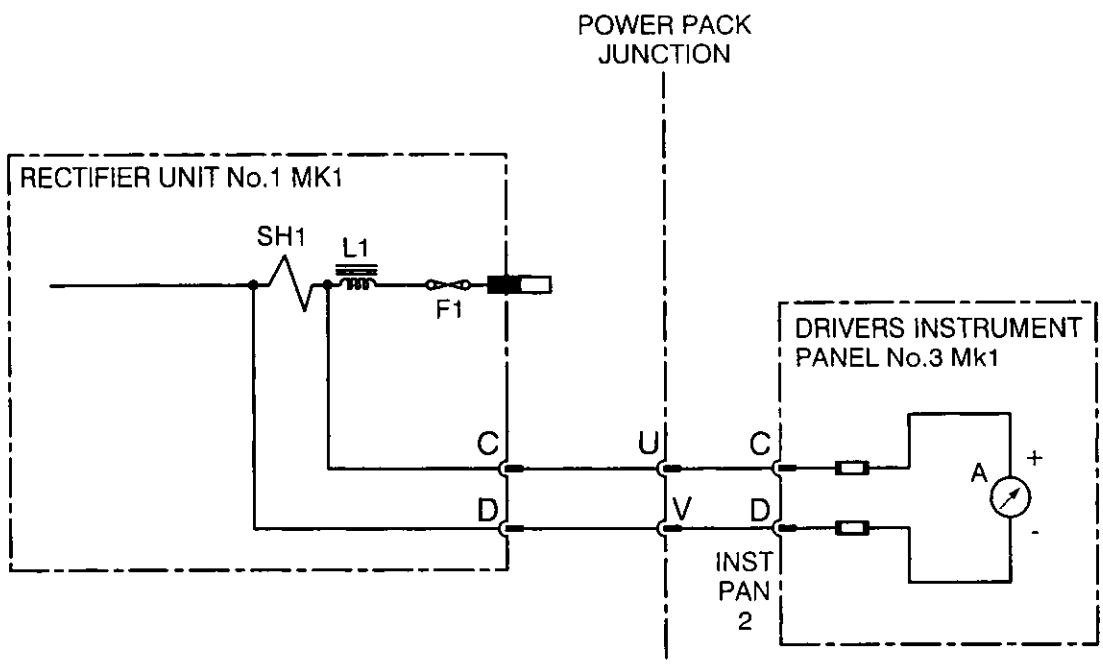

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Fig 13 Ammeter circuit

OIL PRESSURE SWITCH, No1, Mk3

Failure diagnosis

58 Table 10 and Fig 14 enables a fault in the oil pressure switch circuit to be identified.

TABLE 10 OIL PRESSURE SWITCH CIRCUIT - FAILURE DIAGNOSIS

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
1	Switch ON hull battery master switch.	Test warning lamp at driver's engine switchboard.	Lamplights	Go to 2.	Renew lamp.
2	Switch OFF hull battery master switch. Disconnect DP4 from distribution panel. Switch ON hull battery master switch. Carry out voltage test.	DP4A to suitable earth.	24V dc	Go to 3.	Renew/repair distribution panel.
3	Switch OFF hull battery master switch. Disconnect harness from driver's engine switchboard. Carry out resistance test.	Driver's engine switchboard pins K to F.	145Ω	Go to 4.	Renew/repair driver's engine switchboard.
4	Switch ON engine switch. Carry out continuity test.	Driver's engine switchboard pins A to E.	continuity	Go to 5.	Renew/repair driver's engine switchboard.
5	Carry out continuity test.	All wires, each end of harness driver's engine switchboard to distribution panel.	continuity	Go to 6.	Renew/repair harness driver's engine switchboard to distribution panel.
6	Reconnect the driver's engine switchboard to the distribution panel. Disconnect DP2 from distribution panel. Switch ON hull battery master switch. Carry out voltage test.	DP2P to suitable earth.	24V dc	Go to 7.	Renew/repair distribution panel.

(continued)

TABLE 10 OIL PRESSURE SWITCH CIRCUIT - FAILURE DIAGNOSIS (continued)

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
7	Switch OFF hull battery master switch. Reconnect DP2 to distribution panel. Disconnect DLB12 from distribution link box. Switch ON hull battery master switch. Carry out voltage test.	Harness plug DLB12P to suitable earth.	24V dc	Go to 8.	Renew/repair harness distribution panel to distribution link box.
8	Switch OFF hull battery master switch. Reconnect DLB12 to distribution link box. Disconnect DLB21 from distribution link box. Switch ON hull battery master switch. Carry out voltage test.	DLB21D to DLB21E	24V dc	Go to 9.	Renew/repair distribution link box.
9	Switch OFF hull battery master switch. Reconnect DLB21 to distribution link box. Disconnect harness from power pack junction. Switch ON hull battery master switch. Carry out voltage test.	Harness plug power pack junction D to E.	24V dc	Go to 10.	Renew/repair harness power pack junction to distribution link box.
10	Switch OFF hull battery master switch. Reconnect harness to power pack junction. Remove the power pack access plates in the driver's compartment. Remove the engine junction box cover. Disconnect terminals (input) D and E. Switch ON hull battery master switch. Carry out voltage test.	Harness engine junction box D to E (input).	24V dc	Go to 11.	Renew/repair harness power pack junction to engine junction box.
11	Switch OFF hull battery master switch. Reconnect harness engine junction box D to E (input). Disconnect harness engine junction box D to E (output). Switch ON hull battery master switch. Carry out voltage test.	Harness engine junction box D to E (output).	24V dc	Go to 12.	Renew/repair engine junction box.
12	Switch OFF hull battery master switch. Reconnect harness engine junction box D to E (output). Disconnect harness at oil pressure switch. Switch ON hull battery master switch Carry out voltage test.	Oil pressure switch harness D to E.	24V dc	Renew oil pressure switch.	Renew/repair harness engine junction box to oil pressure switch.

Removal and refitting

59 For removing and refitting refer to Chapter 1-2.

Testing

60 Ensure the amber oil pressure warning light, on the driver's engine switchboard, illuminates prior to engine start up and extinguishes within seconds of engine starting.

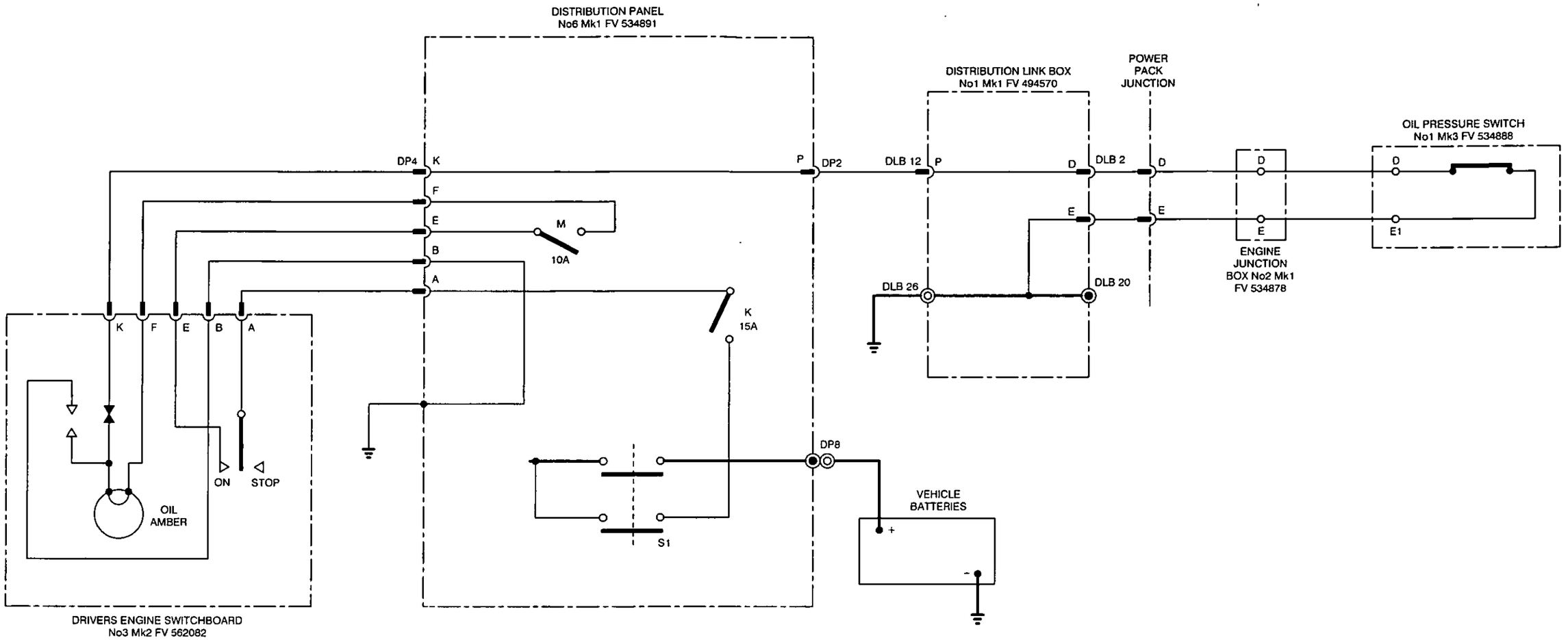

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Fig 14 Oil pressure switch and warning light circuit

FUEL SYSTEM ELECTRICAL SYSTEM

Injection pump stop solenoid

Failure diagnosis

61 Table 11 and Fig 15 enables a fault in the injection pump stop solenoid circuit to be identified.

TABLE 11 INJECTION PUMP STOP SOLENOID CIRCUIT - FAILURE DIAGNOSIS

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
1	Disconnect DP4 from distribution panel. Switch ON hull battery master switch. Carry out voltage test.	DP4A to suitable earth.	24V dc	Go to 2.	Renew/repair distribution panel.
2	Switch OFF hull battery master switch. Disconnect harness from driver's engine switchboard. Carry out continuity test	All wires, each end of harness driver's engine switchboard to distribution panel.	continuity	Go to 3.	Renew/repair harness driver's engine switchboard to distribution panel.
3	Switch ON engine switch. Carry out continuity test.	Driver's engine switchboard pins A to C and C to E	continuity	Go to 4.	Renew/repair driver's engine switchboard.
4	Disconnect DLB23. Carry out resistance test.	DP4C to suitable earth.	0.77Ω	Go to 9.	Go to 5.
5	Reconnect the driver's engine switchboard to the distribution panel. Disconnect DP2. Switch ON hull battery master switch. Carry out voltage test.	DP2F to suitable earth.	24V dc	Go to 6.	Renew/repair distribution panel.
6	Switch OFF hull battery master switch. Disconnect DLB12 from distribution link box, reconnect DP2. Switch ON hull battery master switch. Carry out voltage test.	Harness at DLB12F to suitable earth.	24V dc	Go to 7.	Renew/repair harness distribution panel to distribution link box.
7	Switch OFF hull battery master switch. Disconnect DLB21 from distribution link box, reconnect DLB12. Switch ON hull battery master switch. Carry out voltage test.	DLB21F to DLB21E.	24V dc	Go to 8.	Renew/repair distribution link box.

(continued)

TABLE 11 INJECTION PUMP STOP SOLENOID CIRCUIT - FAILURE DIAGNOSIS (continued)

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
8	Switch OFF hull battery master switch. Disconnect harness at power pack junction, and reconnect DLB21. Switch ON hull battery master switch. Carry out voltage test.	Power pack junction harness F to E	24V dc	Go to 9.	Renew/repair harness power pack junction to distribution link box.
9	Switch OFF hull battery master and engine switches. Carry out resistance test.	Power pack junction socket F to E	0.77Ω	End of test.	Go to 10.
10	Remove the power pack access plates in the driver's compartment. Remove the engine junction box cover. Carry out resistance test.	Engine junction box F to E.	0.77Ω	Renew/repair harness power pack junction to engine junction box.	Go to 11.
11	Carry out resistance test.	Engine junction box F to E5.	0.77Ω	Renew/repair engine junction box.	Go to 12.
12	Disconnect solenoid (remove end cap for access).	Solenoid F to E5.	0.77Ω	Renew/repair harness engine junction box to injection stop solenoid.	Renew solenoid.

NOTE

The injection pump stop solenoid has two windings, a pull-in winding , which has a typical resistance of 0.77Ω and a hold-on winding, which has a typical resistance of 39Ω. If a fault develops in which the solenoid fails to hold-on, the 39Ω winding may be unserviceable. This can be checked by actuating the solenoid manually and measuring the resistance of the hold-on winding. Renew the pump assembly if the solenoid fails this test.

Removal

62 The procedure for the removal of the injector pump stop solenoid is as follows:

62.1 Switch 'OFF' hull battery master switch.

62.2 Remove access plates to power pack in driver's compartment.

62.3 Disconnect fuel injection pipes 1, 2 and 3 at pump and oil reservoir breather tube at reservoir.

62.4 Remove end cover from solenoid and disconnect.

62.5 Remove the harness complete with solenoid and cap.

62.6 Remove the fuel pump complete with solenoid; refer to Chap 1-3.

Refitting

63 Refit in the reverse order to removing.

Testing

64 Ensure the procedures, detailed for the refitting and retiming of a new fuel pump and solenoid in Chap 1-3, are successfully carried out.

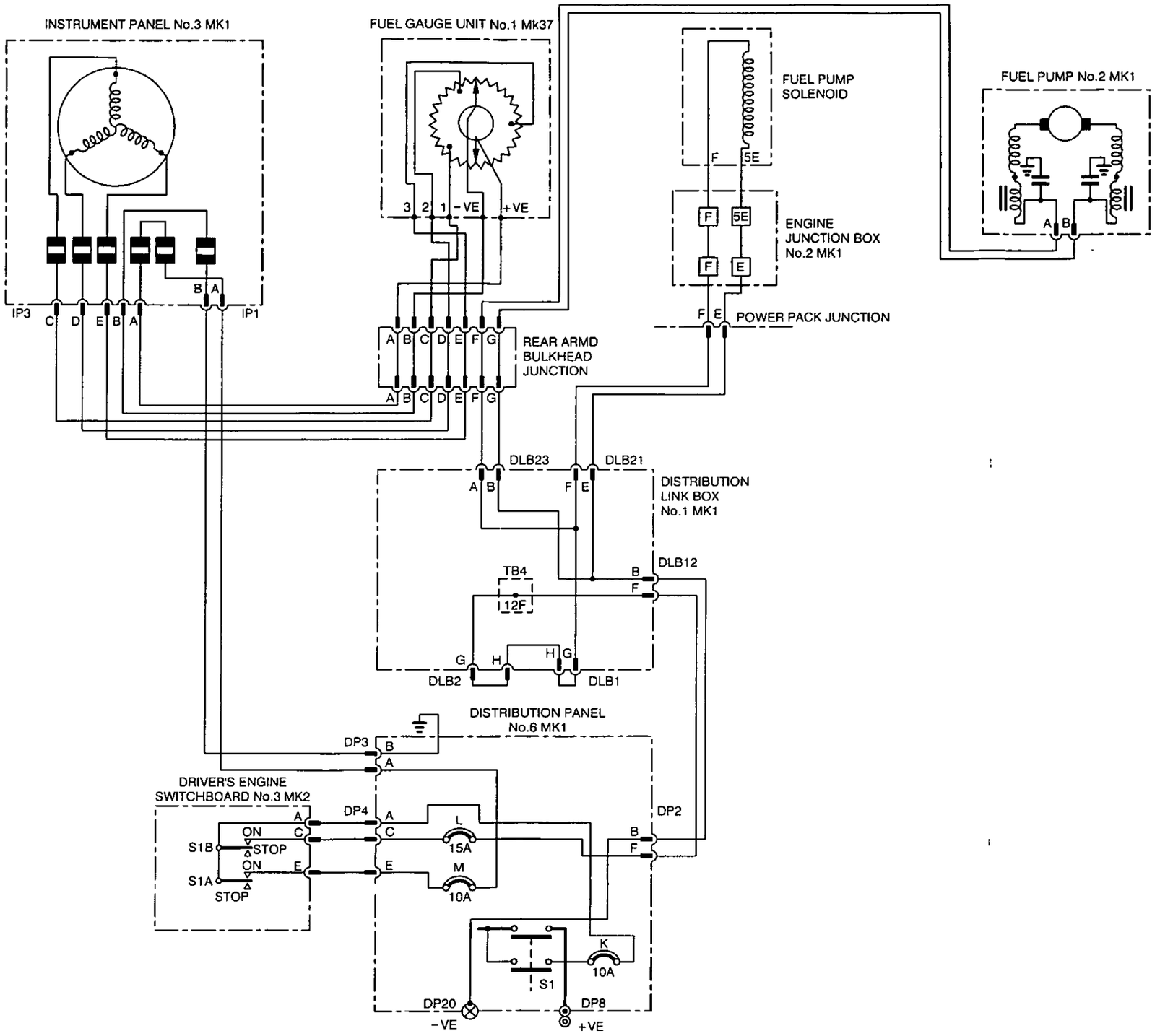

Fig 15 Fuel system electrical components

Fuel pressurising pump No 2, Mk 1

Failure diagnosis

65 Table 12 and Fig 15 enables a fault in the fuel pressurising pump circuit to be identified.

TABLE 12 FUEL PRESSURISING PUMP CIRCUIT - FAILURE DIAGNOSIS

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
1	Disconnect DP4 from distribution panel. Switch ON hull battery master switch. Carry out voltage test.	DP4A to suitable earth.	24V dc	Go to 2.	Renew/repair distribution panel.
2	Switch OFF hull battery master switch. Disconnect harness from driver's engine switchboard. Carry out continuity test.	All wires, each end of harness driver's engine switchboard to distribution panel.	continuity	Go to 3.	Renew/repair harness driver's engine switchboard to distribution panel.
3	Switch ON engine switch. Carry out continuity test.	Driver's engine switchboard pins A to C.	continuity	Go to 4.	Renew/repair driver's engine switchboard.
4	Disconnect DLB21. Carry out resistance test.	DP4F to suitable earth.	0.2Ω	Go to 11.	Go to 5.
5	Reconnect the driver's engine switchboard to the distribution panel. Disconnect DP2. Switch ON hull battery master switch. Carry out voltage test.	DP2F to suitable earth.	24V dc	Go to 6.	Renew/repair distribution panel.
6	Switch OFF hull battery master switch. Disconnect DLB12 from distribution link box, reconnect DP2. Switch ON hull battery master switch. Carry out voltage test.	Harness at DLB12F to suitable earth.	24V dc	Go to 7.	Renew/repair harness distribution panel to distribution link box.
7	Switch OFF hull battery master switch. Reconnect DLB12, disconnect harness DLB1 To DLB2. Carry out continuity test.	All wires each end of harness DLB1 to DLB2.	continuity	Go to 8.	Renew/repair harness DLB1 to DLB2.
8	Switch ON hull battery master switch. Carry out voltage test.	DLB2G to suitable earth.	24V dc	Go to 8.	Renew/repair distribution link box.
9	Carry out voltage test.	DLB1H to suitable earth.	24V dc	Go to 8.	Renew/repair distribution link box.

(continued)

TABLE 12 FUEL PRESSURISING PUMP CIRCUIT - FAILURE DIAGNOSIS (continued)

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
10	Switch OFF hull battery master switch. Disconnect harness DLB! To DLB2. Disconnect DLB23 from distribution link box. Switch ON hull battery master switch. Carry out voltage test.	DLB21A to DLB21B	24V dc	Go to 11.	Renew/repair distribution link box
11	Switch OFF hull battery master switch. Reconnect DLB23 to distribution link box. Remove rectangular plate in L.H. rear of personnel compartment for access to the fuel pump connection. Remove connection. Switch ON hull battery master switch. Carry out voltage test.	Fuel pump harness A to B	24V dc	Renew fuel pump.	Renew or repair fuel pump to DLB23 harness.

Removal, refitting and testing

66 For removal, refitting and testing of the fuel pressurising pump refer to Chap 1-3.

Fuel gauge unit No 1, Mk 37

Removal, refitting and testing

67 For removing, refitting and testing of the fuel gauge unit see Chap 1-3.

Fuel indicating circuit

Failure diagnosis

68 Table 41 and Fig 40 enables a fault in the fuel indicating circuit to be identified.

69 Remove instrument panel from mounting.

TABLE 13 FUEL INDICATING CIRCUIT - FAILURE DIAGNOSIS

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
1	Disconnect DP4 from distribution panel. Switch ON hull battery master switch. Carry out voltage test.	DP4A to suitable earth.	24V dc	Go to 2.	Renew/repair distribution panel.
2	Switch OFF hull battery master switch. Disconnect harness from driver's engine switchboard. Carry out continuity test.	All wires, each end of harness driver's engine switchboard to distribution panel.	continuity	Go to 3.	Renew/repair harness driver's engine switchboard to distribution panel.
3	Switch ON engine switch. Carry out continuity test.	Driver's engine switchboard pins A to E	continuity	Go to 4.	Renew/repair driver's engine switchboard.
4	Disconnect DP3 from distribution panel. Switch ON hull battery master switch. Carry out voltage test.	DP3A to suitable earth.	24V dc	Go to 5.	Renew/repair distribution panel.
5	Switch OFF hull battery master switch. Disconnect IP1 from instrument panel. Carry out continuity test.	All wires, each end of harness IP1 to DP3.	continuity	Go to 6.	Renew/repair harness IP1 to DP3.
6	Disconnect IP3 to fuel gauge unit at junction on fuel tank bulkhead. Carry out resistance test.	A to B C to D D to E C to E	500Ω 475Ω 475Ω 475Ω	Go to 8.	Renew gauge unit.
7	Reconnect IP3 to fuel gauge unit at junction on fuel tank bulkhead. Disconnect IP3 at instrument panel. Carry out resistance test.	Harness plug IP3C to D IP3D to IP3E IP3C to IP3E	 700Ω 700Ω 700Ω	Fuel meter fault renew or repair instrument panel.	Renew/repair harness IP3 to fuel gauge unit.

Removal, refitting and testing

70 For removing, refitting and testing of components in the fuel indicating circuit, refer to Chap 1-3.

STARTER MOTOR, No 3, Mk 2

Failure diagnosis of starter motor heavy circuit

71 Table 14 and Fig 16 enables a fault in the starter motor heavy circuit to be identified.

TABLE 14 STARTER MOTOR HEAVY CIRCUIT - FAILURE DIAGNOSIS

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
1	Switch OFF hull battery master switch. Disconnect harness at power pack junction. Switch ON hull battery master switch. Carry out voltage test.	At harness dc +ve (from DLB19) to dc -ve (from DLB20).	24V dc	Go to 2.	Go to Table 15.
2	Carry out resistance test.	Test rectifier unit as detailed in Table 36.		Go to 3.	Renew rectifier unit.
3	Remove power pack. Disconnect leads between rectifier unit and starter motor. Carry out continuity test.	Each end of leads to starter motor.	continuity	Renew starter motor.	Renew/repair starter motor leads.

Failure diagnosis of starter motor solenoid circuit

72 Table 15 and Fig 16 enables a fault in the starter motor solenoid circuit to be identified.

TABLE 15 STARTER MOTOR SOLENOID CIRCUIT - FAILURE DIAGNOSIS

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
1	Switch OFF hull battery master switch. Disconnect DP4 from distribution panel. Switch ON hull battery master switch. Carry out voltage test.	DP4A to earth	24V dc	Go to 3.	Go to 2.
2	Switch OFF hull battery master switch. Disconnect DP8 from distribution panel. Carry out voltage test.	DP8 to earth.	24V dc	Renew or repair distribution panel.	Renew or repair power supply cable or batteries.
3	Ensure gear lever is in neutral. Switch ON engine switch. Carry out continuity test.	Harness DP4A to DP4C and DP4C to DP4E	continuity	Go to 4.	Go to 5.
4	Ensure gear lever is in neutral. Switch ON starter switch. Carry out continuity test.	Harness DP4G to DP4F	continuity	Go to 7.	Go to 5.

(continued)

NOTE

If there is an open circuit on line G check serviceability of the gear interlock switch.

TABLE 15 STARTER MOTOR SOLENOID CIRCUIT - FAILURE DIAGNOSIS (continued)

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
5	Disconnect harness from driver's engine switchboard. Ensure gear lever is in neutral. Switch ON engine switch. Carry out continuity test.	Engine switchboard socket A to C and C to E.	continuity	Renew or repair harness driver's engine switchboard to distribution panel.	Renew or repair driver's engine switchboard.
6	Ensure gear lever is in neutral. Switch ON starter switch. Carry out continuity test.	Engine switchboard socket G to F.	continuity	Renew or repair harness driver's engine switchboard to distribution panel.	Renew or repair driver's engine switchboard.
7	Carry out resistance test.	Plug DP4G to suitable earth.	6.75Ω	End of test.	Go to 8.
8	Disconnect DP2, reconnect DP4 and engine switchboard to distribution panel, reconnect DP8. Ensure hull battery master, engine switch and starter switch are ON. Carry out voltage test.	DP2A to suitable earth.	24V dc	Go to 9.	Renew or repair distribution panel.
9	Switch OFF hull battery master switch. Reconnect DP2, disconnect DLB12. Switch ON hull battery master switch. Carry out voltage test.	DLB12A to suitable earth.	24V dc	Go to 10.	Renew or repair harness distribution link box to distribution panel.
10	Switch OFF hull battery master switch. Reconnect DLB12, disconnect DLB21. Switch ON hull battery master switch. Carry out voltage test.	DLB21A to suitable earth.	24V dc	Go to 11.	Renew or repair distribution link box.

(continued)

TABLE 15 STARTER MOTOR SOLENOID CIRCUIT - FAILURE DIAGNOSIS (continued)

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
11	Switch OFF hull battery master switch. Carry out resistance test.	Harness DLB21A to suitable earth	6.75Ω	End of test.	Go to 12.
12	Disconnect harness from power pack junction. Carry out resistance test.	Power pack junction pin A to suitable earth.	6.75Ω	Renew or repair harness distribution link box to power pack junction.	Go to 13.
13	Remove access plates in driver's compartment. Remove cover from Engine Junction Box (EJB). Carry out resistance test.	EJB terminal A to suitable earth.	6.75Ω	Renew or repair harness power pack junction to EJB.	Go to 14.
14	Remove power pack. Carry out continuity test.	EJB terminal A to starter motor solenoid.	continuity	Renew starter motor.	Renew or repair harness EJB to starter motor solenoid.

Removal

73 The procedure to remove the starter motor is as follows:

73.1 Switch 'OFF' hull battery master switch.

73.2 Remove the power pack from the vehicle.

73.3 Disconnect leads.

73.4 Remove securing strap.

73.5 Remove starter.

NOTES

(1) The starter yoke is dowelled to the starter cradle along with LV10/5315-99-866-7461 pin straight headed, stud (FV 452228).

(2) The starter motor is a sealed unit and no repairs can be carried out at unit level.

Refitting

74 Refit in the reverse order to removing ensuring the following:

74.1 The dowel pin must be fitted and the securing strap clamp is tightened to 24.4 Nm (18 lbf ft).

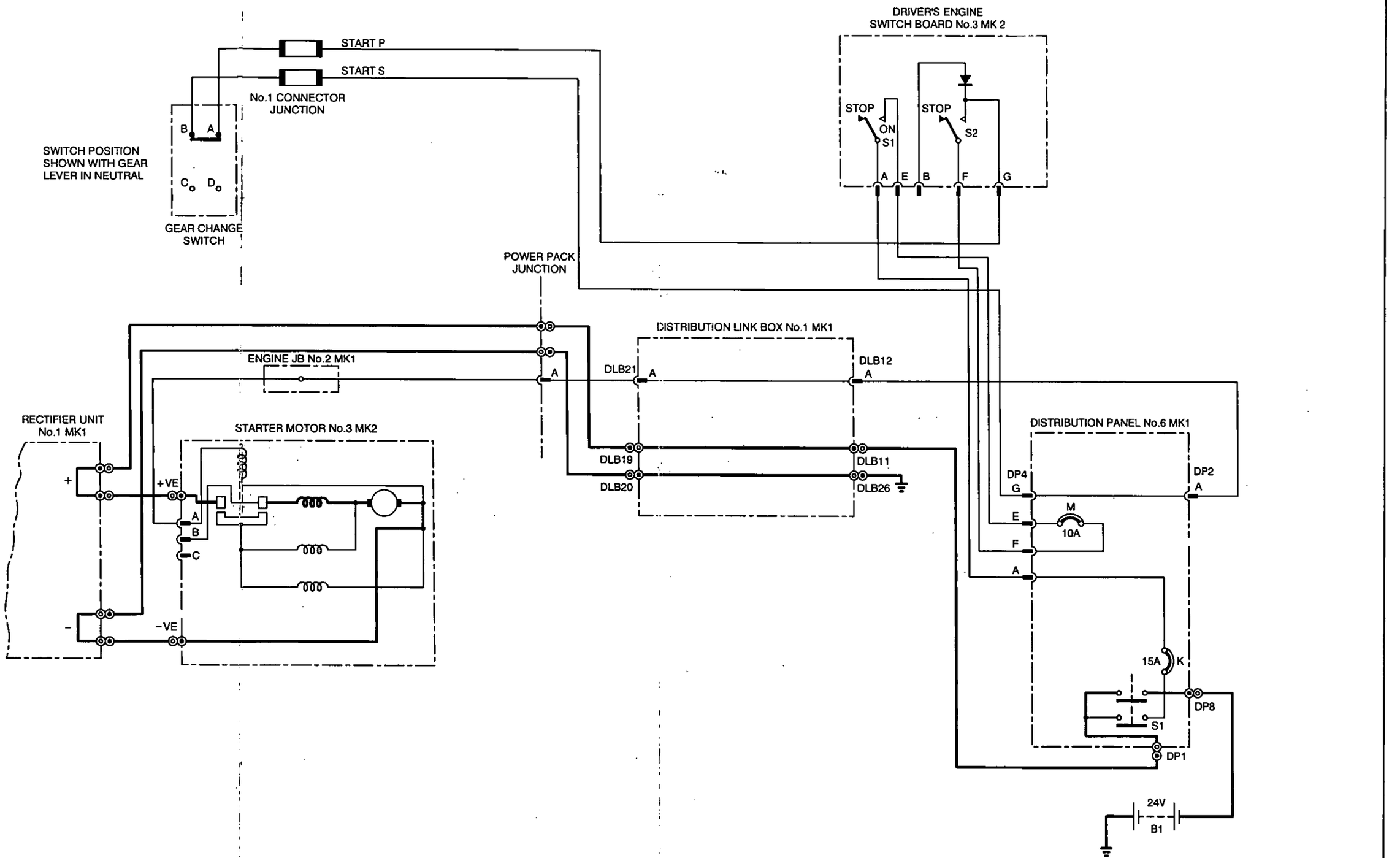

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Fig 16 Starter motor circuit

Testing

75 Start the engine and ensure correct operation of starter.

FIREWIRE SYSTEM

Testing general

76 Set test switch on firewire control box to TEST position with hull battery master switch 'ON'.

77 Check that fire alarm horn is actuated and warning light flashes.

78 If the test in Para 210 is satisfactory the system is serviceable. If the test in Para 210 is unsatisfactory, check circuit breakers C and J in the distribution panel. If the circuit breakers are satisfactory continue with the following failure diagnosis.

Failure diagnosis of the firewire control box supply circuit

79 To obtain access to the Firewire control box, remove the battery clamp and securing strip. Move the batteries in the container towards the power pack to the full extent of the positive and negative leads.

80 Table 16 and Fig 17 enables a fault in the firewire control box supply circuit to be identified.

TABLE 16 FIREWIRE CONTROL BOX SUPPLY CIRCUIT - FAILURE DIAGNOSIS

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
1	Switch OFF hull battery master switch. Disconnect JW4 and JW5 from the firewire control box. Switch ON hull battery master switch. Carry out ac voltage test.	Plug JW4A to JW4B and JW5A to JW5B.	3.9V ac	Go to 3.	Go to 2.
2	Switch OFF hull battery master switch. Disconnect JW1 from firewire control box. Switch ON hull battery master switch. Carry out voltage test.	Harness JW1A to JW1B and JW1B to JW1C.	24V dc	Renew firewire control box.	Go to 3.
3	Switch OFF hull battery master switch. Disconnect DP7 from distribution panel. Switch ON hull battery master switch. Carry out voltage test.	DP7A to DP7B and DP7B to DP7C.	24V dc	Renew or repair harness DP7 to JW1.	Go to 4.
4	Switch OFF hull battery master switch. Disconnect DP8 from distribution panel. Carry out voltage test.	Harness DP8 to suitable earth.	24V dc	Renew or repair distribution panel.	Renew or repair power supply cable or batteries.

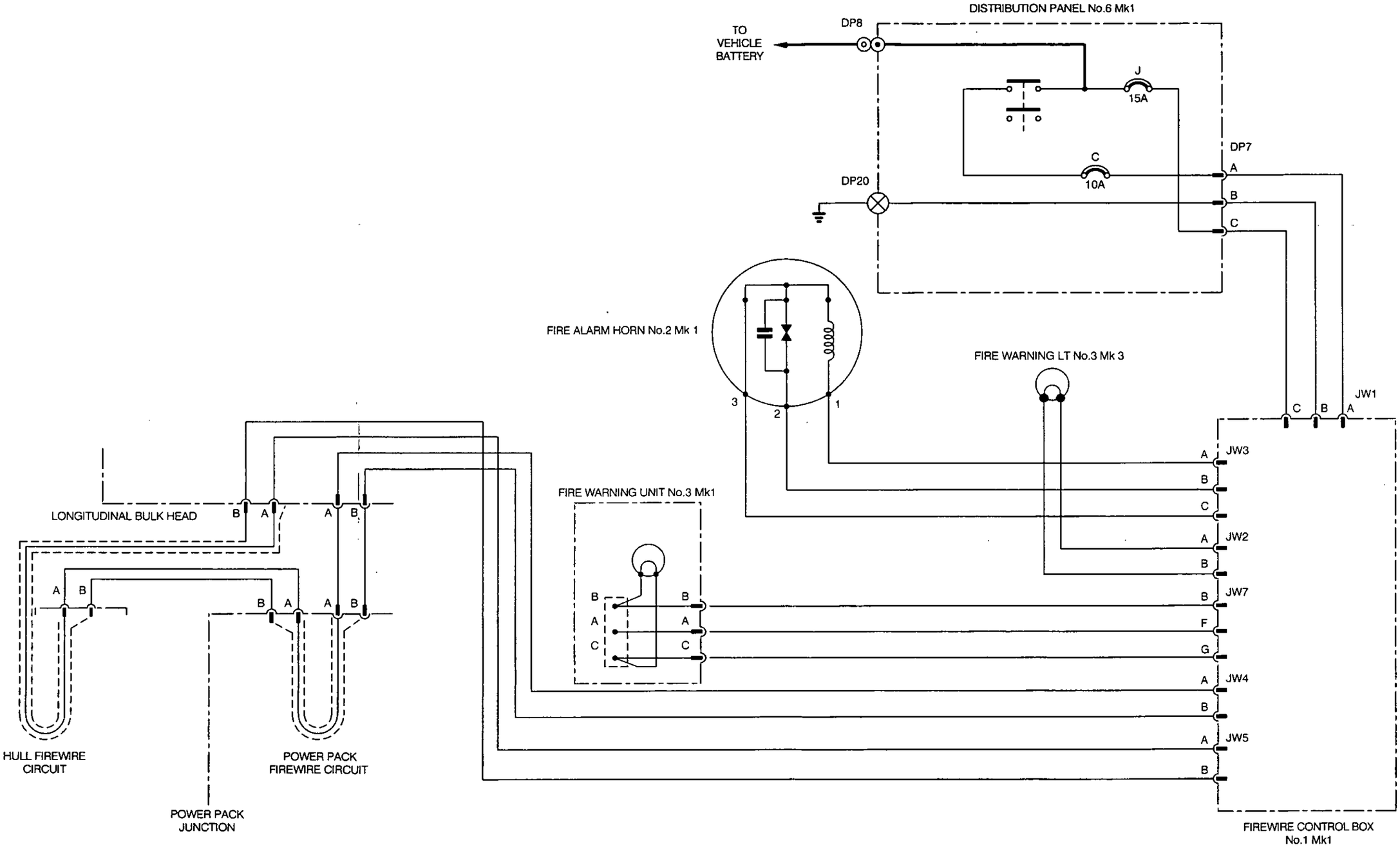

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Fig 17 Firewire system

Failure diagnosis of the firewire element circuit

81 To obtain access to the firewire control box, remove the battery clamp and securing strip. Move the batteries in the container towards the power pack to the full extent of the positive and negative leads.

82 Table 17 and Fig 17 enables a fault in the firewire element circuit to be identified and assumes satisfactory completion of Table 16 and all connections have been remade.

TABLE 17 FIREWIRE ELEMENT CIRCUIT - FAILURE DIAGNOSIS

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
1	Switch OFF hull battery master switch. Disconnect JW4 and JW5. Carry out resistance test.	JW4a to JW5A	130Ω	Go to 5.	Go to 2.
2	Reconnect JW4 and JW5. Disconnect firewire harness plugs at power pack junction. Switch ON hull battery master switch. Carry out ac voltage test.	Pins A to B of each harness plug.	3.9V ac	Go to 3.	Renew or repair harness JW4/5 to power pack junction.
3	Switch OFF hull battery master switch. Remove firewire hull connection at bulkhead and connection at hull located in front of the steering unit. Carry out resistance test	Firewire circuit centre pin at bulkhead plug and pin A at hull.	25.30Ω	Go to 5.	Go to 4.
4	Remove the steering unit and assembly coil reservoir. Carry out resistance test.	Test firewire elements individually.	2.30Ω per inch	Go to 5.	Renew firewire element.
5	Using megohmmeter (Table 2, Serial 1) carry out insulation test.	Harness JW5 at bulkhead connection A to B.	In excess of 1MΩ	Go to 6.	Renew firewire element.
6	With harness plugs disconnected, carry out continuity test of power pack firewire circuit.	Between pins A of the two-Firewire sockets.	76Ω to 114Ω.	Go to 7.	Renew firewire element.
7	Using megohmmeter (Table 2, Serial 1) carry out insulation test.	Pins A to B power pack junction plug.	In excess of 1MΩ	End of test.	Remove power pack. Test each individual element and renew if below 20MΩ.

Failure diagnosis of the fire alarm horn circuit

83 To obtain access to remove the firewire control box, remove the hull batteries.

84 Table 18 and Fig 17 enables a fault in the fire alarm horn circuit to be identified and assumes satisfactory completion of Table 16 and all connections have been remade.

CAUTION

EQUIPMENT DAMAGE. Do not let cable ends touch or earth, feed to horn bypasses master switch, when test switch at firewire control box is operated.

TABLE 18 FIRE ALARM HORN CIRCUIT - FAILURE DIAGNOSIS

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
1	Disconnect JW3 from firewire control box. Carry out resistance test.	Harness B to A A to C B to C	 2.35Ω 2.35Ω 0Ω	Go to 3.	Go to 2.
2	Remove horn from hull mounting, release screw retaining terminal cover, remove cover and remove terminal connections at horn. Carry out continuity test.	All wires, each end of harness horn to firewire control box.	continuity	Go to 3.	Renew or repair harness horn to firewire control box.
3	Reconnect JW3 to firewire control box. Switch ON hull battery master switch. Carry out voltage test.	Horn +ve and -ve with the switch set to 'TEST' at firewire control box.	24V dc	Renew horn.	Renew or repair firewire control box.

Failure diagnosis of the fire alarm warning light circuit

85 To obtain access to remove the firewire control box, remove the hull batteries.

86 Table 19 and Fig 17 enables a fault in the fire alarm warning light circuit to be identified and assumes satisfactory completion of Table 16 and all connections have been remade and the fire alarm warning light lamps are serviceable.

CAUTION

EQUIPMENT DAMAGE. Do not let cable ends touch or earth, feed to horn bypasses master switch, when test switch at firewire control box is operated.

TABLE 19 FIRE ALARM WARNING LIGHT CIRCUIT - FAILURE DIAGNOSIS

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
1	Disconnect JW7 from firewire control box. Remove lamp from fire warning unit. Carry out resistance test.	Harness B to A C to A	 130Ω 0Ω	Go to 3.	Go to 2.
2	Disconnect harness at fire warning unit. Carry out resistance test.	Fire warning unit B to A C to A	 130Ω 0Ω	Renew or repair harness fire warning unit to firewire control box.	Renew fire-warning unit.
3	At fire warning unit. Using megohmeter (Table 2, Serial 1) Carry out insulation test.	Measure the insulation resistance between all electrical connections (pins) connected together and the case.	In excess of 1.5MΩ	Go to 4.	Renew fire-warning unit.
4	Switch ON hull battery master switch. Carry out voltage test.	JW7F to JW7B with the switch set to TEST at firewire control box.	24V dc	Go to 5.	Renew or repair firewire control box.
5	Switch OFF hull battery master switch. Remove lamp from fire warning light. Switch ON hull battery master switch. Carry out voltage test.	Lamp holder center pin to earth with the switch set to TEST at firewire control box.	24V dc	Renew fire warning light.	Go to 6.
6	Switch OFF hull battery master switch. Disconnect JW2 from firewire control box. Switch ON hull battery master switch. Carry out voltage test.	JW2A to JW2B with the switch set to TEST at firewire control box.	24V dc	Renew or repair harness fire warning light to firewire control box.	(continued) Renew or repair firewire control box.

Firewire element connectors

87 Contamination of the element connectors will result in a lowering of the insulation resistance between centre wire and earth. Great care must therefore be taken to protect exposed end connections whenever the system is disconnected and for this purpose the following plastic blanking caps are to be demanded as expense items:

87.1	LV6/MT4 5340-99-807-0558	Cap, protective, dust and moisture seal (female)
87.2	LV6/MT4 5340-99-807-0559	Cap, protective, dust and moisture seal (male)

88 Should the connectors become contaminated by oil, dirt, or moisture brush out with Reagent (Table 1, Serial 2) and allow to dry for a minimum of 10 minutes. Great care must be taken to ensure that the connection is scrupulously clean and dry. Do not use a workshop airline to speed the process. Check the insulation resistance between centre wire and earth before reconnection. With megohmmeter set to 500V, minimum insulation resistance should be 1MΩ.

Fire alarm warning light removal and refitting

89 The fire warning light is the same construction as a vehicle sidelight and its removal and refitting are as detailed for a sidelight.

Fire alarm warning horn removal and refitting

90 The Fire alarm warning horn is the same construction as the vehicle traffic horn, its removal and refitting are self-evident.

Fire warning unit No3 Mk1

Removal

91 The procedure to remove the fire-warning unit No 3 Mk1 is as follows:

91.1 Switch the hull battery switch to OFF.

91.3 Disconnect the harness at the connector beneath the unit.

91.4 Unscrew and remove the four mounting screws and remove the unit.

Refitting

92 Refitting is the reverse of the procedure detailed for removal.

Firewire control box

Removal

93 The procedure to remove the firewire control box is as follows:

93.1 Switch the hull battery switch to OFF.

93.2 Disconnect all harnesses from the control box.

93.3 Unscrew and remove the four mounting screws and remove the control box.

Refitting

94 Refitting is the reverse of the procedure detailed for removal.

Firewire element

Removal

95 The firewire circuit consists of six elements; each element is connected by couplings similar to Fig 18. Fig 18 shows a terminal coupling, the firewire is removed as follows:

95.1 Switch the hull battery switch to OFF.

95.2 Release the quick release clip (Fig 43 (6)) nearest to the coupling.

95.3 Clamp the nut (3) unscrew and remove the coupling (4) from the cranked barrel (2).

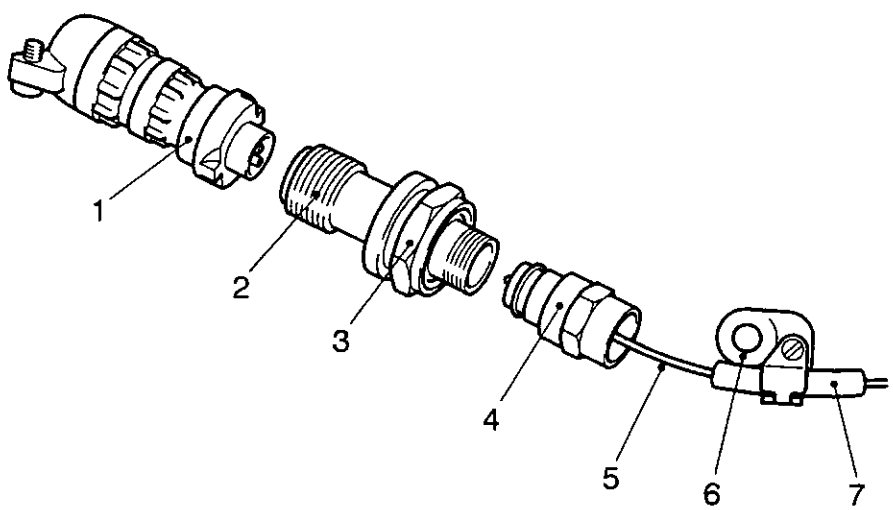
95.4 Repeat the procedure at the other end of the element, release all the quick release clips and lift out the element.

Refitting

96 Refitting is the reverse of the procedure detailed for removal, ensuring the following:

96.1 The new element (5) is a capillary tube, inspect it before installation and ensure that it is not damaged during installation.

96.2 Ensure that the sleeves (7) are fitted wherever the clips (6) are used to secure the element.



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1	Two pin socket	5	Element
2	Cranked barrel	6	Clip
3	Nut	7	Sleeve
4	Coupling		

Fig 18 Firewire element and terminal coupling

Testing

97 Carry out the procedure detailed in AESP 2350-T-250-201.

ENGINE AND GEARBOX TEMPERATURE INDICATING CIRCUITS

Engine temperature indicating circuit

Failure diagnosis

98 Table 20 and Fig 19 enables a fault in the engine temperature indicating circuit to be identified.

TABLE 20 ENGINE TEMPERATURE INDICATING CIRCUIT – FAILURE DIAGNOSIS

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
1	Switch OFF hull battery master switch. Disconnect DP4 from distribution panel. Switch ON hull battery master switch. Carry out voltage test.	DP4A to earth.	24V dc	Go to 3.	Go to 2.
2	Switch OFF hull battery master switch. Disconnect DP8 from distribution panel. Carry out voltage test.	DP8 to earth.	24V dc	Renew or repair distribution panel.	Renew or repair power supply cable or batteries.
3	Switch ON engine switch. Carry out continuity test.	Harness DP4A to DP4C and DP4A to DP4E	continuity	Go to 5.	Go to 4.
4	Disconnect harness at driver's engine switchboard. Carry out continuity test.	Driver's engine switchboard DP4A to DP4C and DP4A to DP4E	continuity	Renew or repair harness driver's engine switchboard to distribution panel.	Renew or repair driver's engine switchboard.
5	Reconnect DP4 and DP8. Lower instrument panel and disconnect IP1. Switch ON hull battery master and engine switches. Carry out voltage test.	IP1A to suitable earth.	24V dc	Go to 7.	Go to 6.
6	Switch OFF hull battery master switch. Disconnect DP3 from distribution panel. Switch ON hull battery master. Carry out voltage test.	Distribution panel DP3A to suitable earth.	24V dc	Renew or repair harness distribution panel to instrument panel.	Renew or repair distribution panel.

(continued)

TABLE 20 ENGINE TEMPERATURE INDICATING CIRCUIT - FAILURE DIAGNOSIS (continued)

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
7	Switch OFF hull battery master switch. Disconnect IP2. Turn instrument dimmer fully counter clockwise. Carry out resistance test.	IP1A to IP2B IP1A to IP1C	450Ω 700Ω	Go to 8.	Engine coolant temperature gauge fault. Renew/repair instrument panel.
8	Reconnect DP3. Carry out resistance test.	Harness IP1A to suitable earth	100Ω	End of test.	Go to 9.
9	Disconnect DP3. Carry out continuity test.	Pin C each end of harness IP1 TO DP3	continuity	Go to 10.	Renew or repair harness IP1 to DP3.
10	Disconnect DP2. Carry out continuity test.	DP3C to DP2C	continuity	Go to 11.	Renew or repair distribution panel.
11	Disconnect DLB12. Carry out continuity test.	DP2C to DLB12C	continuity	Go to 12.	Renew or repair harness DP2 to DLB12.
12	Disconnect DLB21. Carry out continuity test.	DLB12C to DLB21C	continuity	Go to 13.	Renew or repair distribution link box.
13	Reconnect DLB21, DLB12, DP2, DP3, IP1 and IP2. Disconnect harness at power pack junction. Switch ON hull battery and engine switches. Carry out voltage test.	Power pack junction harness pin C to suitable earth	10V dc	Go to 14.	Renew or repair harness DLB12 to power pack junction.
14	Switch OFF hull battery and engine switches. Carry out resistance test.	Power pack junction socket pin C to E	100Ω	End of test.	Go to 15.

(continuity)

TABLE 20 ENGINE TEMPERATURE INDICATING CIRCUIT - FAILURE DIAGNOSIS (continued)

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
15	Remove power pack access plates in the driver's compartment. Remove cover from engine junction box. Carry out resistance test.	Engine junction box C to E	100Ω	Renew or repair harness engine junction box to power pack junction.	Go to 16.
16	Carry out resistance test.	Engine junction box C to E3.	100Ω	Renew or repair engine junction box.	Go to 17.
17	Disconnect coolant temperature sensor. Carry out resistance test.	Coolant temperature sensor C to E3.	100Ω	Renew or repair harness - engine junction box to coolant. temperature sensor.	Renew coolant temperature sensor.

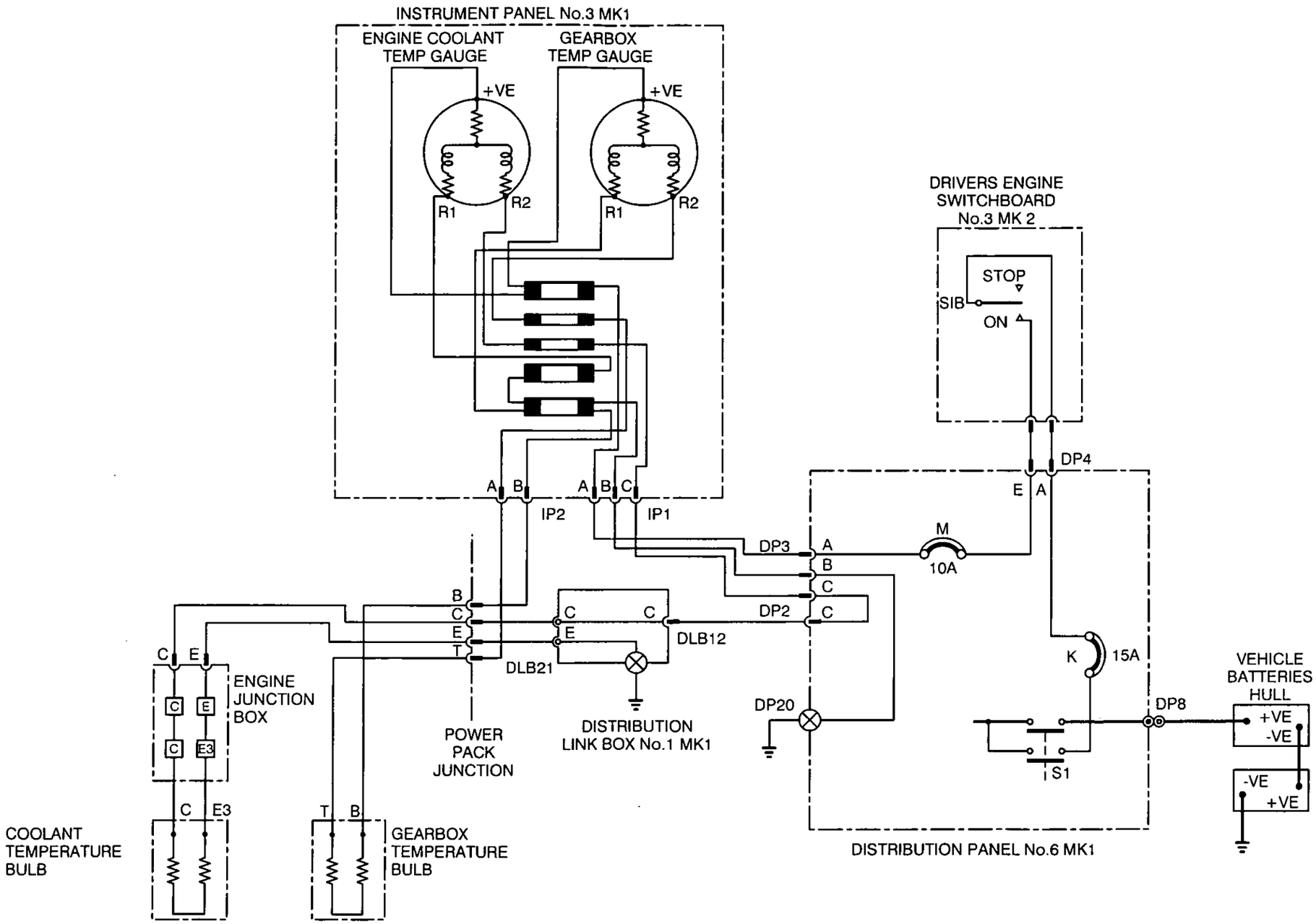

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Fig 19 Engine and gearbox temperature indicating circuits

Gearbox temperature indicating circuit

Failure diagnosis

99 Table 21 and Fig 19 enables a fault in the gearbox temperature indicating circuit to be identified.

TABLE 21 GEARBOX TEMPERATURE INDICATING CIRCUIT - FAILURE DIAGNOSIS

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
1	Switch OFF hull battery master switch. Disconnect DP4 from distribution panel. Switch ON hull battery master switch. Carry out voltage test.	DP4A to earth	24V dc	Go to 3.	Go to 2.
2	Switch OFF hull battery master switch. Disconnect DP8 from distribution panel. Switch ON hull battery master switch. Carry out voltage test.	DP8 to earth	24V dc	Renew or repair distribution panel.	Renew or repair power supply cable or batteries.
3	Switch ON engine switch. Carry out continuity test.	Harness DP4A to DP4C and DP4A to DP4E	continuity	Go to 5.	Go to 4.
4	Disconnect harness at driver's engine switchboard. Carry out continuity test.	Driver's engine switchboard DP4A to DP4C and DP4A to DP4E	continuity	Renew or repair harness driver's engine switchboard to distribution panel.	Renew or repair driver's engine switchboard .
5	Reconnect DP4 and DP8. Lower instrument panel and disconnect IP1. Switch ON hull battery master and engine switches. Carry out voltage test.	IP1A to suitable earth.	24V dc	Go to 7.	Go to 6.
6	Switch OFF hull battery master switch. Disconnect DP3 from distribution panel. Switch ON hull battery master. Carry out voltage test.	Distribution panel DP3A to suitable earth.	24V dc	Renew or repair harness distribution panel to instrument panel.	Renew or repair distribution panel.

(continued)

TABLE 21 GEARBOX TEMPERATURE INDICATING CIRCUIT - FAILURE DIAGNOSIS (continued)

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
7	Switch OFF hull battery master switch. Disconnect IP2. Turn instrument dimmer fully counter clockwise. Carry out resistance test.	IP1A to IP2B IP1A to IP2A	450Ω 700Ω	Go to 8.	Gearbox coolant temperature gauge fault. Renew/repair instrument panel.
8	With gearbox cold, carry out resistance test.	IP2A to IP2B	100Ω	End of test.	Go to 9.
9	Disconnect harness at power pack junction. Carry out resistance test.	Power pack junction harness pins B to T	100Ω	Go to 10.	Renew or repair harness.
10	Disconnect gearbox temperature sensor. Carry out resistance test.	Gearbox temperature sensor B to T.	100Ω	Renew or repair harness power pack junction to gearbox temperature sensor.	Renew gearbox temperature sensor.

REV/MIN SENDER UNIT AND TACHOMETER

Failure diagnosis

100 Table 22 and Fig 20 enables a fault in the rev/min sender unit and tachometer circuit to be identified.

TABLE 22 REV/MIN SENDER UNIT AND TACHOMETER CIRCUIT – FAILURE DIAGNOSIS

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
1	Switch OFF hull battery master switch. Disconnect IP1 from instrument panel. Carry out resistance test.	Instrument panel IP1E to IP1D	2500Ω	Go to 2.	Tachometer fault. Renew/repair instrument panel.
2	Carry out resistance test.	Harness plug IP1E to IP1D	50Ω	End of test.	Go to 3.
3	Disconnect DP3 from distribution panel. Carry out resistance test.	Distribution panel DP3D to DP3E	50Ω	Renew or repair harness dist panel to instrument panel.	Go to 4.

(continued)

TABLE 22 REV/MIN SENDER UNIT AND TACHOMETER CIRCUIT - FAILURE DIAGNOSIS (continued)

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
4	Disconnect DP3 from distribution panel. Carry out resistance test.	Distribution panel DP2D to DP2E	50Ω	Renew or repair distribution panel.	Go to 5.
5	Disconnect DLB12 from distribution link box. Carry out resistance test.	Distribution link box DLB12D to DLB12E	50Ω	Renew or repair harness distribution panel to distribution link box.	Go to 6.
6	Disconnect DLB21 from distribution link box. Carry out resistance test.	Distribution link box DLB21G to DLB21H	50Ω	Renew or repair distribution link box.	Go to 7.
7	Disconnect harness from power pack junction. Carry out resistance test.	Power pack junction G to H	50Ω	Renew or repair harness distribution link box to power pack junction.	Go to 8.
8	Remove power pack access plates in the driver's compartment. Remove cover from engine junction box. Carry out resistance test.	Engine junction box (input) G to H	50Ω	Renew or repair harness engine junction box to power pack junction.	Go to 9.
9	Carry out resistance test.	Engine junction box (output) G to H	50Ω	Renew or repair engine junction box.	Go to 10.
10	Disconnect tachometer sender unit. Carry out resistance test.	Tachometer sender unit G to H	50Ω	Renew or repair harness engine junction box to tachometer sender unit.	Renew tachometer sender unit.

Removal

101 The procedure to remove the tachometer sender unit is as follows:

101.1 Remove the three securing studs.

101.2 Remove the two nuts securing the side plate cover and remove the cover.

101.3 Identify, for ease of correct reassembly the two leads, and disconnect the leads.

101.4 Release the screening cable unit and withdraw the leads.

Refitting

102 The procedure for refitting a tachometer sender unit is the reverse of the procedure detailed for removal.

Testing

103 Ensure correct operation of the tachometer, whenever the tachometer sender unit is replaced.

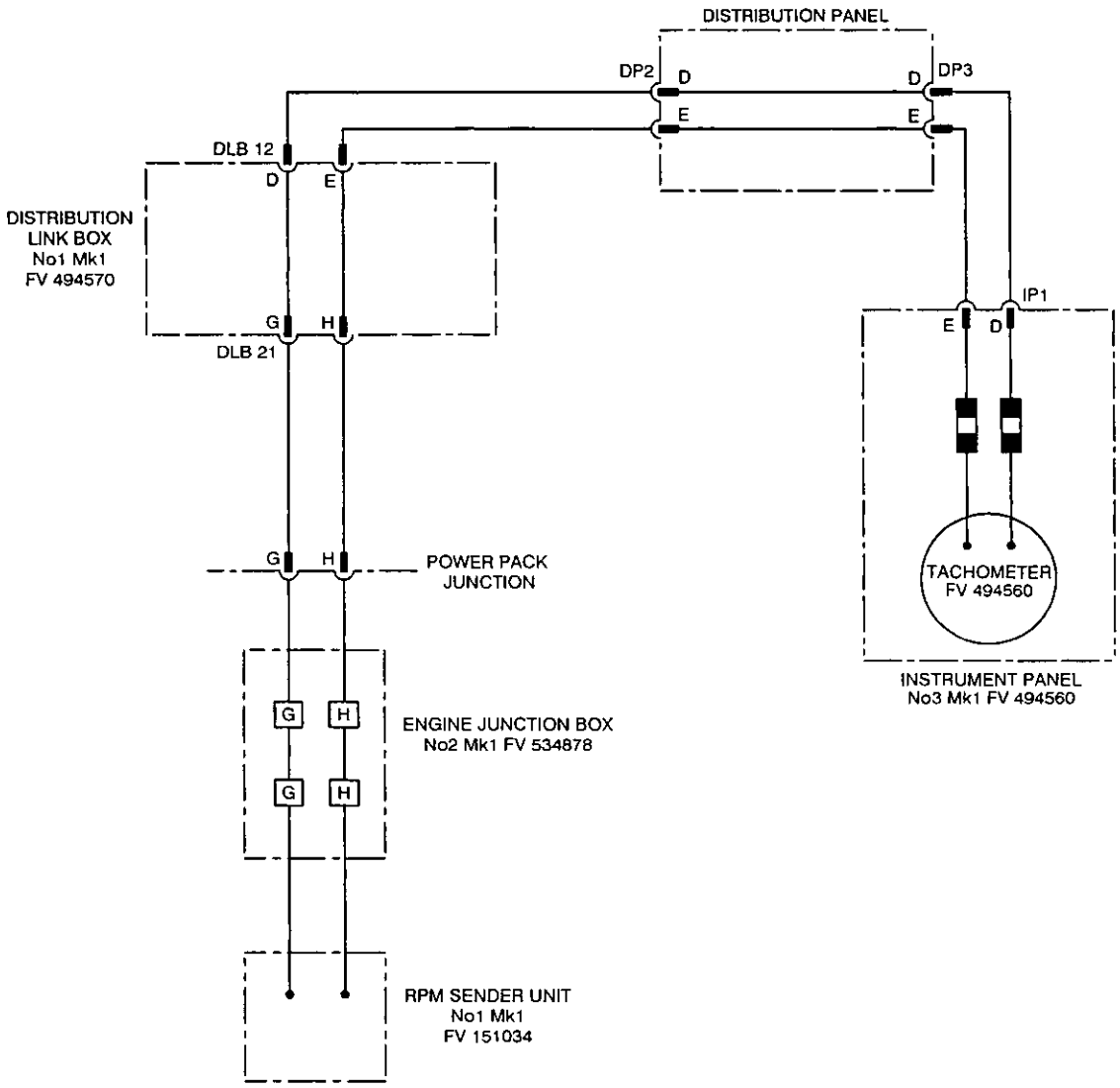

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Fig 20 Rev/min sender unit and tachometer circuit

INSTRUMENT PANEL

Failure diagnosis

104 Failure diagnosis of the instruments in the instrument panel are detailed in Tables 9, 13, 20, 21 and 22.

Removal

105 The procedure to remove the instrument panel is as follows:

105.1 Switch the hull battery switch to OFF.

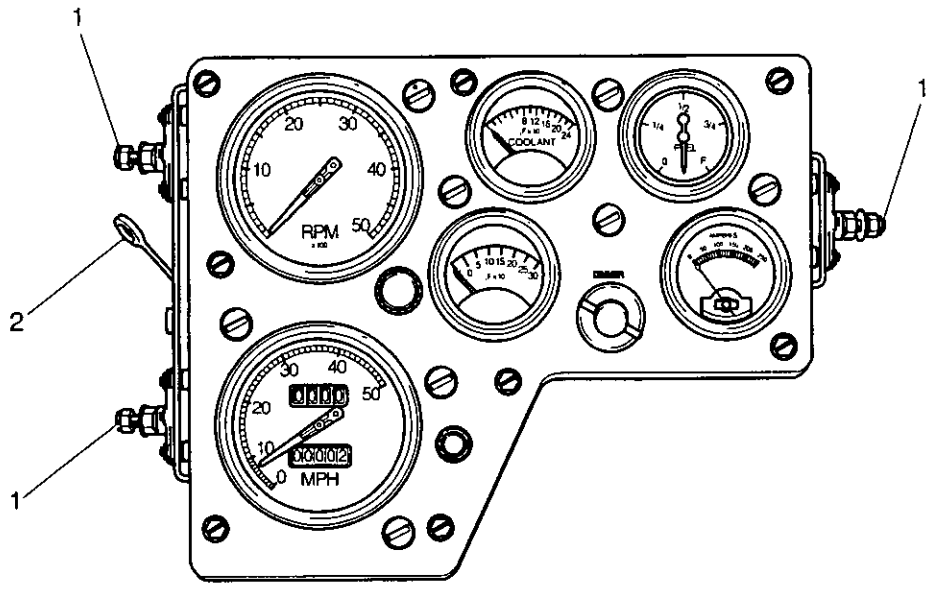
105.2 Disconnect the three connectors on the underside of the instrument panel.

105.3 Disconnect the earth lead (Fig 21 (2))

105.4 Slacken the three mounting nuts (1) and slide the instrument panel out of its mounting fixture.

Refitting

106 The procedure for refitting an instrument panel is the reverse of the procedure detailed for removal.



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1 Mounting nuts 2 Earth lead

Fig 21 Instrument panel

GEAR INTERLOCK SWITCH

Failure diagnosis (assembly in vehicle)

107 Table 23A enables a fault in the gear interlock switch circuit to be identified.

TABLE 23A GEAR INTERLOCK SWITCH CIRCUIT - FAILURE DIAGNOSIS

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
1	Switch OFF hull battery master switch. Remove power pack access covers. Disconnect switch harness at bulkhead. Put gear selector in neutral. Carry out continuity test.	Harness plug pin A to B.	continuity	Go to 2.	Renew switch.
2	Put gear selector in any forward gear. Carry out continuity test.	Harness plug pin C to D.	continuity	End of test.	Renew switch.

Failure diagnosis (assembly removed from vehicle)

108 Table 23B enables a fault in the gear interlock switch circuit to be identified.

TABLE 23B GEAR INTERLOCK SWITCH CIRCUIT - FAILURE DIAGNOSIS

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
1	Switch OFF hull battery master switch. Remove switch cover plate from gear range selector. Disconnect switch at terminals A, B, C and D. Carry out continuity test of harness within gear range selector.	All terminals each end of harness	continuity	Go to 2.	Renew harness.
2	Put gear selector in neutral. Carry out continuity test.	Switch A to B	continuity	Go to 3.	Renew switch.
3	Put gear selector in any forward gear. Carry out continuity test.	Switch C to D	continuity	End of test.	Renew switch.

Removal

109 The procedure to remove the gear interlock switch is as follows:

109.1 Remove the gear range selector assembly as detailed in Chap 1-1.

109.2 Unscrew the four screws securing the switch cover to the gear range selector assembly and remove the cover.

109.3 Unscrew and remove the two screws securing the switch mounting bracket inside the gear range selector assembly.

109.4 Disconnect the four leads from the switch and remove the switch and mounting bracket from the gear range selector assembly.

109.5 Mark the location of the switch on the mounting bracket (for ease of correct assembly), unscrew the nuts securing the switch to the bracket and remove the switch.

Refitting

110 The procedure for refitting a gear interlock switch is the reverse of the procedure detailed for removal, ensuring the following:

110.1 Manually check the operation of the new switch.

110.2 Fit the new switch to the mounting bolts and secure with the four nuts.

110.3 Locate the mounting into gear range selector housing.

110.4 Connect leads A, B, C and D at the switch.

110.5 Secure the switch mounting to the gear range selector housing (two bolts). 'Do not tighten at this stage.

110.6 Move the gear range selector lever to the NEUTRAL position.

110.7 Connect a multimeter across terminals A and B at the switch. Move the switch into contact with the boss on the gear range selector lever until continuity is obtained between terminals A and B.

110.8 When this is achieved, secure the switch-mounting bracket. Move the gear range selector into a forward gear range. Connect a multimeter across terminals C and D at the switch and ensure that continuity is obtained.

110.9 When this is achieved, recheck NEUTRAL position as detailed at Para 110.7.

110.10 When both conditions are achieved, refit the cover plate. Refit the gear range selector assembly to the vehicle.

Testing

111 Ensure the vehicle cannot be started with the gear range selector in any position other than neutral.

PERISCOPE WIPER MOTOR

Failure diagnosis

112 Table 24 enables a fault in the periscope wiper motor circuit to be identified.

TABLE 24 PERISCOPE WIPER MOTOR CIRCUIT - FAILURE DIAGNOSIS

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
1	Switch ON hull battery master switch and wiper motor switch unit on the hull. Carry out voltage test.	Harness plug (motor connection) between pins A and B	24V dc	Go to 2.	Go to 3.
2	Switch OFF wiper motor and hull battery master switch. Remove commutator end cap of motor (six screws). Remove the two screwed caps retaining spring and brushes. Examine commutator for signs of pitting or burning. Clean using a clean rag only, if necessary. Ensure brushes slide freely in their holders. Carry out resistance test.	Test field winding.	75Ω	Go to 3.	Renew periscope wiper motor.
3	Switch OFF wiper motor and hull battery master switch. Carry out continuity test.	Harness AJB4 to harness plug at motor.	continuity	Renew/repair harness.	Renew switch unit..

Removal

113 The procedure to remove the periscope wiper motor is as follows:

113.1 Switch OFF the hull battery master switch.

113.2 Disconnect the harness plug at the wiper motor.

113.3 Remove the locking nut securing the wiper arm operating linkage.

113.4 Remove the three bolts securing the unit to the driver's hatch.

113.5 Remove the motor from the mounting, easing off operating arm attached to wiper arm linkage. Ensure that the Woodruff keys do not fall from the shaft when removing the operating arm.

Refitting

114 The procedure for refitting a periscope wiper motor is the reverse of the procedure detailed for removal.

Testing

115 Ensure correct operation of the periscope wiper whenever the periscope wiper motor is renewed.

DISTRIBUTION PANEL No 6 Mk 1

Failure diagnosis

CAUTION

EQUIPMENT DAMAGE. The distribution panel is a sealed unit and should not be opened up at unit level. If frequent changing of the desiccator's element is found necessary the panel should be removed and sent to workshops for drying out, resealing and subsequent pressure testing.

116 Check desiccators/indicator. Indicator will be blue when dampness is not present and pink if damp. If damp replace element.

117 Table 25 and Fig 22 enables a fault in the distribution panel No 6 Mk 1 to be identified.

TABLE 25 DISTRIBUTION PANEL NO 6 MK 1 - FAILURE DIAGNOSIS

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
1	Set battery master switch to OFF. Disconnect all external plugs and sockets. Carry out continuity test.	DP20 to DP7B DP20 to DP2B DP20 to DP17B DP20 to DP17D DP20 to DP16B DP20 to DP16D DP20 to DP12B DP20 to DP14B DP20 to DP13B DP20 to DP3B DP20 to DP4B DP20 to DP10B DP20 to DP10D DP20 to DP6B DP20 to DP6D DP20 to DP19A DP20 to I.V.SKT outer	continuity	Go to 2.	Renew distribution panel.
2	Carry out continuity test.	DP2P toDP4K DP2F to DP9A DP2K to DP4E DP2K to DP4F DP2K to DP3A DP2L to DP4L DP2H to DP4H DP2A to DP4G DP2J to DP3A DP2N to DP20 DP2N to DP4J DP2C to DP3C DP2D to DP3D DP2E to DP3E DP2M to DP4A	continuity	Go to 3	Renew distribution panel.

(continued)

TABLE 25 DISTRIBUTION PANEL NO 6 MK 1 - FAILURE DIAGNOSIS (continued)

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
3	Carry out continuity test.	DP16G to DP12D	continuity	Go to 4.	Renew distribution panel.
4	Carry out continuity test.	DP14D to DP13D DP4C to DP9A	continuity	Go to 5.	Renew distribution panel.
5	Carry out continuity test.	DP10C to DP10A DP10C to DP6C DP10C to DP6A DP10C to DP19A DP10Cto I.V.SKT inner	continuity	Go to 6.	Renew distribution panel.
6	Carry out continuity test.	DP7A to I.V.SKT inner DP17A to DP17C	continuity	Go to 7.	Renew distribution panel.
7	Set battery master switch to ON. Carry out continuity test. .	DP8 to DP7C DP8 to DP6A	continuity	Go to 8.	Renew distribution panel.
8	Set battery master switch to ON. Carry out resistance test.	DP15 to DP14C and DP15 to DP13C	165Ω 165Ω	Go to 9.	Renew distribution panel.
9	Set battery master switch to ON. Switch ON SW5. Carry out resistance test.	DP15 to DP14B	165Ω	Go to 10.	Renew distribution panel.
10	Carry out resistance test.	DP2G to DP2B	123Ω	Go to 11.	Renew distribution panel.
11	Carry out resistance test.	DP16F to DP12C	165Ω	End of test.	Renew distribution panel.

Removal

118 The procedure to remove the distribution panel No 6 Mk 1 is as follows:

118.1 Set the battery master switch to OFF.

118.2 Disconnect the negative then the positive terminals at vehicle and radio batteries.

118.3 Disconnect DP1, DP8 and DP15.

118.5 Disconnect DP3, DP4, DP6, DP9 and DP1O from front of panel.

118.6 Remove the earth strap.

118.7 Remove the four securing nuts.

118.8 Disconnect all connections at rear of assembly.

118.9 Remove panel assembly.

Refitting

119 Refit in reverse order to removing.

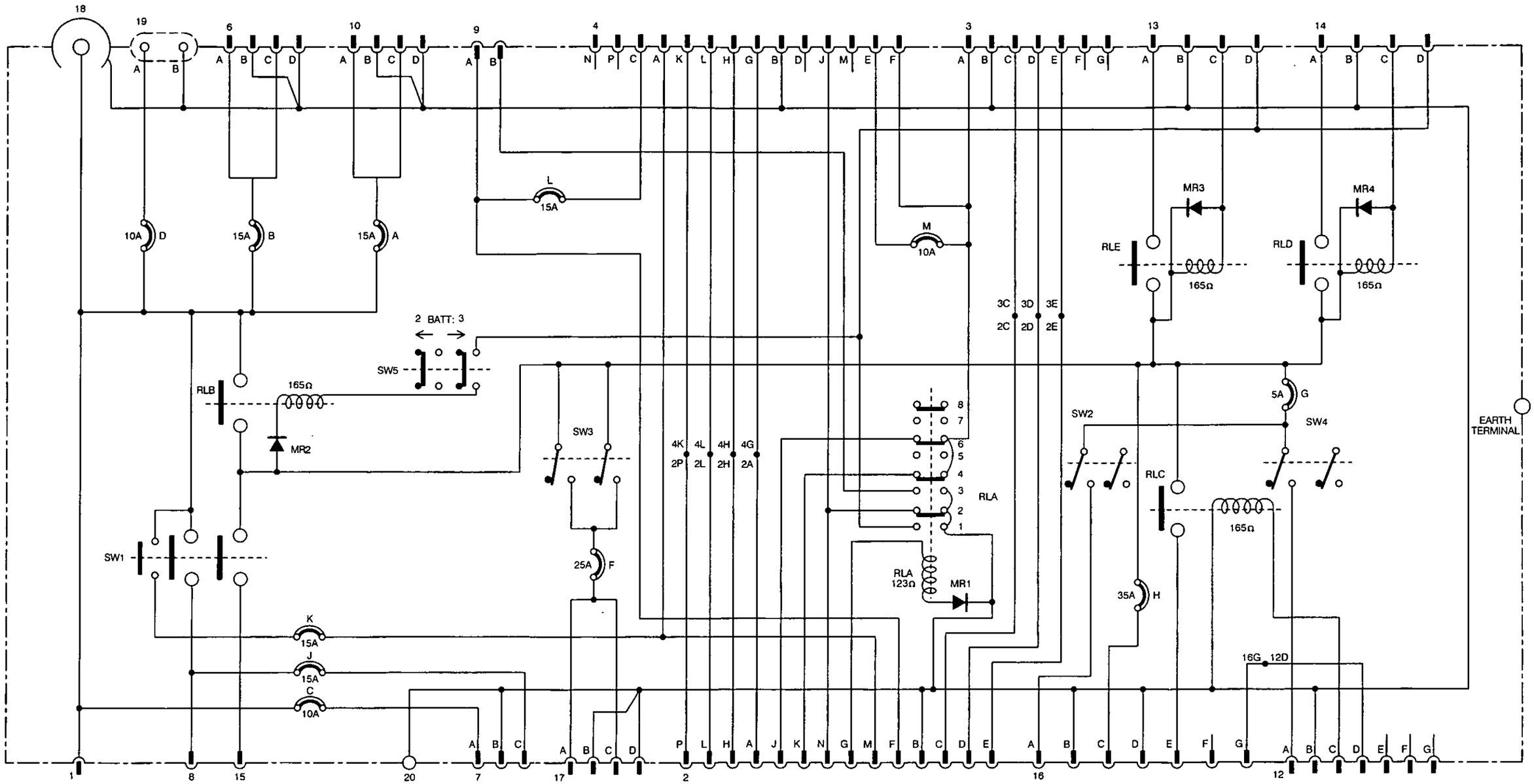

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Fig 22 Distribution panel No 6 Mk1

SMOKE GRENADE DISCHARGER SYSTEM

WARNING

ACCIDENTAL GRENADE DISCHARGE. BEFORE CARRYING OUT ANY MAINTENANCE ON THE SMOKE GRENADE DISCHARGER SYSTEM, ENSURE EACH GRENADE TUBE IS UNLOADED.

Failure diagnosis

120 Table 26 and Fig 23 enables a fault in the smoke grenade discharger circuit to be identified.

TABLE 26 SMOKE GRENADE DISCHARGER CIRCUIT - FAILURE DIAGNOSIS

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
1	Disconnect DP10 from distribution panel; switch ON hull battery master switch. Carry out voltage test.	DP10A to DP10B	24V dc	Go to 3.	Go to 2.
2	Switch OFF hull battery master switch. Disconnect DP8 from distribution panel. Switch ON hull battery master switch. Carry out voltage test.	DP8 to suitable earth.	24V dc	Renew or repair distribution panel.	Renew or repair power supply cable or batteries.
3	Switch OFF hull battery master switch. Reconnect DP10 and disconnect AJB3 from auxiliary junction box. Switch ON hull battery master switch. Carry out voltage test.	Harness AJB3A to AJB3B	24V dc	Go to 4.	Renew or repair harness DP10 to AJB3.
4	Switch OFF hull battery master switch. Reconnect AJB3 and disconnect AJB1. Switch ON hull battery master switch. Carry out voltage test.	AJB1A to AJB1B	24V dc	Go to 5.	Renew or repair auxiliary junction box.
5	Switch OFF hull battery master switch. Reconnect AJB1 and disconnect SBB1. Switch ON hull battery master switch. Carry out voltage test.	Harness SBB1A to SBB1N.	24V dc	Go to 6.	Renew or repair harness AJB1 to SBB1.
6	Switch OFF hull battery master switch. Reconnect SBB1 and disconnect SBB2 and SBB3. Switch ON hull battery master switch. Carry out voltage test.	SBB2C to suitable earth and SBB3C to suitable earth.	24V dc	Go to 7.	Renew or repair smoke button box.

(continued)

TABLE 26 SMOKE GRENADE DISCHARGER CIRCUIT - FAILURE DIAGNOSIS (continued)

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
7	Switch OFF hull battery master switch. Reconnect SBB2 and SBB3and disconnect harnesses at smoke dischargers. Switch ON hull battery master switch Carry out voltage test.	Harness pin A at each discharger to suitable earth.	24V dc	Go to 8.	Renew or repair harness to relevant discharger.
8	Remove cover from off side discharger junction box (located at outside of vehicle under head lamp bracket). Carry out resistance test. Repeat the test on the near side dischargers.	Between the terminal at junction box and the firing pin of each discharger barrel in turn.	22Ω	End of test.	Replace complete smoke discharger.

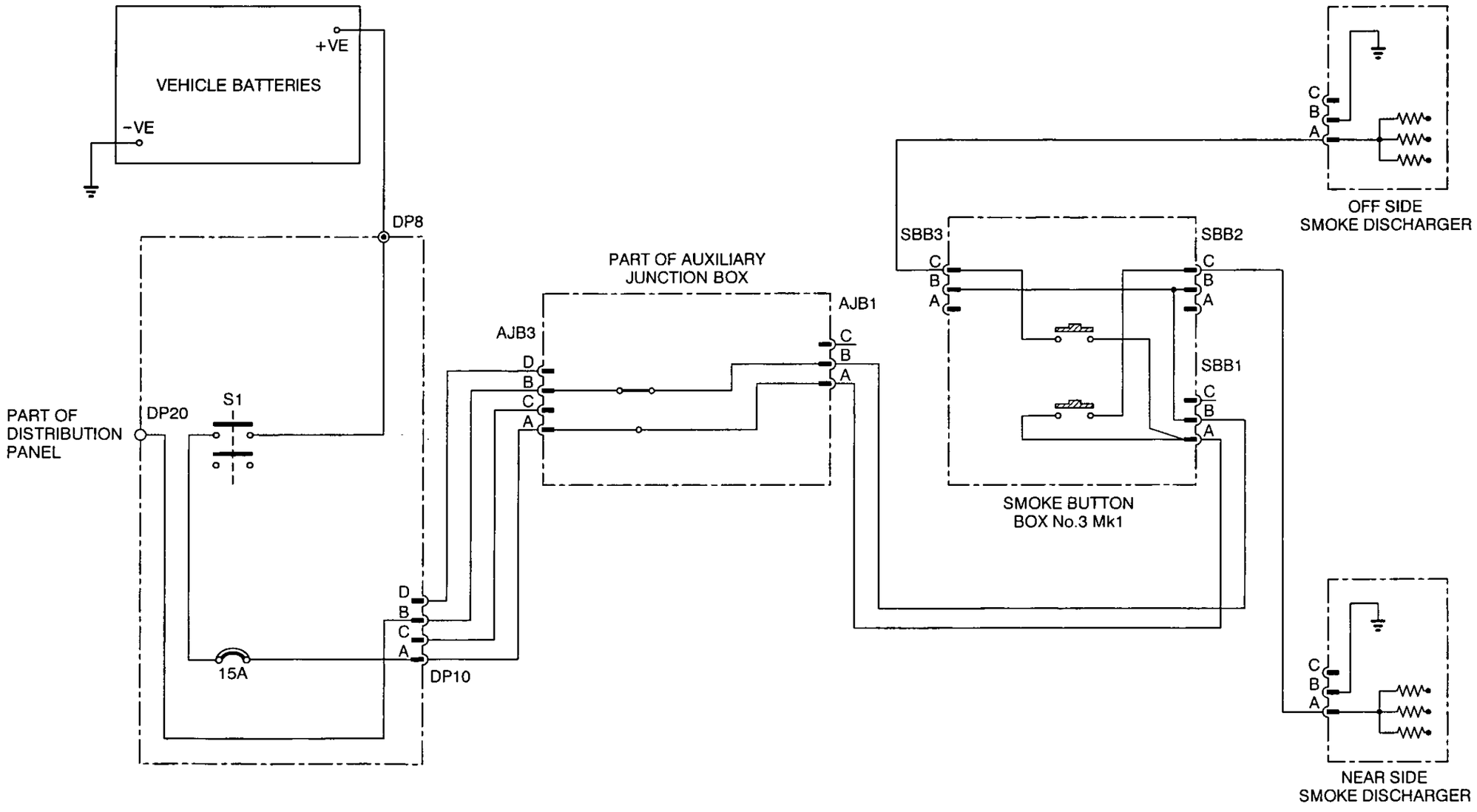

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Fig 23 Smoke grenade discharger circuit

Battery analogue

121 The connector analogue is connected between the two vehicle batteries. Its purpose is to sense temperature and make suitable adjustment to the rate of charge by altering the dc controlled voltage. It consists fundamentally of two thermostats; the tropical thermostat has normally open contacts, which close at a temperature above 49 deg ± 3 deg C (120 deg ± 5 deg F), with 5 deg C (9 deg F) differential. The arctic thermostat has normally closed contacts opening at a temperature above 41° ± 3°C (105 deg ± 5 deg F), with a 5 deg C (9 deg F) differential. Only the tropical thermostat is connected on this vehicle in the normal role. When the contacts close, i.e. at a temperature above 49 deg ± 3 deg C (120 deg ± 5 deg F), the positive dc supply is applied to the input resistance chain in the base circuit of T2 in the control panel thus causing a drop in the regulated voltage from 28.5 to 27.5V dc due to a lower collector current flowing at T2.

Failure diagnosis

122 Table 27 and Fig 24 enables a fault in the battery analogue circuit to be identified.

TABLE 27 BATTERY ANALOGUE CIRCUIT - FAILURE DIAGNOSIS

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
1	Disconnect DLB9. Switch ON battery master and driver's engine switches. Carry out voltage test.	Harness DLB9A to suitable earth.	24V dc	Go to 2.	Go to 3.
2	Carry out voltage test.	Harness DLB9A to DLB9C.	Open circuit if ambient temperature is below 49deg ± 3 deg C (120 deg ± 5F) or closed circuit if ambient temperature is above 49 deg ± 3 deg C (120 deg ± 5 deg F)	Go to 6.	Renew analogue unit.
3	Disconnect plug DP8. Carry out voltage test.	DP8 to earth.	24V dc	Go to 6.	Go to 4.
4	Disconnect harness DP8 from batteries. Carry out continuity test of harness.	Each end of harness DP8.	continuity	Go to 5.	Repair/renew harness.
5	Carry out voltage test.	Test batteries and battery earth.	24V dc	Repair or renew harness analogue unit to DLB9.	Renew batteries.

(continued)

TABLE 27 BATTERY ANALOGUE CIRCUIT - FAILURE DIAGNOSIS (continued)

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
6	Switch OFF battery master and driver's engine switches. Reconnect DLB9. CB's K and L, reset if necessary. Disconnect DP2. Switch ON battery master and driver's engine switches. Carry out voltage test.	DP2F to suitable earth.	24V dc	Go to 9.	Go to 7.
7	Disconnect DP4 at distribution panel. Carry out voltage test.	Panel DP4 A to C.	24V dc	Go to 8.	Renew or repair distribution panel.
8	Reconnect DP4 at distribution panel. Disconnect DP4 at driver's engine switchboard. Carry out voltage test.	Harness DP4 A to C.	24V dc	Renew or repair driver's engine switchboard.	Renew or repair harness DP4.
9	Switch OFF battery master and driver's engine switches. Disconnect DLB12 reconnect DP2 Switch ON battery master and driver's engine switches. Carry out voltage test.	Harness DLB12F to suitable earth.	24V dc	Go to 10.	Renew or repair harness DP2 to DLB12.
10	Switch OFF battery master and driver's engine switches. Disconnect harness DLB1 to DLB2, carry out continuity test.	Each end of harness DLB1 to DLB2.	continuity	Go to 11.	Renew or repair harness DLB1 to DLB2.
11	Disconnect harnesses DLB7, 8, 9 and 12. Carry out continuity test.	DLB12F to DLB2G DLB2H to DLB1H DLB1G to DLB9A DLB2C to DLB7A DLB1C to DLB8A DLB11 to DLB8B DLB11 to DLB7B	continuity	Go to 12.	Renew or repair distribution link box.

(continued)

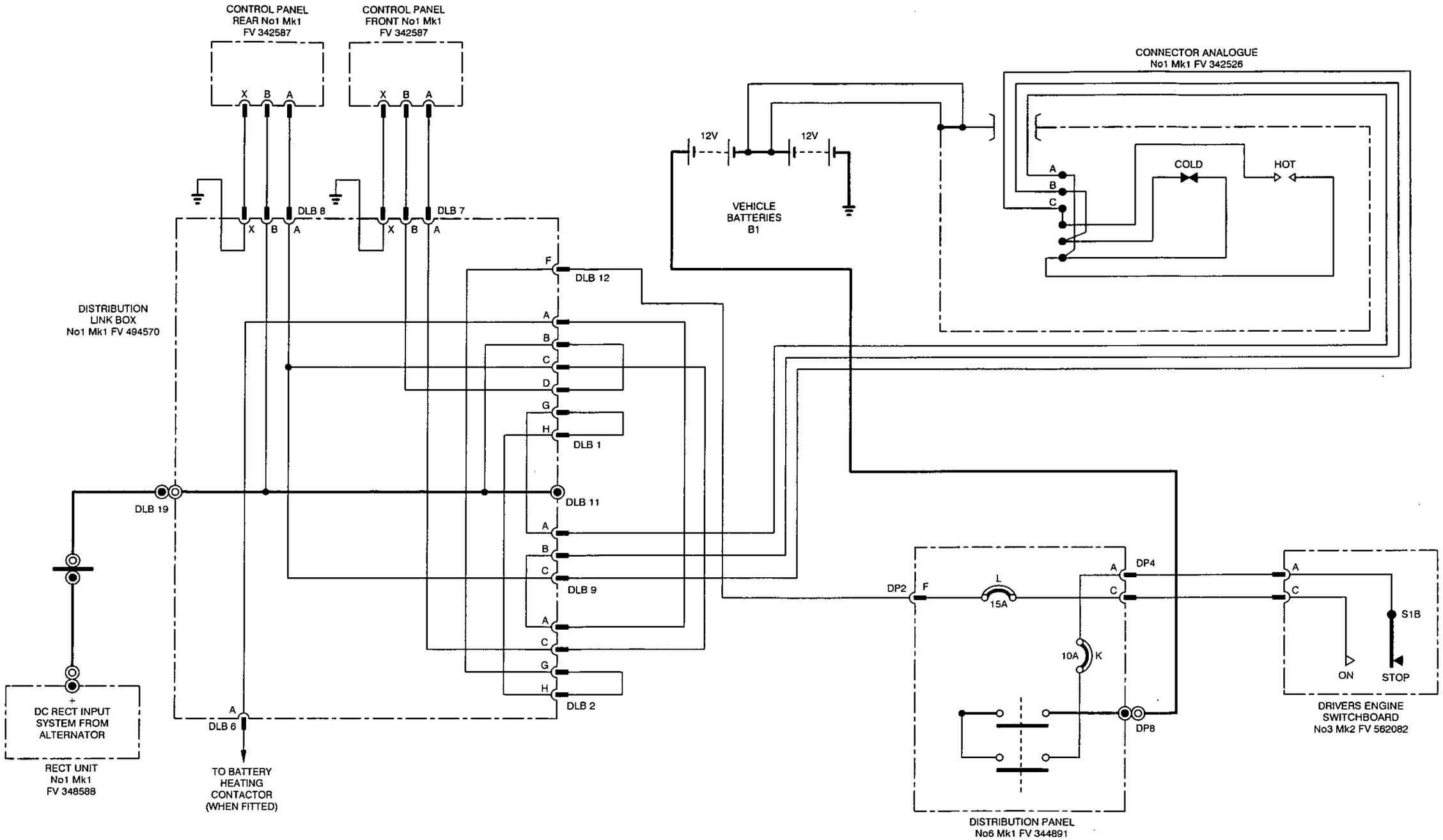

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Fig 24 Battery analogue circuit

TABLE 27 BATTERY ANALOGUE CIRCUIT - FAILURE DIAGNOSIS (continued)

Serial (1)	Action (2)	Test point (3)	Correct result (4)	Action if correct (5)	Action if incorrect (6)
12	Disconnect harness DLB8 at rear control panel. Carry out continuity test.	Each end of all connection in harness.	continuity	Go to 13.	Renew or repair harness DLB8 to rear control panel.
13	Carry out resistance test.	Rear control panel. Multimeter +ve lead on pin X –ve lead on pin A.	1700Ω	Go to 14.	Renew rear control panel.
14	Carry out resistance test.	Rear control panel. Multimeter -ve lead on pin X +ve lead on pin A.	10000Ω	Go to 15.	Renew rear control panel.
15	Disconnect harness DLB7 at front control panel. Carry out continuity test.	Each end of all connection in harness.	continuity	Go to 16.	Renew or repair harness DLB7 to front control panel.
16	Carry out resistance test.	Front control panel. Multimeter +ve lead on pin X –ve lead on pin A.	1700Ω	Go to 17.	Renew front control panel.
17	Carry out resistance test.	Front control panel. Multimeter -ve lead on pin X +ve lead on pin A.	10000Ω	End of test.	Renew front control panel.

LIGHTING AND HORN CIRCUITS

123 Fig 49A and 49B are wiring diagrams of all lighting circuits on the vehicle and the horn circuit. External lighting sockets, spot and inspection lights are included. Using Fig 25A and 25B as a guide, fault finding should be self-evident.

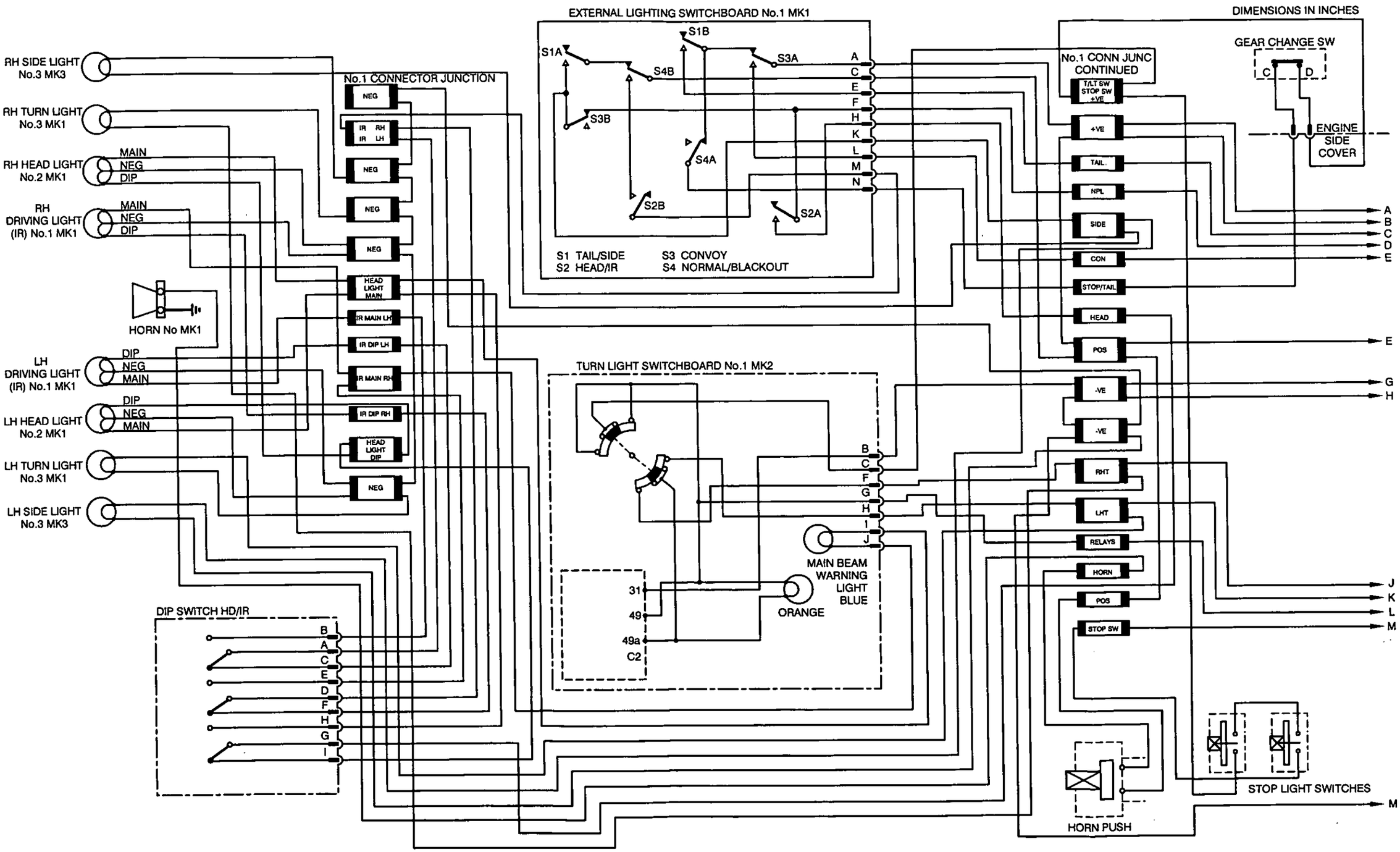

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Fig 25A Lighting and horn circuits

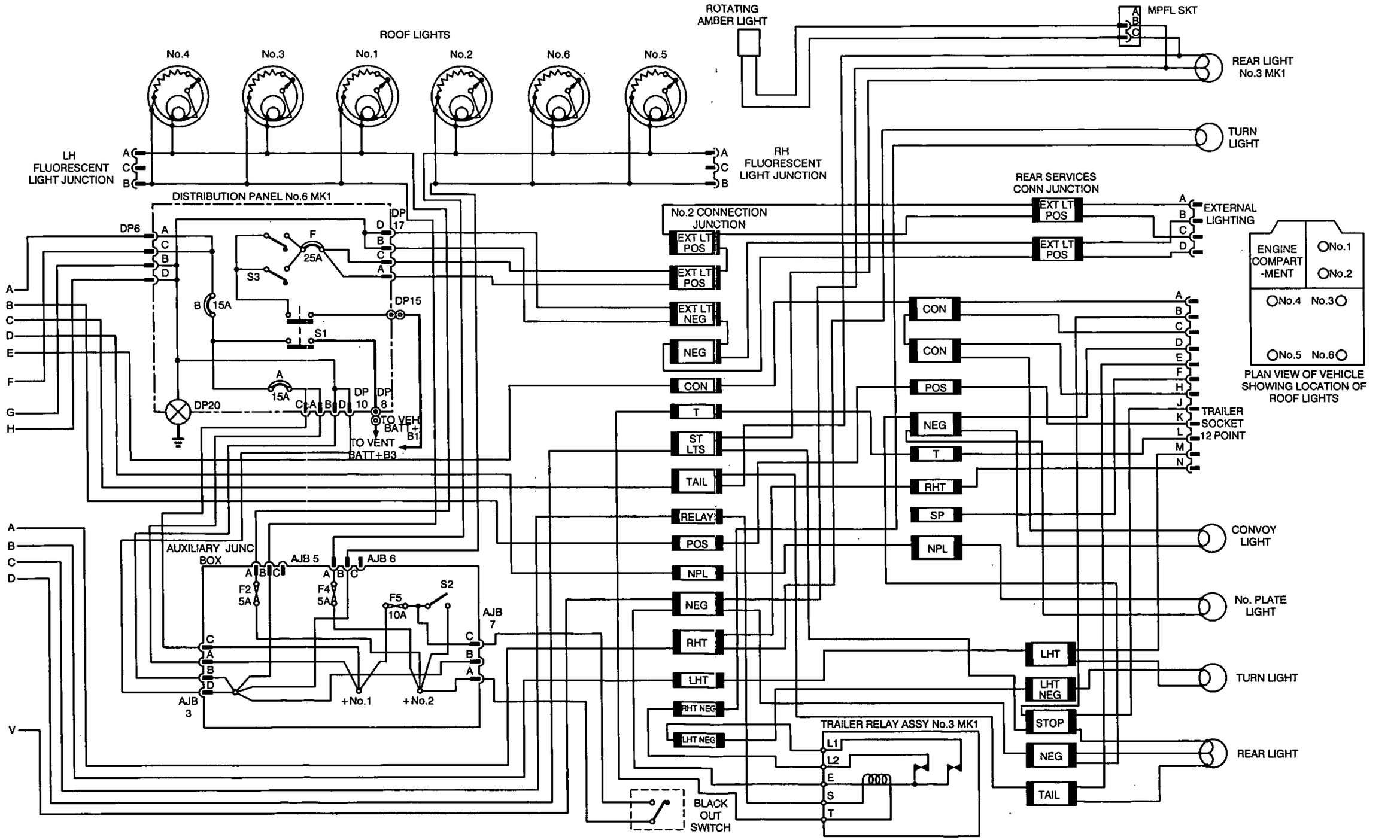

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Fig 25B Lighting and horn circuits

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