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# CARRIER MAINTENANCE FULL TRACKED FV434 MK 1 AND 1/1 (BOWMAN)

## MAINTENANCE INSTRUCTIONS

This publication contains information covering the requirement of Categories 5.1 at information level 2



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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 of itself be 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 this 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 it is 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 (see AESP 0100-A-001-013).

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

| Category/Sub-category | | | Information level | | | |
|---|---|---|---|---|---|---|
| | | | 1 User/ Operator | 2 Unit Maintenance | 3 Field Maintenance | 4 Base Maintenance |
| 1 | 0 | Purpose and Planning Information | 101 | 101 | 101 | 101 |
| | 1 | Equipment Support Policy Directives | * | * | * | * |
| 2 | 0 | Operating Information | 201 | 201 | 201 | 201 |
| | 1 | Aide Memoire | * | * | * | * |
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| 4 | 1 | Installation Instructions | * | * | * | * |
| | 2 | Preparation for Special Environments | * | * | * | * |
| 5 | 1 | Failure Diagnosis | 201 | 522 | 522 | 522 |
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| 7 | 1 | Illustrated Parts Catalogues | 711 | 711 | 711 | 711 |
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| | 3 | Complete Equipment Schedule, Production | * | * | * | * |
| | 4 | Complete Equipment Schedule, Service Edition (Simple Equipment) | 741 | 741 | 741 | 741 |
| | 5 | Complete Equipment Schedule, Service Edition (Complex Equipment) | * | * | * | * |
| 8 | 1 | Modification Instructions | 811 | 811 | 811 | 811 |
| | 2 | General Instructions, Special Technical Instructions and Servicing Instructions | 821 | 821 | 821 | 821 |
| | 3 | Service Engineered Modification Instructions (RAF only) | * | * | * | * |

* Categories/Sub-categories not published

**Associated Publications**

| Reference | Title |
|---|---|
| AESP 2300-A-201 | Introduction to A, B and C vehicle hydraulic systems |
| AESP 2350-T-250 | FV430 Series, Vehicles, All Marks |
| AESP 5800-H-204-741 | C.E.S. Command control comms and info system (CCCI) in FV434 |
| AESP 6140-A-100-013 | Secondary batteries lead acid |
| AESP 6920-D-100-101 | Direct fire weapon effect simulator family (DFWES) |
| AESP 6920-D-102-201 | Target weapon effects simulator (TAGWES) |
| AESP 6920-D-210-211 | TAGWES on fighting vehicle FV432 and fighting vehicle FV434 |
| Army Code 30304 | Complete equipment schedule (FV434) |
| Army Code 44900 | IKEE CLANSMAN Basic harness for FV434 |
| Army Code 45268 | IKEE CLANSMAN Basic harness for FV434 |
| Army Code 45317 | MODIFICATION KIT, Electronic Equipment, Radio Station UK/VRC 353 for FV434 |
| Army Code 71276 | Standing orders for the safety of crews of Armoured Fighting Vehicles |
| EMER Comms Inst H 225 | Installation instructions |
| IETP (TBA) | Bowman radio publications |

**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 Carrier Maintenance Full Tracked FV434 Mk 1 and supplements information given in AESP 2350-T-251-522 Carrier Personnel Full Tracked FV432 MK 2 & 2/1 – Repair Instructions. 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) HEAVY WEIGHT. THE POWER PACK WEIGHS 1816kg (4000lb). DUE CONSIDERATION MUST BE GIVEN TO THE REGULATIONS GOVERNING THE LIFTING OF HEAVY WEIGHTS WHEN MOVING THIS EQUIPMENT.**

**(2) PERSONAL INJURY. BEFORE COMMENCING ANY REPAIR TO VEHICLE, ENSURE THAT BATTERY MASTER SWITCHES ARE IN THE OFF POSITION AND THAT THE VEHICLE IS SECURELY CHOCKED TO PREVENT MOVEMENT.**

**(3) FIRE HAZARD. A DANGER OF FIRE ALWAYS EXISTS WHEN WORKING ON FUEL SYSTEMS WITHIN THE VEHICLE. MASTER SWITCHES MUST BE TURNED OFF, DOORS AND HATCHES MUST BE OPENED TO DISPERSE FUMES, FIRE EXTINGUISHING EQUIPMENT MUST BE TO HAND AND THE WARNING GIVEN IN THE USER HANDBOOK MUST BE OBSERVED.**

**(4) FIRE HAZARD. DUE TO THE EXTREME HEAT FROM THE EXHAUST MANIFOLD AND CONSEQUENT FIRE RISK, IT IS ESSENTIAL, WHEN HYDRAULIC CONNECTIONS ARE BROKEN, TO MOP UP ANY SPILT HYDRAULIC FLUID IMMEDIATELY, PREVENTING ACCUMULATION OF HYDRAULIC FLUID ON OR AROUND THE ENGINE.**

**(5) FIRE HAZARD. NO FUEL STOP IS FITTED TO THIS VEHICLE. ANY LEAKAGE OF FUEL WILL BE FROM PIPES WHEN UNIONS ARE BROKEN.**

**(6) FIRE HAZARD. REMEMBER, WHEN THE POWER PACK IS REMOVED FROM THE HULL THAT THE FIXED FIRE FIGHTING EQUIPMENT IS INOPERABLE SO ALTERNATIVE FIRE FIGHTING EQUIPMENT MUST BE TO HAND.**

**(7) 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.**

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

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

**(6.2) ON THE MATERIAL SAFETY DATA SHEEET.**

**(6.3) IN THE LOCAL SAFETY ORDERS AND REGULATIONS.**

**(7) LETHAL VOLTAGES. DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT. WHEN CARRYING OUT WORK ON ANY BOWMAN RADIO EQUIPMENT DURING FAILURE DIAGNOSTICS, REFER TO EMER MGMT S-262**

**(8) FIRE HAZARD. BOWMAN EQUIPMENT MAY CAUSE FLAMMABLE SUBSTANCES TO IGNITE AT REFUELLING POINT. BOWMAN SYSTEM MUST BE TURNED TO STANDBY DURING REFUELLING**

(9) PERSONNEL INJURY. BOWMAN ANTENNAS MAY TRANSMIT AT ANY TIME. SHOULD A CREW MEMBER GRAB AN ANTENNA WHILST TRANSMITTING THEY MAY SUFFER RF BURNS. UNDER NO CIRCUMSTANCES MUST AN ANTENNA BE TOUCHED WHEN FITTED TO THE VEHICLE UNLESS EQUIPMENT IS TURNED TO STANDBY.

(10) PERSONNEL INJURY. CARE MUST BE TAKEN WHILST MOVING THE VEHICLE WITH THE ANTENNAS FITTED. TOUCHING OF OVERHEAD CABLES MAY INDUCE HIGH VOLTAGES INTO THE VEHICLE CAUSING POSSIBLE ELECTROCUTION OF CREW MEMBERS.

(11) PERSONNEL INJURY. WHEN CARRYING OUT ANY TYPE WORK ON THE FV432 (BOWMAN) VEHICLE ATTENTION MUST BE MADE TO THE VARIOUS SAFETY NOTICES WHICH ARE POSITIONED THROUGHOUT THE VEHICLE.

(12) PERSONAL INJURY. ALL USERS AND MAINTAINERS MUST PAY ATTENTION TO THE BOWMAN SAFETY NOTICES AS ISSUED BY BOWMAN LAND DIGITIZATION (BLD) TO UNITS.

CAUTIONS

(1) ELECTRICAL COMPONENT PROTECTION. Semi-conducting devices and capacitors, having a comparatively low dc 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, megohometer. 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) 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).

(4) EQUIPMENT DAMAGE. A vehicle with a disabled engine should NOT be towed without first removing the gearbox coupling connecting the main gearbox to the steering unit. If this is not done, moving parts of the main gearbox will rotate at high speed with only limited lubrication thus creating a definite risk of overheating and seizure. In an emergency, a vehicle may be towed forward for up to half a mile but in no circumstances must a vehicle be towed in reverse, as the gearbox rear oil pump operation is non-reversible, operating only when the vehicle moves forward.

(5) EQUIPMENT DAMAGE. If the steering unit fails, necessitating towing of the vehicle, the drive between the steering unit and final drives must be disconnected.

(6) EQUIPMENT DAMAGE. If a final drive fails, the tracks must be removed.

(7) EQUIPMENT DAMAGE. When towing, an 'A' frame towing bar must be used and the towing speed restricted to 16 kph (10mph) max.

# CHAPTER 1-0

## POWER PACK ASSEMBLY – LIST OF CHAPTERS

## CONTENTS



## LIST OF CHAPTERS

1 This chapter is further sub-divided as follows:

Chap

1-1 Power pack
1-2 Engine
1-3 Fuel system
1-4 Cooling system
1-5 Transmission

# CHAPTER 1-1

# POWER PACK

## CONTENTS



## GENERAL

### WARNING

**HEAVY WEIGHT. THE POWER PACK WEIGHS 1816kg (4000lb). 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 consist of removing the pack for repair or replacement purposes, or to obtain access to repairable sub-assemblies/components. Para 8, to 12 give an indication of maintenance or repair tasks that can be carried out with the power pack installed. Unless accessibility is obvious, however, it can be assumed that it is easier to remove the power pack for repair purposes rather than waste time and effort in attempting repairs with the power pack installed.

2 The power pack fitted to the Carrier Maintenance, (FV434) is similar to that fitted to the Carrier Personnel Full Tracked FV432 MK 2 & 2/1, excepting that, to supply power for the hydraulically operated crane, an additional power take-off drive to a hydraulic pump is fitted to one the intermediate (idler) gears of the transfer gearbox. Unit repairs to the power pack will therefore be similar to those detailed for in AESP 2350-T-251-522.

### Special tools and equipment

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

**TABLE 1 WORKSHOP SPECIAL TOOLS**

| Serial No (1) | NSN (2) | Designation (3) | FV No (4) |
|---|---|---|---|
| 1 | 9ACR 4910-99-802-3190 | Beam lifting, power pack, universal | 586352 |

**DATA**

4 Overall dimensions:

| | | |
|---|---|---|
| 4.1 | Length: | 1626mm (5 ft 4 in.) |
| 4.2 | Width | 1372mm (4 ft 6 in.) |
| 4.3 | Height | 1397mm (4 ft 7 in.) |

5 Min hook height to lift power pack clear — 3581mm (11 ft 9 in.)

6 Max governed speed — 3750 rev/min. (under full load)

7 Idling speed — 780 to 800 rev/min.

**ACCESSIBILITY**

8 In addition to the tasks listed in AESP 2350-T-251-522, Carrier Personnel Full Tracked FV432 MK 2 & 2/1 that can be carried out with the power pack installed. The following maintenance/repair tasks can be carried out in the Carrier Maintenance Full Tracked FV434 Mk 1.

8.1 Removing crane hydraulic pump and Power Take Off (PTO) drive.

8.2 Repairs to transfer gearbox bearing cover plates.

**REMOVING POWER PACK**

NOTES

(1) Power pack is secured in five positions; access to these positions is detailed in AESP 2350-T-251-522.

(2) Use lifting beam (Table 1, Serial 1) to lift power pack.

9 Carry out operations detailed in AESP 2350-T-251-522.

**Inside crew compartment**

10 Slacken locknut and unscrew knob on crane hydraulic pump operating lever. Remove bolts securing access plate (positioned centrally in bulkhead between power pack/crew, compartments); lift and slide access plate clear of pump operating lever. Unscrew six 5/16 in. UNF bolts securing outer housing (13) to inner housing (14). Withdraw outer housing, complete with operating lever and sliding dog mechanism; use suitable container to collect approx 1/2 pint oil as it drains from housing. DO NOT disconnect hose connections to pump. Secure assembly clear of rear of power pack.

11 Remove access plate below and to left of PTO assembly; remove LH rear bolt securing power pack.

12 Carry out all operations detailed in AESP 2350-T-251-522.

**Lifting out Power Pack**

13 Lift and remove power pack as detailed in AESP 2350-T-251-522.

**Test running**

**WARNINGS**

**(1) FIRE HAZARD. CARE MUST BE TAKEN WHEN WORKING ON THE FUEL SYSTEM WITHIN THE POWER PACK COMPARTMENT. SPILT FUEL COULD COME INTO CONTACT WITH HOT EXHAUST SYSTEM, WHICH MAY CREATE A RISK OF FIRE.**

**(2) PERSONAL INJURY. CARE MUST BE TAKEN WHILST WORKING ON COMPONENTS AND ASSEMBLIES WITHIN THE POWER PACK COMPARTMENT. THERE MAY BE A RISK OF BURNS TO SKIN AND CLOTHING.**

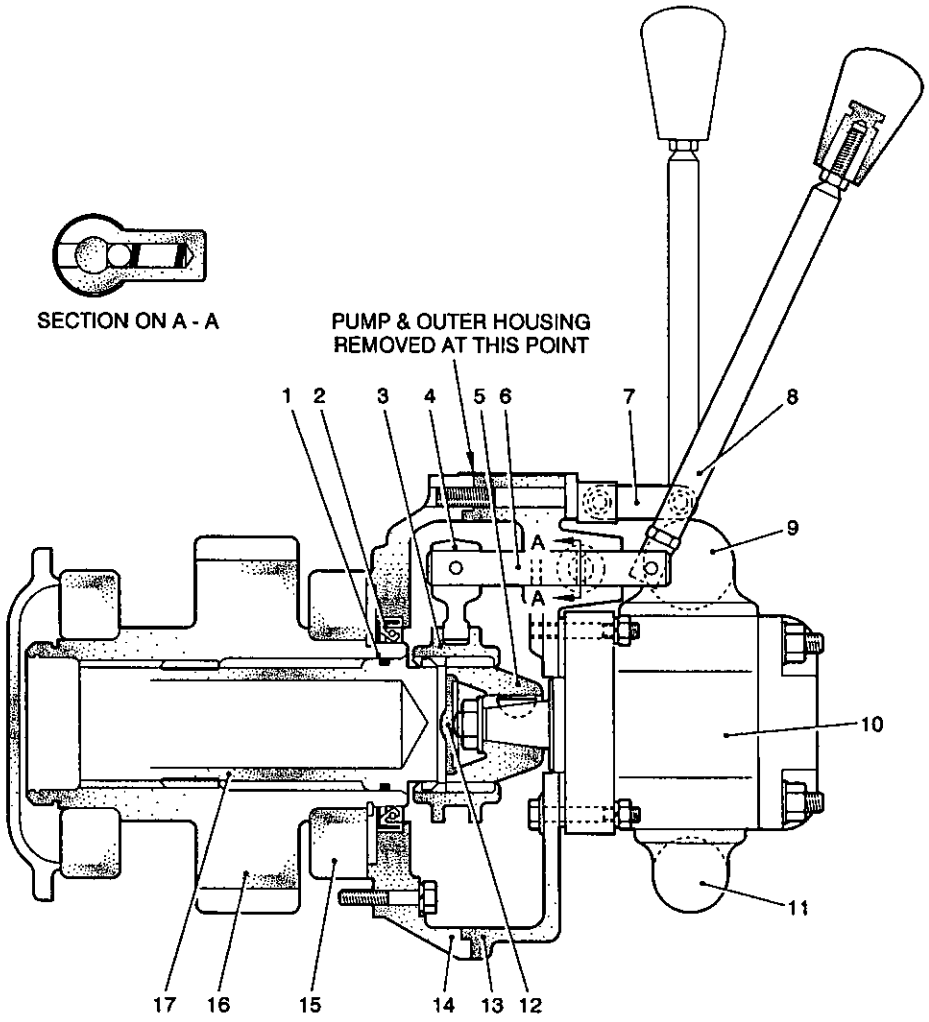
14 After repairs have been carried out or, if fitting a replacement power pack, test run pack outside vehicle as detailed in AESP 2350-T-251-522. Note particularly the WARNINGS to be observed before test running.

15 To retain hydraulic pump drive shaft (Fig 1 (17)) and avoid oil spillage during test running, manufacture and fit a simple retaining plate to inner housing (14). The plate is to incorporate a centrally mounted adjustable screw with a single ball bearing into the end of the screw, bearing against the drive shaft centre.

**Refitting**

16 Refit power pack as detailed in AESP 2350-T-251-522.

17 Ensure flange faces of inner and outer housing of PTO assembly are free from 'burrs' and provide a good metal-to-metal joint. Refit outer housing; remove filler bolt and fill casing until oil reaches level of filler hole 0.3L to 0.5L (0.5 to 0.75 pint). Refit bolt. Refit access plate to bulkhead at rear of power pack. Refit knob on crane hydraulic pump operating lever.

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| | | | |
|---|---|---|---|
| 1 | O ring | 9 | Pump inlet elbow |
| 2 | Oil seal | 10 | Hydraulic pump |
| 3 | Sliding dog | 11 | Pump outlet elbow |
| 4 | Sliding dog fork | 12 | Thrust button |
| 5 | Driven gear | 13 | Outer housing |
| 6 | Operating Shaft | 14 | Inner housing |
| 7 | Operating lever link | 15 | Bearing |
| 8 | Operating Lever | 16 | Intermediate gear |
| | | 17 | Driving shaft |

Fig 1 Drive assembly for crane hydraulic pump

# CHAPTER 1-2

# ENGINE

## CONTENTS



## GENERAL

1 The engine fitted in the Carrier, Maintenance, Full Tracked, (FV434) is identical to that fitted to the Carrier Personnel Full Tracked FV432 MK 2 & 2/1. All unit repairs are as detailed in AESP 2350-T-251-522.

# CHAPTER 1-3

# FUEL SYSTEM

## CONTENTS



## GENERAL

1 Table 1 lists the adhesives, sealants and lubricants required to carry out the operations detailed in this sub chapter.

**TABLE 1 ADHESIVES, SEALANTS AND LUBRICANTS**

| Serial (1) | NSN/FV (2) | Mfr ID (3) | Description (4) |
|---|---|---|---|
| 1 | 8040-99-220-2851 | EC 1099 | Adhesive, 5 litre |

## MAIN FUEL TANK

### 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. NO FUEL STOP IS FITTED TO THIS VEHICLE. ANY LEAKAGE OF FUEL WILL BE FROM PIPES WHEN UNIONS ARE BROKEN.**

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

2 The main fuel tank is located under the load compartment floor. The fuel pressurizing pump is fitted to the fuel tank with the pump end assembly, complete with coarse filter, submerged in the tank; the fully enclosed motor being outside and not in contact with fuel. The fuel injection pump is base mounted to RH side of engine casing being driven from the upper crankshaft by spur gearing to pump coupling. A fine filter is fitted between the pressurizing and injection pumps.

3 Details of the air cleaner assembly, fuel filter, fuel injection pump and injectors are to be found in AESP 2350-T-251-522.

4 Schematic fuel system layout is shown in Fig 1, for reference only.

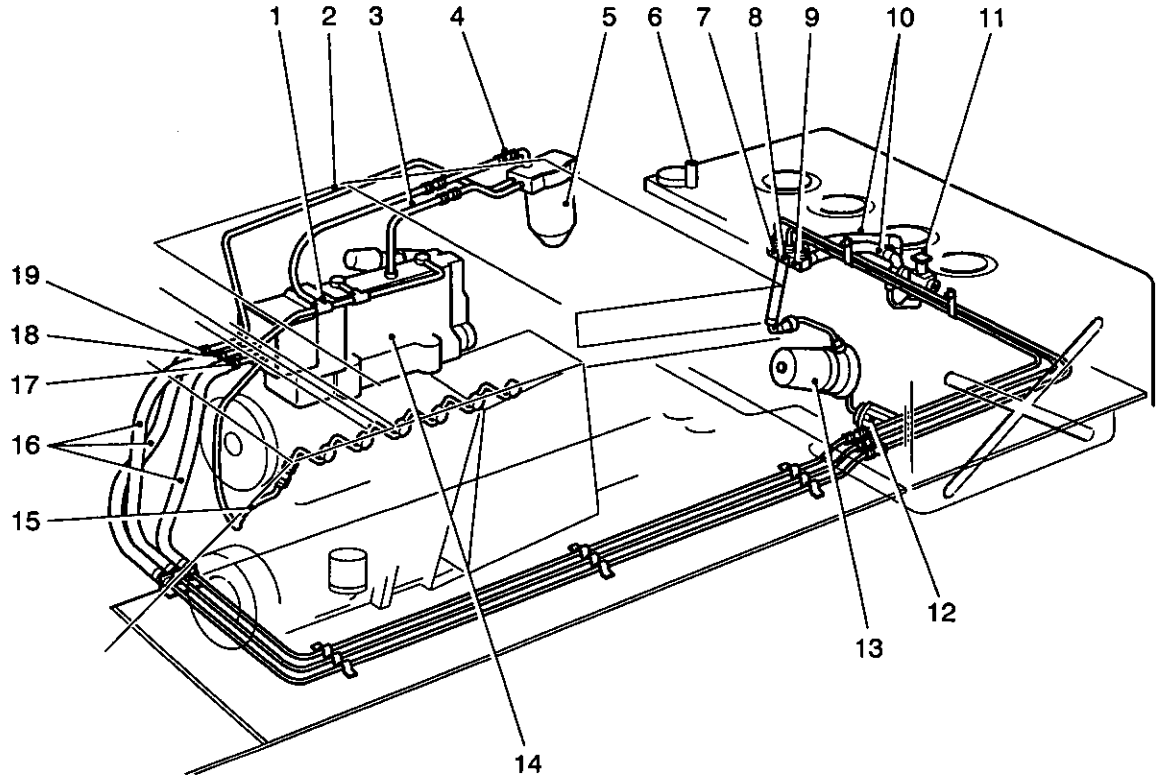


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Fig 1 Fuel system layout

| | | | |
|---|---|---|---|
| 1 | Injection pump leak-off | 11 | Heater connection valve |
| 2 | Fuel feed line | 12 | Fuel tank filter |
| 3 | Injection pump feed | 13 | Fuel pump |
| 4 | Relief valve | 14 | Fuel injection pump |
| 5 | Fuel filter | 15 | Injector leak-off |
| 6 | Tank vent pipe | 16 | Flexible pipes |
| 7 | Fuel feed connection | 17 | Injector leak-off connection |
| 8 | Injection pump leak-off connection | 18 | Injection pump leak-off connection |
| 9 | Injector leak-off connection | 19 | Fuel filter feed connection |
| 10 | Flexible pipes | | |

**Removal**

5 Turn the master switch OFF. Remove access platform hull floor and drain fuel through drain valve located in bottom of fuel tank.

6 Remove fuel filler pipe and vent pipe.

7 Remove ventilation trunking and RH bulkhead lamp cover from load compartment front bulkhead.

8 Remove screws securing load compartment floor plates and lift floor plates clear of vehicle.

9 Remove floor support members.

10 Release and remove fuel tank straps.

11 Remove rubber stop pads from tank recess, rear bulkhead.

12 Remove fuel pipe between tank and heater stop valve.

13 Remove flexible pipes at front bulkhead.

14 Lower crane operators platform and disconnect electrical connection from junction box at lower centre of rear bulkhead.

15 Remove nuts securing access plate and ease access plate away until electrical connection to pressurizing pump can be disconnected. Remove access plate.

16 Disconnect fuel pipe and electrical plug from pressurizing pump.

17 Remove screws securing pump to tank and manipulate pump to clear coarse filter attached to pump inlet, whilst removing pump through aperture in tank.

18 Attach rope slings through fuel tank lifting handles. Lift tank, taking care not to scrape tank on bulkhead and ensure that electrical wires running from fuel gauge unit DO NOT catch on bulkhead.

**Maintenance/inspection**

19 Inspect exterior of tank for damage. Inspect seams and cover plates for signs of leaks. Renew cover plate gaskets if necessary.

NOTE

Welding repairs to the fuel tank are not to be carried out at unit level. Tanks are to be back loaded to the supporting workshop if repairs are found to be necessary.

20 Clean neck filter and fuel vent pipe.

21 Inspect securing clamps and cables for serviceability.

22 Remove fuel gauge as detailed in Para 30 to 34.

23 Carry out electrical test to fuel gauge unit as detailed in Chap 5.

24 Inspect electrical wires and union threads for serviceability.

**Refitting**

25 Refit tank in reverse order to removing.

26 Felt and rubber supports fitted in the hull are to be serviceable. Felts that have become detached must be secured using adhesive, (Table 1, Ser 1). All rubbers found detached must be replaced.

27 Tank recess is to be thoroughly cleaned.

28 Fuel tank unions are to be tightened correctly.

29 Fit fuel tank securing straps. Take care not to over tighten securing nuts.

**FUEL GAUGE UNIT**

**Removal**

30 Gain access to unit; Para 6 to 8 refers.

31 Disconnect electrical connections in top of unit noting position of each wire.

32 Remove screws securing fuel gauge unit flange to tank.

33 Ease unit clear of tank and manipulate unit to guide float arm with float through tank aperture.

34 If necessary remove terminal block from unit by removing screws securing block and carefully easing terminal block, complete with rheostat, away from unit.

NOTES

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

(2) The terminal block is located to the flange of the unit by a dowel.

**Refitting**

**CAUTION**

**EQUIPMENT DAMAGE. Inspect float arm and float before refitting. The float is finished with a cellulose coat, which if damaged or broken will result in the cork being soaked with fuel, rendering the assembly unserviceable.**

35 Refit in reverse order to removing.

36 Locate flange of unit to tank with master bolt.

37 Check condition of flange gasket, renew if necessary.

38 Tighten all flange bolts evenly.

**FUEL PRESSURIZING PUMP No 2, Mk 1**

**Removal**

39 Drain fuel tank.

40 Remove pump as detailed in Para 16 to 17.

41 Carry out electrical tests as detailed in Chap 5.

**Refitting**

42 Refit in reverse order to removing.

43 Ensure filter is clean and check serviceability of gaskets.

44 Tighten flange bolts evenly and pipe connections correctly.

# CHAPTER 1-4

# COOLING SYSTEM

## CONTENTS



## GENERAL

1 The cooling system for the Carrier, Maintenance, Full Tracked, (FV434) is identical to that fitted to the Carrier Personnel Full Tracked FV432 MK 2 & 2/1. Unit repairs are detailed in AESP 2350-T-251-522.

# CHAPTER 1-5

# TRANSMISSION

## CONTENTS



## GENERAL

1 The transmission assemblies fitted to the Carrier, Maintenance, Full Tracked, (FV 434) are similar to those fitted to the Carrier Personnel Full Tracked FV432 MK 2 & 2/1. Exceptions are a power take off drive assembly, which is fitted to the transfer gearbox, and the final drive gear ratios, which are different. Unit repairs to the power take off drive assembly are detailed in this chapter. All other transmission assembly unit repairs are detailed in AESP 2350-T-251-522.

### Adhesives, sealants and lubricants

2 Table 1 lists the adhesives, sealants and lubricants required to carry out the procedures detailed in this sub chapter.

**TABLE 1 ADHESIVES, SEALANTS AND LUBRICANTS**

| Serial (1) | NSN / Part No (2) | Mfr / ID (3) | Description (4) |
|---|---|---|---|
| 1 | 8030-99-220-2370 | Hylomar | Sealing compound |

## POWER TAKE-OFF DRIVE ASSEMBLY

3 The power take-off assembly is a totally enclosed unit consisting of an inner and outer clutch housing bolted together on a centre flange.

4 The inner housing contains an oil seal to fit over the transfer gearbox intermediate gear shaft and the housing is bolted to the transfer gearbox.

5 The outer housing supports a hydraulic pump, and a dog clutch is included in the drive from the transfer gearbox. An oil level/filler plug is incorporated in the outer face.

6 Removing and refitting procedures for the outer housing are detailed in Chap 6.

**Inner housing**

Removal

7 Remove the outer housing as detailed in Chap 6.

8 Remove bolts securing inner housing to transfer gearbox.

9 Remove housing with care ensuring that the oil seal is not damaged.

Maintenance/inspection

10 Clean housing ensuring that all traces of sealing compound are removed from mating surfaces.

11 Inspect oil seal for lip wear. If wear is apparent, the seal must be renewed. Ensure that the lip faces fit into housing when refitting seal.

Refitting

12 Apply jointing compound, (Table 1, Ser 1), to mating faces.

13 Refit housing in reverse order to removing.

**Splined drive shaft**

Removal

14 Pull drive shaft from intermediate gearbox.

NOTE

Excessive pressure should not be necessary as the shaft is only held by the interference of the O-ring.

Maintenance/inspection

15 Clean the shaft, inspect the O-ring, and renew if necessary.

16 Inspect drive splines at both ends of the shaft and remove any burrs. If the shaft splines show any signs of side wear then the shaft must be replaced.

Refitting

17 Push the shaft into the intermediate gear. Resistance should be felt as the O-ring enters the intermediate gear.

**Outer housing**

Maintenance/inspection

18 Inspect all components of the dog clutch for wear; check that there is no excessive wear on the thrust button and that the positioning ball and spring move freely in the housing.

19 Renew any component found to be excessively worn.

## CHAPTER 2-0

## FINAL DRIVE, SUSPENSION AND TRACKS – LIST OF CHAPTERS

### CONTENTS



### LIST OF CHAPTERS

1 This chapter is further sub divided as follows:

Chap

2-1 Final drives
2-2 Suspension and tracks

# CHAPTER 2-1

# FINAL DRIVE

## CONTENTS



## GENERAL

1 The final drive for the Carrier, Maintenance, Full Tracked, (FV434) is similar to that fitted to the Carrier Personnel Full Tracked FV432 MK 2 & 2/1, but with a different final drive gear ratio. Repairs are detailed in AESP 2350-T-251-522.

# CHAPTER 2-2

# SUSPENSION AND TRACKS

## CONTENTS

Para



Table Page



## GENERAL

1 The suspension system of Carrier, Maintenance, Full Tracked, FV434 is similar to that to the Carrier Personnel Full Tracked FV432 MK 2 & 2/1. Unit repairs detailed in AESP 2350-T-251 522, with the exceptions listed in Para 2, 3, 4 and 5.

### Workshop special tools

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

**TABLE 1 WORKSHOP SPECIAL TOOLS**

| Serial (1) | FV No (2) | NSN/Part No (3) | Designation (4) |
|---|---|---|---|
| 1 | 586352 | 5120-99-867-0378 | Gauge, axle arm setting |

## SHOCK ABSORBERS

3 The function of the Carrier, Maintenance (FV434), includes the use of a hydraulically operated crane with consequent increased loading of the suspension system. To counteract this, front and rear wheel stations are fitted with hydraulic shock absorbers with a built in lockout system for use when lifting with the crane. Unit repairs to the absorber/lock-out assemblies are confined to assembly change and bleeding as detailed in Chapter 6.

## TORSION BARS

4 Although the torsion bars fitted to Carrier, Maintenance, (FV434) are identical to those fitted to FV432 series vehicles, the suspension loading of Carrier, Maintenance, (FV434) requires a different initial setting of the torsion bars.

5 Use workshop special tool, (Table 1, Ser 1), for setting in accordance with procedure detailed in AESP 2350-T-251-522.

# CHAPTER 3

# HULL, FITTINGS AND CONTROLS

## CONTENTS



## HULL

### General

1 The hull details of the Carrier, Maintenance, Full Tracked, FV434 are similar to those of the Carrier Personnel Full Tracked FV432 MK 2 & 2/1, with the following exceptions:

1.1 The Carrier, Maintenance, Full Tracked FV434 has an open load compartment instead of a personnel compartment and mortar hatch.

1.2 The fixed fire extinguisher cylinders for fire fighting equipment are positioned on the crew/power pack compartments bulkhead. To aid access to the cylinders remove the HF Mounted (role) radio high power (HMOP) in accordance with the IETP (TBA) Bowman radio publications.

1.3 A hydraulic crane is mounted on the roof of the crew compartment. Unit repairs are detailed in Chap 6.

1.4 The NBC filter box is located inside LH hull wall of the crew compartment.

1.5 An escape hatch has been cut into the floor for crew evacuation

### Unit repairs

2 Unit repairs are detailed in AESP 2350-T-251-522.

## CONTROLS

### General

3 The controls fitted to the Carrier, Maintenance, Full Tracked FV434, less those fitted for operating the crane and shock absorber lock out struts, are similar to those fitted to FV432 series vehicles, except that an additional hand throttle is fitted for remote control of the engine when the crane is being operated.

4 This hand throttle control consists of a quadrant mounted lever linked to the accelerator cross shaft. The connecting rods are fitted with adjustable fork ends. Access to all items is readily obtainable but removal of drivers seat is necessary to gain access to the fork end on the accelerator cross shaft.

### Unit repairs

5 Unit repairs for controls fitted to crane and shock absorber lock out struts are detailed in Chap 6. Unit repairs and adjustments to all other controls are detailed in AESP 2350-T-251-522.

# 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/Part No (2) | Mfr ID (3) | Designation (4) |
|---|---|---|---|
| 1 | HI/8040-99-220-2852 | Araldite | Adhesive |

### 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/Part No (2) | Mfr ID (3) | Designation (4) |
|---|---|---|---|
| 1 | Z4/6625-99-102-5387 | N/A | 500V Megohometer |
| 2 | Z4/6625-99-252-3606 | N/A | Multimeter |

**Pressure test**

4 Ensure that a filter is fitted to the filter unit.

5 Close all doors and hatches.

6 Close fan switch at Distribution panel, No 6, Mk 1.

7 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.

8 If pressure fails to reach the required 3 in. SWG, it will be due to:

8.1 Clogged filters.

8.2 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.

**PRESSURE RELIEF VALVE, No. 1, Mk 1**

9 Refer to AESP 2350-T-251-522.

**FAN PRESSURIZING, No. 4, Mk 1**

**Removing**

10 External operations:

10.1 Open fan pressurizing switch at Distribution panel, No 6, Mk 1.

10.2 Open filter compartment door in vehicle hull (refer to Fig 1).

10.3 Release and remove filter assembly (refer to Fig 2).

10.4 Remove eight screws (refer to Fig 3 (1)) securing inner rubber duct outer retaining ring.

10.5 Remove eight nuts securing the four filter housing vibro mounting brackets. These are the nuts, which secure the vibro mounting brackets to the hull.

10.6 Remove eight nuts (refer to Fig 3 (6)) securing outer rubber duct and push screws inward to facilitate operation detailed in Sub-Para 10.7.

10.7 Withdraw filter housing complete with vibro mounting brackets.

10.8 Remove three screws securing fan unit in filter compartment.

10.9 Remove the 10 screws to release retaining ring and outer rubber duct.

10.10 Remove rear retaining ring complete with screws. Thin ring in at the back of the outer duct and the screws are those from which the nuts were removed in sub-Para 10.5.

10.11 Remove retaining ring complete with outer duct, (outer duct is stuck to vehicle hull). This will expose inner duct rear retaining ring.

10.12 Remove plastic covered round metal ring from interior of inner duct.

10.13 Remove eight screws from rear retaining ring of inner duct.

10.14 Remove inner duct complete with retaking ring.

11 Internal operations.

11.1 Disconnect cables and earth braid from the HF Power Amplifier (HFPA) (Fig 4 (5)) and remove the HFPA in accordance with the IETP (TBA) Bowman radio publication.

11.2 Remove the nuts and washers securing the HFPA mounting plate (4) to the hull and remove the mounting plate.

11.1 Remove the headrest (9).

11.2 Remove the plug (1) to disconnect fan.

11.3 Remove the vacuum suction/pressure gauge tube (7) from fan unit casing at mounting plate.

11.4 Remove the five bolts (8) securing fan to mounting.

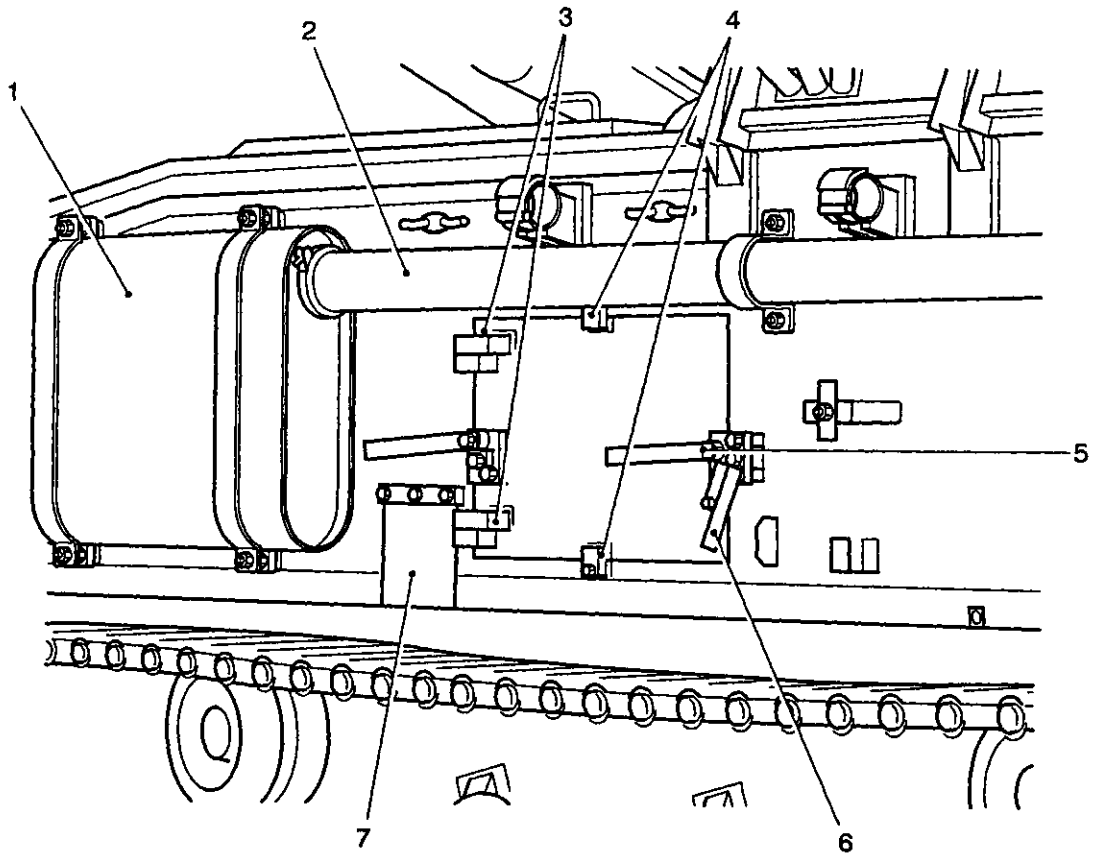
11.5 Disconnect air duct (2) at first bend at rear of fan unit (and bolt at rear of duct).

11.6 Turn fan unit round so that air duct faces towards off side of vehicle, tilt fan unit backwards and remove.

**Refitting**

12 Check rubber seal on access door and rubber ducts for serviceability. Replace if damaged, using Adhesive, (Table 1, Ser 1).

13 Refitting is the reverse order to removing. Carry out a pressure test; refer to Para 4 to 8

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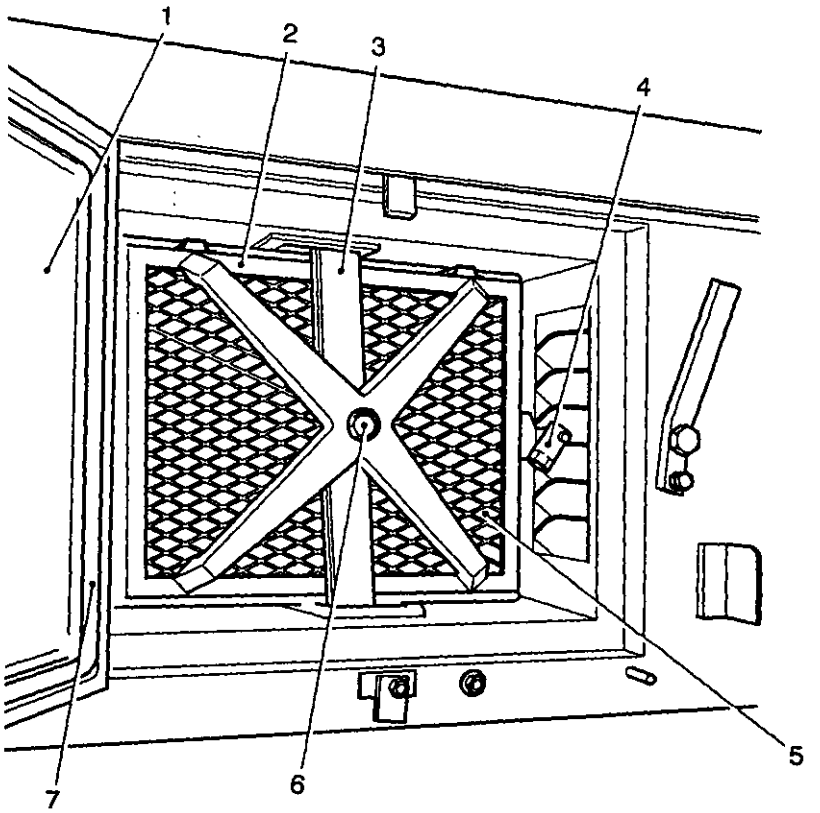
| | | | |
|---|---|---|---|
| 1 | Silencer | 5 | Door handle |
| 2 | Exhaust pipe | 6 | Catch handle |
| 3 | Hinge | 7 | Fixed fire extinguisher control |
| 4 | Sealing clamp bolts | | |

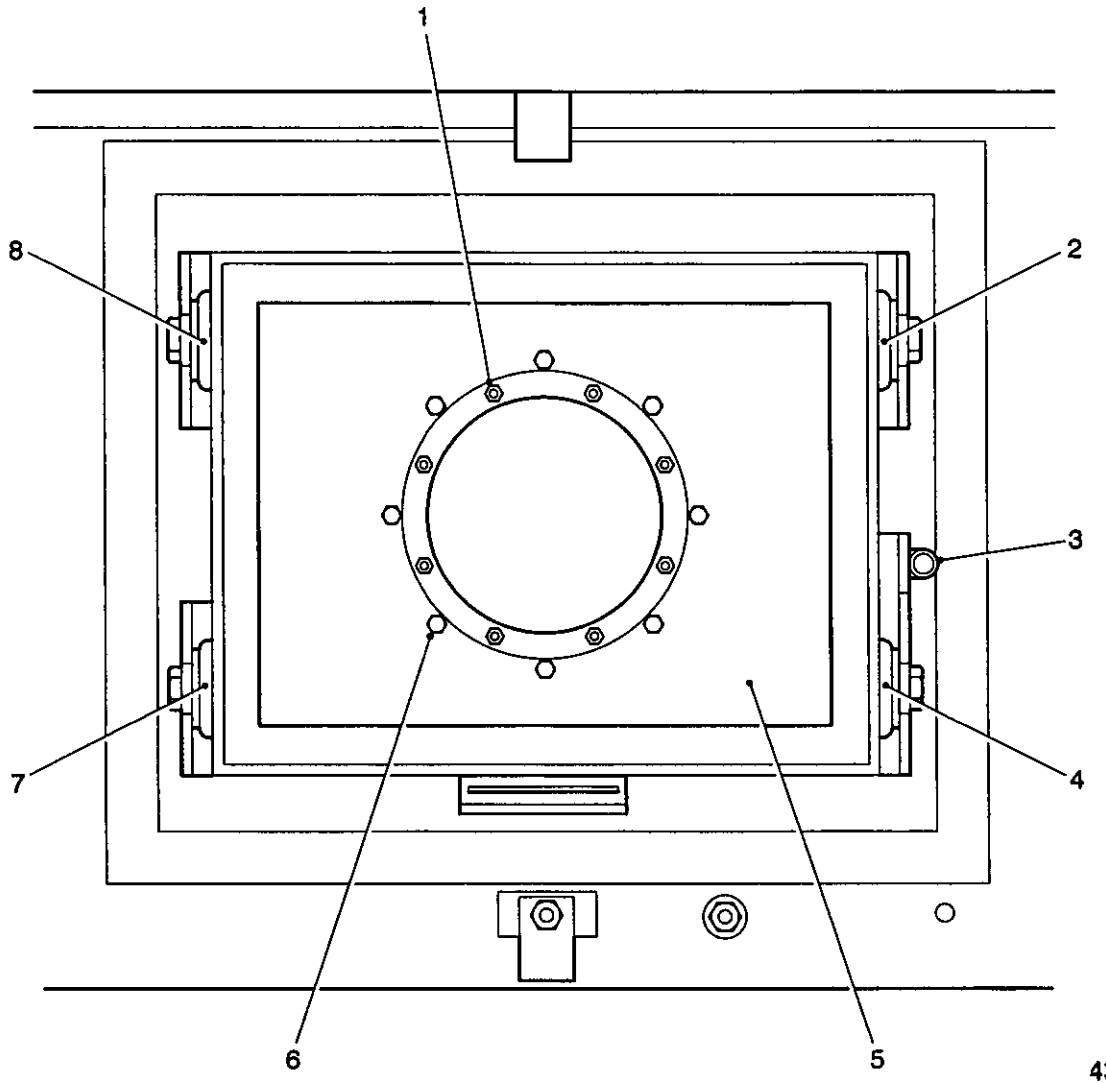
Fig 1 External view of filter access door




434/070

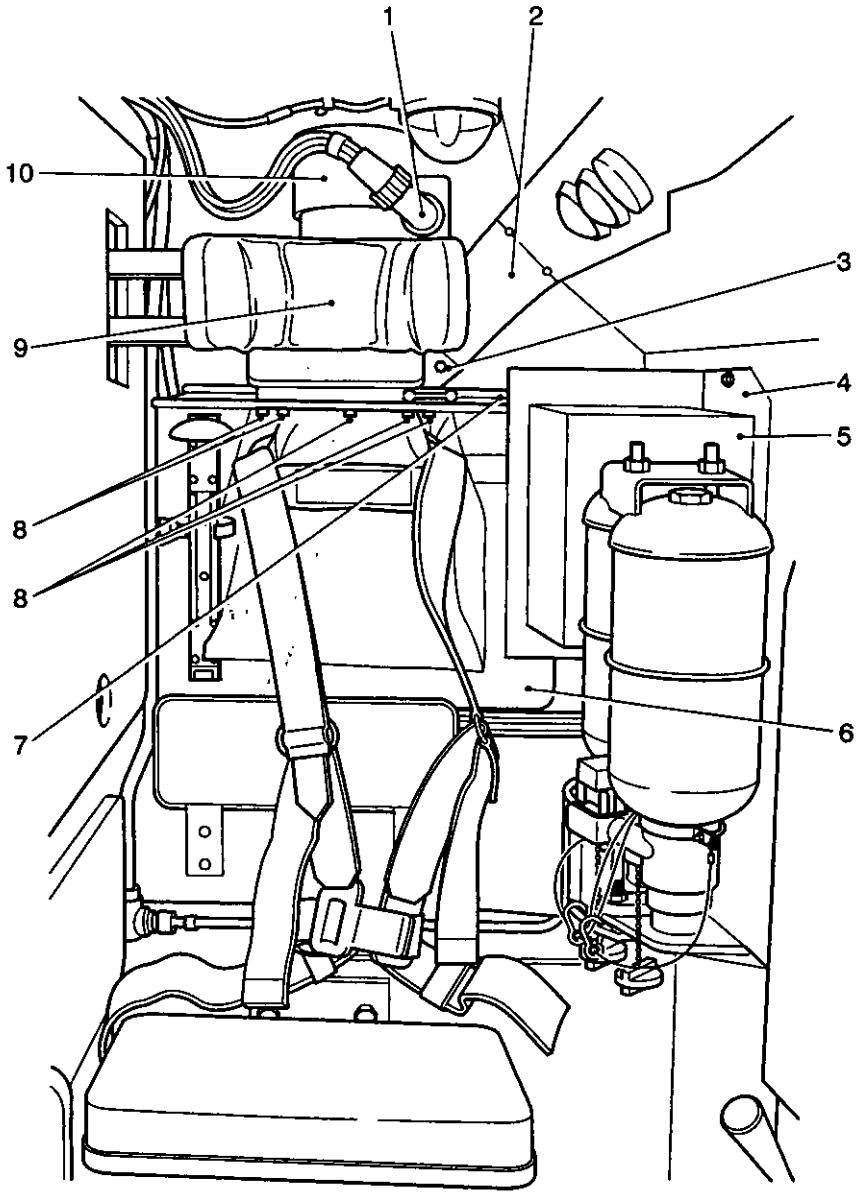
| | | | |
|---|---|---|---|
| 1 | Access door | 5 | Particulate filter |
| 2 | Filter holder | 6 | Clamping bolt |
| 3 | Clamp bar | 7 | Door seal |
| 4 | Spanner | | |

Fig 2 Filter and filter holder




| | | | |
|---|---|---|---|
| 1 | Screws, securing inner rubber duct outer retaining ring | 5 | Filter housing |
| 2 | Vibro mounting and bracket | 6 | Nuts, securing outer rubber duct |
| 3 | Spanner stowage | 7 | Vibro mounting and bracket |
| 4 | Vibro mounting and bracket | 8 | Vibro mounting and bracket |

Fig 3 Filter housing with filter removed




430/50015

| | | | |
|---|---|---|---|
| 1 | Input plug to fan motor | 6 | Filter housing |
| 2 | Air duct | 7 | Tube to suction/pressure gauge |
| 3 | Air duct securing bolt | 8 | Bolts, securing fan to housing |
| 4 | HFPA mounting bracket | 9 | Headrest |
| 5 | HFPA | 10 | Fan motor |

Fig 4 Fan pressurising unit

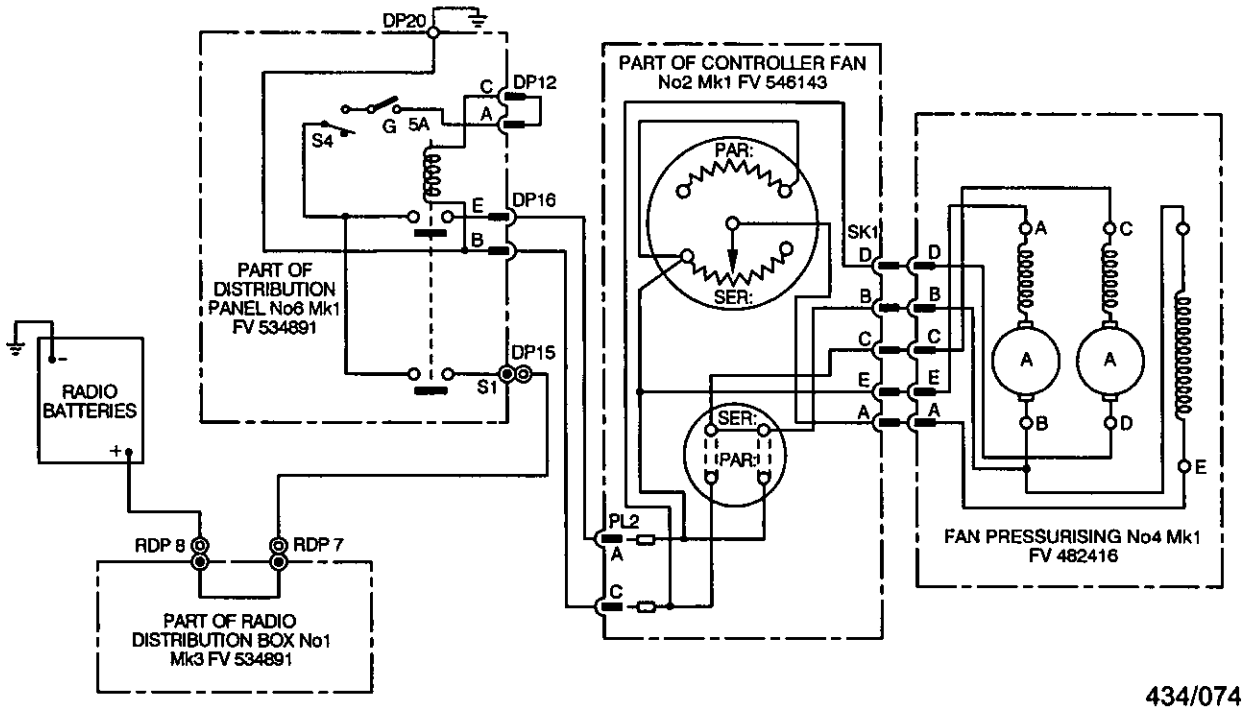



Fig 5 Ventilation system wiring diagram

## ELECTRICAL TESTING

14 Check circuit breaker G at Distribution panel, No. 6, Mk 1. If tripped, reset.

### Failure diagnosis

15 Table 3 enables a fault in the pressurising fan to be traced, with reference to Fig 2.

**TABLE 3 PRESSURISING FAN – FAILURE DIAGNOSIS**

| Serial (1) | Action (2) | Test point (3) | Correct result (4) | Action if correct (5) | Action if incorrect (6) |
|---|---|---|---|---|---|
| 1 | Switch battery master to ON, carry out voltage check at fan controller. | SK1D to SK1E | 24V | Replace fan unit | Go to2 |
| 2 | At socket PL2, carry out voltage check. | PL2A to PL2C | 24V | Go to 4 | Go to 3 |
| 3 | Test distribution panel. Refer to AESP 2350-T-250-522, Chap 5. | N/A | N/A | Go to 4 | Replace or repair distribution panel. (continued) |

**TABLE 3 PRESSURISING FAN – FAILURE DIAGNOSIS (continued)**

| Serial (1) | Action (2) | Test point (3) | Correct result (4) | Action if correct (5) | Action if incorrect (6) |
|---|---|---|---|---|---|
| 4 | At controller, check for continuity at following switch positions: | | Continuity | Go to 5 | Replace controller |
| | OFF | PL2A to SK1E | | | |
| | OFF | PL2C to SK1D | | | |
| | MIN | PL2A to SK1E | | | |
| | MIN | PL2A to SK1A | | | |
| | MIN | PL2C to SK1D | | | |
| | MIN | PL2A to SK1B | | | |
| | MIN | PL2A to SK1C | | | |
| | MAX | PL2C to SK1B | | | |
| | MAX | PL2C to SK1D | | | |
| | MAX | PL2A to SK1A | | | |
| | MAX | PL2A to SK1C | | | |
| | MAX | PL2A to SK1E | | | |
| 5 | Using multimeter, (Table 2, Ser 2), carry out resistance checks at following lever positions: | | Resistance (Ω) (typical) | Go to 6 | Replace controller |
| | Low Range Min | PL2A to SK1A | 0 | | |
| | Low Range 1 | PL2A to SK1A | 2 | | |
| | Low Range 2 | PL2A to SK1A | 5 | | |
| | Low Range 3 | PL2A to SK1A | 8.5 | | |
| | Low Range 4 | PL2A to SK1A | 14 | | |
| | Low Range 5 | PL2A to SK1A | 30 | | |
| 6 | Using multimeter, (Table 2, Ser 2), carry out resistance checks at following lever positions: | | Resistance (Ω) (typical) | End of test | Replace controller |
| | High range 5 | PL2A to SK1A | 0 | | |
| | High range 6 | PL2A to SK1A | 2 | | |
| | High range 7 | PL2A to SK1A | 3.6 | | |
| | High range 8 | PL2A to SK1A | 5.2 | | |
| | High range 9 | PL2A to SK1A | 6.8 | | |
| | High range Max | PL2A to SK1A | 8.7 | | |

NOTE

If the tests in Table 27 are satisfactory, but the fan motor still fails to operate, the fan unit is faulty. Unless the fault can be remedied by servicing the brush gear, the fan unit should be replaced.

16 On vehicles from No 17 onwards the Motor, driving, No. 9, Mk 1, FV546142 incorporated in fan unit, No. 4, Mk 1, FV422416 will be fitted with a diode across the shunt field coils to prevent damage to the motor relay by back e.m.f. from the motor field when the motor is switched off (refer to Fig 3). This will be denoted by the erasure of Mod 1 on the motor modification record plate.

17 When the vehicle is to be used in a cold theatre, provision is made for a multi-fuel heater to be fitted. Unit repair techniques for the multi-fuel heater will be issued when full information is available.

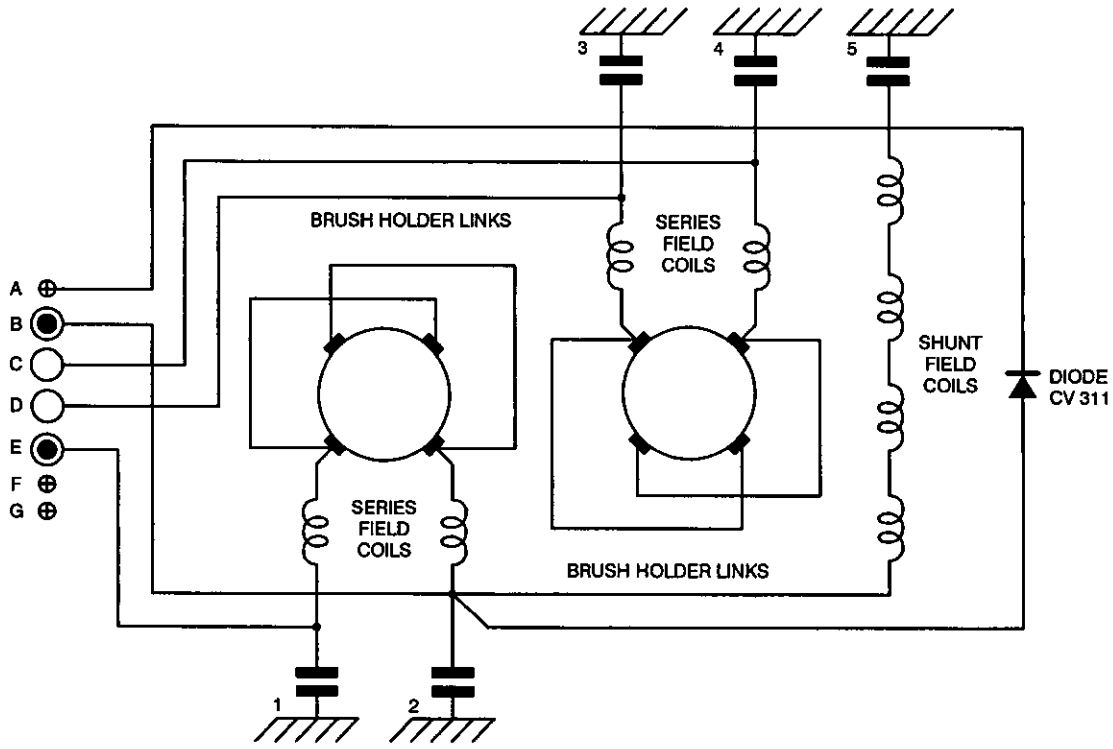



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Fig 6 Motor, driving, No 9, Mk 1 circuit diagram

## CHAPTER 5

## ELECTRICAL SYSTEM

## CONTENTS



(continued)

**CONTENTS (continued)**



(continued)

## CONTENTS (continued)

Table



Fig

## GENERAL

1 This chapter details the Level 2 repairs to the electrical system.

### Adhesives, sealants and lubricants

2 Table 1 lists the adhesives, sealants and lubricants required to carry out the procedures described within this chapter.

**TABLE 1 ADHESIVES, SEALANTS AND LUBRICANTS**

| Serial (1) | NSN/FV No. (2) | Mfr ID (3) | Designation (4) |
|---|---|---|---|
| 1 | HI/8040-99-220-2852 | Araldite | Adhesive |

### Special tools and test equipment

3 Table 2 lists the special tools and equipment required to carry out the procedures described within this chapter.

**TABLE 2 SPECIAL TOOLS AND EQUIPMENT**

| Serial (1) | NSN/FV No. (2) | Mfr ID (3) | Designation (4) |
|---|---|---|---|
| 1 | Z4/6625-99-102-5387 | N/A | 500V Megohmmeter |
| 2 | Z4/6625-99-252-3606 | N/A | Multimeter set, general purpose, hand held |

### Maintenance

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 megohmeter 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 (Table 2, Ser 1), (subject to the conditions detailed in Para 4).

6 The 'cold' resistance of all rotating machines must be tested with a 500V megohmmeter (Table 2, Ser 1) 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 Pwr J 305.

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, (Table 2, Ser 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.

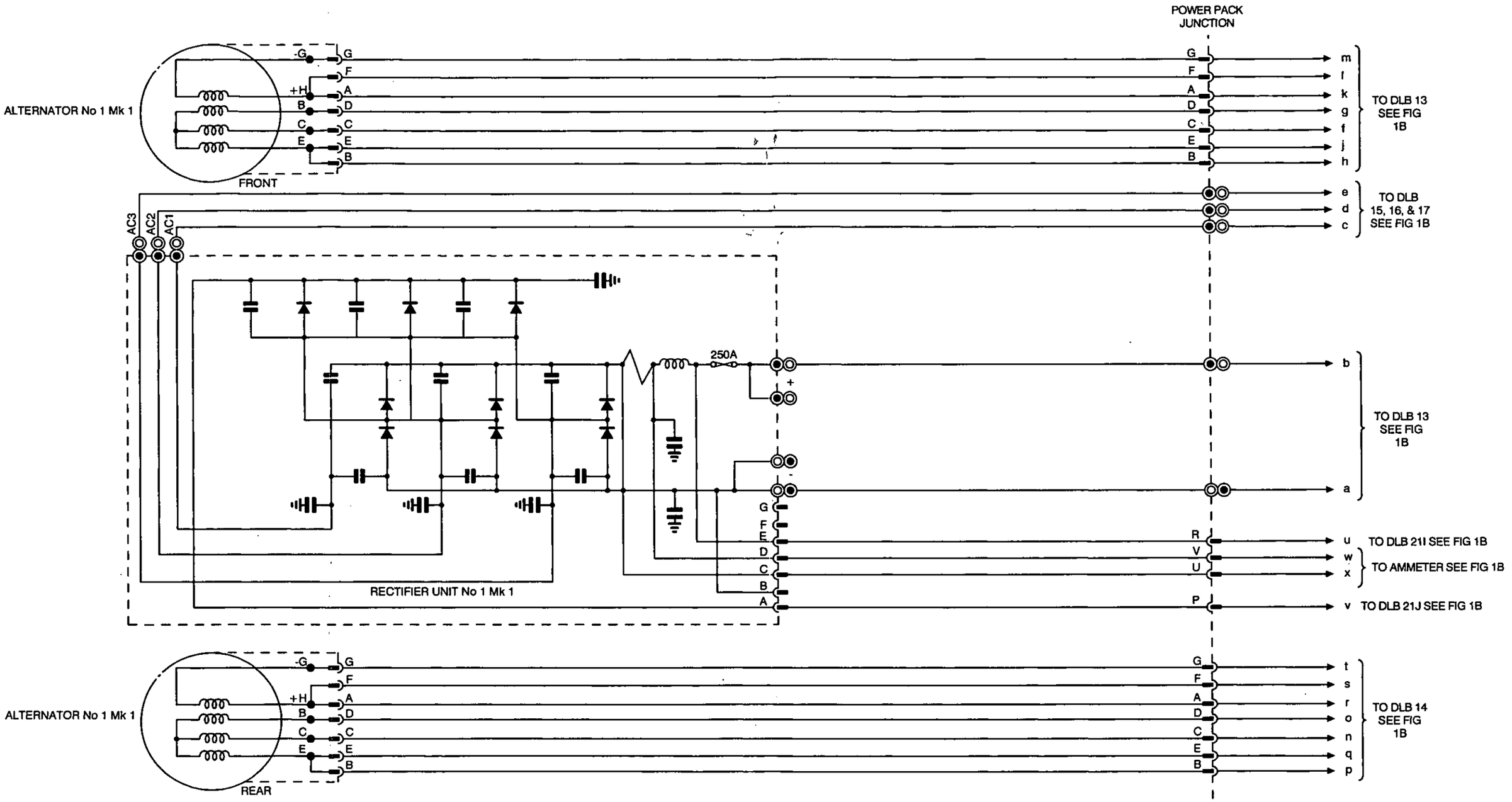
12.2 The engine is not running, unless otherwise stated.

12.3 No Circuit Breaker (CB) is tripped and all fuses are serviceable. The location of all CBs and fuses is detailed in 2350-T-252-201.

12.4 Diagnostic equipment is serviceable and correctly calibrated.

**SMOKE DISCHARGER SYSTEM**

13 Refer to AESP 2350-T-251-522.




434/047

Fig 1A Generating system, circuit diagram (part view)

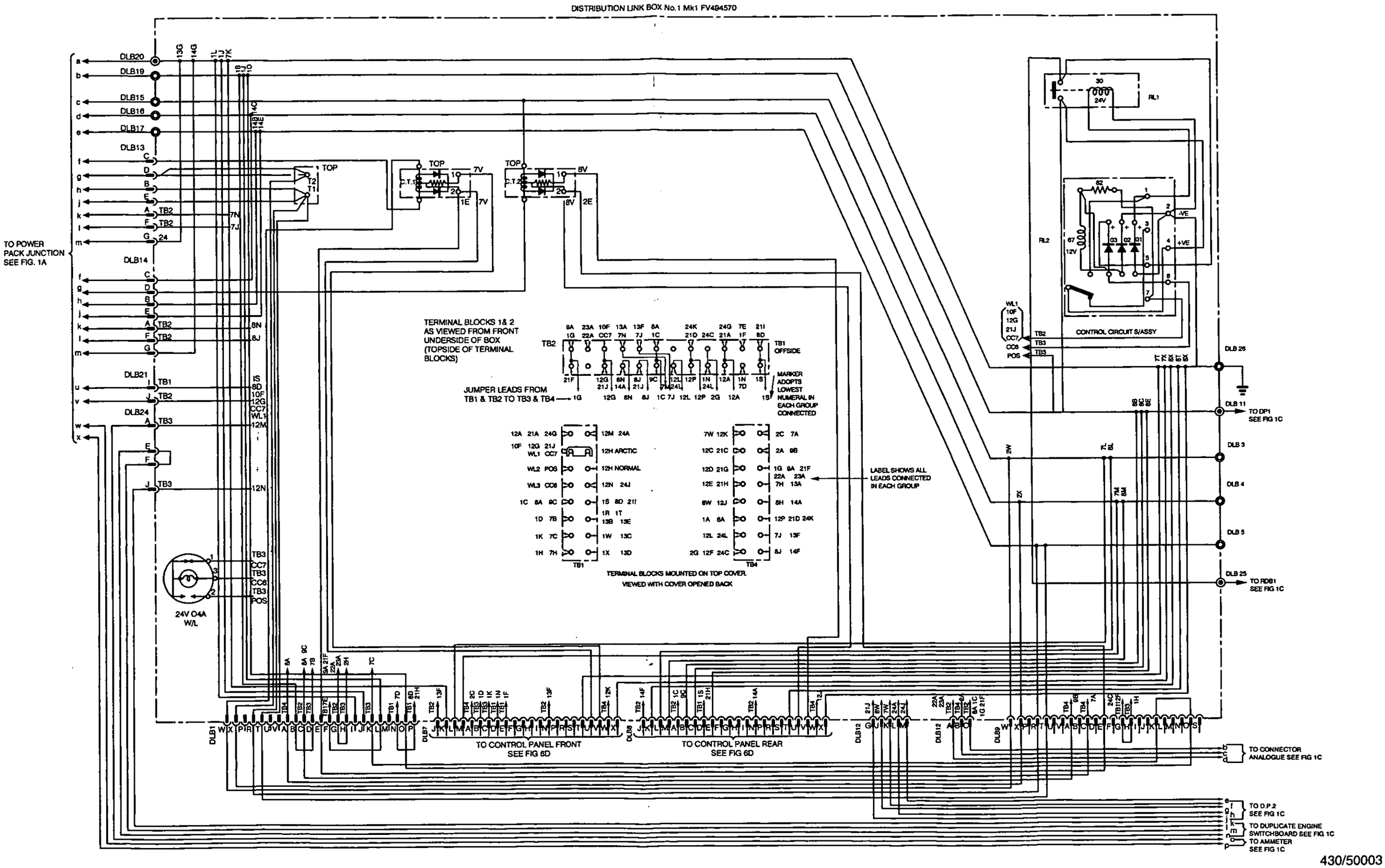



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Fig 1B Generating system, circuit diagram (part view)

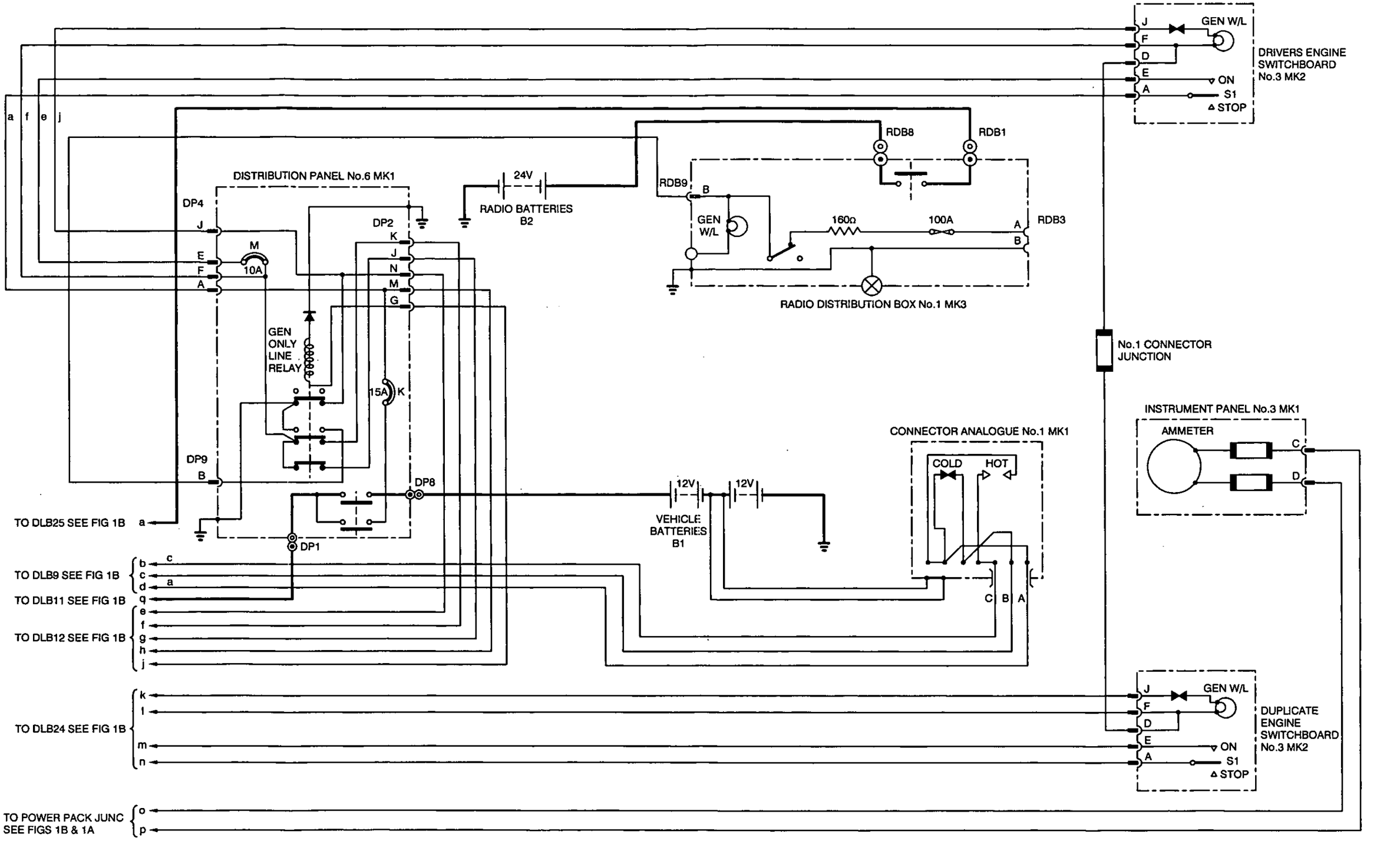


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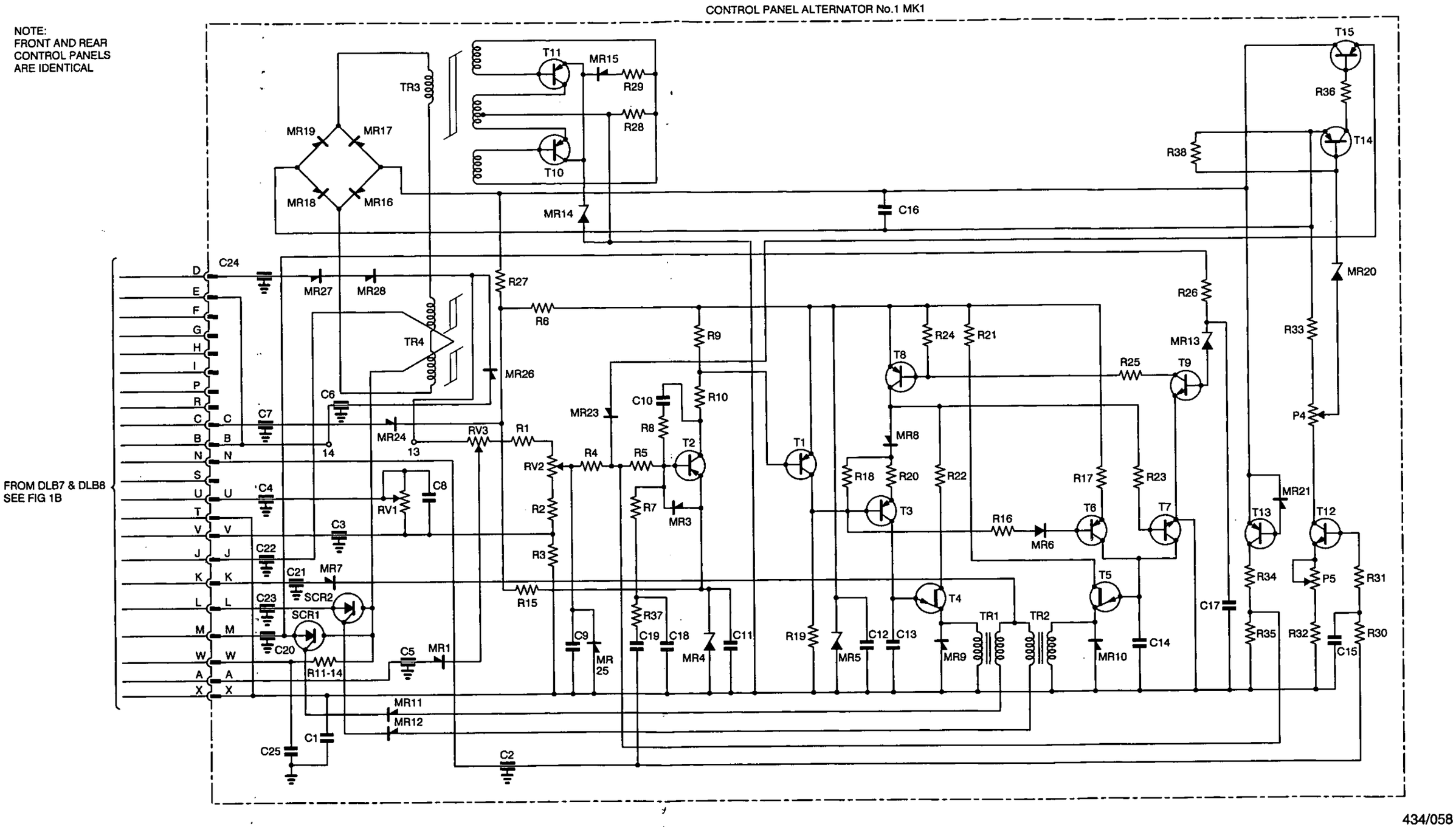
Fig 1C Generating system, circuit diagram (part view)

NOTE:
FRONT AND REAR
CONTROL PANELS
ARE IDENTICAL




434/058

Fig 1D Generating system, circuit diagram (part view)

**DISTRIBUTION PANEL NO 6, MK 1 (FV 534891)**

**Removing and refitting**

14 Refer to AESP 2350-T-251-522.

**Testing**

15 Refer to AESP 2350-T-251-522.

**RADIO DISTRIBUTION BOX, NO 1, MK 3 (FV 534990)**

**Removing and refitting**

16 Set battery master switch to OFF.

17 Disconnect the radio batteries.

18 Disconnect cables and earth braids from the Vehicle User Data Terminal (VUDT) (Fig 2 (4)) and Twin selector Box (TSB) in accordance with IETP (TBA) Bowman radio publication.

19 Remove the four screws (2) and washers securing the top plate (3) (with VUDT and TSB attached) to the LH and RH brackets (1) and withdraw the bracket.

20 Disconnect cables and earth strap to the radio distribution box (5).

21 Remove the four bolts (6) and washers securing the radio distribution box to the RDB/PDU bracket.

22 Refit in the reverse order to removing.

**Testing**

23 Refer to AESP 2350-T-251-522.

**INJECTION PUMP STOP SOLENOID**

**Removal and refitting**

24 Switch battery master OFF.

25 Remove access plates to power pack in drivers compartment.

26 Disconnect fuel injection pipes 1, 2, and 3 at pump, and oil reservoir breather tube at reservoir.

27 Remove end cover from solenoid and disconnect.

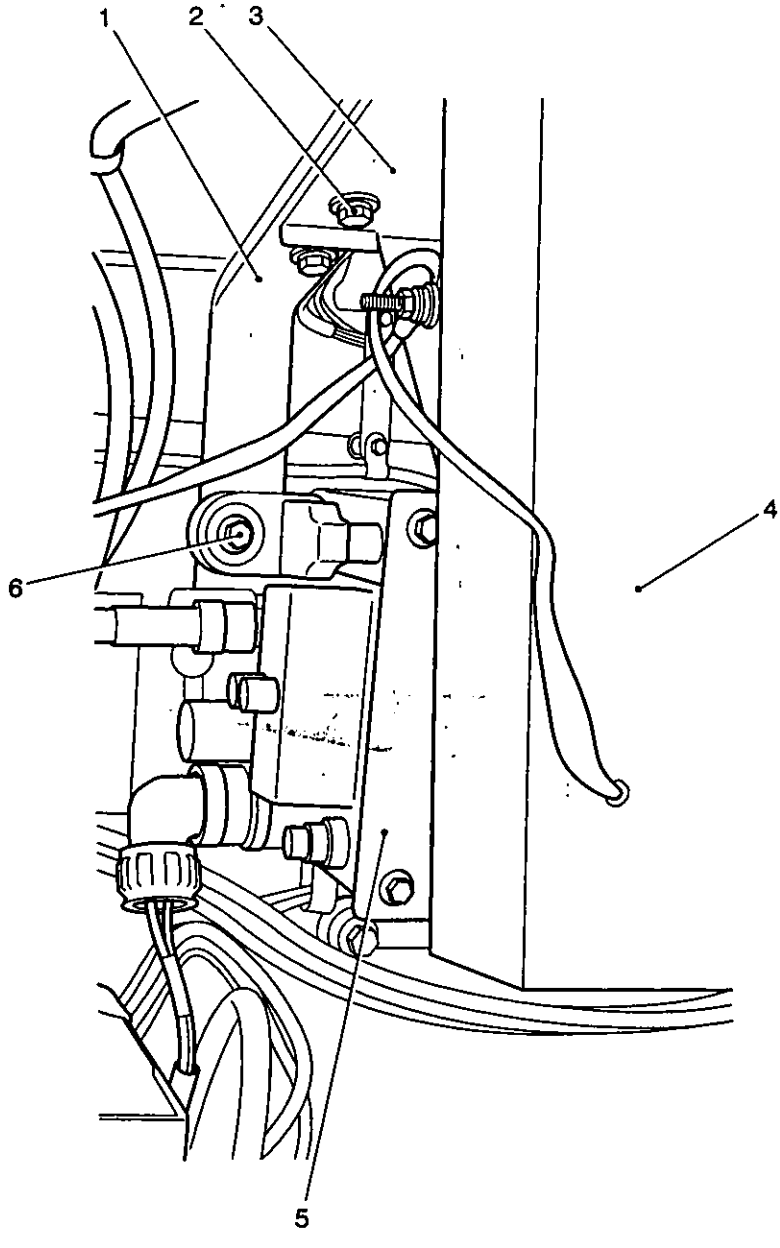
28 Remove harness complete with solenoid and cap.

29 Remove fuel pump, Chap 1-3 refers, complete with solenoid.

30 Refitting is the reverse of removal.

**Testing**

31 Switch battery master OFF and check circuit breakers K and L at distribution panel. If tripped reset. If unit fails to function carry out procedure detailed in Tables 3 and 4 and with reference to Fig 3.

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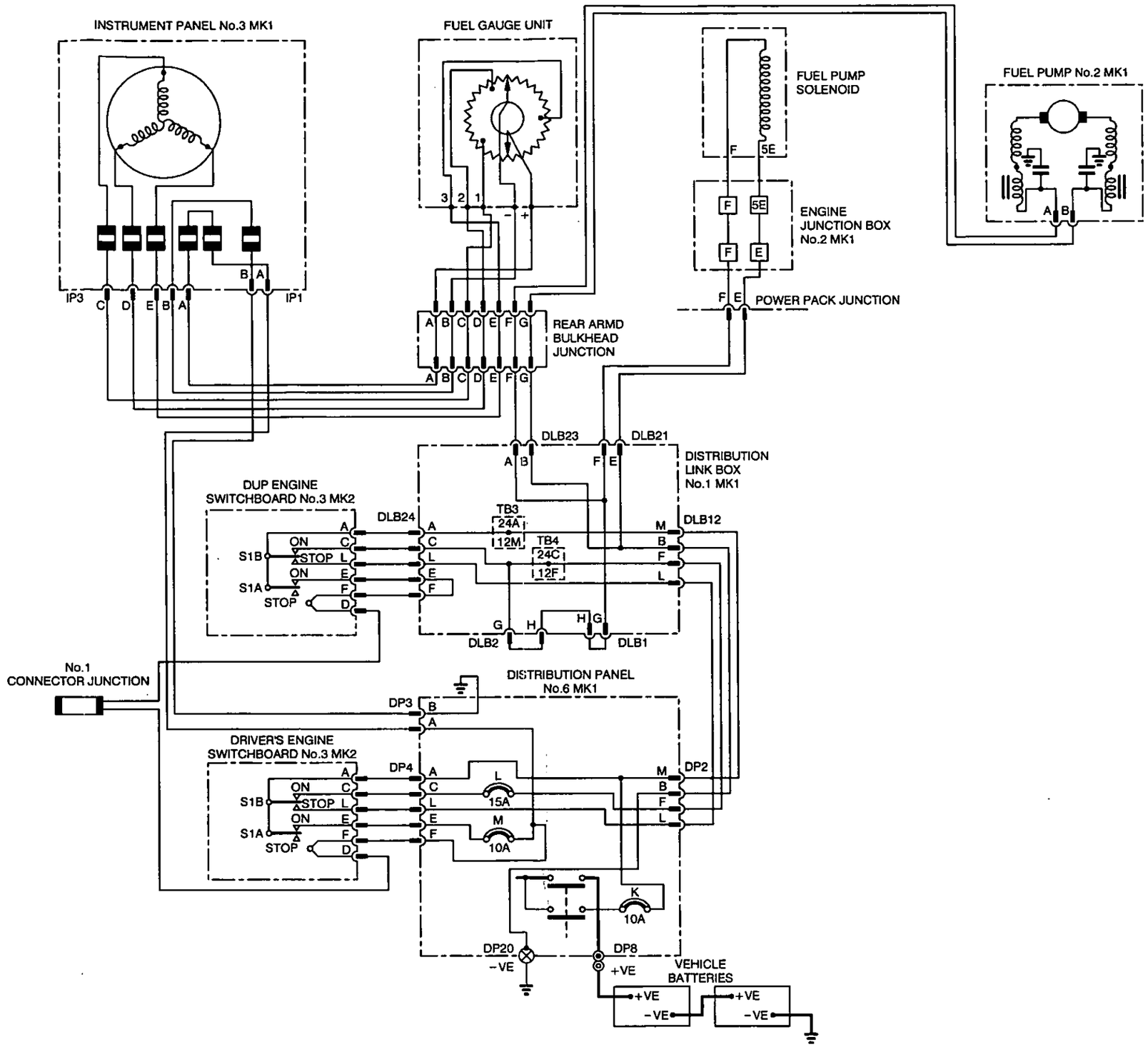
| | | | |
|---|---|---|---|
| 1 | LH bracket | 4 | VUDT |
| 2 | Screw | 5 | Radio distribution box |
| 3 | Top plate | 6 | Screw |

Fig 2 Radio distribution box mounting




434/059

Fig 3 Fuel system electrical components circuit diagram

Failure diagnosis from the drivers engine switch board

32 Table 3 enables a fault in the fuel injection pump solenoid to be located from the drivers engine switch board with reference to Fig 3.

**TABLE 3 FUEL INJECTION PUMP SOLENOID – FAILURE DIAGNOSIS (driver's switchboard)**

| Serial (1) | Action (2) | Test point (3) | Correct result (4) | Action if correct (5) | Action if incorrect (6) |
|---|---|---|---|---|---|
| 1 | Disconnect drivers engine switchboard harness plug. With engine switch ON, carry out continuity test. | A to C | Continuity | Go to 2 | Replace switch board |
| 2 | Disconnect drivers engine switchboard harness plug. With engine switch OFF, carry out continuity test. | A to L | Continuity | Go to 3 | Replace switch board |
| 3 | Disconnect harness between switchboard and DP4. Carry out continuity test. | A to A<br>C to C<br>L to L<br>E to E<br>F to F | Continuity | Go to 4 | Replace harness |
| 4 | Disconnect plug DLB12. Switch battery master to ON. Carry out voltage check. | Pin F to suitable earth | 24V | Go to 7 | Go to 5 |
| 5 | Disconnect harness at DP2. Carry out continuity check. | DP2M to DLB12M<br>DP2B to DLB12B<br>DP2F to DLB12F<br>DP2L to DLB12L | Continuity | Go to 6 | Replace harness |
| 6 | Remove and test distribution panel. Refer to AESP 2350-T-250-522. | N/A | N/A | Go to 7 | Renew or repair distribution box |
| 7 | Reconnect DLB12 and open distribution link box. Set battery master and engine switches to ON. Carry out voltage check. | TB4 12F to suitable earth | 24V | Go to 8 | Renew or repair distribution link box |
| 8 | Switch battery master to OFF. Disconnect plug DLB23. Carry resistance check. | TB4 24C to suitable earth | 0.77Ω (typical) | Go to 9 | Renew or repair distribution link box |
| 9 | Disconnect harness DLB21 to power pack junction. Carry out continuity check. | F to F<br>E to E | Continuity | Go to 10 | Replace harness |

(continued)

**TABLE 3 FUEL INJECTION PUMP SOLENOID – FAILURE DIAGNOSIS (driver's switchboard) (continued)**

| Serial (1) | Action (2) | Test point (3) | Correct result (4) | Action if correct (5) | Action if incorrect (6) |
|---|---|---|---|---|---|
| 10 | Remove engine cover assembly. Test cables, power pack junction box to engine junction box and fuel pump solenoid. | Connecting cables | Continuity | Go to 11 | Renew or repair defective cables |
| 11 | Gain access to fuel pump solenoid. Carry out resistance check. | E to F | 0.77Ω (typical) | Go to 12 | Remove stop solenoid for examination. See note at end of table |
| 12 | Refit stop solenoid. Reconnect all connections and carry out functional test. | Stop solenoid system | Correct functioning | End of test | Replace assembly |

NOTE

(1) The injection pump stop solenoid contains two windings. A 'pull in' and a 'hold in' winding, with typical resistances as follows:

Pull in winding: 0.77Ω
Hold on winding: 39Ω

(2) 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.

Failure diagnosis from drivers duplicate engine switch board

33 Table 4 enables a fault in the fuel injection pump solenoid to be located from the drivers duplicate engine switch board with reference to Fig 3.

**TABLE 4 FUEL INJECTION PUMP SOLENOID – FAILURE DIAGNOSIS (duplicate switchboard)**

| Serial (1) | Action (2) | Test point (3) | Correct result (4) | Action if correct (5) | Action if incorrect (6) |
|---|---|---|---|---|---|
| 1 | Disconnect DLB12, switch the battery master to ON. Carry out voltage check. | DLB12 harness, plug pin M to suitable earth | 24V | Go to 4 | Go to 2 |
| 2 | Switch battery master to OFF, disconnect harness DLB12 to DP2. Carry out continuity check. | M to M<br>B to B<br>F to F<br>L to L | Continuity | Go to 3 | Renew harness. |
| 3 | Remove and test distribution panel. Refer to AESP 2350-T-250-522. | N/A | N/A | Go to 4 | Renew or repair distribution box |

(continued)

**TABLE 4 FUEL INJECTION PUMP SOLENOID – FAILURE DIAGNOSIS (duplicate switchboard) (continued)**

| Serial (1) | Action (2) | Test point (3) | Correct result (4) | Action if correct (5) | Action if incorrect (6) |
|---|---|---|---|---|---|
| 4 | Disconnect harness DLB12 at power pack junction Switch battery master and duplicate engine switch to ON. Carry out voltage check. | F to E | 24V | Go to 7 | Go to 5 |
| 5 | Disconnect harness DLB21. Carry out continuity check. | F to F<br>E to E | Continuity | Go to 6 | Renew harness. |
| 6 | Open distribution link box. Carry out voltage check. | TB4 12F and TB4 24C to suitable earth | 24V | Go to 7 | Remove and test distribution link box |
| 7 | Remove engine cover assembly. Test cables, power pack junction box to engine junction box and fuel pump stop solenoid. | Connecting cables | Continuity | Go to 8 | Renew or repair defective cables |
| 8 | Gain access to fuel pump solenoid. Carry out resistance check. | E to F | 0.77Ω (typical) | Go to 9 | Remove stop solenoid for examination. See note at end of table |
| 9 | Refit stop solenoid. Reconnect all connections and carry out functional test. | Stop solenoid system | Correct functioning | End of test | Replace assembly |

NOTE

(1) The injection pump stop solenoid contains two windings. A 'pull in' and a 'hold in' winding, with typical resistances are as follows:

Pull in winding: 0.77Ω
Hold on winding: 39Ω

(2) 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.

**PUMP, FUEL PRESSURIZING No. 2, Mk 1 (FV342593)**

**Removal and refitting**

34 See Chapter 1-3 of this publication.

**Testing**

35 Set battery master to OFF and check circuit breakers K and L at distribution panel. If tripped reset. If unit fails to function, carry out procedure detailed in Tables 5 and 6.

Failure diagnosis from drivers engine switchboard

36 Table 5 enables a fault in the fuel pressurising pump to be located from the drivers engine switch board with reference to Fig 3.

**TABLE 5 FUEL PRESSURISING PUMP – FAILURE DIAGNOSIS (driver's switchboard)**

| Serial (1) | Action (2) | Test point (3) | Correct result (4) | Action if correct (5) | Action if incorrect (6) |
|---|---|---|---|---|---|
| 1 | Disconnect drivers engine switchboard harness plug. With engine switch ON, carry out continuity test. | A to C | Continuity | Go to 2 | Replace switch board |
| 2 | Disconnect drivers engine switchboard harness plug. With engine switch OFF, carry out continuity test. | A to L | Continuity | Go to 3 | Replace switch board |
| 3 | Disconnect harness between switchboard and DP4. Carry out continuity test. | A to A<br>C to C<br>L to L<br>E to E<br>F to F | Continuity | Go to 4 | Replace harness |
| 4 | Disconnect plug DLB12. Switch battery master to ON. Carry out voltage check. | Pin F to suitable earth | 24V | Go to 7 | Go to 5 |
| 5 | Disconnect harness at DP2. Carry out continuity check. | DP2M to DLB12M<br>DP2B to DLB12B<br>DP2F to DLB12F<br>DP2L to DLB12L | Continuity | Go to 6 | Replace harness |
| 6 | Remove and test distribution panel. Refer to AESP 2350-T-250-522. | N/A | N/A | Go to 7 | Renew or repair distribution box |
| 7 | Reconnect DLB12 and open distribution link box. Set battery master and engine switches to ON. Carry out voltage check. | TB4 12F to suitable earth | 24V | Go to 8 | Renew or repair distribution link box |
| 8 | Disconnect DLB23. Carry out voltage check. | DLB23 sockets A & B to suitable earth | 24V | Go to 9 | Renew or repair distribution link box |
| 9 | Remove connection at fuel tank junction. Carry out voltage check. | Pins F & G at harness to suitable earth | 24V | Go to 10 | Replace harness |

(continued)

**TABLE 5 FUEL PRESSURISING PUMP – FAILURE DIAGNOSIS (driver's switchboard) (continued)**

| Serial (1) | Action (2) | Test point (3) | Correct result (4) | Action if correct (5) | Action if incorrect (6) |
|---|---|---|---|---|---|
| 10 | At fuel tank junction socket, carry out continuity check through fuel pump motor. | Pins F & G | Continuity | Go to 12 | Go to 11 |
| 11 | Remove access plate in rear bulkhead, disconnect fuel pump harness. Carry out voltage check. | A & B to suitable earth | 24V | Go to12 | Replace harness. |
| 12 | Carry out continuity check at fuel pump connection. | A & B | Continuity | End of test | Replace fuel pump |

Failure diagnosis from drivers duplicate engine switch board

37 Table 6 enables a fault in the fuel pressurising pump to be located from the drivers duplicate engine switch board with reference to Fig 3.

**TABLE 6 FUEL PRESSURISING PUMP – FAILURE DIAGNOSIS (duplicate switchboard)**

| Serial (1) | Action (2) | Test point (3) | Correct result (4) | Action if correct (5) | Action if incorrect (6) |
|---|---|---|---|---|---|
| 1 | Disconnect drivers engine switchboard harness plug. With engine switch ON, carry out continuity test. | A to C | Continuity | Go to 2 | Replace switch board |
| 2 | Disconnect drivers engine switchboard harness plug. With engine switch OFF, carry out continuity test. | A to L | Continuity | Go to 3 | Replace switch board |
| 3 | Disconnect harness between switchboard and DP4. Carry out continuity test. | A to A<br>C to C<br>L to L<br>E to E<br>F to F | Continuity | Go to 4 | Replace harness |
| 4 | Disconnect plug DLB12. Switch battery master to ON. Carry out voltage check. | Pin F to suitable earth | 24V | Go to 7 | Go to 5 |
| 5 | Disconnect harness at DP2. Carry out continuity check. | DP2M to DLB12M<br>DP2B to DLB12B<br>DP2F to DLB12F<br>DP2L to DLB12L | Continuity | Go to 6 | Replace harness |

(continued)

**TABLE 6 FUEL PRESSURISING PUMP – FAILURE DIAGNOSIS (duplicate switchboard) (continued)**

| Serial (1) | Action (2) | Test point (3) | Correct result (4) | Action if correct (5) | Action if incorrect (6) |
|---|---|---|---|---|---|
| 6 | Remove and test distribution panel. Refer to AESP 2350-T-250-522. | N/A | N/A | Go to 7 | Renew or repair distribution box |
| 7 | Reconnect DLB12 and open distribution link box. Set battery master and duplicate engine switches to ON. Carry out voltage check. | TB4 12F to suitable earth | 24V | Go to 8 | Renew or repair distribution link box |
| 8 | Disconnect DLB23. Carry out voltage check. | DLB23 sockets A & B to suitable earth | 24V | Go to | Go to 9 |
| 9 | Open distribution link box. Carry out voltage check. | TB4 12F – 24C to suitable earth | 24V | Go to 10 | Go to 11 |
| 10 | Remove and test distribution link box and harness DLB1 & DLB2. | Various | Various | Go to 11 | Replace or repair components as required |
| 11 | Duplicate engine switchboard with engine switch ON. Carry out continuity check. | Pins A to C | Continuity | Go to 12 | Renew or repair duplicate engine switch board |
| 12 | Remove connection at fuel tank junction. Carry out voltage check. | Pins F & G at harness to suitable earth | 24V | Go to 13 | Replace harness |
| 13 | At fuel tank junction socket, carry out continuity check through fuel pump motor. | Pins F & G | Continuity | Go to 15 | Go to 14 |
| 14 | Remove access plate in rear bulkhead, disconnect fuel pump harness. Carry out voltage check. | A & B to suitable earth | 24V | Go to15 | Replace harness |
| 15 | Carry out continuity check at fuel pump connection. | A & B | Continuity | End of test | Replace fuel pump |

**FUEL GAUGE TANK UNIT**

**Removing and refitting**

38 Refer to Chapter 1-3 of this publication.

**Testing fuel indicating circuit**

39 Switch the battery master to OFF and check circuit breakers K, L and M on the distribution panel. If tripped, reset.

Failure diagnosis from drivers engine switchboard

40 Table 7 enables a failure to be traced in the fuel indicating circuit, from the drivers engine switchboard, with reference to Fig 3.

**TABLE 7 FUEL INDICATING CIRCUIT – FAILURE DIAGNOSIS (driver's engine switchboard)**

| Serial (1) | Action (2) | Test point (3) | Correct result (4) | Action if correct (5) | Action if incorrect (6) |
|---|---|---|---|---|---|
| 1 | Remove instrument panel from mounting. Disconnect IP1. Switch battery master and engine switches to ON. Carry out voltage check. | Harness plug A & B | 24V | Go to 3 | Go to 2 |
| 2 | Disconnect harness DP3 to IP1. Carry out continuity check. | IP1A to DP3A<br>IP1B to DP3B | Continuity | Go to 5 | Replace harness |
| 3 | With engine switch ON, carry out continuity check at engine switchboard. | Socket IP3:<br>A to C<br>A to E<br>D to F | Continuity | Go to 4 | Replace engine switch board |
| 4 | Disconnect DP4 to engine switchboard. Carry out continuity check. | A to A<br>C to C<br>L to L<br>E to E<br>F to F | Continuity | Go to 5 | Replace harness |
| 5 | Remove and test distribution panel. Refer to AESP 2350-T-250-522. | N/A | N/A | Go to 6 | Renew or replace distribution box |
| 6 | With battery master and engine switches ON, carry out voltage checks at rear armoured bulkhead panel. | Pins A & B to suitable earth | 24V | Go to 8 | Go to 7 |
| 7 | Disconnect harness IP3. Carry out continuity check. | C to C<br>D to D<br>E to E<br>B to B<br>A to A | Continuity | Go to 8 | Replace harness |
| 8 | Carry out resistance check at terminals at the armoured bulkhead front. | A to B<br>1 to 2<br>2 to 3<br>1 to 3 | 500Ω<br>475Ω<br>475Ω<br>475Ω | Go to 9 | Replace fuel gauge unit |
| 9 | Disconnect IP3 from instrument panel and carry out resistance check at panel socket. | C to D<br>D to E<br>E to C | 700Ω<br>700Ω<br>700Ω | End of test | Replace fuel gauge meter |

Failure diagnosis from drivers duplicate engine switch board

41 Table 8 enables a failure to be traced in the fuel indicating circuit, from the drivers duplicate engine switchboard, with reference to Fig 3.

**TABLE 8 FUEL INDICATING CIRCUIT – FAILURE DIAGNOSIS (duplicate engine switchboard)**

| Serial (1) | Action (2) | Test point (3) | Correct result (4) | Action if correct (5) | Action if incorrect (6) |
|---|---|---|---|---|---|
| 1 | Remove instrument panel from mounting. Disconnect IP1. Switch battery master and duplicate engine switches to ON. Carry out voltage check. | Harness plugs A & B | 24V | Go to 3 | Go to 2 |
| 2 | Disconnect harness DP3 to IP1. Carry out continuity check. | IP1A to DP3A<br>IP1B to DP3B | Continuity | Go to 5 | Replace harness |
| 3 | With engine switch ON, carry out continuity check at engine duplicate switch board. | Socket IP3:<br>A to C<br>A to E<br>D to F | Continuity | Go to 4 | Replace engine switch board |
| 4 | Disconnect DP24 to duplicate engine switchboard. Carry out continuity check. | A to A<br>C to C<br>L to L<br>E to E<br>F to F | Continuity | Go to 5 | Replace harness |
| 5 | Remove and test distribution panel. Refer to AESP 2350-T-250-522. | N/A | N/A | Go to 6 | Renew or replace distribution box |
| 6 | Open distribution link box, switch battery master and duplicate engine switches to ON. Carry out voltage check. | TB3 24A<br>TB3 12M<br>to suitable earth | 24V | Go to 7 | Remove and test distribution link box |
| 7 | With battery master and engine switches ON, carry out voltage checks at rear armoured bulkhead panel. | Pins A & B to suitable earth | 24V | Go to 9 | Go to 8 |
| 8 | Disconnect harness IP3. Carry out continuity check. | C to C<br>D to D<br>E to E<br>B to B<br>A to A | Continuity | Go to 9 | Replace harness |

(continued)

**TABLE 8 FUEL INDICATING CIRCUIT – FAILURE DIAGNOSIS (duplicate engine switchboard)(continued)**

| Serial (1) | Action (2) | Test point (3) | Correct result (4) | Action if correct (5) | Action if incorrect (6) |
|---|---|---|---|---|---|
| 9 | Carry out resistance check at terminals at the armoured bulkhead front. | A to B<br>1 to 2<br>2 to 3<br>1 to 3 | 500Ω<br>475Ω<br>475Ω<br>475Ω | Go to 10 | Replace fuel gauge unit |
| 10 | Disconnect IP3 from instrument panel and carry out resistance check at panel socket. | C to D<br>D to E<br>E to C | 700Ω<br>700Ω<br>700Ω | End of test | Replace fuel gauge meter |

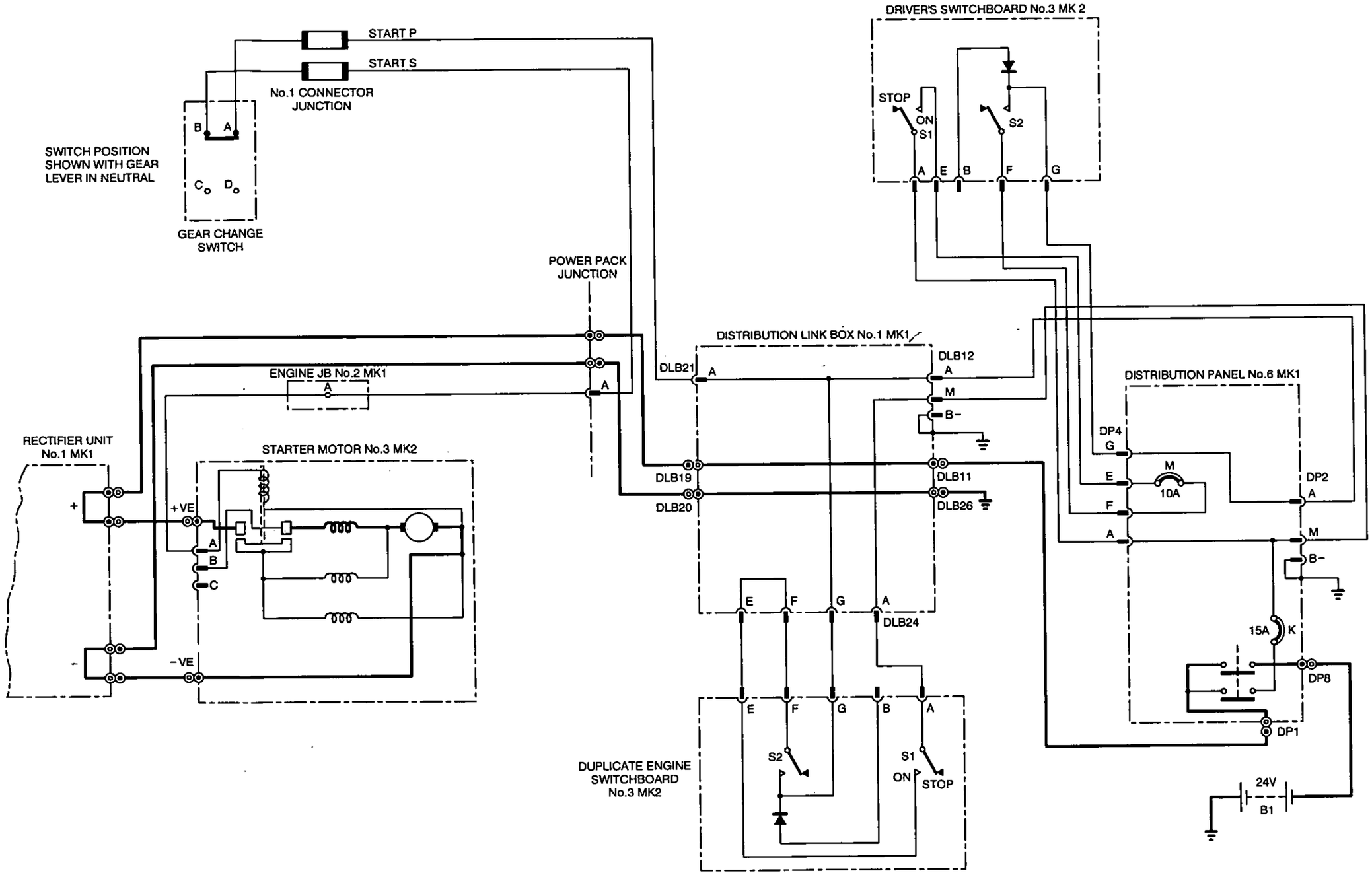



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Fig 4 Starter motor circuit

## STARTER MOTOR

### Removing and refitting

42 The gear lever must be placed in neutral for the following tests. The starter motor is a sealed unit and no repairs should be attempted at unit level.

43 Switch battery master to OFF.

44 Remove power pack from vehicle.

45 Disconnect leads.

46 Remove securing strap.

47 Remove starter. Starter yoke is dowelled to starter cradle.

48 Refitting is the reverse of removal.

### Testing of the heavy current circuit

49 Switch the battery master OFF and disconnect dc -ve and dc +ve cables.

Failure diagnosis

50 Table 9 enables a fault to be traced in the motor heavy current circuit, with reference to Fig 4.

**TABLE 9 HEAVY CURRENT CIRCUIT – FAILURE DIAGNOSIS**

| Serial (1) | Action (2) | Test point (3) | Correct result (4) | Action if correct (5) | Action if incorrect (6) |
|---|---|---|---|---|---|
| 1 | Switch battery master ON. Carry out voltage check. | dc –ve cable<br>dc +ve cable | 24V | Go to 2 | Go to 3 |
| 2 | Switch battery master OFF. Remove power pack. Carry out continuity checks on cables and rectifier unit. | Various | Continuity | Replace starter assembly | Repair or renew defective cables or components |
| 3 | Switch battery master to OFF. Disconnect DLB11 and DLB26. Switch battery master to ON. Carry out voltage check. | DLB11 to DLB26 | 24V | Remove and test distribution link box | Go to 4 |
| 4 | Carry out security check of connections. | DP8<br>DP1<br>Earth | Security | Remove and test distribution panel. Refer to AESP 2350-T-250-522. | Re-secure |

### Testing of the starter solenoid circuit

51 Switch battery master to OFF, check if circuit breakers K and M at distribution panel have tripped. Reset if necessary.

Failure diagnosis from drivers engine switchboard

52 Table 10 enables a fault in the starter solenoid circuit to be traced from the drivers engine switchboard, with reference to Fig 4.

**TABLE 10 STARTER SOLENOID CIRCUIT – FAILURE DIAGNOSIS (driver's switchboard)**

| Serial (1) | Action (2) | Test point (3) | Correct result (4) | Action if correct (5) | Action if incorrect (6) |
|---|---|---|---|---|---|
| 1 | Disconnect DP4. Switch battery master to ON. Carry out voltage check. | DP4A socket to suitable earth | 24V | Go to4 | Go to 2 |
| 2 | Switch battery master to OFF. Disconnect DP8. Carry out voltage check. | DP8 to suitable earth | 24V | Go to 3 | Replace or recharge battery |
| 3 | Remove and test distribution panel. Refer to AESP 2350-T-250-522. | N/A | N/A | Go to 4 | Replace or repair distribution panel |
| 4 | Set engine and starter switches to ON. Carry out continuity check on harness plug DP4. | DP4A to DP4E<br>DP4G to DP4F | Continuity | Go to 6 | Go to 5 |
| 5 | Disconnect harness DP4. Carry out continuity check. | DP4A to DP4E<br>DP4G to DP4F | Continuity | Go to 6 | Replace harness |
| 6 | Ensure engine and starter switches are ON. Carry out continuity check at drivers switch board. | A to E<br>F to G | Continuity | Go to 7 | Replace engine switch board |
| 7 | Locate socket DP4. Carry out resistance check. | DP4G to suitable earth. | 6.75Ω | Go to 10 | Go to 8 |
| 8 | Reconnect DP4 and engine switch board. Disconnect DLB12. Ensure battery master, engine and starter switches to ON. Carry out voltage check. | DLB12A to suitable earth. | 24V | Go to 10 | Go to 9 |
| 9 | Disconnect harness DLB12 to DP2. Carry out continuity check. | DLB12A to DP2A<br>DLB12M to DP2M | Continuity | Go to 10 | Replace harness. |
| 10 | Ensure battery master, engine and starter switches are ON. Carry out voltage check at socket DP2. | DP2A to suitable earth | 24V | Go to 12 | Go to 11 |

(continued)

**TABLE 10 STARTER SOLENOID CIRCUIT – FAILURE DIAGNOSIS (driver's switchboard) (continued)**

| Serial (1) | Action (2) | Test point (3) | Correct result (4) | Action if correct (5) | Action if incorrect (6) |
|---|---|---|---|---|---|
| 11 | Remove and test distribution panel. Refer to AESP 2350-T-250-522. | N/A | N/A | Go to 12 | Replace or repair distribution box |
| 12 | Refit DLB12. Ensure battery master, engine and starter switches are ON. Disconnect DLB21. Carry out voltage check. | DLB21A to suitable earth | 24V | Go to 13 | Test distribution link box |
| 13 | At DLB21 harness plug, carry out resistance check. | DLB21A to suitable earth | 6.75Ω | Go to 14 | Replace harness |
| 14 | At power pack junction services socket, carry out resistance check. | Pin A to suitable earth | 6.75Ω | Go to 17 | Go to 15 |
| 15 | Remove access plate in drivers compartment. Remove cover from engine junction box. Carry out continuity check. | Engine harness services socket pin A to engine junction box terminal A | Continuity | Go to 16 | Remove power pack and repair or replace harness |
| 16 | At EJB, carry out resistance check. | EJBA to suitable earth | 6.75Ω | Go to 17 | Remove power pack and repair or replace harness |
| 17 | At harness EJB, carry out continuity check. | EJBA to starter motor solenoid connection | Continuity | Go to 18 | Replace harness |
| 18 | At starter motor solenoid, carry out resistance check. | Starter solenoid connections | 6.75Ω | End of test | Replace starter |

Failure diagnosis from duplicate engine switch board

53 Table 11 enables a fault in the starter solenoid circuit to be traced from the duplicate engine switch board, with reference to Fig 4.

**TABLE 11 STARTER SOLENOID CIRCUIT – FAILURE DIAGNOSIS (duplicate switchboard)**

| Serial (1) | Action (2) | Test point (3) | Correct result (4) | Action if correct (5) | Action if incorrect (6) |
|---|---|---|---|---|---|
| 1 | Disconnect DLB12. Switch battery master to ON. Carry out voltage check. | DLB12M to DLB12B | 24V | Go to 3 | Go to 2 |

(continued)

**TABLE 11 STARTER SOLENOID CIRCUIT – FAILURE DIAGNOSIS (duplicate switchboard)(continued)**

| Serial (1) | Action (2) | Test point (3) | Correct result (4) | Action if correct (5) | Action if incorrect (6) |
|---|---|---|---|---|---|
| 2 | Disconnect harness DBL12 to DP2. Carry out continuity check. | DLB12A to DP2A<br>DLB12M to DP2M | Continuity | Go to 3 | Replace harness |
| 3 | At socket DP2, carry out voltage check. | DP2M to DP2B | 24V | Go to 6 | Go to 4 |
| 4 | At harness DP8. Carry out voltage check. | DP8 to suitable earth | 24V | Go to 5 | Replace harness or recharge battery. |
| 5 | Remove and test distribution panel. Refer to AESP 2350-T-250-522. | N/A | N/A | Go to 6 | Replace or repair distribution panel |
| 6 | Switch battery master to OFF. Disconnect DLB24. Switch battery master to ON. Carry out voltage check. | DLB24A to suitable earth | 24V | Go to 7 | Replace or repair distribution panel |
| 7 | Switch S1 and S2 to ON, on duplicate switch board. Refit DLB24 and remove DLB21. Switch battery master to ON. Carry out voltage check. | DLB21A to suitable earth | 24V | Go to 9 | Go to 8 |
| 8 | Switch battery master to OFF. Disconnect harness DLD24. Carry out continuity check. | DLB24A to A<br>DLB24G to G<br>DLB24F to F<br>DLB24E to E | Continuity | Go to 9 | Replace harness |
| 9 | Set switches S1 and S2 to ON, on duplicate engine switch board. Carry out continuity check. | A to E<br>F to G<br>F to B<br>G to B | Continuity | Go to 10 | Replace duplicate switchboard |
| 10 | Test distribution link box. Refer to AESP 2350-T-250-522. | N/A | N/A | Go to 11 | Replace or repair distribution link box |
| 11 | Remove engine services plug at power pack junction. Switch battery master to ON. Carry out voltage check. | Plug pin A to suitable earth | 24V | Go to 13 | Go to 12 |

(continued)

**TABLE 11 STARTER SOLENOID CIRCUIT – FAILURE DIAGNOSIS (duplicate switchboard) (continued)**

| Serial (1) | Action (2) | Test point (3) | Correct result (4) | Action if correct (5) | Action if incorrect (6) |
|---|---|---|---|---|---|
| 12 | Harness from DLB21 to power pack junction, including No.1 connector junction and gear change switch, (ensure gear lever is at neutral). Carry out continuity check. | DLB21A to power pack A | Continuity | Go to 13 | Replace harness |
| 13 | Remove access plate in drivers compartment. Remove cover from engine junction box. Carry out continuity check. | Engine harness services socket pin A to engine junction box terminal A | Continuity | Go to 14 | Remove power pack and repair or replace harness |
| 14 | At EJB, carry out resistance check. | EJBA to suitable earth | 6.75Ω | Go to 15 | Remove power pack and repair or replace harness |
| 15 | At harness EJB, carry out continuity check. | EJBA to starter motor solenoid connection | Continuity | Go to 16 | Replace harness |
| 16 | At starter motor solenoid, carry out resistance check. | Starter solenoid connections | 6.75Ω | End of test | Replace starter |

## FIREWIRE SYSTEM

### Testing general

54 With battery master switch 'ON', set test switch on firewire control box to 'Test' position. Check that the fire alarm horn is actuated and warning light flashes. If the check is satisfactory, the system is serviceable, if unsatisfactory check circuit breakers C and J. If tripped, reset. If check is still unsatisfactory, carry out tests detailed in following paragraphs.

### Testing supply circuit to firewire control box

55 To obtain access to firewire control box, remove battery clamp and securing strip. Move batteries in container towards power pack to full extent of positive and negative leads.

Failure diagnosis

56 Table 12 enables a fault in the supply circuit to the firewire control box to be traced, Fig 5 refers.

**TABLE 12 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 | Disconnect plugs JW4 and JW5 from firewire control box. Carry out voltage check. | JW4A to JW4B<br>JW5A to JW5B | 3.9V (Nominal) | Refer to Table 14 | Go to 2 |
| 2 | Remove plug JW1, switch battery master to ON. Carry out voltage check. | JW1A to JW1B<br>JW1B to JW1C | 24V | Replace Fire wire control box | Go to 3 |
| 3 | Disconnect Plug DP7. Carry out continuity check on harness. | JW1A to DP7A<br>JW1B to DP7B<br>JW1C to DP7C | Continuity | Go to 4 | Replace harness |
| 4 | Ensure battery master switch is ON. At socket DP7, carry out voltage check. | DP7A to DP7B<br>DP7B to DP7C | 24V | End of test | Go to 5 |
| 5 | Disconnect DP8. Carry out voltage check. | DP8 to suitable earth. | 24V | Go to 6 | Replace harness DP8 or recharge batteries |
| 6 | Test distribution panel. Refer to AESP 2350-T-250-522. | N/A | N/A | End of test | Replace or repair distribution panel |
| 7 | Remove plugs JW4 and JW5 from firewire control box. Carry out resistance check. | JW4A to JW5A | 130Ω (typical) | End of test | Go to 2 |
| 8 | Refit JW4 and JW5. Remove firewire harness plugs at power pack junction. Carry out voltage check. | Pins A to B at each plug | 3.9V | Go to 8 | Go to 3 |
| 9 | Carry out continuity check on sections of JW4 from firewire control box to bulkhead connections. See note at end of table. | JW4A to JW4A<br>JW4B to JW4B | Continuity | Go to 4 | Replace harness |
| 10 | Repeat test at Ser 3 on JW5. | JW5A to JW5A<br>JW5B to JW5B | Continuity | Go to 5 | Replace harness (continued) |

**TABLE 12 FIREWIRE CONTROL BOX SUPPLY CIRCUIT – FAILURE DIAGNOSIS (continued)**

| Serial (1) | Action (2) | Test point (3) | Correct result (4) | Action if correct (5) | Action if incorrect (6) |
|---|---|---|---|---|---|
| 11 | Remove firewire hull connection at bulkhead and connection located in front of steering unit. | Centre pin at bulkhead plug to pin A at hull | 25.3Ω (typical) | Go to 7 | Go to 6 |
| 12 | Remove steering unit and assembly coil reservoir. Carry out resistance check on individual firewire elements. | Centre pins | 2.3Ω/inch (typical) | Go to 7 | Replace defective section of element |
| 13 | Carry out insulation resistance check on harness, firewire hull connection to power pack junction harness plug, using megohmmeter, (Table 2, Ser 1). | Pins A and B at connection in hull (located in front of steering unit) | In excess of 1 MΩ | End of test | Replace defective section of elements |
| 14 | Remove power pack firewire circuit harness plugs. Carry out resistance check. | Pin A to A of firewire sockets | 76Ω to 114Ω | Go to 9 | Replace harness |
| 15 | Carry out insulation resistance check on power pack junction plug, using megohmmeter, (Table 2, Ser 1). | Pin A to pin B | In excess of 1 MΩ | End of test | Go to 10 |
| 16 | Carry out insulation resistance check on individual elements using megohmmeter, (Table 2, Ser 1). | Pin A to pin B | In excess of 20 MΩ | End of test | Replace defective elements |

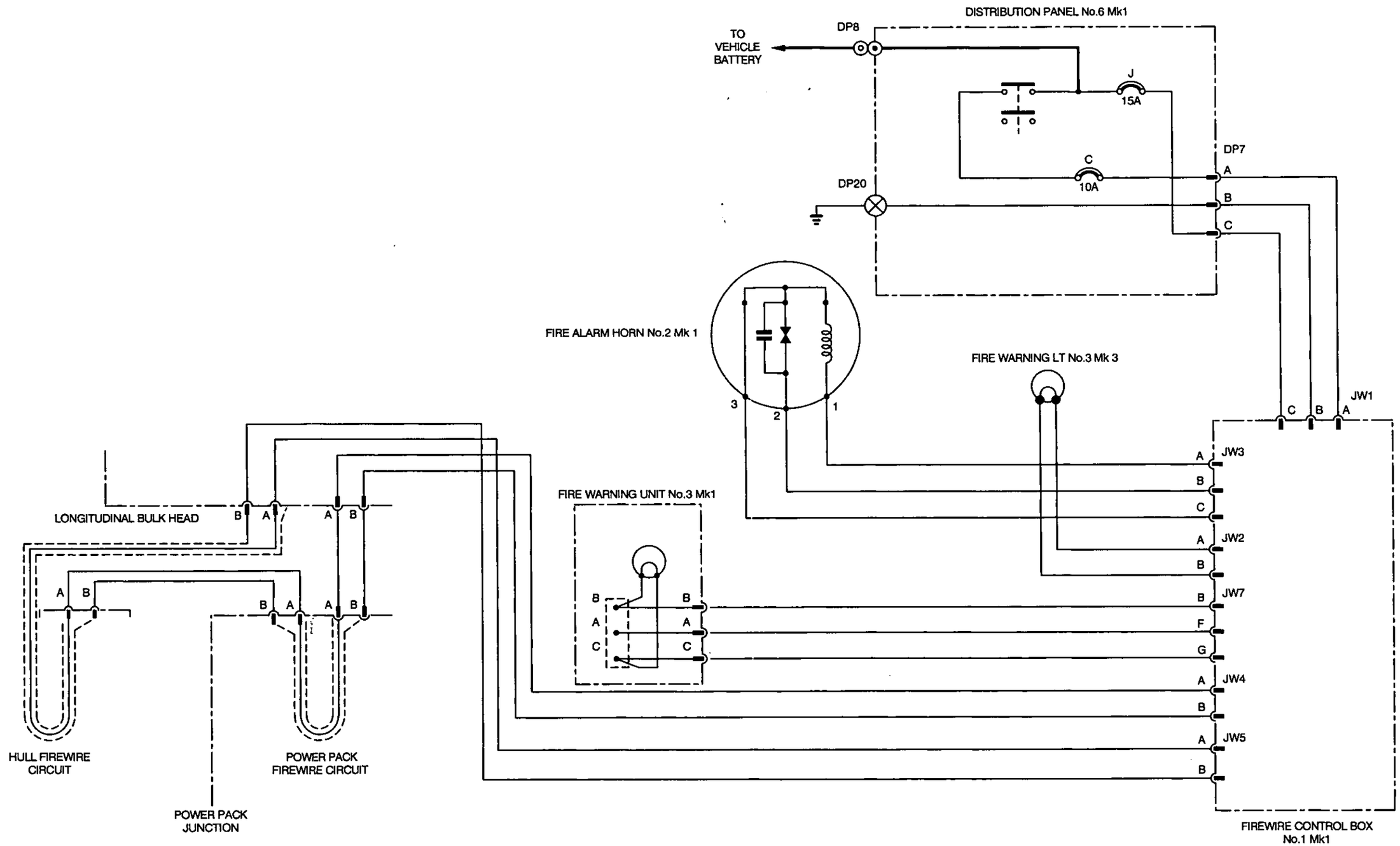


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Fig 5 Firewire system – circuit diagram

**Testing firewire element circuit**

Failure diagnosis

57 Table 13 enables a fault in the firewire element circuit to be traced, with reference to Fig 5.

**TABLE 13 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. |

NOTE

Bulkhead connections are difficult to reach in drivers or power pack compartments. Removing floorboard in drivers compartment will facilitate this operation.

**Testing fire alarm horn circuit**

**CAUTION**

**EQUIPMENT DAMAGE. During testing at Table 14, Ser 3, do not let the cable ends touch or earth. The feed to the horn by passes the master switch when the 'TEST' switch at firewire control box is operated.**

Failure diagnosis

58 Table 14 enables a fault to be traced in the fire alarm horn circuit, with reference to Fig 5.

**TABLE 14 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 | Remove plug JW3 at firewire control box. Carry out resistance check. | JW3A to JW3B<br>JW3A to JW3C<br>JW3B to JW3C | 2.35Ω<br>2.35Ω<br>zeroΩ<br>(typical) | End of test | Go to 2 |
| 2 | Remove horn from hull mounting, disconnect terminal connections. Carry our continuity check on harness JW3 to horn. | JW3A to horn 1<br>JW3B to horn 2<br>JW3C to horn 3 | Continuity | Go to 3 | Replace harness |
| 3 | Reconnect JW3. Carry out voltage check at harness horn connections, with switch set to 'TEST' at firewire control box | 1 to 2 | 24V | Go to 4 | Remove and test firewire control box |
| 4 | Carry out resistance check at horn harness connections. | 2 to 1<br>3 to 1<br>3 to 2 | 2.35Ω<br>2.35Ω<br>zeroΩ | End of test | Replace fire alarm horn |

**Testing fire alarm warning light circuit**

59 If inoperative, remove and test bulbs, replace if unsatisfactory. If warning lights fail to operate and bulbs are serviceable, carry out failure diagnosis as detailed in Para 58.

60 The fire warning lamp box is mounted by four screws to the HMOP mounting plate which in turn is mounted to the cross bulkhead wall.

Failure diagnosis

61 Table 15 enables a fault to be traced the warning light circuit, with reference to Fig 5.

**TABLE 15 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 | Remove harness plug at flasher warning light unit. Switch battery master to ON, put switch at firewire control panel to 'TEST'. Carry out voltage check. | A to B | 24V | Go to 4 | Go to 2 |
| 2 | Carry out continuity check at harness JW7 to flasher warning light unit. | B to B<br>A to A<br>C to C | Continuity | Go to 3 | Replace harness |
| 3 | Test supply circuit, Para 56, (Table 14), refers. | N/A | N/A | Remove and test firewire control box | Action as detailed in Table 14 |
| 4 | Remove bulb from flasher warning light unit. Carry out resistance check . | A to B<br>A to C | 130Ω<br>zeroΩ | Go to 5 | Replace flasher warning light unit |
| 5 | Disconnect flasher warning light unit. Carry out insulation resistance check using megohmmeter, (Table 2, Ser 1). | All pins together to case | In excess of 1.5MΩ | Go to 6 | Replace flasher warning light unit |
| 6 | With bulb removed from flasher unit, switch battery master to ON and switch on control box to 'TEST'. Carry out voltage check. | Bulb holder centre pin to earth. | 24V | End of test | Go to 7 |
| 7 | Carry out continuity check on harness JW2 to warning light connection. | JW2A and JW2B to bulb holder | Continuity | Go to 8 | Replace harness |
| 8 | Remove and test firewire control box. | N/A | N/A | End of test | Replace firewire control box |

**Firewire element connectors**

62 See AESP 2350-T-251-522.

**LIGHTING AND HORN CIRCUITS**

63 Fig 6A and Fig 6B are wiring diagrams of all lighting circuits on the vehicle and the horn circuit. External lighting sockets, spot and inspection lights are included and trailer relay and sockets. Using Fig 6A and Fig 6B as a guide, fault finding should be self-evident.

**OIL PRESSURE SWITCH No. 1, Mk 3 (FV534888)**

**Removing and refitting**

64 Refer to AESP 2350-T-251-522 Chap 1-2.

**Testing**

65 Test warning lamp at drivers engine switchboard. Replace if unserviceable. Switch battery master switch OFF. Check circuit breakers K and M at distribution panel. Reset if tripped.

Failure diagnosis from drivers engine switchboard

66 Table 16 enables a fault to be traced in the oil pressure switch from the drivers switchboard, with reference to Fig 7

**TABLE 16 OIL PRESSURE SWITCH – FAILURE DIAGNOSIS (engine switchboard)**

| Serial (1) | Action (2) | Test point (3) | Correct result (4) | Action if correct (5) | Action if incorrect (6) |
|---|---|---|---|---|---|
| 1 | Disconnect DP4. Switch battery master to ON. Carry out voltage check. | DP4A to suitable earth | 24V | Go to 3 | Go to 2 |
| 2 | Test distribution panel. Refer to AESP 2350-T-250-522. | N/A | N/A | Go to 3 | Replace or repair distribution panel |
| 3 | At drivers switch board socket, carry out resistance check. | K to F | 145Ω (typical) | Go to 4 | Replace engine switchboard |
| 4 | At drivers switchboard, with engine switch on, carry out continuity check. | A to E | Continuity | Go to 5 | Replace engine switchboard |
| 5 | Carry out continuity check on harness DP4 to drivers switchboard. | DP4A to A<br>DP4B to B<br>DP4E to E<br>DP4F to F<br>DP4K to K | Continuity | Go to 6 | Replace harness |
| 6 | At socket DP4, carry out continuity check. | DP4K to suitable earth | Continuity | Go to8 | Go to 7 |
| 7 | Test distribution panel. Refer to AESP 2350-T-250-522. | N/A | N/A | Go to 8 | Replace or repair distribution panel |
| 8 | Reconnect DP4. Open front access door, remove engine services plug from power pack junction. Carry out voltage check. | Harness plug D to suitable earth | 24V | Go to 10 | Go to 9 |

(continued)

**TABLE 16 OIL PRESSURE SWITCH – FAILURE DIAGNOSIS (engine switchboard) (continued)**

| Serial<br><br>(1) | Action<br><br>(2) | Test point<br><br>(3) | Correct result<br>(4) | Action if correct<br>(5) | Action if incorrect<br>(6) |
|---|---|---|---|---|---|
| 9 | Harness DLB21 to power pack junction. Carry out continuity check. | DLB21D to D DLB21E to E | Continuity | Go to 10 | Replace harness |
| 10 | At socket DLB21, carry out voltage check. | DLB21D to suitable earth | 24V | Go to 13 | Go to 11 |
| 11 | Disconnect plug DLB12. Carry out voltage check at harness plug. | DLB12P to suitable earth | 24V | Replace distribution link box | Go to 12 |
| 12 | Harness DLB12 to DP2. Carry out continuity check. | DLB12P to DP2P DLB12M to DP2M | Continuity | Go to 13 | Replace harness |
| 13 | At socket DP2, carry out voltage check. | DP2P to suitable earth | 24V | Go to 15 | Go to 14 |
| 14 | Test distribution panel. Refer to AESP 2350-T-250-522. | N/A | N/A | Go to 15 | Replace or repair distribution panel |
| 15 | Gain access to and remove engine junction box cover. Carry out continuity checks on cables from p p junction to engine junction box. | D to D<br>E to E | Continuity | Go to 16 | Replace or repair defective cables |
| 16 | Unscrew oil pressure switch cap. Carry out continuity checks on cables from engine junction box to oil pressure switch. | D to D<br>E to E | Continuity | Go to 17 | Replace or repair defective cables |
| 17 | Reconnect engine services plug at power pack junction. Disconnect oil pressure switch. Carry out voltage check at feed cable. | D to earth | 24V | Replace oil pressure switch | End of test |

Failure diagnosis from drivers duplicate engine switchboard

67 Table 17 enables a fault in the oil pressure switch to be traced from the drivers duplicate engine switchboard, with reference to Fig 7.

**TABLE 17 OIL PRESSURE SWITCH – FAILURE DIAGNOSIS (duplicate switchboard)**

| Serial (1) | Action (2) | Test point (3) | Correct result (4) | Action if correct (5) | Action if incorrect (6) |
|---|---|---|---|---|---|
| 1 | Disconnect DP2. Carry out voltage check at socket. | DP2M to suitable earth | 24V | Go to 3 | Go to 2 |
| 2 | Test distribution panel. Refer to AESP 2350-T-250-522. | N/A | N/A | Go to 3 | Replace or repair distribution panel |
| 3 | Reconnect DP2, disconnect DLB12. Switch battery master to ON, carry out voltage check at harness plug. | DLB12M to suitable earth | 24V | Go to5 | Go to 5 |
| 4 | Harness DP2 to DLB12, carry out continuity check. | DP2M to DLB12M DP2P to DLB12P | Continuity | Go to 5 | Replace harness |
| 5 | At drivers duplicate switch board socket, carry out resistance check. | K to F | 145Ω (typical) | Go to 6 | Replace engine switchboard |
| 6 | At drivers duplicate switchboard, with engine switch on, carry out continuity check. | A to E | Continuity | Go to 7 | Replace engine switchboard |
| 7 | Carry out continuity check on harness DLB24 to drivers duplicate switchboard. | DLB24A to A<br>DLB24B to B<br>DLB24E to E<br>DLB24F to F<br>DLB24K to K | Continuity | Go to 8 | Replace harness |
| 8 | Reconnect DLB24. Open front access door, remove engine services plug from power pack junction. With engine and battery master switches ON, carry out voltage check. | Harness plug D to suitable earth. | 24V | Go to 10 | Go to 9 |
| 9 | Harness DLB21 to power pack junction. Carry out continuity check. | DLB21D to D<br>DLB21E to E | Continuity | Go to 10 | Replace harness |
| 10 | At socket DLB21, carry out voltage check. | DLB21D to suitable earth | 24V | Go to 12 | Go to 11 |

(continued)

**TABLE 17 OIL PRESSURE SWITCH – FAILURE DIAGNOSIS (duplicate switchboard) (continued)**

| Serial (1) | Action (2) | Test point (3) | Correct result (4) | Action if correct (5) | Action if incorrect (6) |
|---|---|---|---|---|---|
| 11 | Test distribution link box. Refer to AESP 2350-T-250-522. | N/A | N/A | Go to 12 | Replace or repair distribution link box |
| 12 | Harness DLB12 to DP2. Carry out continuity check. | DLB12P to DP2P<br>DLB12M to DP2M | Continuity | Go to 13 | Replace harness |
| 13 | At socket DP2, carry out voltage check. | DP2P to suitable earth | 24V | Go to 15 | Go to 14 |
| 14 | Test distribution panel. Refer to AESP 2350-T-250-522. | N/A | N/A | Go to 15 | Replace or repair distribution panel |
| 15 | Gain access to and remove engine junction box cover. Carry out continuity checks on cables from power pack junction to engine junction box. | D to D<br>E to E | Continuity | Go to 16 | Replace or repair defective cables |
| 16 | Unscrew oil pressure switch cap. Carry out continuity checks on cables from engine junction box to oil pressure switch. | D to D<br>E to E | Continuity | Go to 17 | Replace or repair defective cables |
| 17 | Reconnect engine services plug at power pack junction. Disconnect oil pressure switch. Carry out voltage check at feed cable. | D to earth | 24V | Replace oil pressure switch | End of test |

**GENERATING SYSTEM**

**Removing and refitting Control panels No. 1, Mk 1**

68 Refer to AESP 2350-T-251-522, Chap 5.

**Removing and refitting Alternators No. 1, Mk 1**

69 Refer to AESP 2350-T-251-522, Chap 5.

**Testing general**

70 Refer to AESP 2350-T-251-522, Chap 5, and Figs 1A, 1B, 1C and 1D.

**Controlled dc voltage check**

71 Refer to AESP 2350-T-251-522.

**Adjusting dc controlled voltage**

72 Refer to AESP 2350-T-251-522.

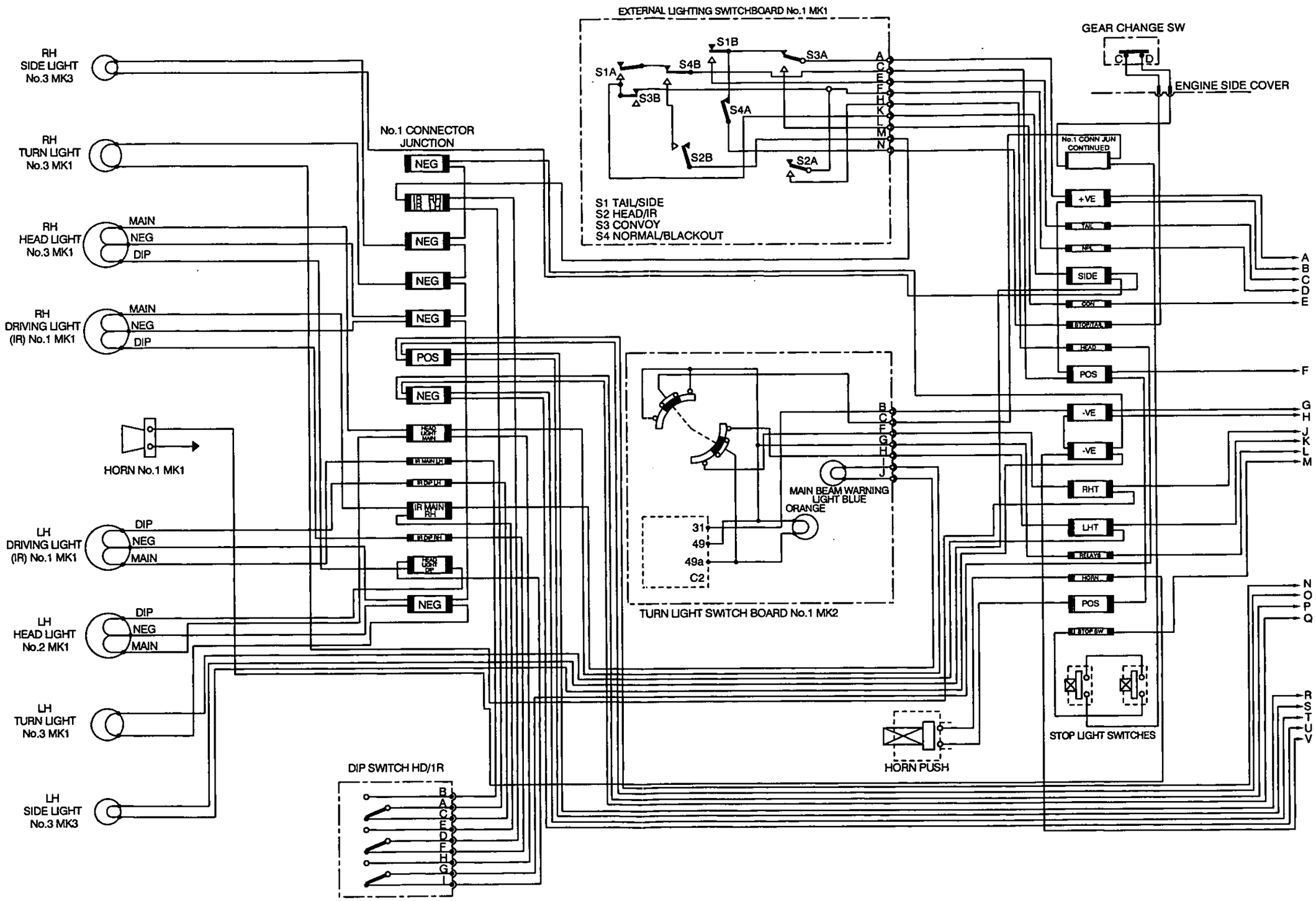


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Fig 6A Lighting and horn circuits (part view)

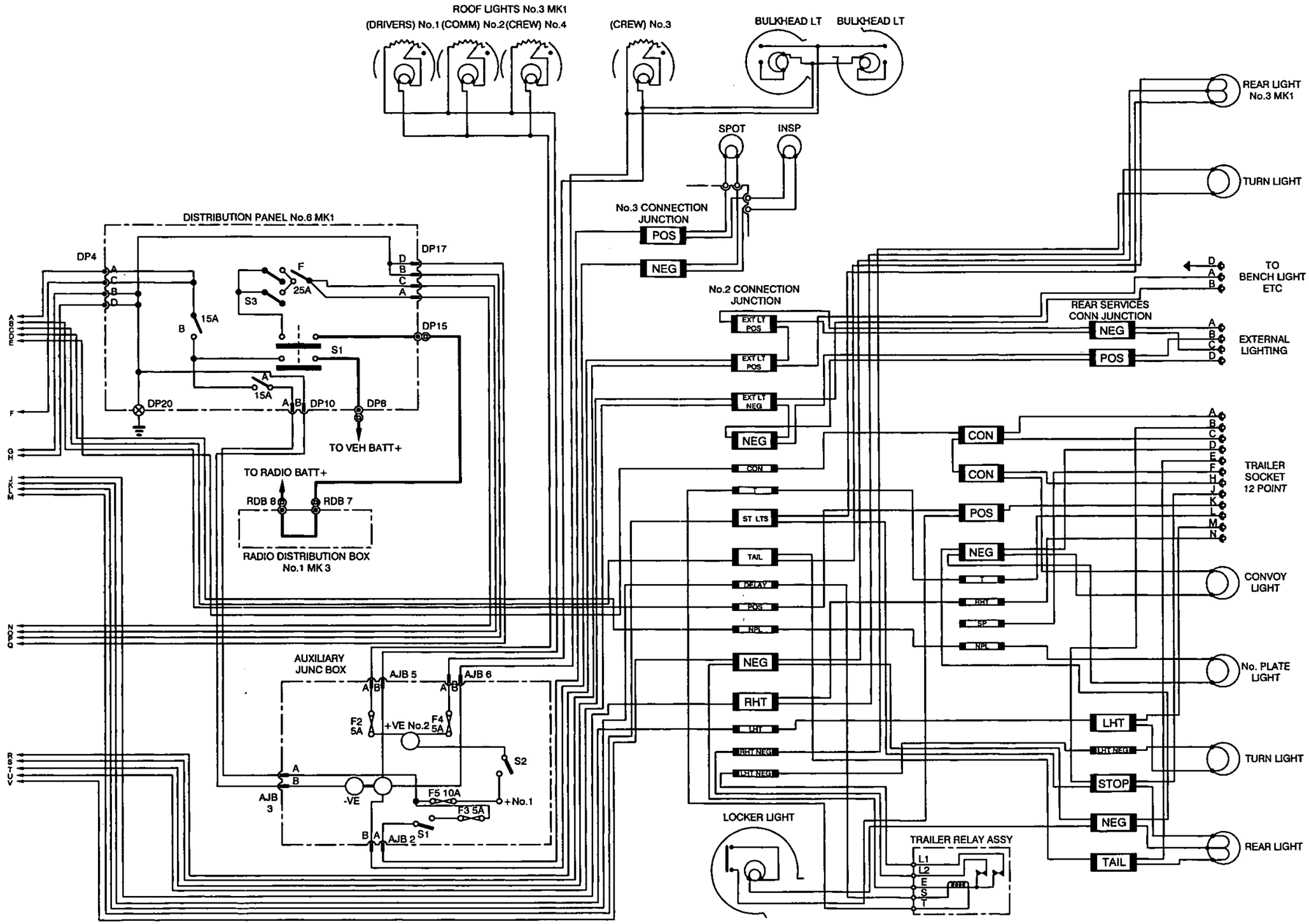


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Fig 6B Lighting and horn circuits (part view)

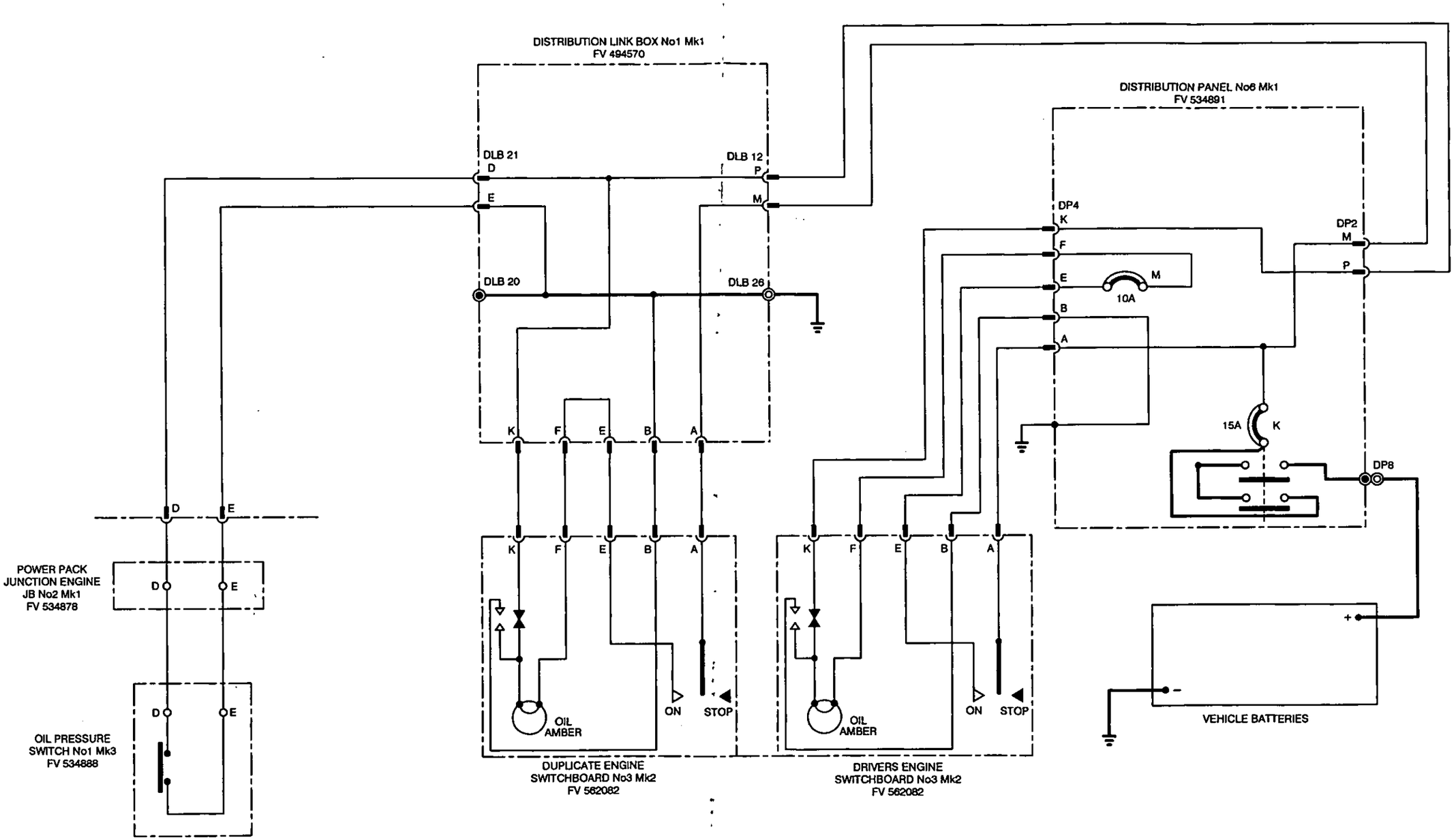


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Fig 7 Oil pressure switch and warning light circuits

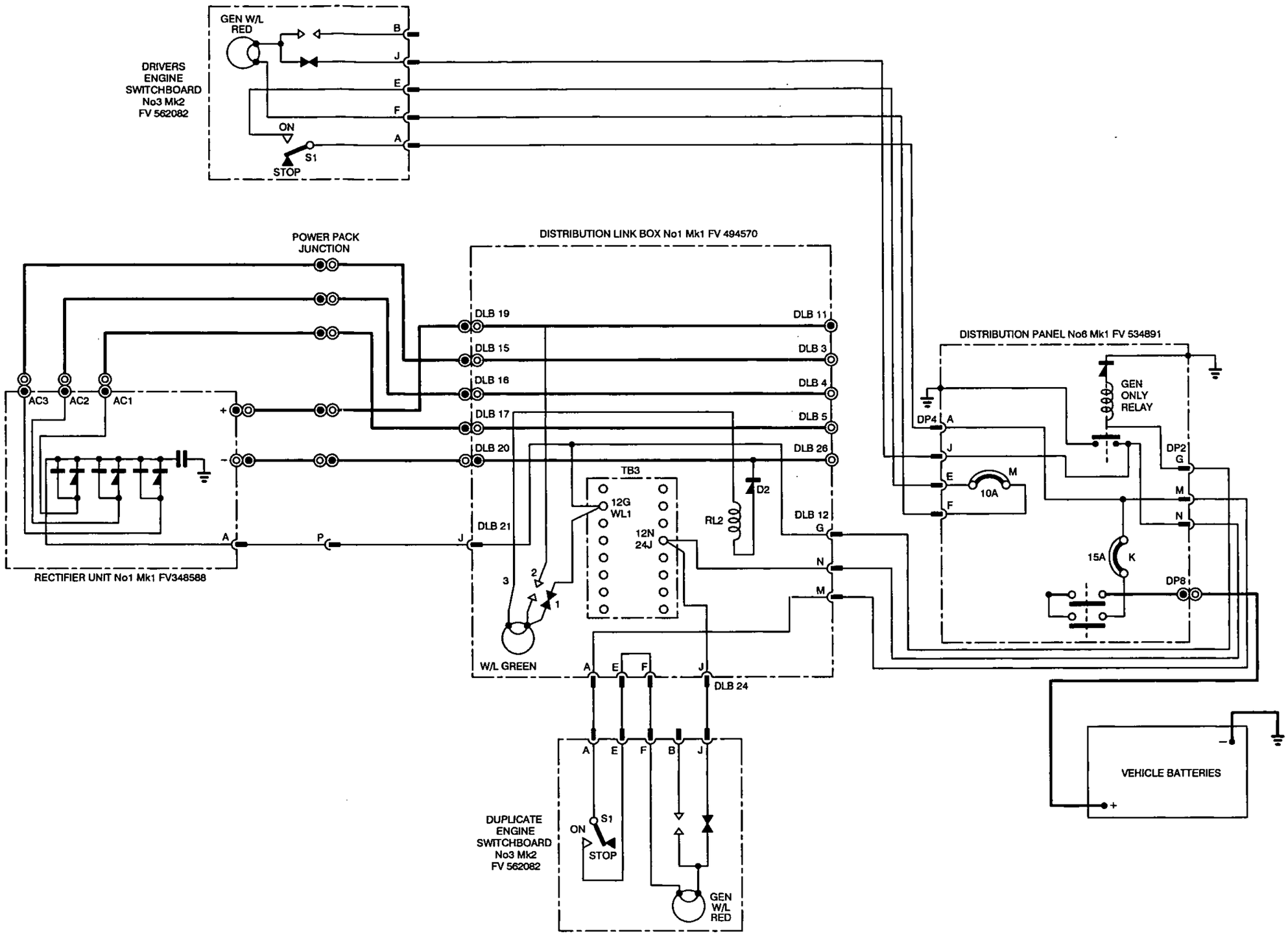


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Fig 8 'Generator only' line and warning light circuits

**Testing 'generator only' line circuit**

73 With the engine speed set to 750 rpm, a voltage of not less than 16V should be indicated on a voltage check between terminals WL1 12G and earth, at TB3 in the distribution link box. If this is not achieved, proceed as detailed in Para 73.

Failure diagnosis

74 Table 18 enables a fault in the generator only line circuit to be traced, with reference to Fig 8.

**TABLE 18 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 | Ensure battery master switch is OFF. Disconnect 12G and 12N from TB3 and dc –ve at power pack junction. Using multimeter, (Table 2, Ser 2), carry out resistance check. | -ve lead to 12G, +ve lead to earth<br>With leads reversed | 160Ω (typical)<br>In excess of 10000Ω | Go to3 | Go to 2 |
| 2 | Test distribution panel. Refer to AESP 2350-T-250-522. | N/A | N/A | Go to 3 | Replace or repair distribution panel |
| 3 | Remove DLB12, using multimeter, (Table 2, Ser 2), carry out resistance checks at harness plug. | -ve lead to G, +ve lead to earth<br>With leads reversed | 270Ω (typical)<br>In excess of 10000Ω | Go to 5 | Go to 4 |
| 4 | Harness DLB12 to DP2, carry out continuity check. | DLB12G to DP2G<br>DLB12M to DP2M<br>DLB12N to DP2N | Continuity | Go to 5 | Replace harness |
| 5 | Test distribution panel. Refer to AESP 2350-T-250-522. | N/A | N/A | Go to 6 | Replace or repair distribution panel |
| 6 | Refit DP2 and DLB12. Carry out continuity check on harness from distribution link box to power pack junction. | DLB15<br>DLB16<br>DLB17 | Continuity | Go to 7 | Replace harness |

(continued)

**TABLE 18 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) |
|---|---|---|---|---|---|
| 7 | Reconnect harness to power pack junction. Remove caps DLB3, 4, 5 and disconnect DLB21. Using multimeter, (Table 2 Ser 2), carry out resistance checks. | +ve lead on DLB21J harness plug, -ve lead on DLB3, 4 and 5 in turn | 40Ω (typical) | Go to 9 | Go to 8 |
| | | With leads reversed | In excess of 10000Ω | | |
| 8 | Test distribution panel. Refer to AESP 2350-T-250-522. | N/A | N/A | Go to 9 | Replace or repair distribution panel |
| 9 | Reconnect DLB21, open distribution link box cover and disconnect TB3 12G. Using multimeter, (Table 2, Ser 2), carry out resistance checks. | +ve lead on 12G harness plug, -ve lead on DLB3, 4 and 5 in turn | 40Ω (typical) | Go to 11 | Go to 10 |
| | | With leads revered | In excess of 10000Ω | | |
| 10 | Wiring from power pack junction to auxiliary rectifiers. Carry out continuity check. | AC1<br>AC2<br>AC3 | Continuity | Go to 11 | Replace or repair defective wiring. |
| 11 | Using multimeter, (Table 2, Ser 2), carry out resistance check on auxiliary rectifiers. | +ve lead on A at socket, -ve lead on: | | End of test | Replace rectifier unit |
| | | AC1<br>AC2<br>AC3 | 40Ω<br>40Ω<br>40Ω (typical) | | |
| | | With leads reversed | In excess of 10000Ω | | |

**TABLE 19 ALTERNATOR FIELD TICKLE CIRCUIT – FAILURE DIAGNOSIS (drivers switchboard) (continued)**

| Serial (1) | Action (2) | Test point (3) | Correct result (4) | Action if correct (5) | Action if incorrect (6) |
|---|---|---|---|---|---|
| 9 | Remove DP2. Using megohmmeter, (Table 2, Ser 1), set to 100Ω range, carry out resistance checks in the distribution link box. | TB4 8J to suitable earth<br>TB4 7J to suitable earth | 0.35Ω (typical)<br>0.35Ω (typical) | Go to 11 | Go to 10. NOTE If Ser 10 and 11 are correct result, go to 12 |
| 10 | Harness DLB13 and DLB14 to power pack junction. Carry out continuity check. | DLB13G to G<br>DLB13F to F<br>DLB14G to G<br>DLB14F to F | Continuity | Go to11 | Replace harness |
| 11 | At power pack junction, sockets for DLB13 and DLB14, carry out resistance check. | DLB13G to DLB13F<br>DLB14G to DLB14F | 0.35Ω | Go to 12. See Note at Ser 9(6) | Go to 13 |
| 12 | Test distribution link box. Refer to AESP 2350-T-250-522. | N/A | N/A | Go to 13 | Replace or repair distribution link box |
| 13 | Remove power pack access plates in drivers compartment and access plate to rear alternator in personnel compartment. Remove harness plugs at alternators, carry out continuity check. | G to G<br>F to F | Continuity | Go to 15 | Go to 14 |
| 14 | At alternator sockets, carry out resistance checks. | G to F | 0.35Ω (typical) | Go to 15 | Replace alternator. Refer to AESP 2350-T-250-522. |
| 15 | Remove DP2. Carry out resistance checks at distribution link box. | TB4 8W to TB4 8J<br>TB4 7W to TB4 7J | 40Ω 40Ω | End of test | Go to 16 |
| 16 | Harness DLB8 and DLB7 to front and rear control panels. Carry out continuity check. | DLB7W to W<br>DLB7J to J<br>DLB8W to W<br>DLB8J to J | Continuity | Replace relevant control panel | Replace harness |

Failure diagnosis from duplicate drivers switchboard

77 Carry out fault finding procedure as detailed in Table 19 and then carry out additional checks as detailed in Para 73.

78 Table 20 enables a fault to be traced in the alternator tickle circuit from the drivers duplicate 8switchboard.

**TABLE 20 ALTERNATOR FIELD TICKLE CIRCUIT – FAILURE DIAGNOSIS (duplicate switchboard)**

| Serial (1) | Action (2) | Test point (3) | Correct result (4) | Action if correct (5) | Action if incorrect (6) |
|---|---|---|---|---|---|
| 1 | Open distribution link box, switch battery master to ON. Carry out voltage checks. | TB3 24A-12M to suitable earth | 24V | Go to 2 | Go to 10 |
| 2 | Disconnect DLB24. Ensure battery master is ON, carry out voltage check. | DLB24A to suitable earth | 24V | Go to 4 | Go to 3 |
| 3 | Test distribution link box. Refer to AESP 2350-T-250-522. | N/A | N/A | Go to 4 | Replace or repair distribution link box |
| 4 | Harness DLB24 to drivers duplicate switchboard. Carry out continuity check. | DLB24A to A<br>DLB24E to E<br>DLB24F to F | Continuity | Go to 5 | Replace harness |
| 5 | At drivers duplicate switchboard, with engine switch ON, carry out continuity checks. | E to A<br>D to F | Continuity | Go to 6 | Replace duplicate engine switchboard |
| 6 | Disconnect drivers engine switchboard. Switch battery master and duplicate engine switch to ON. Carry out voltage check. | Pin D at harness plug to suitable earth. | 24V | Go to 8 | Go to7 |
| 7 | Harness DP4 to drivers engine switchboard. Carry out continuity check. | DP4E to E<br>DP4F to F<br>DP4A to A | Continuity | Go to 8 | Replace harness |
| 8 | Disconnect DP4, switch battery master and duplicate engine switches to ON. Carry out voltage check. | DP4F at harness plug to suitable earth | 24V | End of test | Go to 9 |
| 9 | Test distribution panel. Refer to AESP 2350-T-250-522. | N/A | N/A | End of test | Replace or repair distribution panel (continued) |

**CONNECTOR, ANALOGUE, No. 1, Mk 1 (FV342526)**

79 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, tropical and arctic. The tropical thermostat has normally open contacts which close at a temperature above 120 ± 5 deg F (49 ± 2.8 deg C) with a 9 deg F (5 deg C) differential. The arctic thermostat has normally closed contacts opening at a temperature above 105 ± 5 deg F (41 ± 2.8 deg C) with a 9 deg F (5 deg C) differential. Only the tropical thermostat is connected on this vehicle in the normal role. When the contacts close, at temperatures above 120 ± 5 deg F (49 ± 2.8 deg C), the positive dc supply is applied to the input resistance chain in the base circuit of TR1 in the control panel; this causes a drop in the regulated voltage from 28.5V to 27.5V dc due to a lower collector current flowing at TR2. If the analogue is suspected of faulty operation, i.e. overcharging of batteries in a tropical climate, check circuit breakers K and L on distribution panel, reset if tripped. If fault persists, refer to Para 81

**Testing the connector analogue circuit**

Failure diagnosis

80 Table 21 enables a fault in the connector analogue circuit to be traced, from both the drivers and duplicate drivers switchboard, with reference to Fig 10.

**TABLE 21 CONNECTOR 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 battery master and engine switches to ON. Carry out voltage check. | DLB9A to suitable earth | 24V | Go to 2 | Go to 3 |
| 2 | At harness plug DLB9, carry out continuity check. | DLB9A to DLB9C | If temp below 120 ± 5 deg F Open circuit If temp above 120 ± 5 deg F Continuity | Go to 3 | Replace analogue unit |
| 3 | Disconnect DP8. Carry out voltage check at harness plug. | DP8 | 24V | Go to 4 | Check battery connections |
| 4 | Reconnect DP8 and disconnect DLB12. Ensure battery master and drivers engine switch are ON and carry out voltage check. | DLB12F to suitable earth | 24V | Go to 5 | Go to 6 |
| 5 | Switch drivers engine switch to OFF. Carry out voltage check. | DLB12M to suitable earth | 24V | Go to 7 | Go to 6 |
| 6 | Disconnect DP2. Carry out continuity check on harnessDP2 to DLB12. | DP2M to DLB12M DP2F to DLB12F | Continuity | Go to 7 | Replace harness |

(continued)

**TABLE 21 CONNECTOR ANALOGUE CIRCUIT – FAILURE DIAGNOSIS (continued)**

| Serial (1) | Action (2) | Test point (3) | Correct result (4) | Action if correct (5) | Action if incorrect (6) |
|---|---|---|---|---|---|
| 7 | Ensure battery master is ON. Carry out voltage check. | DP2M to suitable earth | 24V | Go to 9 | Go to 8 |
| 8 | Test distribution panel. Refer to AESP 2350-T-250-522. | N/A | N/A | Go to 9 | Replace or repair distribution panel |
| 9 | Switch battery master and engine switch ON. Carry out voltage check. | DP2F and suitable earth | 24V | Go to 13 | Go to 10 |
| 10 | Harness DP4 to drivers engine switchboard. Carry out continuity check. | DP4A to A DP4C to C | Continuity | Go to 11 | Replace harness |
| 11 | Drivers engine switchboard. Ensure engine switch is ON. Carry out continuity check. | A to C | Continuity | Go to 12 | Replace switchboard |
| 12 | Test distribution panel. Refer to AESP 2350-T-250-522. | N/A | N/A | Go to 13 | Replace or repair distribution panel |
| 13 | Reconnect DLB12, DP2, DP4 and drivers switchboard. Disconnect DLB24. Switch battery master to ON. Carry out voltage check. | DLB24A to suitable earth | 24V | Reconnect DLB24, go to 15 | Go to 14 |
| 14 | Test distribution link box. Refer to AESP 2350-T-250-522. | N/A | N/A | Go to 15 | Replace or repair distribution link box |
| 15 | Disconnect harness from duplicate engine switchboard. Set engine switch to ON. Carry out continuity check. | A to C | Continuity | Go to 16 | Replace switchboard |
| 16 | Harness DLB24 to duplicate engine switchboard. Carry out continuity check. | DLB24A to A DLB24C to C | Continuity | Go to 17 | Replace harness |
| 17 | Disconnect DLB2, switch battery master and engine switches to ON. Carry out voltage check. | DLB2G to suitable earth | 24V | Go to 18 | Go to 19 |

(continued)

**TABLE 21 CONNECTOR ANALOGUE CIRCUIT – FAILURE DIAGNOSIS (continued)**

| Serial<br>(1) | Action<br>(2) | Test point<br>(3) | Correct result<br>(4) | Action if correct<br>(5) | Action if incorrect<br>(6) |
|---|---|---|---|---|---|
| 18 | Reconnect DLB2, disconnect DLB1. Carry out voltage check. | DLB1H to suitable earth | 24V | Go to 20 | Go to 19 |
| 19 | Test distribution link box. Refer to AESP 2350-T-250-522. | N/A | N/A | Go to 20 | Replace or repair distribution link box |
| 20 | Disconnect DLB8 and DLB9. Carry out continuity check. | DLB8A to DLB9C | Continuity | Go to 22 | Go to 21 |
| 21 | Test distribution link box. Refer to AESP 2350-T-250-522. | N/A | N/A | Go to 22 | Replace or repair distribution link box |
| 22 | Harness DLB8 to rear control panel. Carry continuity check. | DLB8A to A<br>DLB8B to B<br>DLB8X to X | Continuity | Go to 23 | Replace harness |
| 23 | Rear control panel. Using multimeter, (Table 2, Ser 2), carry out resistance check. | +ve lead to X, -ve lead to B<br>With leads reversed | 1700Ω<br>In excess of 10000Ω | Go to 25 | Replace rear control panel |
| 24 | Rear control panel. Using multimeter, (Table 2, Ser 2), carry out resistance check. | +ve lead to X, -ve lead to A<br>With leads reversed | 1600Ω<br>In excess of 10000Ω | Go to 25 | Replace rear control panel |
| 25 | Disconnect DLB9 and DLB7. Carry out continuity check. | DLB7A to DLB9C | Continuity | Got to 27 | Go to 26 |
| 26 | Test distribution link box. Refer to AESP 2350-T-250-522. | N/A | N/A | Go to 27 | Replace or repair distribution link box |
| 27 | Harness DLB2 to DLB1. Carry out continuity check. | DLB1A to DLB2A<br>DLB1C to DLB2C | Continuity | Go to 28 | Replace harness |
| 28 | Harness DLB7 to front control panel. Carry out continuity check. | DLB7A to A<br>DLB7B to B<br>DLB7X to X | Continuity | Go to 29 | Replace harness |

(continued)

**TABLE 21 CONNECTOR ANALOGUE CIRCUIT – FAILURE DIAGNOSIS (continued)**

| Serial<br>(1) | Action<br>(2) | Test point<br>(3) | Correct result<br>(4) | Action if correct<br>(5) | Action if incorrect<br>(6) |
|---|---|---|---|---|---|
| 29 | Front control panel. Using multimeter, (Table 2, Ser 2), carry out resistance check. | +ve lead to X, -ve lead to B<br>With leads reversed | 1700Ω<br>In excess of 10000Ω | Go to 29 | Replace rear control panel |
| 30 | Front control panel. Using multimeter, (Table 2, Ser 2), carry out resistance check. | +ve lead to X, -ve lead to A<br>With leads reversed | 1600Ω<br>In excess of 10000Ω | End of test | Replace rear control panel |

**TABLE 22 ENGINE TEMPERATURE INDICATING CIRCUIT – FAILURE DIAGNOSIS (engine switchboard) (continued)**

| Serial<br>(1) | Action<br>(2) | Test point<br>(3) | Correct result<br>(4) | Action if correct<br>(5) | Action if incorrect<br>(6) |
|---|---|---|---|---|---|
| 5 | Switch battery master to OFF. Harness DP4 to drivers engine switchboard. Carry out continuity check. | DP4A to A<br>DP4E to E<br>DP4C to C<br>DP4F to F | Continuity | Go to 6 | Replace harness |
| 6 | At engine switchboard, ensure engine switch is ON. Carry out continuity check. | A to C<br>A to E<br>D to F | Continuity | Go to 7 | Replace engine switchboard |
| 7 | Refit DP4 and remove harness plug IP1. Switch engine and battery master switches to ON. Carry out voltage check. | IP1A to suitable earth | 24V | Go to 9 | Go to 8 |
| 8 | Switch battery master to OFF. Harness IP1 to DP3, carry out continuity check. | IP1A to DP3A<br>IP1B to DP3B | Continuity | Go to 9 | Replace harness |
| 9 | Switch battery master to ON. At socket DP3, carry out voltage check. | DP3A to suitable earth. | 24V | Go to 11 | Go to 10 |
| 10 | Test distribution panel. Refer to AESP 2350-T-250-522. | N/A | N/A | Go to 11 | Replace or repair distribution panel |
| 11 | Switch battery master and engine switches to OFF. Turn instrument dimmer fully anti-clockwise. Disconnect IP2, carry out resistance check to IP1. | IP1A to IP2B<br>IP1A to IP1C | 450Ω<br>700Ω<br>(typical) | Go to 12 | Replace engine coolant gauge |
| 12 | At harness plug IP1, carry out resistance check. | IP1C to suitable earth | 100Ω<br>(typical) | Go to 14 | Go to 13 |
| 13 | Harness IP1 to DP3, carry out continuity check. | IP1A to DP3A<br>IP1B to DP3B | Continuity | Go to 14 | Replace harness |
| 14 | Reconnect IP1 and IP2. Disconnect DP2. Carry out continuity check. | DP3C to DP2C | Continuity | Go to 16 | Go to 15 |
| 15 | Test distribution panel. Refer to AESP 2350-T-250-522. | N/A | N/A | Go to 16 | Replace or repair distribution panel |

(continued)

**TABLE 22 ENGINE TEMPERATURE INDICATING CIRCUIT – FAILURE DIAGNOSIS (engine switchboard) (continued)**

| Serial (1) | Action (2) | Test point (3) | Correct result (4) | Action if correct (5) | Action if incorrect (6) |
|---|---|---|---|---|---|
| 16 | Reconnect DP3. Harness DP2 to DLB12, carry out continuity check. | DP2C to DLB12C<br>DP2F to DLB12F<br>DP2M to DP2M | Continuity | Go to 17 | Replace harness |
| 17 | Reconnect DP2, disconnect DLB21. Carry out continuity check. | DLB12C to DLB21C | Continuity | Go to 19 | Go to 18 |
| 18 | Test distribution link box. Refer to AESP 2350-T-250-522. | N/A | N/A | Go to 19 | Replace or repair distribution link box |
| 19 | Reconnect DLB12. Harness DLB21 to engine services harness plug, carry out continuity check. | DLB21E to E<br>DLB21C to C | Continuity | Go to 20 | Replace harness |
| 20 | Reconnect DLB21. Switch battery master and engine switches to ON, carry out voltage check at engine services harness plug. | Pin C to suitable earth | 10V | Go to 22 | Go to 21 |
| 21 | Test distribution link box. Refer to AESP 2350-T-250-522. | N/A | N/A | Go to 22 | Replace or repair distribution link box |
| 22 | Switch battery master and engine switches to OFF. Carry out resistance check at power pack junction. | C to E | 100Ω (typical) | End of test | Go to 23 |
| 23 | Remove power pack access plates in drivers compartment and remove cover from engine junction box. Carry out continuity check from harness power pack junction to engine junction box. | C to C<br>E to E | Continuity | Go to 24 | Replace harness |
| 24 | At harness, engine junction box to coolant temperature bulb, carry out continuity check. | C to C<br>E3 to E3 | Continuity | Go to 25 | Replace harness |
| 25 | At thermometer bulb, carry out resistance check. | C to E3 | 100Ω (with cold engine) | End of test | Replace thermometer bulb |

Failure diagnosis from drivers duplicate engine switchboard

88 Table 23 enables a fault to be traced in the engine temperature indicating circuit, from the drivers duplicate engine switchboard, with reference to Fig 10.

**TABLE 23 ENGINE TEMPERATURE INDICATING CIRCUIT – FAILURE DIAGNOSIS (duplicate switchboard)**

| Serial (1) | Action (2) | Test point (3) | Correct result (4) | Action if correct (5) | Action if incorrect (6) |
|---|---|---|---|---|---|
| 1 | Disconnect DLB12, switch battery master ON. Carry out voltage check. | DLB12M to suitable earth | 24V | Go to 3 | Go to 2 |
| 2 | Disconnect DP2, carry out continuity check on harness DP2 to DLB12. | DLB12C to DP2C<br>DLB12F to DP2F<br>DLB12M to DP2M | Continuity | Go to 3 | Replace harness |
| 3 | Ensure battery master ON, carry out voltage check. | DP2M to suitable earth | 24V | Go to 6 | Go to 4 |
| 4 | Switch battery master to OFF. Disconnect DP8. Carry out voltage check. | DP8 to suitable earth | 24V | Go to 5 | Check harness DP8 and vehicle battery B1 |
| 5 | Test distribution panel. Refer to AESP 2350-T-250-522. | N/A | N/A | Go to 6 | Replace or repair distribution panel |
| 6 | Disconnect DLB24, carry out continuity check. | DLB24F to DLB24E | Continuity | Go to 9 | Go to 7 |
| 7 | Switch battery master to ON. Carry out voltage check. | DLB24A to suitable earth | 24V | Got to 9 | Go to 8 |
| 8 | Test distribution link box. Refer to AESP 2350-T-250-522. | N/A | N/A | Go to 9 | Replace or repair distribution link box |
| 9 | Harness DLB24 to duplicate engine switchboard. Carry out continuity check. | DLB24A to A<br>DLB24C to C<br>DLB24E to E<br>DLB24F to F | Continuity | Go to 9 | Replace harness |
| 10 | At drivers duplicate engine switchboard, carry out continuity check:<br>With engine switch ON<br><br>With engine switch OFF | <br><br>A to C<br>E to A<br><br>D to F | Continuity | Go to 11 | Replace duplicate switchboard |

(continued)

**TABLE 23 ENGINE TEMPERATURE INDICATING CIRCUIT – FAILURE DIAGNOSIS (duplicate switchboard) (continued)**

| Serial (1) | Action (2) | Test point (3) | Correct result (4) | Action if correct (5) | Action if incorrect (6) |
|---|---|---|---|---|---|
| 11 | Engine switchboard to duplicate engine switchboard harness. Carry out continuity check. | D to D | Continuity | Go to 12 | Check continuity through No. 1 connector junction. Replace if defective |
| 12 | Reconnect duplicate engine switchboard and DLB24. Lower instrument panel and disconnect IP1. Switch battery master and duplicate engine switch ON. Carry out voltage check. | IP1A to suitable earth | 24V | Go to 16 | Go to 13 |
| 13 | Switch battery master and duplicate engine switches OFF. Carry out continuity check on harness IP1 to DP3. | IP1A to DP3A<br>IP1B to DP3B<br>IP1C to DP3C | Continuity | Go to 14 | Replace harness |
| 14 | Switch battery master and duplicate engine switches to ON. Carry out voltage check. | DP3A to suitable earth | 24V | Go to 16 | Go to 15 |
| 15 | Test distribution panel. Refer to AESP 2350-T-250-522. | N/A | N/A | Go to 16 | Replace or repair distribution panel |
| 16 | Switch battery master and duplicate engine switch OFF. Turn instrument dimmer fully anti-clockwise. Disconnect IP2, carry out resistance check. | IP1A to IP2B IP1A to IP1C | 450Ω 700Ω (typical) | Go to 17 | Replace coolant temperature gauge |
| 17 | At IP1 harness plug, carry out resistance check. | IP1C to suitable earth | 100Ω (typical) | Go to 19 | Go to 18 |
| 18 | Carry out continuity check on harness IP1 to DP3. | IP1A to DP3A<br>IP1B to DP3B<br>IP1C to DP3C | Continuity | Go to 19 | Replace harness |
| 19 | Reconnect IP1 and IP2, disconnect DP2. Carry out continuity check. | DP3C to DP2C | Continuity | Go to 21 | Go to 20 |

(continued)

**TABLE 23 ENGINE TEMPERATURE INDICATING CIRCUIT – FAILURE DIAGNOSIS (duplicate switchboard) (continued)**

| Serial (1) | Action (2) | Test point (3) | Correct result (4) | Action if correct (5) | Action if incorrect (6) |
|---|---|---|---|---|---|
| 20 | Test distribution panel. Refer to AESP 2350-T-250-522. | N/A | N/A | Go to 21 | Replace or repair distribution panel |
| 21 | Harness DP2 to DLB12, carry out continuity check. | DP2C to DLB12C DP2F to DLB12F DP2M to DLB12M | Continuity | Go to 22 | Replace harness |
| 22 | Reconnect DP2, disconnect DLB21. Carry out continuity check. | DLB12C to DLB21C | Continuity | Go to 24 | Go to 22 |
| 23 | Test distribution link box. Refer to AESP 2350-T-250-522. | N/A | N/A | Go to 24 | Replace or repair distribution link box |
| 24 | Reconnect DLB21. Switch battery master and engine switches to ON, carry out voltage check at engine services harness plug. | Pin C to suitable earth | 10V | Go to 26 | Go to 25 |
| 25 | Test distribution link box. Refer to AESP 2350-T-250-522. | N/A | N/A | Go to 26 | Replace or repair distribution link box |
| 26 | Switch battery master and engine switches to OFF. Carry out resistance check at power pack junction. | C to E | 100Ω (typical) | End of test | Go to 27 |
| 27 | Remove power pack access plates in drivers compartment and remove cover from engine junction box. Carry out continuity check from harness power pack junction to engine junction box. | C to C<br>E to E | Continuity | Go to 28 | Replace harness |
| 28 | At harness, engine junction box to coolant temperature bulb, carry out continuity check. | C to C<br>E3 to E3 | Continuity | Go to 29 | Replace harness |
| 29 | At thermometer bulb, carry out resistance check. | C to E3 | 100Ω (typical, with cold engine) | End of test | Replace thermometer bulb |

**Testing gearbox temperature indicating circuit**

89 Switch battery master to OFF. Check circuit breakers K, L and M at distribution panel, reset if required.

Testing using drivers engine switchboard

90 Table 24 enables a fault to be traced in the gearbox temperature indicating circuit, from the drivers engine switchboard, with reference to Fig 11.

**TABLE 24 GEARBOX TEMPERATURE INDICATING CIRCUIT – FAILURE DIAGNOSIS (drivers switchboard)**

| Serial (1) | Action (2) | Test point (3) | Correct result (4) | Action if correct (5) | Action if incorrect (6) |
|---|---|---|---|---|---|
| 1 | Disconnect DP4, switch battery master to ON. Carry out voltage check. | DP4A socket to suitable earth | 24V | Go to 4 | Go to 2 |
| 2 | Disconnect DP8, carry out voltage check. | DP8 to earth | 24V | Go to 3 | Check batteries and harness DP8 |
| 3 | Test distribution panel. Refer to AESP 2350-T-250-522. | N/A | N/A | Go to 4 | Replace or repair distribution panel |
| 4 | Reconnect DP4, disconnect harness at drivers engine switchboard. Switch battery master to ON. Carry out voltage check. | Pin A at harness plug to suitable earth | 24V | Go to 6 | Go to 5 |
| 5 | Switch battery master to OFF. Harness DP4 to drivers engine switchboard. Carry out continuity check. | DP4A to A<br>DP4E to E<br>DP4C to C<br>DP4F to F | Continuity | Go to 6 | Replace harness |
| 6 | At engine switchboard, ensure engine switch is ON. Carry out continuity check. | A to C<br>A to E<br>D to F | Continuity | Go to 7 | Replace engine switchboard |
| 7 | Refit DP4 and remove harness plug IP1. Switch engine and battery master switches to ON. Carry out voltage check. | IP1A to suitable earth | 24V | Go to 9 | Go to 8 |
| 8 | Switch battery master to OFF. Harness IP1 to DP3, carry out continuity check. | IP1A to DP3A<br>IP1B to DP3B | Continuity | Go to 9 | Replace harness |
| 9 | Switch battery master to ON. At socket DP3, carry out voltage check. | DP3A to suitable earth | 24V | Go to 11 | Go to 10 |

(continued)

**TABLE 24 GEARBOX TEMPERATURE INDICATING CIRCUIT – FAILURE DIAGNOSIS (drivers switchboard) (continued)**

| Serial (1) | Action (2) | Test point (3) | Correct result (4) | Action if correct (5) | Action if incorrect (6) |
|---|---|---|---|---|---|
| 10 | Test distribution panel. Refer to AESP 2350-T-250-522. | N/A | N/A | Go to 11 | Replace or repair distribution panel |
| 11 | Switch battery master and engine switches to OFF. Turn instrument dimmer fully anti-clockwise. Disconnect IP2, carry out resistance check to IP1. | IP1A to IP2B<br>IP1A to IP1C | 450Ω<br>700Ω<br>(typical) | Go to 12 | Replace gearbox temperature gauge |
| 12 | At temperature unit harness IP2, carry out resistance check. | IP2A to IP2B | 100Ω (typical) with gearbox cold | Go to 14 | Go to 13 |
| 13 | Remove engine services socket, carry out resistance check. | B to T | 100Ω | Go to 14 | Go to 15 |
| 14 | Harness, engine services socket to IP2. Carry out continuity check. | IP2A to T<br>IP2B to B | Continuity | Go to 15 | Replace harness |
| 15 | Remove access plates in drivers compartment. Carry out continuity check on wiring from engine services socket to thermometer bulb. | T to T<br>B to B | Continuity | Go to 16 | Replace defective wiring |
| 16 | At thermometer bulb, carry out resistance check. | T to B | 100Ω (typical) | End of test | Replace gearbox temperature bulb |

Testing using duplicate drivers engine switchboard

91 Table 25 enables a fault in the gearbox temperature indicating circuit, to be traced from the drivers duplicate engine switchboard, with reference to Fig 11.

**TABLE 25 GEARBOX TEMPERATURE INDICATING CIRCUIT – FAILURE DIAGNOSIS (duplicate switchboard)**

| Serial (1) | Action (2) | Test point (3) | Correct result (4) | Action if correct (5) | Action if incorrect (6) |
|---|---|---|---|---|---|
| 1 | Disconnect DLB12, switch battery master ON. Carry out voltage check. | DLB12M to suitable earth | 24V | Go to 3 | Go to 2 |
| 2 | Disconnect DP2, carry out continuity check on harness DP2 to DLB12. | DLB12C to DP2C<br>DLB12F to DP2F<br>DLB12M to DP2M | Continuity | Go to 3 | Replace harness |
| 3 | Ensure battery master ON, carry out voltage check. | DP2M to suitable earth | 24V | Go to 6 | Go to 4 |
| 4 | Switch battery master to OFF. Disconnect DP8. Carry out voltage check. | DP8 to suitable earth | 24V | Go to 5 | Check harness DP8 and vehicle battery B1 |
| 5 | Test distribution panel. Refer to AESP 2350-T-250-522. | N/A | N/A | Go to 6 | Replace or repair distribution panel |
| 6 | Disconnect DLB24, carry out continuity check. | DLB24F to DLB24E | Continuity | Go to 9 | Go to 7 |
| 7 | Switch battery master to ON. Carry out voltage check. | DLB24A to suitable earth | 24V | Got to 9 | Go to 8 |
| 8 | Test distribution link box. Refer to AESP 2350-T-250-522. | N/A | N/A | Go to 9 | Replace or repair distribution link box |
| 9 | Harness DLB24 to duplicate engine switchboard. Carry out continuity check. | DLB24A to A<br>DLB24C to C<br>DLB24E to E<br>DLB24F to F | Continuity | Go to 9 | Replace harness |
| 10 | At drivers duplicate engine switchboard, carry out continuity check:<br>With engine switch ON<br><br>With engine switch OFF | <br><br>A to C<br>E to A<br><br>D to F | Continuity | Go to 11 | Replace duplicate switchboard |

(continued)

**TABLE 25 GEARBOX TEMPERATURE INDICATING CIRCUIT – FAILURE DIAGNOSIS (duplicate switchboard) (continued)**

| Serial<br>(1) | Action<br>(2) | Test point<br>(3) | Correct result<br>(4) | Action if correct<br>(5) | Action if incorrect<br>(6) |
|---|---|---|---|---|---|
| 11 | Engine switchboard to duplicate engine switchboard harness. Carry out continuity check | D to D | Continuity | Go to 12 | Check continuity through No. 1 connector junction. Replace if defective |
| 12 | Reconnect duplicate engine switchboard and DLB24. Lower instrument panel and disconnect IP1. Switch battery master and duplicate engine switch ON. Carry out voltage check. | IP1A to suitable earth | 24V | Go to 16 | Go to 13 |
| 13 | Switch battery master and duplicate engine switches OFF. Carry out continuity check on harness IP1 to DP3. | IP1A to DP3A<br>IP1B to DP3B<br>IP1C to DP3C | Continuity | Go to 14 | Replace harness |
| 14 | Switch battery master and duplicate engine switches to ON. Carry out voltage check. | DP3A to suitable earth | 24V | Go to 16 | Go to 15 |
| 15 | Test distribution panel. Refer to AESP 2350-T-250-522. | N/A | N/A | Go to 16 | Replace or repair distribution panel |
| 16 | Switch battery master and engine switches to OFF. Turn instrument dimmer fully anti-clockwise. Disconnect IP2, carry out resistance check to IP1. | IP1A to IP2B<br>IP1A to IP1C | 450Ω<br>700Ω<br>(typical) | Go to 17 | Replace gearbox temperature gauge |
| 17 | At temperature unit harness IP2, carry out resistance check. | IP2A to IP2B | 100Ω (typical) with gearbox cold | Go to 19 | Go to 18 |
| 18 | Remove engine services socket, carry out resistance check. | B to T | 100Ω | Go to 19 | Go to 20 |
| 19 | Harness, engine services socket to IP2. Carry out continuity check. | IP2A to T<br>IP2B to B | Continuity | Go to 20 | Replace harness |

(continued)

**TABLE 25 GEARBOX TEMPERATURE INDICATING CIRCUIT – FAILURE DIAGNOSIS (duplicate switchboard) (continued)**

| Serial (1) | Action (2) | Test point (3) | Correct result (4) | Action if correct (5) | Action if incorrect (6) |
|---|---|---|---|---|---|
| 20 | Remove access plates in drivers compartment. Carry out continuity check on wiring from engine services socket to thermometer bulb. | T to T<br>B to B | Continuity | Go to 21 | Replace defective wiring |
| 21 | At thermometer bulb, carry out resistance check. | T to B | 100Ω (typical) | End of test | Replace gearbox temperature bulb |

**GEAR INTERLOCK SWITCH (FV585553)**

**Removing and refitting**

92 Refer to AESP 2350-T-251-522.

**Testing**

93 Refer to AESP 2350-T-251-522.

**PERISCOPE WIPER MOTOR UNIT (FV462413)**

**Removing and refitting**

94 Refer to AESP 2350-T-251-522.

**Testing on vehicle**

95 Refer to AESP 2350-T-251-522.

**REV/MIN SENDER UNIT AND TACHOMETER (FV494578)**

**Removing and refitting sender unit. No. 1, Mk 1, (FV151034)**

96 Refer to AESP 2350-T-251-522.

**Testing the circuit**

97 Refer to AESP 2350-T-251-522.

**BATTERY LIFTING TOOL**

98 To facilitate removing and refitting batteries, a special tool may be manufactured locally. For manufacturing details see AESP 2350-T-251-522.

## CHAPTER 6

## HYDRAULIC CRANE

## CONTENTS

Para



(continued)

CONTENTS (continued)



## GENERAL

### 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) | Drawing No (2) | Designation (3) |
|---|---|---|
| 1 | REME 002000 | Puller - pump thrust plate |
| 2 | REME 002002 | Spanner pump driving dog |

## FUNCTION AND LOCATION OF COMPONENTS

### Crane and reservoir

2 The Hiab Model 61 hydraulically operated crane, with a two-piece hinged jib and a reservoir integral with the base, is fitted to the right hand side of the vehicle hull. The layout of the crane and associated hydraulic system is shown in Fig 1 and a schematic diagram of the hydraulic system is shown in Fig 2. Both are for reference only.

### Hydraulic pump

3 A Plessey C2.X gear type pump is mounted on the transfer gearbox case at the rear of the engine.

### Filter

4 The filter is mounted on the crew compartment bulkhead, between the reservoir and pump. A shut off valve enables the filter element to be changed without draining the reservoir.

### Main control valve and manifold block assembly

5 A conventional pattern three-spool control valve, directs fluid to the inner and outer boom cylinders and the slewing cylinders. The manifold block on top of the control valve contains relief valves, which limit the pressure in the crane operating circuit and the lockout cylinder circuit.

NOTE

The original Main Control Valve (MCV) (FV649488) is no longer supported by spares, thus on failure it is replaced by the introduction of a new MCV (FV847574). This MCV will be replaced on Base overhaul with the new type of hydraulic control. It is acceptable for the old pattern crane hydraulic control to be replaced on failure at field level.

**Pilot operated check valves**

6 Four pilot operated check valves, bolted to the exterior of the manifold block prevent creep of the lift or slewing rams whilst under load. Return flow through the valve is only possible when pilot pressure is applied to unseat the check valve. This pilot pressure is applied automatically during initial movement of the control valve spool to the lower or slewing position.

**Reflux valves** FLOW CONTROL

7 The reflux valves control the speed or operation of the crane by allowing free flow of fluid into the rams but restricting the flow from the rams. They are located as follows:

7.1 The valves controlling the speed of the outer and inner boom rams are fitted to the outer right hand edge of the hull roof, adjacent to the rear of the main control valve assembly. The valves are fitted with the tapered end towards the junction box.

7.2 The valves controlling the slewing rams are fitted forward of the control valve assembly, adjacent to the king post. The valves are fitted with the tapered end upward.

NOTE

Original reflux valves are replaced upon failure by new pattern valves. Old pattern valves are no longer available nor spares to effect repairs. New valves MUST only be fitted as a vehicle set. (AESP 2350-T-252-811 Modification Instr No 1 (EMER TV 107/4 Instr No 22 refers))

**Hose failure valves**

8 Check valves fitted to each boom ram prevent sudden descent of the load in the event of hose failure. Back pressure from the restrictor in the reflux valves keeps the check valves open during normal functioning of the crane, but should a hose burst, the release of back pressure causes pressure generated by weight of load on ram to close valve and prevent descent of ram.

**Lock out cylinder control valve** Type 1 only

9 The lockout cylinder control valve is bolted to the rear end of the manifold block. A three way rotary valve controls the operation of the lockout cylinders.

**Accumulator**

10 The accumulator is a 10 cubic in. bag type. It is connected into the lockout cylinder circuit between the cylinder and the rotary valve, and is bolted to the armoured cover end of the right hand slewing ram. It is charged with air to 70 kg/cm$^2$ (1000 lbf/in.$^2$) and maintains pressure in the lockout cylinders when they are shut off from the pump delivery

**Lockout cylinders**

11 Four lockout cylinders are fitted to the suspension and are located on each of the outer axle assemblies. They operate as normal suspension dampers whilst the vehicle is travelling, but on introduction of the external pressurized supply, the cylinders are locked rigid to permit crane operation without the vehicle tilting.

## FAILURE DIAGNOSIS

### All modes failure

12 Table 2 enables an all modes failure of the crane hydraulics to be identified. It is assumed that the engine is running at 1000 to 1200 rev/min.

**TABLE 2 ALL MODES FAILURE – FAILURE DIAGNOSIS**

| Serial (1) | Action (2) | Result 1 (3) | Action if result 1 (4) | Result 2 (5) | Action if result 2 (6) |
|---|---|---|---|---|---|
| 1 | Check reservoir full | Yes | Go to 2 | No | Fill reservoir, bleed system and check for leaks |
| 2 | Is reservoir isolating valve open | Yes | Go to 3 | No | Open isolating valve |
| 3 | With control lever in neutral position, is there a return of fluid to the reservoir | Yes | Faulty control valve/manifold assembly | No | Go to 4 |
| 4 | Close reservoir isolating valve from hand pump inlet port. Open reservoir isolating valve and check flow from reservoir | Flow | Renew pump | No flow | Renew filter element |

**Raise circuit**

13 Table 3 enables a failure in the raise circuit to be identified. It is assumed that the engine is running at 1000 to 1200 rev/min and that the crane will not raise the load.

**TABLE 3 RAISE CIRCUIT – FAILURE DIAGNOSIS**

| Serial (1) | Action (2) | Result 1 (3) | Action if result 1 (4) | Result 2 (5) | Action if result 2 (6) |
|---|---|---|---|---|---|
| 1 | Is the load within the max capacity of the crane | Yes | Go to 2 | No | Reduce load |
| 2 | Does the crane respond to slew and lockout controls | Yes | Go to 3 | No | Refer to all modes failure diagnosis (Table 2) |
| 3 | Fit a pressure gauge to the test point of the non-functioning boom cylinder. Operate cylinder control valve and monitor pressure on gauge | Less than 172.5 Bar (2500 lbf/in$^2$.) | Boom cylinder relief valve requires adjustment | 172.5 bar (2500 lbf/in$^2$.) | Check for mechanical seizure |

**Slew circuit**

14 Table 4 enables a failure in the slew circuit to be identified. It is assumed that the engine is running at 1000 to 1200 rev/min and that the crane will not slew.

**TABLE 4 SLEW CIRCUIT – FAILURE DIAGNOSIS**

| Serial (1) | Action (2) | Result 1 (3) | Action if result 1 (4) | Result 2 (5) | Action if result 2 (6) |
|---|---|---|---|---|---|
| 1 | Does the crane respond to raise and lockout controls | Yes | Go to 2 | No | Refer to all modes failure diagnosis (Table 2) |
| 2 | Fit a pressure gauge to the test point of the non-functioning slew circuit. Operate the slew control and monitor the pressure on the gauge | Less than 2000 lbf/in$^2$. | Relief valve requires adjustment | 2000 lbf/in$^2$. | Unserviceable pilot operated check valve, preventing return flow from slew cylinder, or mechanical seizure of king post |

**Lockout circuit**

15 Table 5 enables a failure of the lockout circuit to be identified. It is assumed that with the lockout cylinders pressurised and the lockout control valve moved to the neutral position, the lockout cylinders will not hold the vehicle rigid.

**TABLE 5 LOCKOUT CIRCUIT – FAILURE DIAGNOSIS**

| Serial (1) | Action (2) | Result 1 (3) | Action if result 1 (4) | Result 2 (5) | Action if result 2 (6) |
|---|---|---|---|---|---|
| 1 | Check air pressure in accumulator | Low air pressure | Charge accumulator to correct pressure | Air pressure correct | Go to 2 |
| 2 | With lockout cylinder control valve in the 'engage' position, monitor the pressure on the lockout circuit pressure gauge | 103.5 Bar (1500 lbf/in$^2$.) | Renew lockout cylinder control valve | Less than 103.5 Bar (1500 lbf/in$^2$.) | Lockout cylinder relief valve requires adjustment |

**HYDRAULIC PUMP**

16 The drive assembly and hydraulic pump are shown, in cross section, in Fig 3.

**Removal**

17 Close reservoir isolating valve.

18 Place a container under filter and remove drain plug from base. Allow fluid to drain down below level of service ports.

19 Slacken locknut and unscrew knob from pump engagement lever.

20 Remove 12 bolts securing cover to bulkhead at rear of engine.

21 Place a container under pump body (Fig 3 (8)) to collect fluid, disconnect inlet (7) and delivery (9) pipes from pump, and if necessary, remove pipe from clips to permit withdrawal of pump and clutch casing. Remove inlet elbow from pump.

22 Remove six bolts securing pump drive outer housing to inner housing case and withdraw pump and outer housing with clutch drive dog and engagement mechanism.

23 Remove pins securing engagement lever (6) to anchor post and sliding shaft (5). Withdraw shaft and sliding dog (3) from clutch case ensuring that ball and spring (Fig 3 section A-A) are collected as the shaft is removed.

24 Using puller, (Table 1, Ser 1), remove thrust plate from centre of drive dogs (4) on pump shaft.

25 Lift lock tab and remove nut securing drive dog to pump drive shaft, using spanner (Table 1, Ser 2) to hold drive dog.

26 Remove dog from pump shaft using a suitable three leg puller.

**Refitting**

27 Refit in the reverse order to removing. Ensure that:

27.1 Pump drive shaft O ring (Fig 3(1)) and external oil seal (2) are serviceable.

**Refitting**

38 Refit in the reverse order to removing. Ensure that:

38.1 Hydraulic hose is fitted to hose failure valve/ram port prior to locating inner pivot pin.

38.2 New copper washers are fitted to pipe connections.

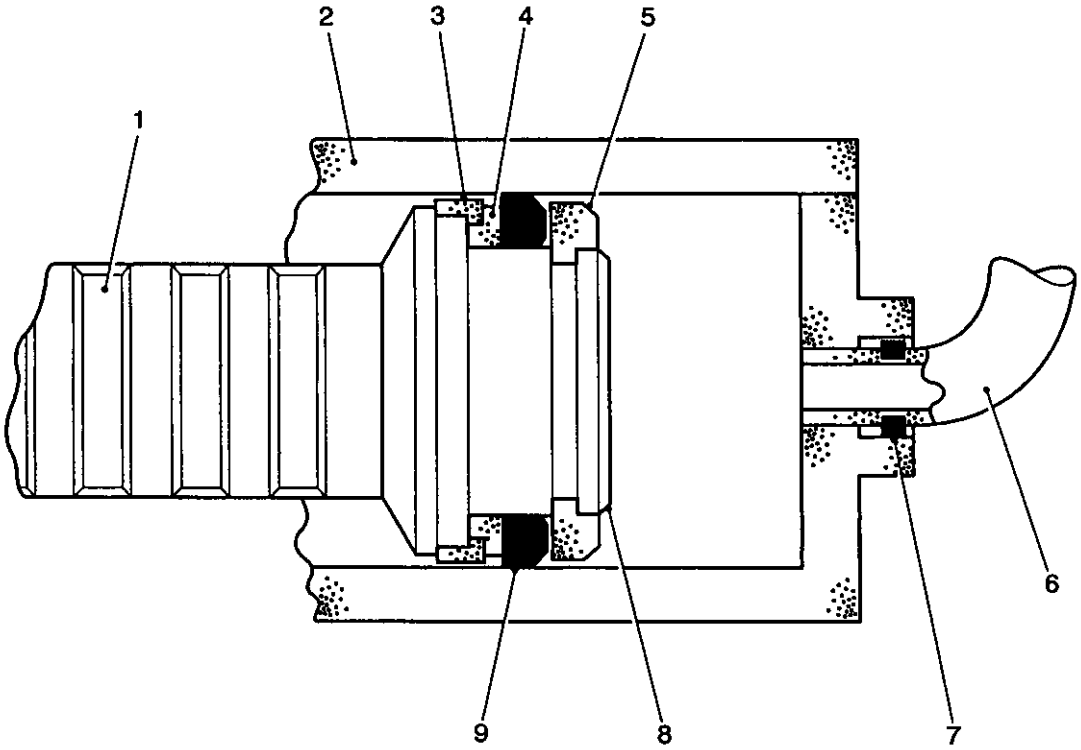
38.3 Pivot pin locking plates are fitted and secure.

38.4 Crane is functionally tested as detailed in Sub-para 32.3.

**SLEWING RAM**

**Indication of piston head seal failure**

39 Leakage of hydraulic fluid from the area near king post base indicates a faulty seal on one or both slew rack piston heads. A cross sectional view of the slew rack and cylinder is shown in Fig 4




| | | | |
|---|---|---|---|
| 1 | Slew rack | 6 | Inlet elbow connection |
| 2 | Cylinder | 7 | O-ring |
| 3 | Support rings piston seal | 8 | Piston |
| 4 | Support rings piston seal | 9 | Piston seal |
| 5 | Collar | | |

Fig 4 Slew rack and cylinder

**Removing RH slew cylinder**

40 Remove hydraulic accumulator as described in Para 81.

41 If necessary, remove section of heater piping from stowage compartment bulkhead.

42 Remove four nuts and washers and remove access cover from bulkhead.

43 From the interior of crew compartment remove:

43.1 The four bolts securing equipment tray to bulkhead above RH slew cylinder.

43.2 To prevent damage to the Bowman radio equipment remove in accordance with IETP (TBA) the following: VUDT; TSB; PLGR; PDU-B; DRM complete with ADR+ and RFPA and the RSB2 mounted on the rear bulkhead wall.

44 Place container to collect hydraulic fluid, disconnect and remove hydraulic hose at connection to elbow (Fig 4 (6)) on end of slew cylinder, and remove elbow.

45 Unscrew slew cylinder (2) from king post mounting, using machined flats on end of cylinder adjacent to elbow location and withdraw cylinder from slewing rack piston (1).

46 Remove collar (5) and withdraw seal (9) and support rings (4) and (3) from piston head.

**Removing LH slew cylinder**

47 Procedure for removing LH slew cylinder is the same as for the RH slew cylinder except that there are no external fittings to be removed for access.

**Inspecting**

48 Ensure that:

48.1 Cylinder is not scored.

48.2 Threads on ends of cylinders are serviceable.

48.3 Piston heads (8) are not scored.

48.4 Support rings and seals (7) are discarded end new ones are fitted on assembling.

**Assembling**

49 Fit support rings (3) and (4) and seal retaining (9) with collar (5) fitted into groove in end of piston.

50 Lubricate interior of slew cylinder with hydraulic fluid and refit cylinder over piston head. It is advisable to ensure that boom is in locked position when fitting cylinder, to ensure rack does not move as cylinder is pushed over piston. Tighten cylinder into housing.

51 Reposition elbow to align with hydraulic hose and connect union.

52 Refit components, removed to gain access to RH cylinder.

53 Bleed cylinders as described in para 113.

54 Check fluid level in reservoir and top up if necessary.

55 Functionally test crane and check for oil leaks.

**LOCK OUT CYLINDER CONTROL VALVE**

Removal

56 Check that control lever is in 'neutral' position, i.e. lock out cylinders not pressurized.

57 Disconnect both ends and remove delivery pipe between small outlet block on manifold end uppermost connection on valve.

58 Disconnect both ends and remove delivery pipe between underside of manifold block and bottom connection on valve.

59 Disconnect pipe to lockout cylinders from center rear connection on valve.

60 Remove bolts securing valve to manifold block and withdraw valve.

Refitting

61 Refit valve in reverse order to removing.

## ACCUMULATOR

### Charging the accumulator

62 Table 6 lists the equipment required for charging the accumulator as shown in Fig 5.

**TABLE 6 EQUIPMENT REQUIRED FOR CHARGING THE ACCUMULATOR**

| Serial (1) | NSN/Part No (2) | Designation (3) | Fig 5 No (4) |
|---|---|---|---|
| 1 | 6685-99-715-6514 | Pressure gauge | 1 |
| 2 | 1730-99-105-0581 | Three way adaptor | 2 |
| 3 | 1660-99-224-4015 | Air hose assembly 420 kgf/cm$^2$ (6000 lbf/in$^2$.) | 4 |
| 4 | 4820-99-833-6365 | Pressure regulator | 5 |
| 5 | 1015-99-962-0841 | Connector valve No. 2, Mk 1 | 6 |
| 6 | 2530-99-800-4003 | Charging head adaptor | 7 |
| 7 | 1730-99-105-0851 | Adaptor, accumulator to three way adaptor | 10 |

63 To check accumulator (Fig 5 (9)) pressure and to recharge if required, proceed as follows:

63.1 Remove dust cap from accumulator valve stem.

63.2 Check valve core for tightness.

63.3 Connect pressure gauge (1) to three-way adaptor (2).

63.4 Using suitable adaptor (10) from inflation kit, connect the three-way adaptor to the accumulator taking care not to damage the accumulator threads.

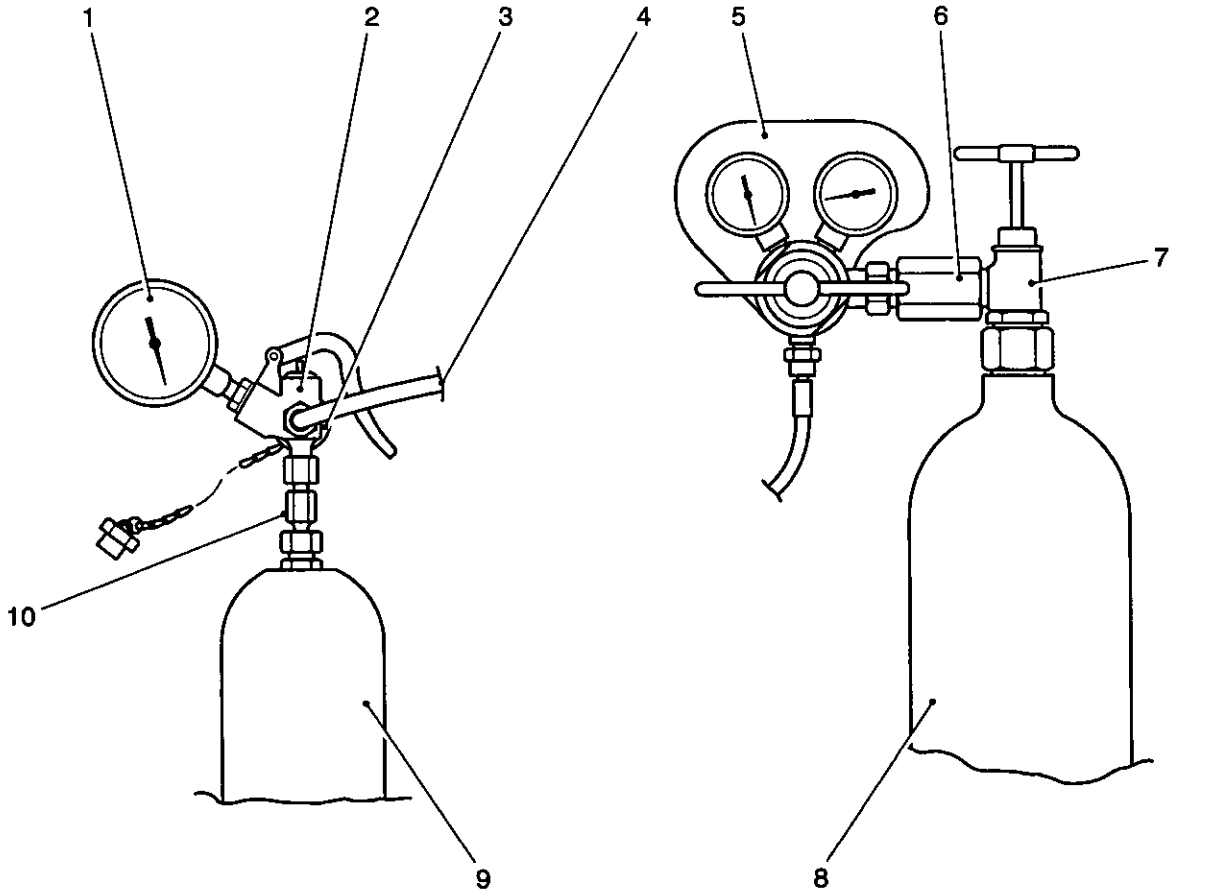
63.5 Ensure unused branch of three-way adaptor is plugged.

63.6 Close wheel valve (3).

63.7 Depress lever on three-way adaptor and read accumulator pressure. Correct pressure is 70 kgf/cm$^2$ (1000 lbf/in.$^2$).

63.8 Release lever and open wheel valve to exhaust pressure in adaptor.

63.9 If pressure in accumulator is below 70 kgf/cm$^2$ (1000 lbf/in.$^2$) recharge as detailed in Para 54 to 80.




| | | | |
|---|---|---|---|
| 1 | Pressure gauge | 6 | Connector, valve No 2 Mk 1 |
| 2 | Three way adaptor | 7 | Charging head adaptor |
| 3 | Wheel valve | 8 | Reservoir, compressed air |
| 4 | Air hose assembly | 9 | Accumulator |
| 5 | Pressure regulator | 10 | Adaptor |

Fig 5 Method of charging accumulator

**Charging procedure**

64 Remove closing plug from air cylinder (Fig 5 (8)).

65 Ensure that leather washer is fitted between adaptor/valve key (7) and air cylinder.

66 Push handles through adaptor body so that the socket end of valve key protrudes from lower end.

67 Locate locket end of valve key overhead of valve in air cylinder and slide adaptor body down the key until threads of adaptor can be engaged with those of cylinder. Tighten adaptor against leather washer.

68 Fit high-pressure regulator (5) to the valve/key adaptor using connector (6) ensuring sealing washer is in place.

69 Remove blanking cap from three-way adaptor inlet union and connect charging hose (4) between three-way adaptor and regulator.

70 Close wheel valve (3).

71 Ensure regulator tap is unscrewed.

72 Open, air cylinder valve slowly end screw regulator tap in until outlet pressure reads 1.4 kgf/cm$^2$ (20 lbf/in.$^2$) above required accumulator pressure.

73 When accumulator is charged, (gas is heard to cease flowing), close cylinder and screw out regulator tap.

74 Open wheel valve to relieve pressure in hose.

75 Remove hose from three-way adaptor and fit blanking cap to inlet union.

76 Close wheel valve and recheck accumulator pressure by depressing lever.

77 Bleed off any excessive pressure by opening wheel valve and depressing lever.

78 When correct pressure is obtained, release lever and open wheel valve.

79 Remove adaptor and hose from accumulator valve stem, check if valve core or separator bag are leaking by applying soap solution to the top or valve and separator bag, securing nut.

80 Refit dust cap on accumulator valve stem.

**Removal**

81 If accumulator loses air pressure, check charging valve core for leakage prior to exchanging accumulator.

82 Remove hydraulic pipe connections at each side of junction block at base or accumulator.

83 Remove four nuts securing retaining clips, withdraw rubber and felt packing, and remove accumulator.

**Refitting**

84 Refit accumulator to vehicle in reverse order to removing.

85 Charge accumulator to 70 kgf/cm$^2$ (1000 lbf/in.$^2$) with dry compressed air as detailed in Para 74 to 80, and check that air valve does not leak to applying soap solution to the top of the valve, and the separator bag securing nut.

36 Bleed lock out cylinder supply line as detailed in Para 113 to 115.

**LOCK OUT CYLINDERS**

87 An illustration of a lockout cylinder is shown in Fig 6 for reference purposes.

NOTE

Lock out cylinders cannot be filled or bled in situ.

**Removal**

88 Remove sidetrack guard.

89 Jack up axle arm and remove road wheels.

90 Remove rubber bump stop.

91 Lower axle arm to full extent.

92 Disconnect hydraulic pipe from lock out cylinder union and fit protective caps to union end pipe.

93 Slacken hose clip and remove flexible hose from breather connection on lock out cylinder. Fit protective cap to hose.

94 Withdraw split pin and remove nut and pin securing lock out cylinder to axle arm. Remove pin.

95 Turn back lock tab, remove nut and pin securing cylinder to hull attachment bracket. Withdrew lock out cylinder assembly.

96 Examine rubber mountings at each end of cylinder. If necessary, backload cylinder to Field workshop for renewal of mountings.

**Filling with fluid**

97 Remove cylinder from vehicle as detailed in Para 88 to 96.

98 Thoroughly clean exterior of cylinder.

99 Stand cylinder vertical with air chamber at bottom and strut fully extended.

100 Remove lower filler plug and fill cylinder with hydraulic fluid, (see servicing schedule for correct grade of oil), to top of filler plughole.

101 Refit upper filler plug and turn unit to normal vertical position.

102 Remove lower filler plug and add as much fluid as possible to that already in unit, without resorting to pressure filling. Refit lower filler plug.

103 Fit cylinder temporarily to vehicle, do not connect hydraulic and breather pipes, or lock securing pins at this stage

104 Jack axle arm up to compress unit to half full distance of travel and unscrew air bleed screw slowly, to release compressed air. When air and oil cease to emerge, lower axle arm to extend strut until oil again emerges, then tighten bleed screw.

105 Remove cylinder assembly from the vehicle, extend fully, and stand unit vertical with air chamber at the top. Remove lower filler plug and top up with fluid.

106 Refit cylinder to vehicle, jack up spin to fullest extent of travel, i.e. cylinder fully compressed, then lower jack to allow cylinder to extend. Remove cylinder from vehicle and top up fluid at lower filler plug if necessary.

107 Refit cylinder to vehicle in reverse order to that detailed at Para's 88 to 96 ensuring that all hydraulic and breather pipes are connected securely and that securing pin nuts are locked by split pin and lock washer.

108 Bleed the lock out cylinder supply line as detailed in Para 113.

**BLEEDING THE HYDRAULIC SYSTEM**

109 The system when installed and working does not require further bleeding, but if hydraulic supply lines have been disconnected at any point, it will be necessary to bleed air from that part of the circuit. This procedure is particularly relevant to the slewing rams and lock out cylinder supply lines.

**Filter**

110 Turn shut-off valve to closed position, place a container beneath outlet port or filter, slacken union on pipe connected to outlet port, turn shut-off valve to the open position arid allow fluid to escape until it is free from air. Re-tighten pipe union.

NOTE

This operation is only necessary after removal and refitting of pump, and must be done prior to refitting cover plate to bulkhead.

**Pump**

111 Bleed filter as described in Para 110. Slacken pump outlet union and allow fluid to flow through the pump until it is free from air. Re-tighten pipe union.

**Slewing rams**

**CAUTION**

**EQUIPMENT DAMAGE. Ensure that boom is unlocked and that area under full arc of travel is unobstructed prior to commencing this operation.**

112 Run engine with pump engaged, operate slewing control to RH or LH slew position and slacken pipe connection at elbow on relevant cylinder. Allow air and fluid to escape until fluid flows free of air. Re-tighten connection. Repeat operation on opposite slew cylinder, ensuring that slew control lever is moved to opposite position.

**Lock out cylinder supply line**

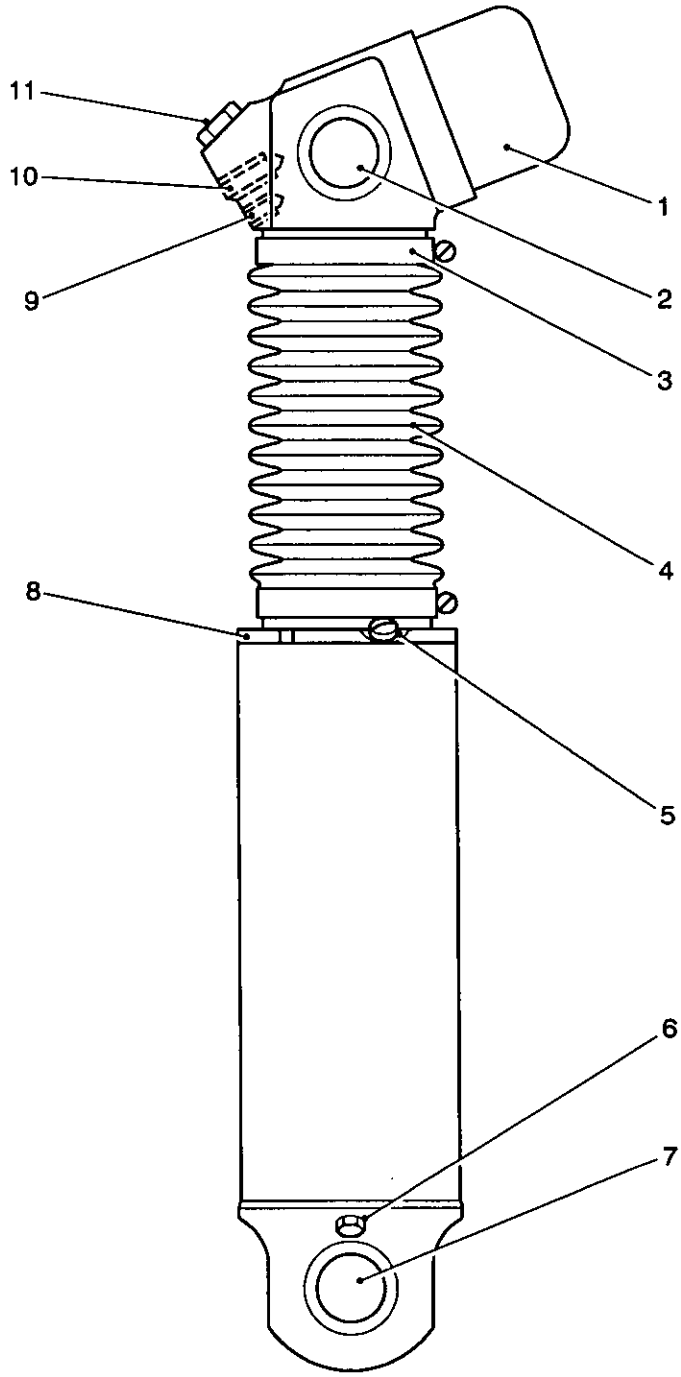
113 Run engine with pump engaged and turn lock out control valve to 'lock out engaged' position. Slacken hydraulic pipe union on LH front lock out cylinder. Allow fluid to escape until it is free of air. Re-tighten union.

114 Turn lock out control to 'discharge' position and then back to 'lock out engaged' to recharge the circuit and make up the lost fluid.

115 Bleed the LH rear lock out cylinder in a similar manner, then proceed to the RH side cylinders, ensuring that the line is recharged after fluid has been bled from each cylinder. It is preferable to bleed the longest pipelines first, hence the reason for commencing with the LH side front cylinder.

**Boom rams**

116 Raise and lower boom several times to expel air. It may be necessary to pull down on the boom to retract rams during the first few extend and retract cycles.

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| | | | |
|---|---|---|---|
| 1 | Air chamber | 7 | Lower attachment point |
| 2 | Upper attachment point | 8 | Bearing housing |
| 3 | Clip | 9 | Lockout connection |
| 4 | Gaiter | 10 | Gaiter breather connection |
| 5 | Air bled screw | 11 | Upper filler plug |
| 6 | Lower filler plug | | |

Fig 6 Lockout cylinder

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