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GENERATOR SET DIESEL ENGINE DRIVEN

4.5KW (5.6KVA) 240V AC, SINGLE PHASE, 50HZ

(AIR-LOG 4169A)

FAILURE DIAGNOSIS

This publication contains information
covering the requirements of Category
5.1 levels 2 and 3.

BY COMMAND OF THE DEFENCE COUNCIL

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PREFACE

Sponsor: EME10(c) (4)

INTRODUCTION

- 1 Service users should forward any comments concerning this publication through the channels prescribed in AESP 0100-P-011-013.
- 2 The subject matter of this publication may be affected by Defence Council Instructions (DCIs), Standard Operating Procedures (SOPs) or by Local Regulations (LRs). When any such Instruction, Order or Regulation contradicts any portion of this publication they are to be taken as the overriding authority.

RELATED AND ASSOCIATED PUBLICATIONS

Related Publications

- 3 The Octad for the subject equipment consists of the publications shown below. All references are prefixed with the first eight digits of this publication.

CATEGORIES AND INFORMATION LEVELS															
CATEGORY	1		2		3		4		5		6	7		8	
LEVEL	1	2	3	1	2	1	2	3	4	6	1	2	1	2	
1 USER/OPERATOR	101	201	201	411	411	201	201	*	*	601	*	*	*	*	
2 UNIT MAINTENANCE	*	*	302	*	*	512	522	532	*	*	712	722	*	*	
3 FIELD MAINTENANCE	*	*	302	*	*	512	522	532	*	*	*	*	*	*	
4 BASE MAINTENANCE	*	*	*	*	*	*	*	*	*	*	*	*	*	*	

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|--------------------------------------|---------------------------------|
| 1.0 Purpose and Planning Information | 5.3 Inspection Standards |
| 2.0 Operating Information | 5.4 Calibration Procedures |
| 3.0 Technical Description | 6.0 Maintenance Schedules |
| 4.1 Installation Instructions | 7.1 Illustrated Parts Catalogue |
| 4.2 Prep for Special Environments | 7.2 Commercial Parts List |
| 5.1 Failure Diagnosis | 8.1 Modification Instructions |
| 5.2 Repair Instructions | 8.2 General Instructions |

* Not Published

Note ...

Reference to AESP 0100-A-001 must be made to ensure the availability of the listed publications.

Associated Publications

<u>Octad No.</u>	<u>Title</u>
AESP 2815-B-641	Engine, Diesel, 1 and 2 Cylinder, Petter 'A' Range, Air and Water Cooled

WARNINGS ...

LETHAL VOLTAGES

- (1) VOLTAGES OUTPUT FROM THIS GENERATOR SET CAN ENDANGER LIFE. CARELESSNESS CAN BE FATAL. ENSURE THAT THE CHASSIS IS CORRECTLY EARTHED AND THAT THE EARTH LEAKAGE CIRCUIT BREAKER FUNCTIONS CORRECTLY FOR OUTPUT 4.
- (2) BEFORE OPENING THE ACCESS COVER TO THE EMERGENCY TERMINALS, THE EMERGENCY TERMINALS 13A CIRCUIT BREAKER SHOULD BE AT THE OFF POSITION.
- (3) THIS GENERATOR SET IS FITTED WITH RFI/EMP FEED THROUGH FILTERS. THE GENERATOR SET MUST BE CORRECTLY EARTHED BEFORE USE.

INJURY TO PERSONNEL

- (1) WHEN REMOVING/REPLACING THE ENGINE/ALTERNATOR FROM THE CHASSIS, PREVENT INJURY TO PERSONNEL BY USING ADEQUATE SUPPORT DURING THE LIFTING OPERATIONS.
- (2) PRECAUTIONS SHOULD BE TAKEN TO PREVENT EXHAUST GASES FROM ENTERING TRENCHES OR OTHER AREAS OCCUPIED BY PERSONNEL.

SPILLAGE OF DIESEL FUEL

PRECAUTIONS SHOULD BE TAKEN TO PREVENT THE SPILLAGE OF FUEL ONTO THE SOFT NOISE ABSORBANT AREAS WITHIN THE ENGINE ENCLOSURE AND THE ACOUSTIC COVER. ANY SUCH SPILLAGES SHOULD BE ATTENDED TO IMMEDIATELY. ANY SPILLAGES MUST BE CLEANED UP BEFORE RUNNING THE GENERATOR SET.

BOOST CHARGING

BOOST CHARGING OF SEALED FOR LIFE (MAINTENANCE FREE) BATTERY. THE GENERATOR SET IS FITTED WITH SUCH A BATTERY. ON NO ACCOUNT MUST THIS BATTERY BE SUBJECTED TO A RAPID BOOST CHARGE OF THE TYPE USED FOR A NORMAL LEAD/ACID TYPE OF BATTERY. ANY BOOST CHARGE MUST BE FROM A CONSTANT VOLTAGE SOURCE NOT EXCEEDING 15 VOLTS AND A MAXIMUM CHARGE CURRENT OF 35 AMPERES (30 AMPERES NOMINAL).

RESUSCITATION

TREATMENT OF THE NON-BREATHING CASUALTY

NOTICE

The inclusion of the emergency resuscitation placard (MOD Form 656) in Military Technical Publications has been discontinued.

This notice is to be retained in the publication until removed by amendment instruction.

Chapter 1

SYSTEM FAILURE DIAGNOSIS

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- 1 INTRODUCTION (WARNINGS AND CAUTIONS)
- 2 TEST EQUIPMENT REQUIRED
- 3 GENERAL
- 4 OPERATING PROBLEMS
- 5 STARTUP PROBLEMS
- 6 Generator is running but POWER ON lamp is extinguished
- 7 BATTERY CHARGE lamp is illuminated while generator is running
- 8 Generator Malfunction when on load

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- 1 Generator Set Status Lamps

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- 2 Generator Running - Trouble Shooting Chart 1
- 3 Generator Running - Trouble Shooting Chart 2
- 4 Generator Malfunction - General Flowchart
- 5 Generator Set - Circuit diagram

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INTRODUCTION

- 1 This chapter provides information that will enable a service technician to analyse faults that may occur when the generator set is in an operational environment. The diagnostic procedures consist of flow diagrams that will enable a technician to determine the cause of a failure. Reference is made to Cat. 522 for repair information. The flow diagrams contained in this chapter expand upon the LEVEL 1 information contained in Cat. 201.

TEST EQUIPMENT REQUIRED

2. Minimum test equipment is required to analyse faults on the generator set, because it is fitted with a protection unit with indicator lamps which assist a technician to determine the cause of a failure (Table 1). The following test equipment is required.
 - 2.1. General purpose analogue multimeter with accuracy better than 5%. An AVO multimeter model 8 is suitable.

GENERAL

3. Provided that the routine maintenance tasks are carried out at the recommended intervals, the generator set should run for many hours without failure, since the mechanical and electrical/electronic components are designed for maximum service life. It is especially important that the correct grade of engine oil is used for the particular operating environment, and that the oil and oil filter are changed at the recommended intervals. Particular attention should be paid to keeping the air intake/outlet ducts and grills free from obstruction by foreign matter such as vegetation, paper, grease and so on. Special attention should also be paid to the battery which is required to produce a heavy current (up to 30A) when the preheaters are used and a very heavy current (up to 300A) when the starter is used. The battery terminals should be checked for cleanliness and tightness; often, corrosion on a battery terminal is an indication of problems with the battery.

OPERATING PROBLEMS

- 4 The heart of the generator set is the Allam MT3E brushless alternator which is driven by a close-coupled Petter AD2 twin-cylinder diesel engine. Provided that routine servicing is carried out, these units will run for many hundreds of hours without problems occurring. The two main features of this generator set are the electronic governor unit for precise engine speed control (this is in addition to the normal mechanical speed governor which is preset to 3300 rpm), the generator set protection unit, the voltage regulator unit, and the battery charger unit. The generator set protection unit and its associated indicator lamps provide a visual indication of the operational status of the generator set when it is running. If a failure occurs, or if operational parameters are exceeded, a lamp will illuminate and the load will be automatically disconnected from the generator set and in some cases the engine will be shut down automatically. For reference purposes the functions of the status lamps are listed in table 1.

TABLE 1 GENERATOR SET STATUS LAMPS

Serial	Lamp Designation	Function	Remarks
(1)	(2)	(3)	(4)
1	POWER ON	When illuminated, 240V 50Hz is available, to the output connectors.	
2	BATTERY CHARGE	is extinguished when the battery charger is operational (with generator running).	

(continued)

TABLE 1 GENERATOR SET STATUS LAMPS (Continued)

Serial	Lamp Designation	Function	Remarks
(1)	(2)	(3)	(4)
3	OIL PRESSURE	Will extinguish when oil pressure is above 15 psi.	
4	ENGINE TEMP	Illuminates when engine temperature exceeds 110°C.	
5	LOW FUEL	Illuminates when fuel level is low in fuel tank.	
6	OVER CURRENT	Illuminates when output current overload occurs for more than five seconds.	Load is automatically disconnected. Must be reset by operating LED INDICATORS RESET button.
7	OVER VOLTAGE	Illuminates when output voltage exceeds 264V for more than five seconds.	Load is automatically disconnected. Must be reset by operating LED INDICATORS RESET button.
8	REVERSE POWER	Illuminates when two generators of this type are connected together in parallel and the output from one exceeds the predetermined level for more than five seconds and is a danger to the other generator.	Load is automatically disconnected and engine is shut down. Must be reset by operating LED INDICATOR RESET button.
9	OVER FREQUENCY	Illuminates if the frequency exceeds 55Hz for more than five seconds.	Load is automatically disconnected and engine is shut down. Must be reset by operating LED INDICATOR RESET button.
10	UNDER FREQUENCY	Illuminates if the frequency falls below 45Hz for more than five seconds.	Load is automatically disconnected and engine is shut down. Must be reset by operating LED INDICATORS RESET button.

TABLE 1 GENERATOR SET STATUS LAMPS (Continued)

Serial	Lamp Designation	Function	Remarks
(1)	(2)	(3)	(4)
11	HIGH TEMP (AIR)	Illuminates when the engine cooling air exceeds 120°C for more than five seconds.	Load is automatically disconnected and engine is shut down. Must be reset by operating LED INDICATORS RESET button.
12	LOW OIL PRESSURE	Illuminates when the engine oil pressure falls below the preset danger level.	Load is automatically disconnected and engine is shut down. Must be reset by operating LED INDICATORS RESET button.

START UP PROBLEMS

5. When in the field, the first signs of problems that an operator may experience with the generator set is that it fails to start. Figure 1 flowchart will assist a technician in solving a startup problem.

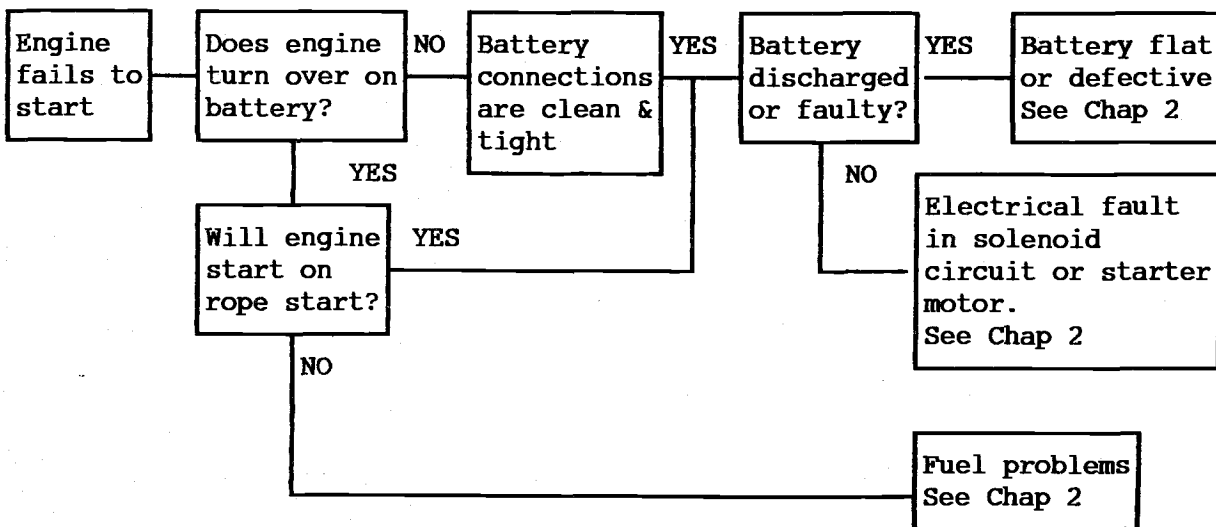


Fig 1 Startup Failure Analysis Flowchart

BATTERY CHARGE lamp is Illuminated while Generator is Running

6 Figure 2 flowchart will assist in fault diagnosis.

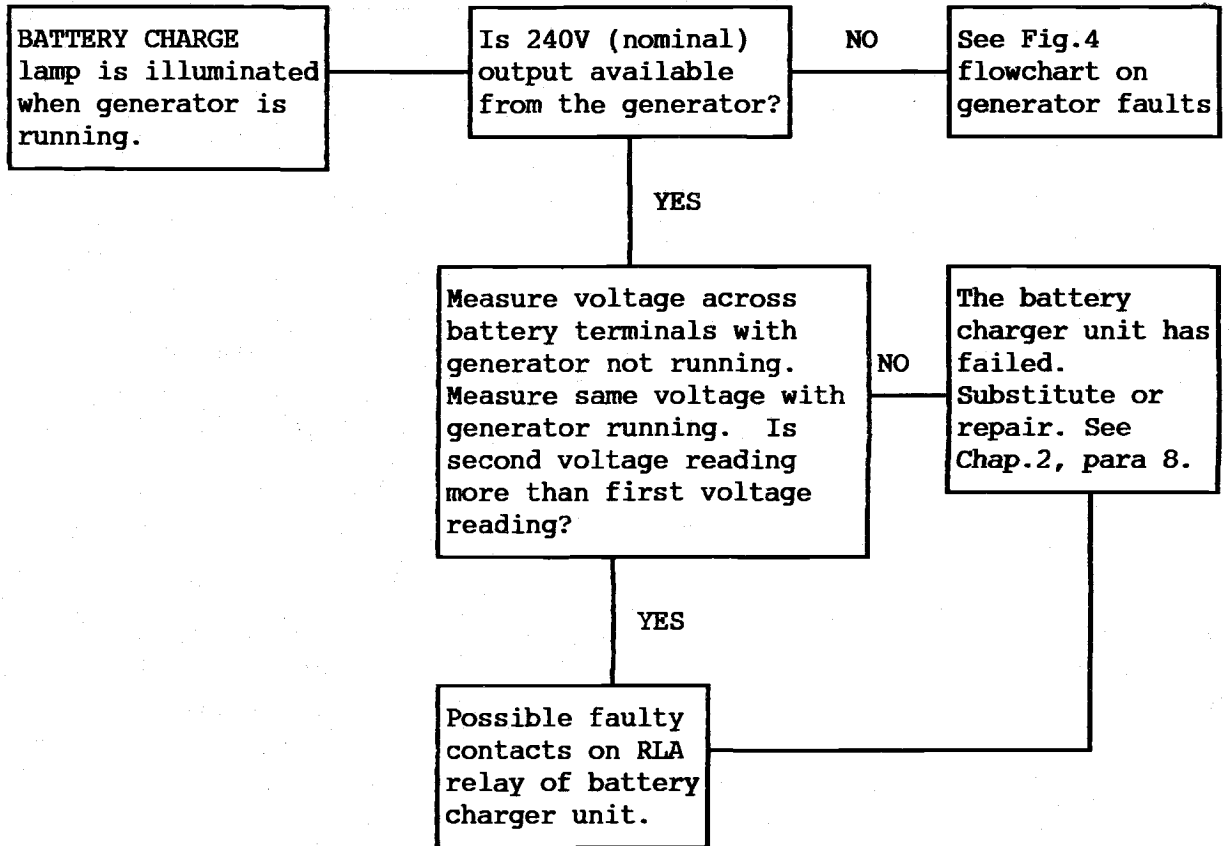


Figure 2. Battery Charger - Trouble Shooting Chart.

Generator is Running but POWER ON lamp is Extinguished.

7. Figure 3 flowchart will assist in fault diagnosis:

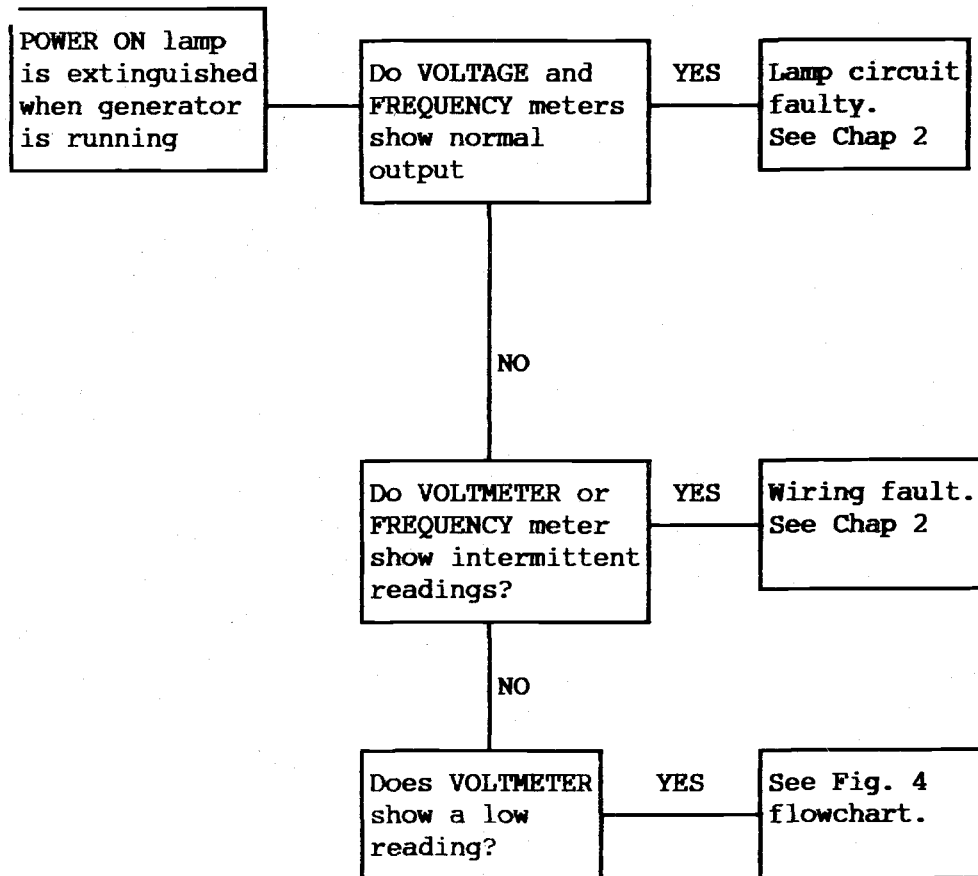


Fig 3. Generator Running - Trouble Shooting Chart.

Generator Malfunction when on Load

8. Fig. 4 Flowchart will assist in fault diagnosis.

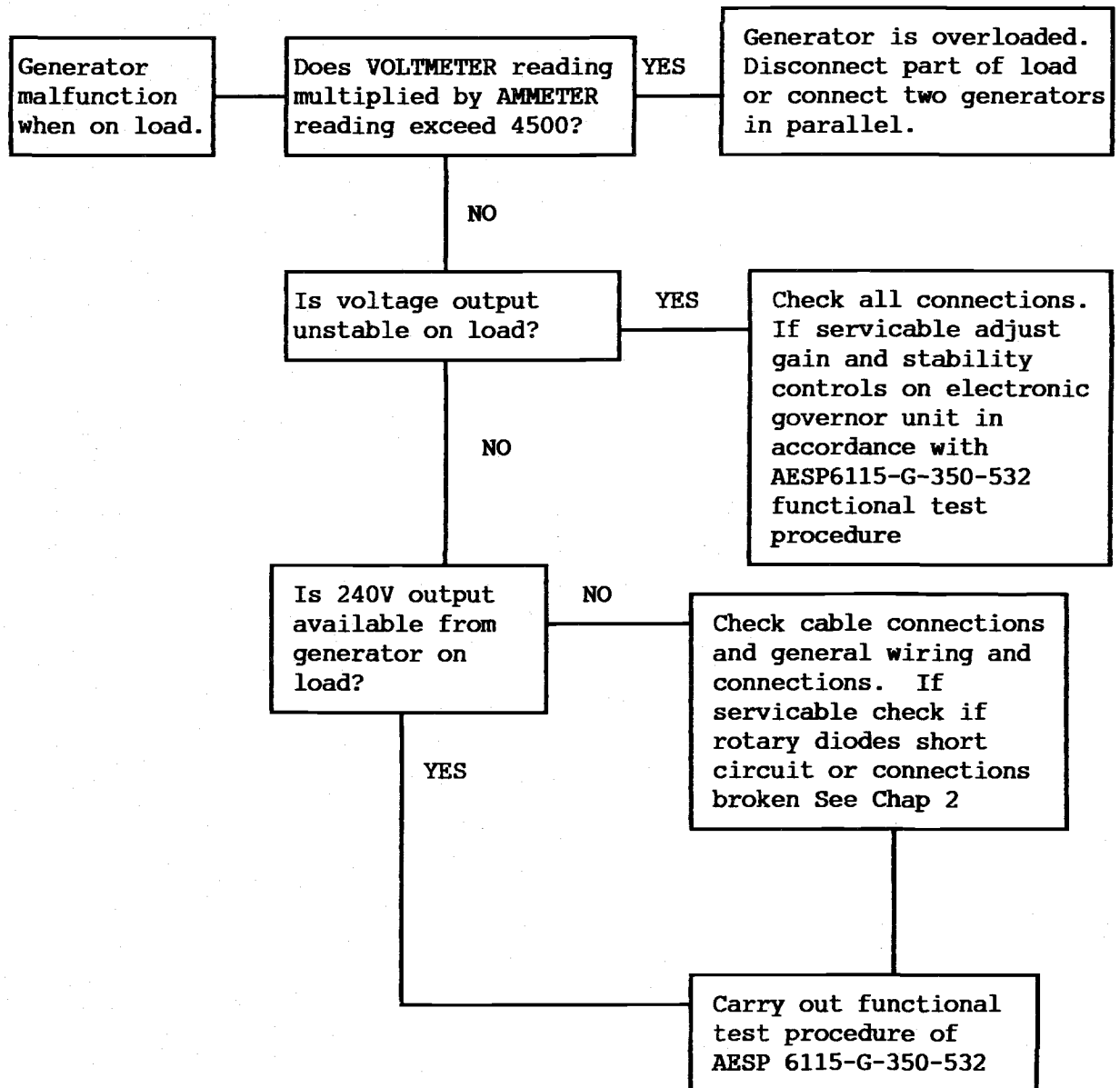
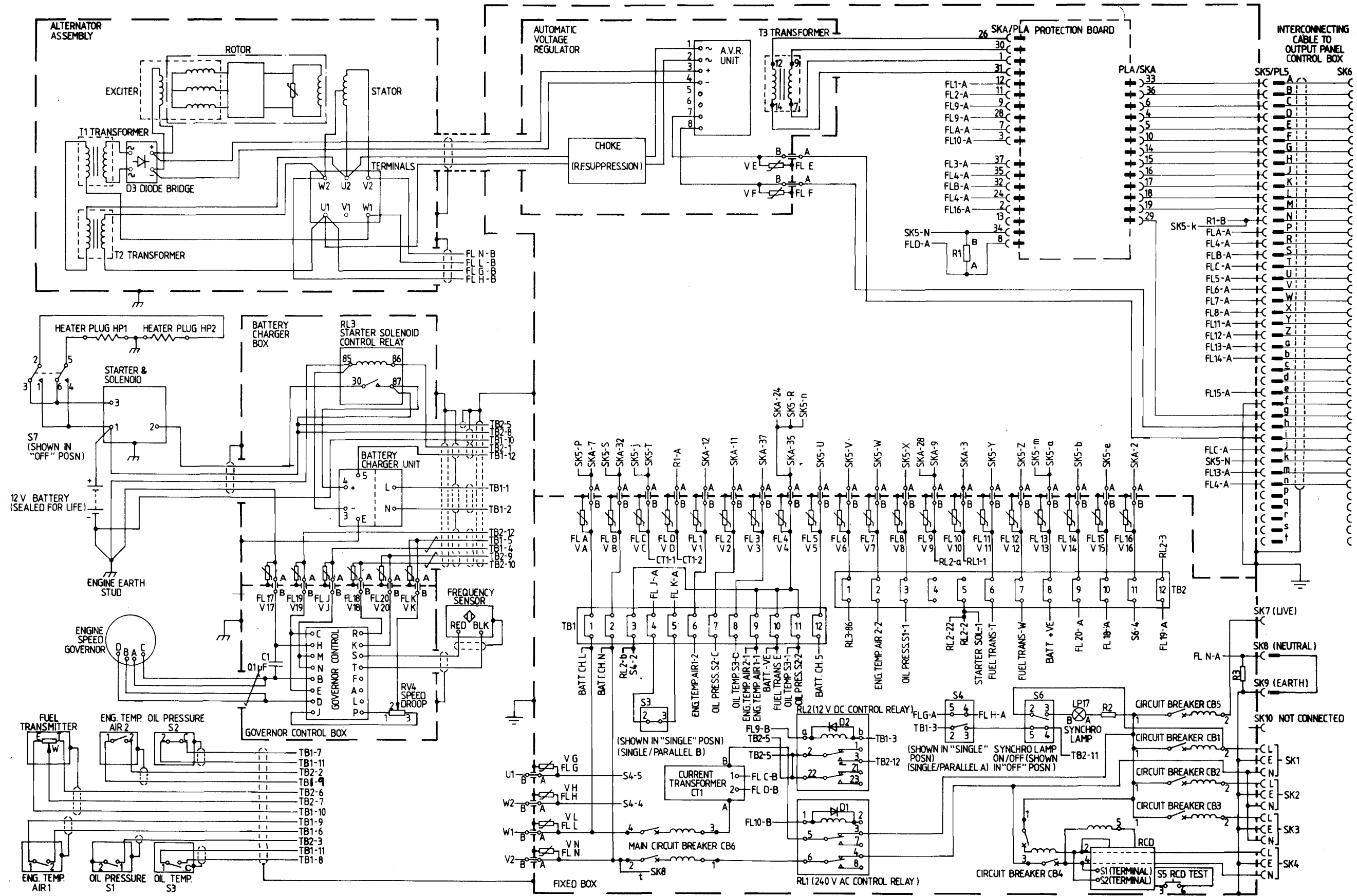


Fig 4. Generator Malfunction - General Flowchart.



Fig

Generator Set - Circuit Diagram

Fig 5

Chapter 2

COMPONENT/ASSEMBLY FAILURE DIAGNOSIS

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- 1 INTRODUCTION
Printed Circuit Boards - Repair Policy
- 2 EQUIPMENT REQUIRED
- 3 ENGINE FAILS TO START
- 4 BATTERY PROBLEMS
- 6 SOLENOID AND STARTER MOTOR PROBLEMS
- 7 FUEL SUPPLY PROBLEMS
- 8 BATTERY CHARGER PROBLEM
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INTRODUCTION

1. This chapter contains information that will enable a technician to determine the cause of faults defined in Chap 1. Where appropriate, flow diagrams and circuit diagrams are used to simplify the task. This chapter assumes that technicians are familiar with the basic principles of operation of a generator set and have an understanding of electrics. When appropriate, reference should be made to AESP 6115-G-350-522 (Disassembly).

1.1. Printed Circuit Boards - Repair Policy

The repair policy is substitution, unless it is evident that a simple repair can make the unit serviceable.

Note ...

If a repair has involved disturbance of electrical or electronic circuits (other than a level 1 repair), then a confidence test should be carried out on the generator set with reference to AESP 6115-G-350-532 chap 2. The generator set should be tested to a level that will satisfy the technician that its normal operational capability is not impaired.

EQUIPMENT REQUIRED

2. The following equipment is required as listed in table 1 below

TABLE 1 TEST EQUIPMENT

Test Equipment (1)	Type (2)	NSN (3)
Multimeter	AVO Model 8 (or equivalent)	6625-99-6209571

ENGINE FAILS TO START

3. The procedures in this section considers the electrical and mechanical possibilities and expands on the information contained in Chap 1.

Battery Problems

Note...

If the battery is flat or defective the generator may not start even on a manual start, because the electronic control circuits require battery power for initial startup.

4. If the battery is flat, attempt manual rope start and recharge it on the generator, for a minimum of six hours. Alternatively, remove the battery from the generator set and boost charge overnight using a constant voltage source. This constant voltage source must not be greater than 15V for a boost charge or must not be greater than 14.7V for an overnight charge. (see WARNING on page (vii)).
5. On completing the recharge, reconnect the battery to the generator set. Connect a dc voltmeter (AVO) set for 15 V to 25 V full scale deflection. Verify that the voltmeter reads 12.6V (nominal). Operate the preheater button for approximately 10 seconds; if the VOLTMETER reads less than 12V when the button is held closed the battery is defective.

Solenoid and Starter Motor Problems (Fig 1)

6. Operate the start switch and listen for sounds of the starter solenoid operating; the starter solenoid is mounted onto the starter assembly. Follow the instruction in Fig 1. When necessary refer to Fig 2 circuit diagram.

Note...

RFI/EMP Filters.

Filters such as FL13 (Fig 2) will test short circuit between wires A and B. The associated varistors such as V13 will test open circuit. If either has gone short circuit to earth (chassis) there should be evidence of overheating or burning in the adjacent area.

CAUTION ...

The battery must be disconnected before performing electrical repairs.

INSTRUCTION

ACTION

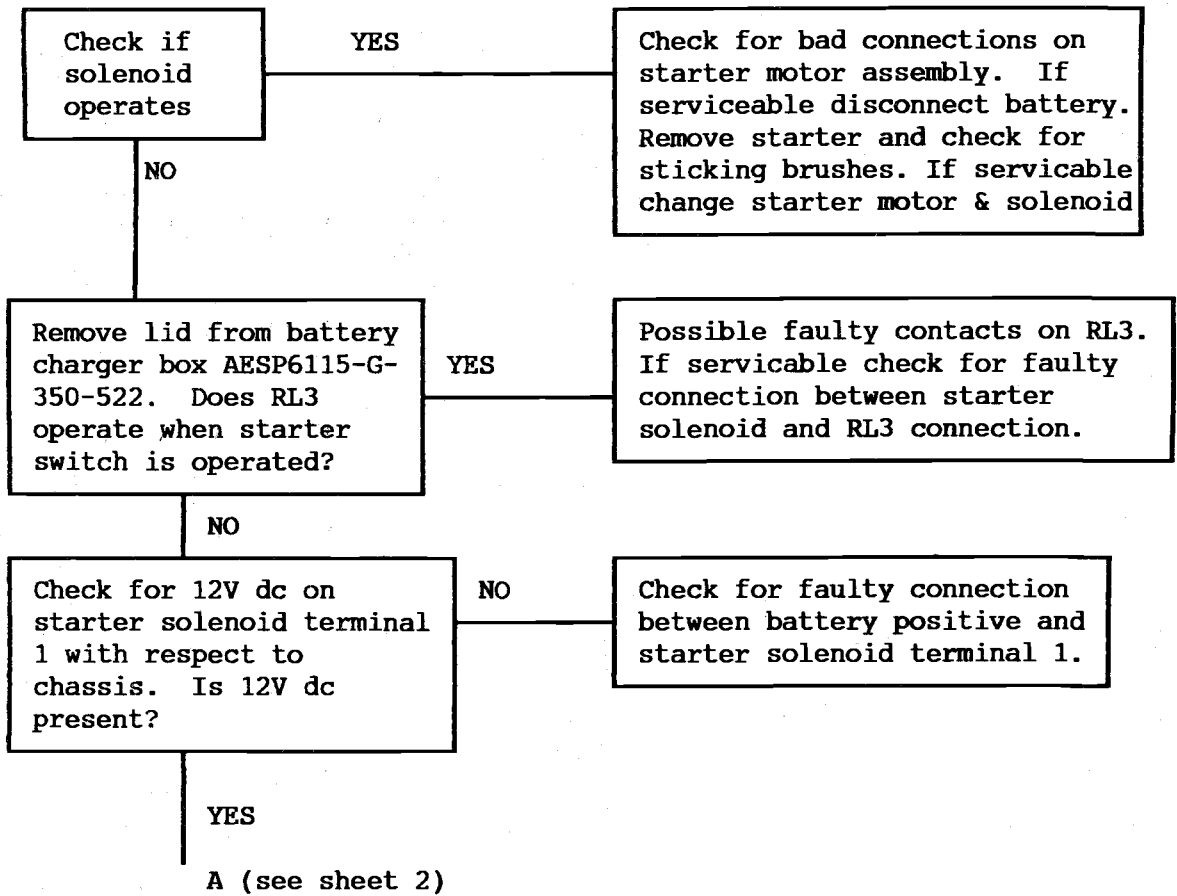


Fig 1 Solenoid Circuit Diagnostic Flowchart (Sheet 1 of 2)

INSTRUCTION

ACTION

Fig 1 (Continued)

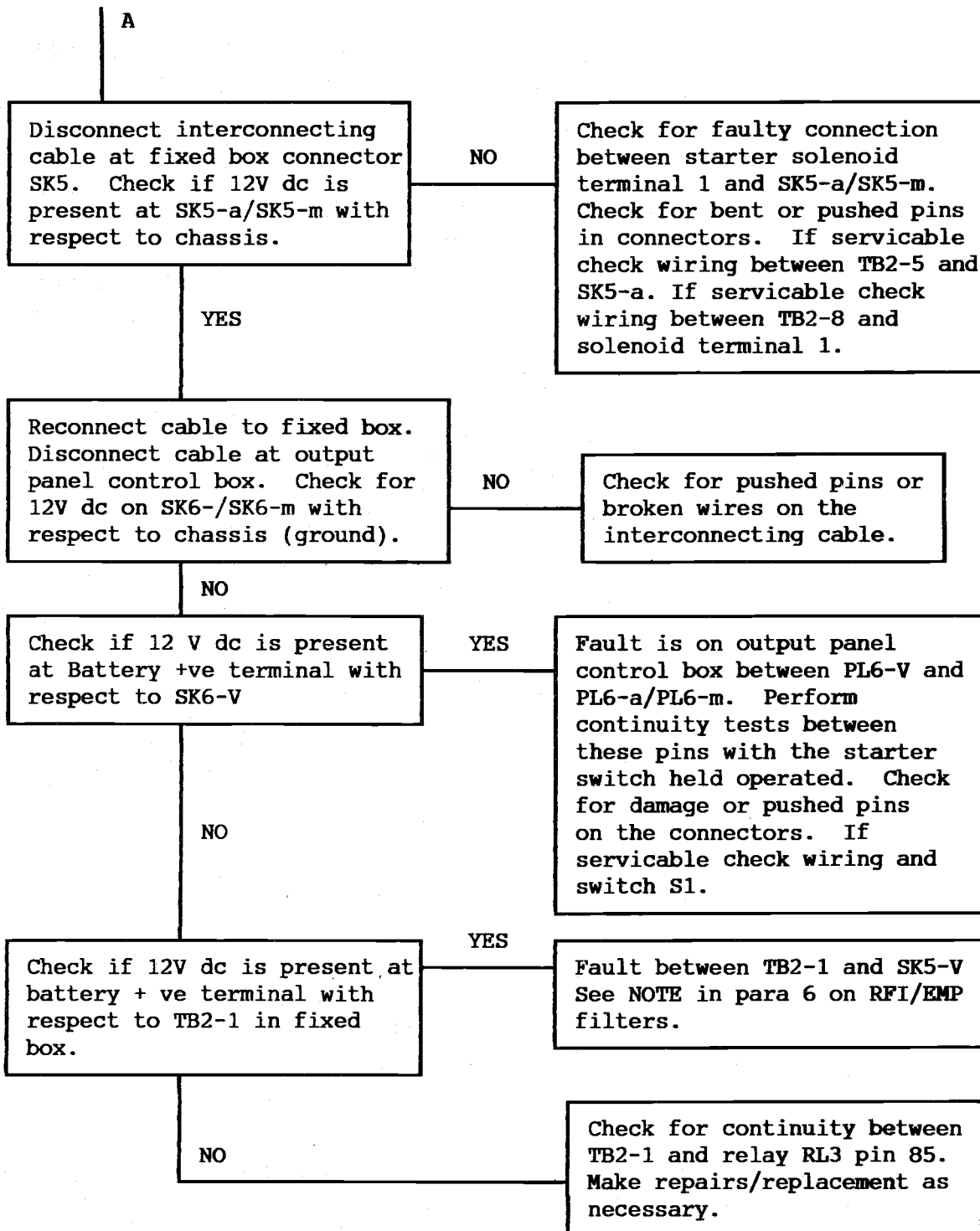


Fig 1 Solenoid Circuit Diagnostic Flowchart (Sheet 2)

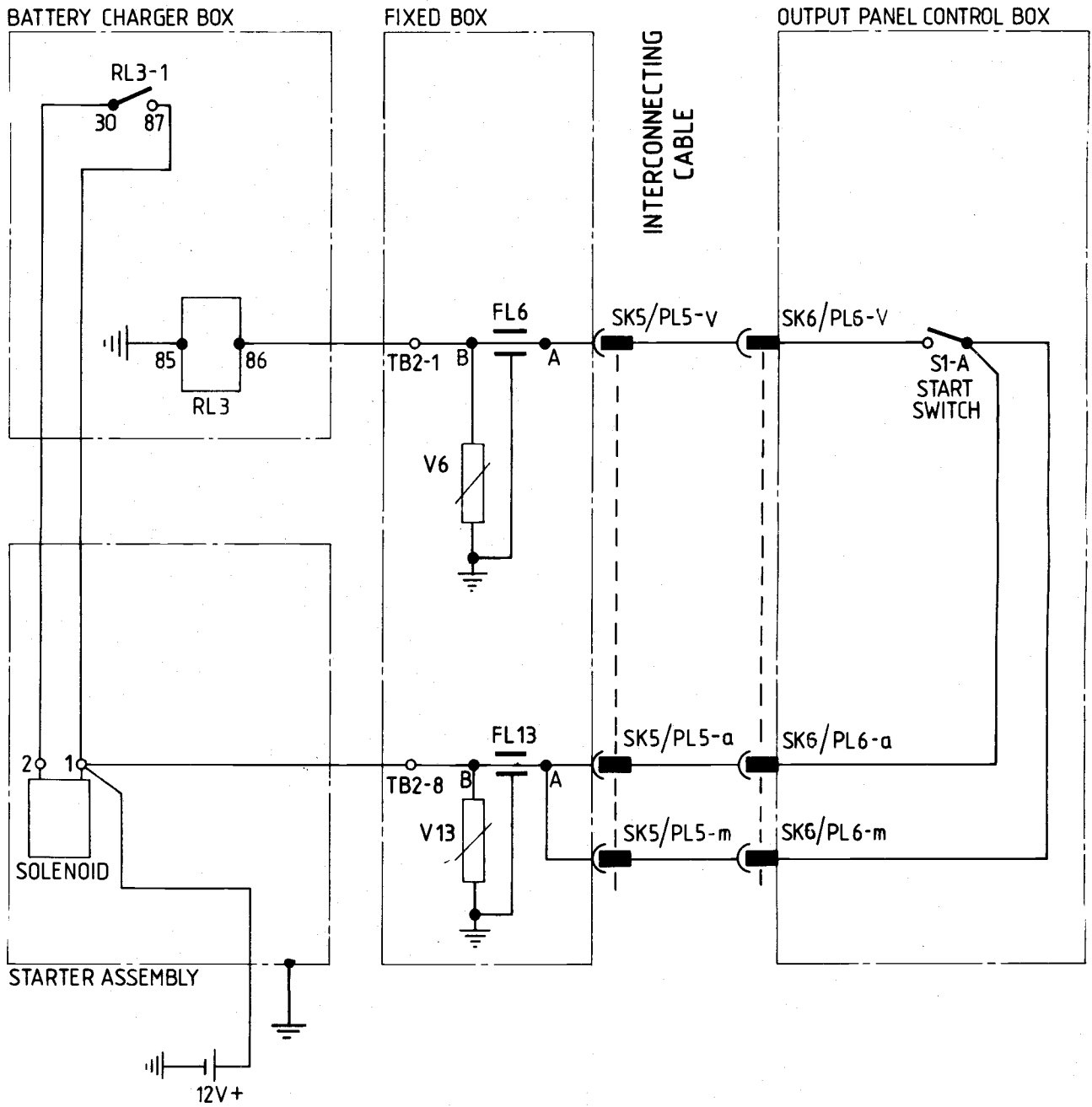
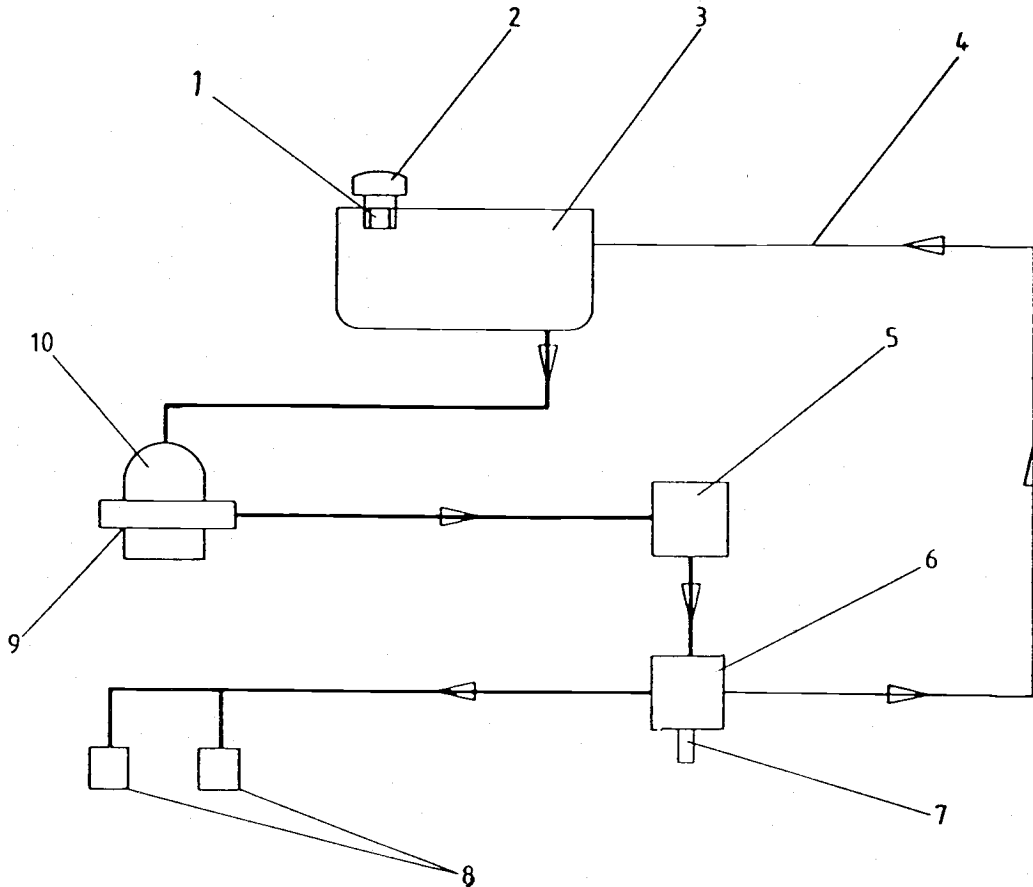


Fig 2 Starter Solenoid Circuit Diagram

Fuel Supply Problems (Fig 3)

7. If the engine is known to be in good condition, then a problem exists with the fuel supply. Verify that there is fuel in the tank and that it is of the correct grade for the operating environment. If the generator is being used on sloping terrain, the fuel tank should be at least half full. If an airlock has occurred in the fuel system then it will need to be primed using the fuel pump hand primer (30 times is recommended). Once the fuel system is primed it will bleed itself automatically, provided all the fuel pipes are connected up correctly and there are no air or fuel leaks. If the fuel is being delivered correctly and the engine still does not start then possibly the fuel is contaminated and the fuel system must be drained, refilled, and primed. If the engine fires but only runs on one cylinder then possibly there is a faulty injector on the non-running cylinder.



- | | |
|---------------------------|---|
| 1. Fuel Tank Inlet Filter | 7. Mechanical Actuator
(Controlled from Electronic Governor) |
| 2. Fuel Tank filler Cap | |
| 3. Fuel Tank | |
| 4. Fuel Bleed Pipe | 8. Fuel Injectors |
| 5. Fuel Filter Bowl | 9. Fuel Pump Hand Primer |
| 6. Fuel Flow Regulator | 10. Fuel Pump |

Fig 3 Fuel System Block Diagram

Battery Charger Problems

8. The battery charger printed circuit board (pcb) is contained within the battery charger box. Access to and removal of the pcb is by removing the lid of the battery charger box (AESP 6115-G-350-522). For reference purposes, a circuit diagram of the pcb is illustrated in fig 4.

Note ...

Solenoid control relay RL3 is also mounted within the battery charger box.

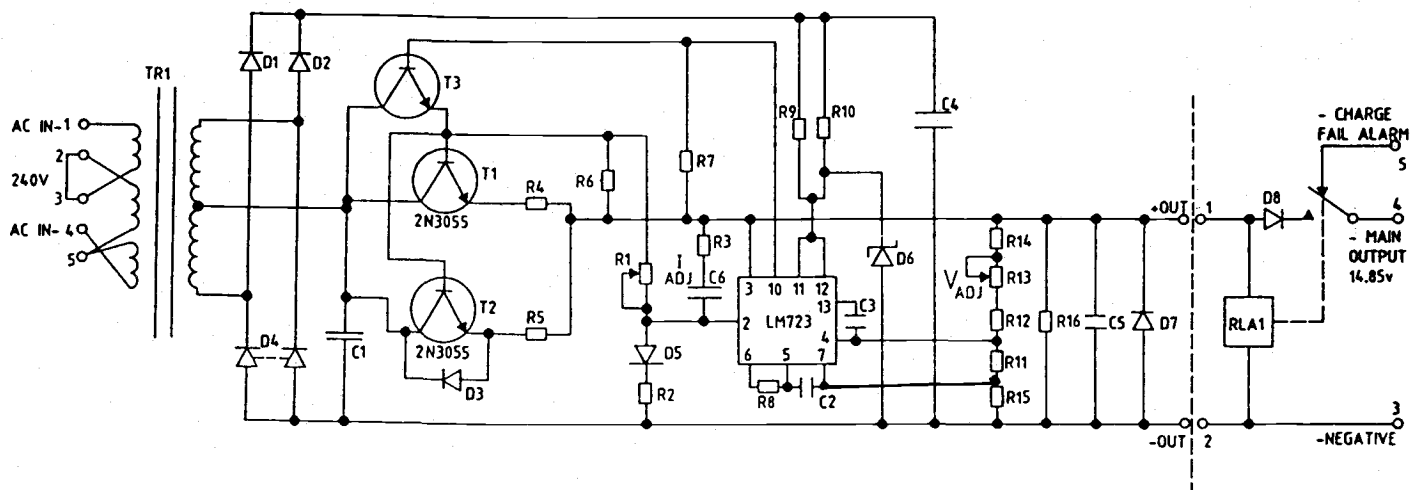


Fig 4 Battery Charger PCB Circuit Diagram

POWER ON Lamp Circuit Fault - General

9. Follow Fig 5 flow chart and refer to Fig 7. For disassembly instructions refer to AESP 6115-G-350-522.

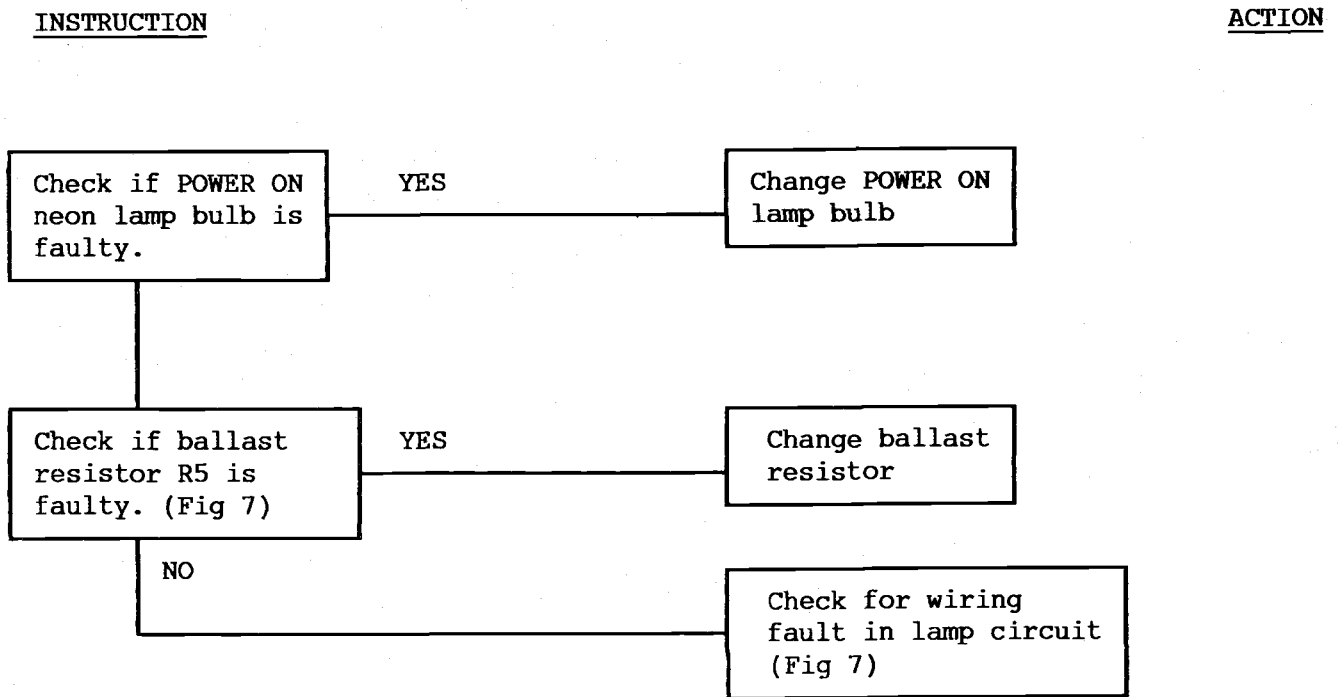


Fig 5 POWER ON Lamp Circuit - Diagnostic Flowchart 1

POWER ON Lamp Circuit fault - Wiring

10. Follow fig 6 flowchart and refer to Fig 7.

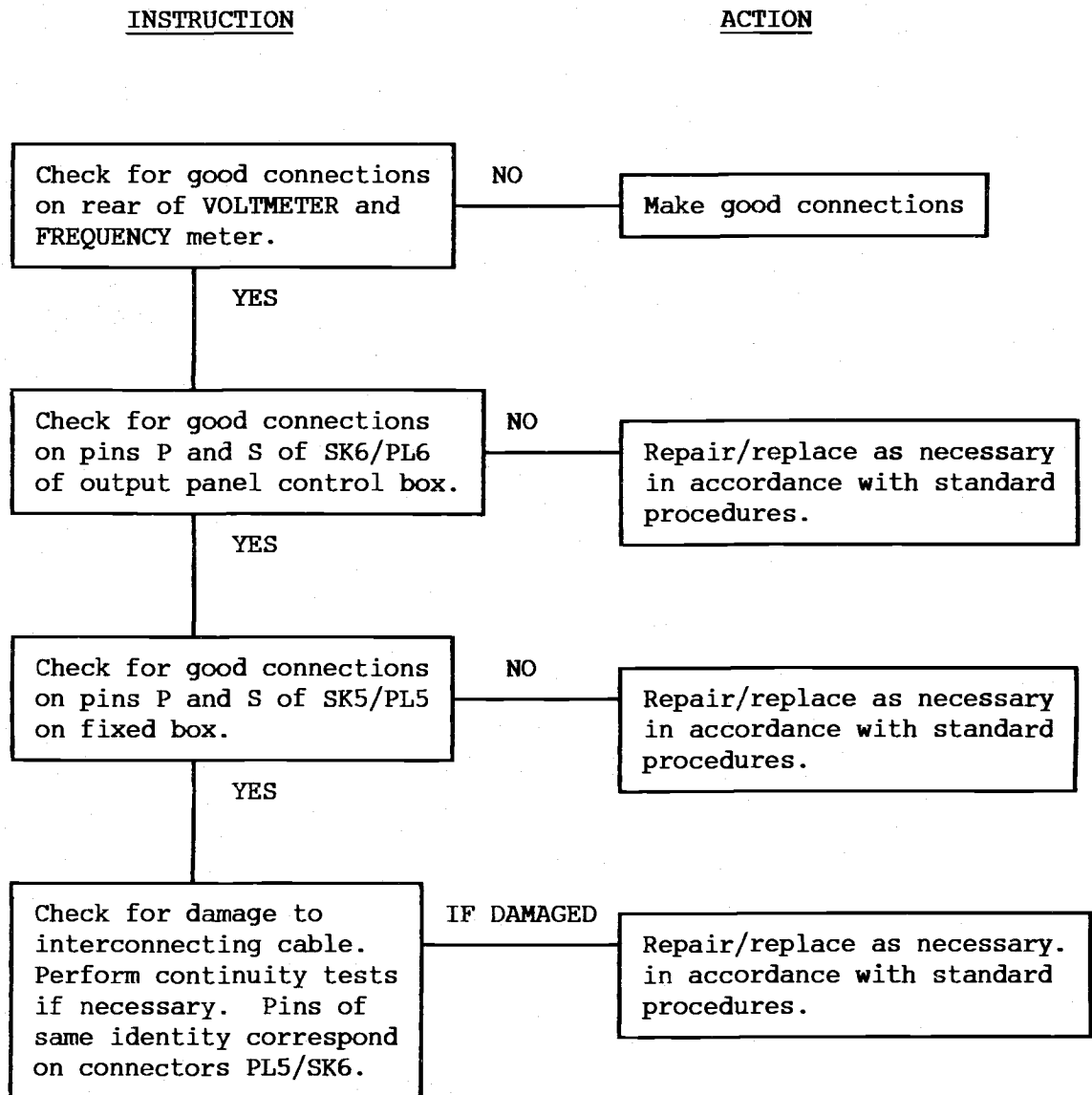


Fig 6 POWER ON Lamp Circuit - Diagnostic Flowchart 2

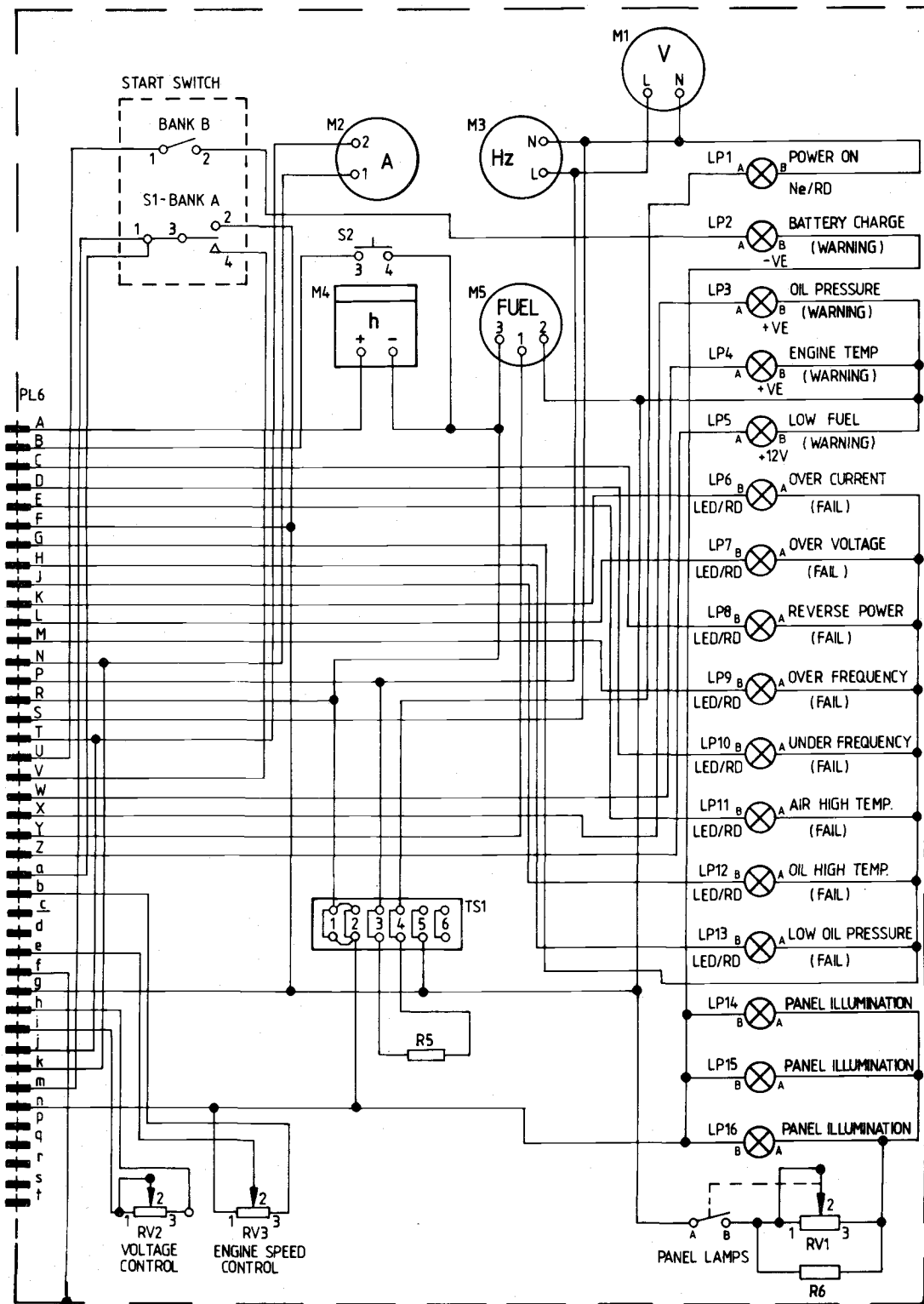


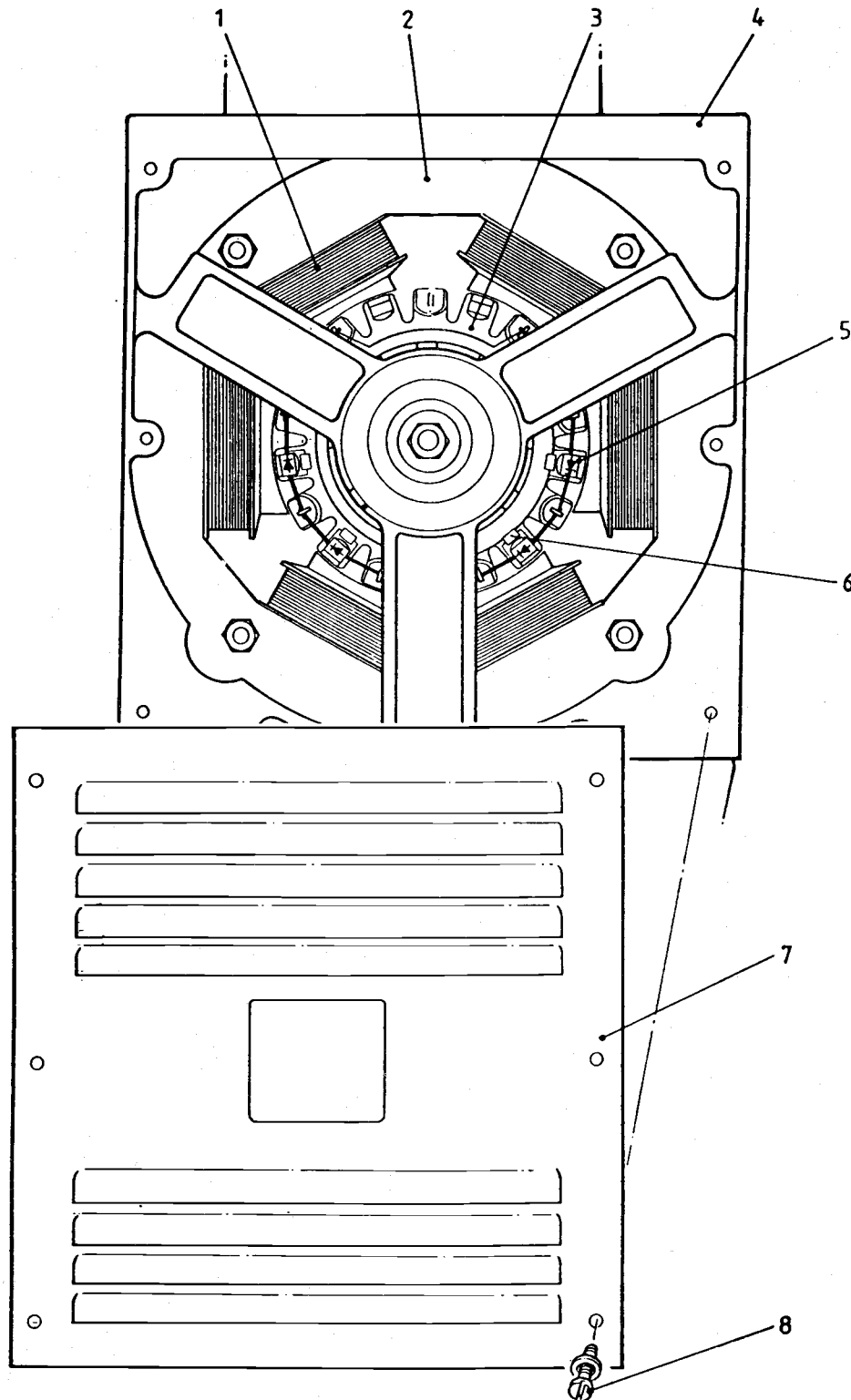
Fig 7 Output Panel Control Box - Circuit Diagram

Generator Output Low - Diode Failure

11. Six diodes are located in the alternator rotor assembly. Access to these diodes is through the stator housing end cover, proceed as follows:

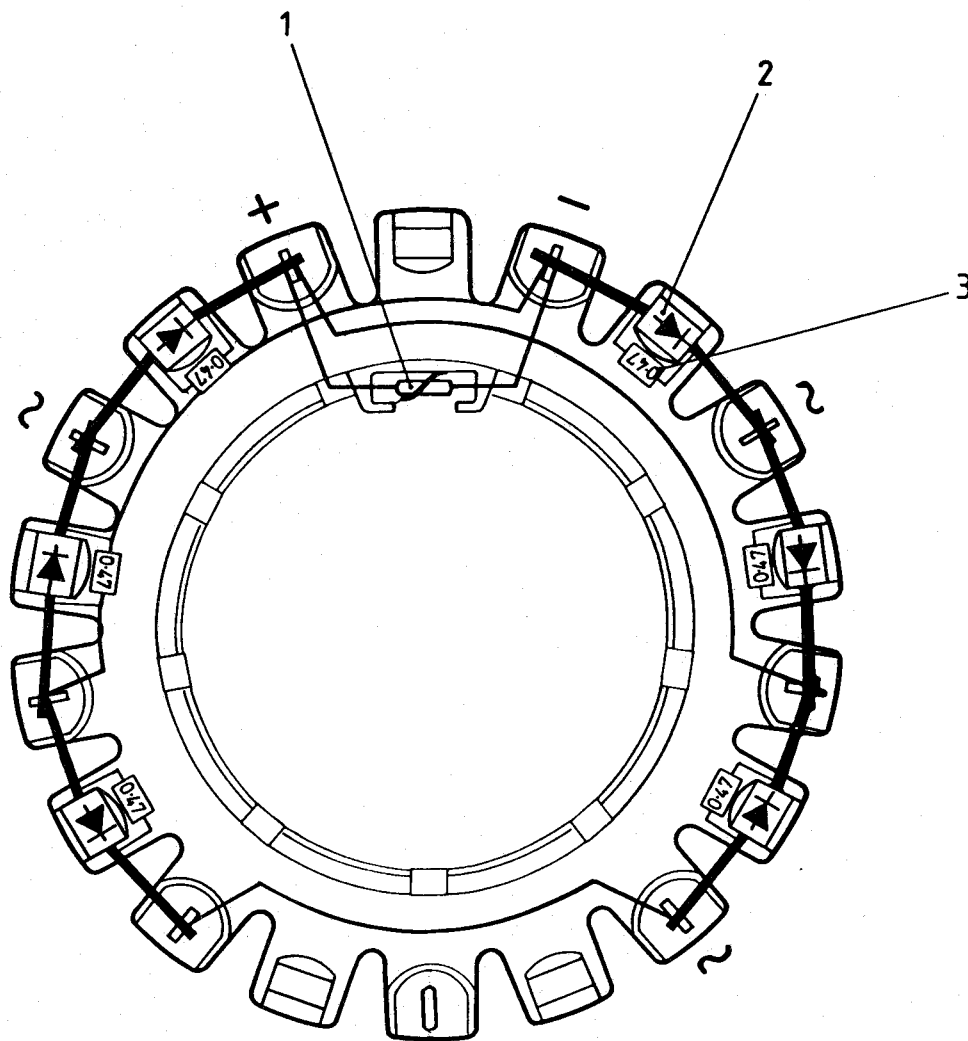
Notes ...

- (1) Where appropriate refer to AESP 6115-G-350-522 for Disassembly.
 - (2) Each diode has a 0.47 μ F capacitor connected across it (Fig. 9).
- 11.1. Ensure engine keyswitch is at the off position.
 - 11.2. Remove the acoustic cover (this is a two-man task).
 - 11.3. Remove the four retaining screws (8 Fig 10) and remove the housing, end cover (7).
 - 11.4. Raise the two decompression levers on top of the engine, so that the engine can be easily turned over without firing.
 - 11.5. The six diodes (5) are soldered to the rotor connections on the rotor assembly. Rotate the engine from the pulley end and expose each diode for testing. A simplified configuration is shown in Fig. 9.
 - 11.6. Using an ohmmeter (AVO) test each diode in turn. The ohmmeter will read 1.5K Ohms in one direction and 0 Ohms (short circuit) in the other direction. Verify that the soldered joints are intact and there are no broken leads.
 - 11.7. On completion of the diode tests, reassemble the housing end cover and secure it with the four retaining screws.



- | | |
|-------------------------|-----------------------------------|
| 1. Stator Coil (1 of 6) | 5. Rotor Diode (1 of 6) |
| 2. Stator Assembly | 6. Suppression Capacitor (1 of 6) |
| 3. Rotor Assembly | 7. Housing End Cover |
| 4. Housing | 8. Retaining Screw (1 of 6) |

Figure 8 Stator/Rotor End View



- 1. Varistor
- 2. Diode (6 off)
- 3. Capacitor (6 off) $0.47\mu\text{F}$
(electrical noise suppression)

Fig 9 Rotor Diodes Configuration - Simplified Diagram

Chapter 3

WIRING LIST

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WIRING LIST

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| 2 | Interconnecting Cable Wires |
| 3 | Remote Box Wires |

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| 1 | Generator Set Circuit Diagram |
| 2 | Remote Box Circuit Diagram |

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WIRING LIST

INTRODUCTION

1 The information provided in this chapter details the point-to-point wiring within the generator set to assist a technician in diagnosing and isolating electrical faults.

2 The information is presented in the form of circuit diagrams supported by tables containing details of individual wires.

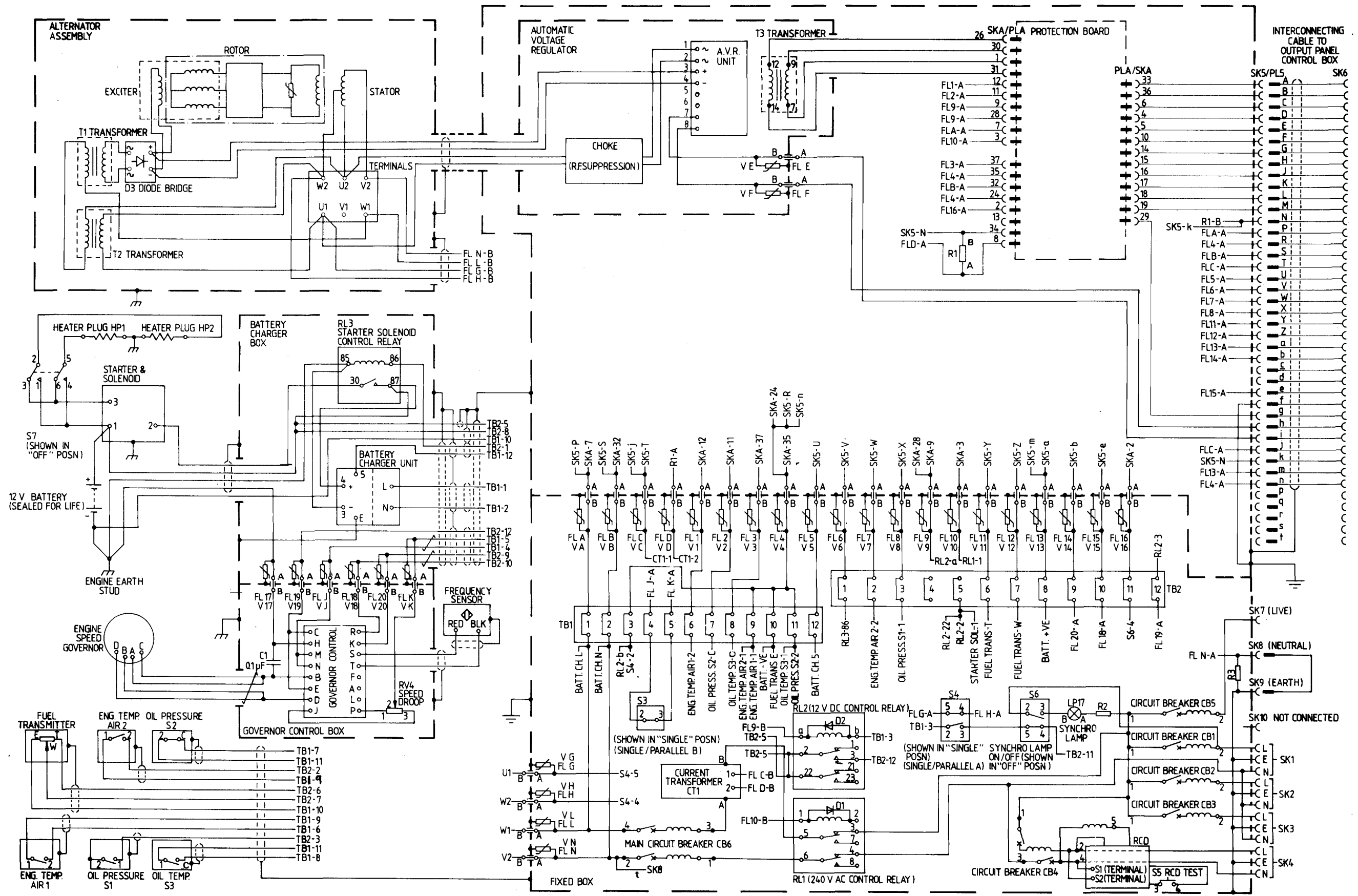


Fig 1

Generator Set - Circuit Diagram

Fig 1

TABLE 1 FIXED BOX/GENERATOR SET WIRES

WIRE No. (1)	SIZE (2)	COLOUR (3)	FROM (4)	TO (5)	ROUTE/REMARKS (6)
1	20 AWG	PINK	SKA - 1	T3 - 7	
2	"	"	" - 2	FL16 - A	
3	"	"	" - 3	FL10 - A	
4	"	"	" - 4	SK5 - D	
5	"	"	" - 5	SK5 - E	
6	"	"	" - 6	SK5 - C	
7	"	"	" - 7	FLA - A	With wire No. 46
8	"	"	" - 8	R1 - A	With wire No. 40
9	"	"	" - 9	FL9 - A	With wire No. 28
10	"	"	" - 10	SK5 - F	
11	"	"	" - 11	FL2 - A	
12	20 AWG	PINK	" - 12	FL1 - A	
13	--	--	" - 13	--	Not fitted
14	20 AWG	PINK	" - 14	SK5 - G	
15	"	"	" - 15	SK5 - H	
16	"	"	" - 16	SK5 - J	
17	"	"	" - 17	SK5 - K	
18	"	"	" - 18	SK5 - L	
19	20 AWG	PINK	" - 19	SK5 - M	
20	--	--	" - 20	--	} Not fitted
21	--	--	" - 21	--	
22	--	--	" - 22	--	
23	--	--	" - 23	--	
24	20 AWG	PINK	" - 24	FL4 - A	With wires No's 35, 47 and 68
25	--	--	SKA - 25	--	Not fitted
26	20 AWG	PINK	" - 26	T3 - 12	
27	--	--	" - 2	--	Not fitted
28	20 AWG	PINK	" - 28	FL9 - A	With wire No. 9
29	"	"	" - 29	SK5 - g	
30	"	"	" - 30	T3 - 9	
31	"	"	" - 31	T3 - 14	
32	"	"	" - 32	FLB - B	With wire No. 48
33	"	"	" - 33	SK5 - A	
34	"	"	" - 34	R1 - B	With wire No. 41
35	"	"	" - 35	FL4 - A	With wires No's 24, 47 and 68
36	20 AWG	PINK	SKA - 36	SK5 - B	
37	"	"	" - 37	FL3 - A	
38	--	--	--	--	} Not fitted
39	--	--	--	--	
40	20 AWG	PINK	R1 - A	FLD - A	From end of wire No. 8
41	20 AWG	PINK	R1 - B	SK5 - N	See wire No.45, from end with wire No. 34
42	--	--	--	--	} Not fitted
43	--	--	--	--	
44	--	--	--	--	

TABLE 1 FIXED BOX/GENERATOR SET WIRES (CONT'D)

WIRE No. (1)	SIZE (2)	COLOUR (3)	FROM (4)	TO (5)	ROUTE/REMARKS (6)
45	20 AWG	PINK	SK5 - N	SK5 - k	From end with wire No. 41
46	"	"	SK5 - P	FLA - A	With wire No. 7
47	"	"	" - R	FL4 - A	With wires No's 24, 35 and 68
48	20 AWG	PINK	" - S	FLB - A	With wire No. 32
49	"	"	" - T	FLC - A	With wire No. 66
50	"	"	" - U	FL5 - A	
51	"	"	" - V	FL6 - A	
52	"	"	" - W	FL7 - A	
53	"	"	" - X	FL8 - A	
54	"	"	" - Y	FL11 - A	
55	"	"	" - Z	FL12 - A	
56	"	"	" - a	FL13 - A	With wire No. 67
57	"	"	" - b	FL14 - A	
58	--	--	" - c	--	} Not fitted
59	--	--	--	--	
60	--	--	" - d	--	
61	20 AWG	PINK	SK5 - e	FL15 - A	
62	"	"	" - f	Chassis earth	
--	--	--	" - g	SKA - 29	See wire No. 29
64	20 AWG	PINK	SK5 - h	FLF - A	
65	"	"	" - i	FLE - A	
66	"	"	" - j	FLC - A	With wire No. 49
67	"	"	" - m	FL13 - A	With wire No. 56
68	"	"	" - n	FL4 - A	With wires No's 24, 35 and 47
69	--	--	" - p	--	} Not fitted
70	--	--	" - q	--	
71	--	--	" - x	--	
72	--	--	" - s	--	
73	--	--	" - t	--	
74	--	--	--	--	
75	--	--	--	--	
76	20 AWG	PINK	FLE - B	AVR - 7	
77	"	"	FLF - B	AVR - 8	
78	--	--	--	--	} Not fitted
79	--	--	--	--	
80	20 AWG	PINK	SDR Red/White wire	AVR - ~1	Via solder sleeve
81	20 AWG	"	SDR White wire	AVR - ~2	" "
82	16 AWG	GREY	SDR Yellow wire	GEN TB - U1	Via solder sleeve thru conduit, with wires No's 105 and 171

TABLE 1 FIXED BOX/GENERATOR SET WIRES (CONT'D)

WIRE No. (1)	SIZE (2)	COLOUR (3)	FROM (4)	TO (5)	ROUTE/REMARKS (6)
83	16 AWG	GREY	SDR Green wire	GEN TB - U2	Via solder sleeve thru conduit, with wires No's 93 and 104 Not fitted
84	--	--	--	--	
85	--	--	--	--	
86	16 AWG	GREY	AVR - +VE	D3 - +VE	Thru conduit with wire No. 95
87	"	"	AVR - -VE	D3 - -VE	Thru conduit with wire No. 96
88	--	--	--	--	Not fitted
89	--	--	--	--	
90	--	--	--	--	
91	--	--	--	--	
92	--	BLACK/ WHITE	GEN STATOR	GEN TB - V2	With wire No. 174
93	--	BLACK/ WHITE	GEN STATOR	GEN TB - U2	With wires No's 83 and 104
94	--	YELLOW/ WHITE	GEN STATOR	GEN TB - W2	With wires No's 106 and 172
95	--	YELLOW/ WHITE	GEN EXCITER	D3 - +VE	With wire No. 86
96	--	GREEN/ WHITE	GEN EXCITER	D3 - -VE	With wire No. 87
97	--	--	--	--	Not fitted
98	--	--	--	--	
99	--	RED/WHITE	T1 - RED/WHITE	D3 - ~1	
100	--	GREEN/ WHITE	T1 - GREEN/ WHITE	D3 - ~2	
101	--	BLACK/ WHITE	T1 - BLACK/ WHITE	GEN TB - W1	With wire No. 173
102	--	--	--	--	Not fitted
103	--	--	--	--	
104	--	BLACK/ WHITE	T2 - BLACK/ WHITE	GEN TB - U2	
105	--	BROWN	T2 - BROWN	GEN TB - U1	With wires No's 82 and 171
106	--	GREEN	T2 - GREEN	GEN TB - W2	With wires No's 94 and 172
107 to 116	--	--	--	--	Not fitted

TABLE 1 FIXED BOX/GENERATOR SET WIRES (CONT'D)

WIRE No. (1)	SIZE (2)	COLOUR (3)	FROM (4)	TO (5)	ROUTE/REMARKS (6)
117	20 AWG	PINK	FLA - B	TB1 - 1A	
118	"	"	FLB - B	TB1 - 2A	
119	"	"	FLC - B	CT1 - 1	
120	"	"	FLD - B	CT1 - 2	
121	"	"	FL1 - B	TB1 - 6A	
122	"	"	FL2 - B	" - 7A	
123	"	"	FL3 - B	" - 8A	
124	"	"	FL4 - B	" - 11A	With link wire No. 181
125	"	"	FL5 - B	TB1 - 12A	
126	"	"	FL6 - B	TB2 - 1B	
127	"	"	FL7 - B	" - 2B	
128	"	"	FL8 - B	TB2 - 3B	
129	"	"	FL9 - B	RL2 - a	
130	"	"	FL10 - B	RL1 - 1	
131	"	"	FL11 - B	TB2 - 6B	
132	"	"	FL12 - B	" - 7B	
133	"	"	FL13 - B	" - 8B	With wire No. 162
134	"	"	FL14 - B	" - 9B	
135	"	"	FL15 - B	" - 10B	
136	20 AWG	"	FL16 - B	TB2 - 11B	
137	--	--	--	--	} Not fitted
138	--	--	--	--	
139	--	--	--	--	
140	20 AWG	PINK	TB1 - 4A	S3 - 2	
141	"	"	TB1 - 5A	S3 - 3	
142	--	--	--	--	Not fitted
143	20 AWG	PINK	TB1 - 3B	S4 - 2	
144	--	--	--	--	Not fitted
145	20 AWG	PINK	TB2 - 11A	S6 - 4	
146	--	--	--	--	Not fitted
147	20 AWG	PINK	R2 - A	CB5 - 1	With wire No. 209
148	"	"	R2 - B	LP17 - A	
149	--	--	--	--	} Not fitted
150	--	--	--	--	
151	20 AWG	PINK	RL1 - 2	RL2 - 23	
152	16 AWG	GREY	RL1 - 6	CB6 - 1	
153	"	"	RL1 - 4	SK3 - N	With wire No. 197
154	"	"	CB6 - 3	CT1 - A	
155	"	"	CT1 - B	RL1 - 5	
156	16 AWG	GREY	RL1 - 3	CB3 - 1	With wires No's 211 and 212
157	--	--	--	--	} Not fitted
158	--	--	--	--	
159	20 AWG	PINK	RL2 - 2	RL2 - 22	With wire No. 162 and from end with wire No. 160

TABLE 1 FIXED BOX/GENERATOR SET WIRES (CONT'D)

WIRE No. (1)	SIZE (2)	COLOUR (3)	FROM (4)	TO (5)	ROUTE/REMARKS (6)
160	20 AWG	PINK	RL2 - 2	TB2 - 5A	With wire No. 301 and from end with wire No. 159
161	16 AWG	GREY	RL2 - 3	TB2 - 12A	With wire No. 295
162	20 AWG	PINK	RL2 - 22	TB2 - 5B	From end with wire No. 159
163	20 AWG	PINK	RL2 - b	TB1 - 3A	With link wire 180
164	--	--	--	--	Not fitted
165	16 AWG	GREY	FLG - A	S4 - 5	
166	"	"	FLH - A	S4 - 4	
167	16 AWG	GREY	FL.L - A	CB6 - 4	From end with wire No. 168
168	20 AWG	PINK	FL.L - A	TB1 - 1A	From end with wire No. 167
169	16 AWG	GREY	FL.N - A	CB6 - 2	With wire No. 215 and from end with wire No. 170
170	20 AWG	PINK	FL.N - A	TB1 - 2A	From end with wire No. 169
171	16 AWG	GREY	FL.G - B	GEN TB - U1	With wires No's 82 and 105 and thru conduit
172	16 AWG	GREY	FL.H - B	GEN TB - W2	With wires No's 94 and 106 and thru conduit
173	16 AWG	GREY	FL.L - B	GEN TB - W1	With wire No. 101 and thru conduit
174	16 AWG	GREY	FL.N - B	GEN TB - V2	With wire No. 92 and thru conduit
175	--	--	--	--	} Not fitted
to	--	--	--	--	
179	--	--	--	--	
180	20 AWG	PINK	TB1 - 3A	TB1 - 9A	With wire No. 181 and from end with wire No. 163
181	20 AWG	PINK	TB1 - 9A	TB1 - 10A	With wire No. 182 and from end with wire No. 180
	AWG	PINK	TB1 - 10A	TB1 - 11A	With wire No. 124 and from end with wire No. 181
183	--	--	--	--	} Not fitted
to	--	--	--	--	
185	--	--	--	--	
186	20 AWG	PINK	EARTH STUD	COLLECTIVE SCREENS ('P' clip)	From end with wires No's 194 and 207

TABLE 1 FIXED BOX/GENERATOR SET WIRES (CONT'D)

WIRE No. (1)	SIZE (2)	COLOUR (3)	FROM (4)	TO (5)	ROUTE/REMARKS (6)
187	--	--	--	--	} Not fitted
to	--	--	--	--	
190	--	--	--	--	
191	20 AWG	GREEN/ YELLOW	SK3 - E	SK2 - E	With wire No. 192
192	20 AWG	"	SK2 - E	SK1 - E	With wire No. 193 from end with wire No. 191
193	20 AWG	GREEN/ YELLOW	SK1 - E	SK4 - E	With wire No. 194 from end with wire No. 192
194	20 AWG	GREEN/ YELLOW	SK4 - E	EARTH STUD	With wires No's 186 and 207 from end with wire No. 193
195	--	--	--	--	} Not fitted
196	--	--	--	--	
197	16 AWG	GREY	SK3 - N	SK2 - N	
198	16 AWG	GREY	SK2 - N	SK1 - N	With wire No. 199 from end with wire No. 197
199	16 AWG	GREY	SK1 - N	CB4 - 3	From end with wire No. 198
200	--	--	--	--	} Not fitted
201	--	--	--	--	
202	16 AWG	GREY	SK1 - L	CB1 - 2	
203	"	"	SK2 - L	CB2 - 2	With wire No. 214
204	"	"	SK3 - L	CB3 - 2	
205	16 AWG	GREY	SK4 - L	CB4 - 2	Thru RCD with wires No's 226 and 227
206	16 AWG	GREY	SK4 - N	CB4 - 4	Thru RCD with wire No. 225
207	20 AWG	GREEN/ YELLOW	EARTH STUD	SK9	With wire No. 220
208	--	--	--	--	Not fitted
209	16 AWG	GREY	CB5 - 1	CB1 - 1	With wire No. 210 from end with wire No. 147
210	16 AWG	GREY	CB1 - 1	CB2 - 1	With wire No. 211 from end with wire No. 209
211	16 AWG	GREY	CB2 - 1	CB3 - 1	With wires No's 156 and 212, from end with wire No. 210

TABLE 1 FIXED BOX/GENERATOR SET WIRES (CONT'D)

WIRE No. (1)	SIZE (2)	COLOUR (3)	FROM (4)	TO (5)	ROUTE/REMARKS (6)
212	16 AWG	GREY	CB3 - 1	CB4 - 1	From end with wire No. 211
213	--	--	--	--	Not fitted
214	20 AWG	PINK	CB1 - 2	S6 - 2	From end with wire No. 202
215	16 AWG	GREY	CB6 - 2	SK8	From end with wire No. 169
216	16 AWG	GREY	CB5 - 2	SK7	
217	20 AWG	PINK	S4 - 3	S6 - 5	
218	20 AWG	PINK	S6 - 3	LP17 - B	
219	--	--	--	--	Not fitted
220	20 AWG	GREEN/ YELLOW	SK9	PANEL EARTH	From end with wire No. 207
221	--	--	--	--	} Not connected
222	--	--	--	--	
223	--	GREEN	RCD - 1 GREEN WIRE	S5 - 3	
224	--	"	RCD - 2 GREEN WIRE	S5 - 4	
225	--	BROWN	RCD - S1	CB4 - 4	With wire No. 206
226	--	BROWN	RCD - S2	CB4 - 2	With wires No's 205 and 227
227	--	BLUE	RCD - BLUE WIRE	CB4 - 2	With wires No's 205 and 226
228	--	RED	RCD - RED WIRE	CB4 - 5	
229 to 261	--	--	--	--	} Not fitted
262	20 AWG	GREEN/ YELLOW	BATT CHARGER FRAME	EARTH STUD	
263	20 AWG	PINK	BATT CHG - 3	RL3 - 85	With wire No. 329
264	20 AWG	"	BATT CHG - 4	RL3 - 87	With wire No. 330
265	--	--	--	--	
266	--	--	--	--	Not fitted
267	16 AWG	GREY	GOV. CONT-C	GOV. CONT-E	From end with wire No. 273
268	20 AWG	PINK	GOV. CONT-M	GOV. CONT-N	From end with wire No. 275
269	--	--	--	--	} Not fitted
270	--	--	--	--	
271	16 AWG	GREY	FL17 - B	GOV. CONT-H	
272	20 AWG	PINK	FL18 - B	GOV. CONT-R	
273	16 AWG	GREY	FL19 - B	GOV. CONT-C	With wire No. 267
274	20 AWG	PINK	FL20 - B	GOV. CONT-K	

TABLE 1 FIXED BOX/GENERATOR SET WIRES (CONT'D)

WIRE No. (1)	SIZE (2)	COLOUR (3)	FROM (4)	TO (5)	ROUTE/REMARKS (6)
275	20 AWG	PINK	FLJ - B	GOV. CONT-M	With wire No. 267
276	20 AWG	PINK	FLK - B	RV4 - 2	
277	--	--	--	--	} Not fitted
278	--	--	--	--	
279	20 AWG	PINK	RV4 - 1	GOV. CONT-P	} Not fitted
280	20 AWG	PINK	RV4 - 3	GOV. CONT-J	
281	--	--	--	--	} Not fitted
282	--	--	--	--	
283	20 AWG	PINK	ENGINE		
			SPEED GOV-A	GOV. CONT-B	With wire No. 285
284	"	"	ENGINE		
			SPEED GOV-B	GOV. CONT-D	With wire No. 286
285	"	"	ENGINE		
			SPEED GOV-C	GOV. CONT-B	With wire No. 283
286	20 AWG	PINK	ENGINE		
			SPEED GOV-D	GOV. CONT-D	With wire No. 284
287	--	--	--	--	Not fitted
288	20 AWG	RED	FREQ SENSOR - RED	GOV. CONT-S	
289	20 AWG	BLUE	FREQ SENSOR - BLACK	GOV. CONT-T	
290	20 AWG	PINK	SCREENS OF WIRES NO'S 288 AND 289	12V NEGATIVE STUD	With wires No's 303, 328, 329 and 344
291	20 AWG	PINK	FL18 - A	TB2 - 10A	
292	"	"	FL20 - A	TB2 - 9A	
293	"	"	FLJ - A	TB1 - 4B	
294	20 AWG	PINK	FLK - A	TB1 - 5B	
295	16 AWG	GREY	FL19 - A	TB2 - 12A	With wire No. 161
296	20 AWG	RED	BATT CHARG. TRANS - L	TB1 - 1B	
297	20 AWG	BLUE	BATT CHARG. TRANS - N	TB1 - 2B	
298	--	--	--	--	Not fitted
299	20 AWG	RED	RL3 - 86	TB2 - 1A	
300	20 AWG	BLUE	BATT. CHARG-5	TB1 - 12B	
301	16 AWG	GREY	START SOL - 1	TB2 - 5A	With wire No. 160 and from end with 302, 330, 334, 335. and 343
302	20 AWG	RED	START SOL - 1	TB2 - 8A	From end with wires No's 301, 330, 334 335 and 343
303	20 AWG	BLUE	ENGINE EARTH STUD	TB1 - 10B	From end with wires 290, 328, 329, 334 and 344
304	--	--	--	--	Not fitted

TABLE 1 FIXED BOX/GENERATOR SET WIRES (CONT'D)

WIRE No. (1)	SIZE (2)	COLOUR (3)	FROM (4)	TO (5)	ROUTE/REMARKS (6)
305	20 AWG	RED	ENG AIR TEMP SW1 - 2	TB1 - 6B	
306	20 AWG	BLUE	ENG AIR TEMP SW1 - 1	TB1 - 9B	With wire No. 309
307	20 AWG	PINK	SCREENS OF WIRES NO 305 AND 306	LOCAL EARTH POINT	With wire No. 310
308	20 AWG	RED	AIR TEMP SW2 -2	TB2 - 2A	
309	20 AWG	BLUE	AIR TEMP SW2 - 1	TB1 - 9B	With wire No. 306
310	20 AWG	PINK	SCREENS OF WIRES NO. 308 AND 309	LOCAL EARTH POINT	With wire No. 307
311	20 AWG	RED	OIL PRESS SW1 - 1	TB2 - 3A	
312		BLUE	SPARE	ENDS INSULATED AND STOWED IN LOOM	
313	20 AWG	PINK	SCREENS OF WIRES NO. 311 AND 312	LOCAL EARTH POINT	With wire No. 316
314	20 AWG	RED	OIL PRESS SW2 - C	TB1 - 7B	
315	20 AWG	BLUE	OIL PRESS SW2 - 2	TB1 -11B	With wire No. 318
316	20 AWG	PINK	SCREENS OF WIRES NO. 314 AND 315	LOCAL EARTH POINT	With wire No. 313
317	20 AWG	RED	OIL TEMP SW3 - C	TB1 - 8B	
318	20 AWG	BLUE	OIL TEMP SW3 - 1	TB1 - 11B	With wire No. 315
319	20 AWG	PINK	SCREENS OF WIRES NO. 317 AND 318	LOCAL EARTH POINT	
320	20 AWG	RED	FUEL TRANS-T	TB2 - 6A	
321	20 AWG	BLUE	FUEL TRANS-W	TB2 - 7A	
322	20 AWG	PINK	SCREENS OF WIRES NO. 320 AND 321	LOCAL EARTH POINT	With wire No. 325
323	20 AWG	RED	SPARE	ENDS INSULATED AND STOWED	
324	20 AWG	BLUE	FUEL TRANS-E	TB1 - 10B	With wire No. 303

TABLE 1 FIXED BOX/GENERATOR SET WIRES (CONT'D)

WIRE No. (1)	SIZE (2)	COLOUR (3)	FROM (4)	TO (5)	ROUTE/REMARKS (6)
325	20 AWG	PINK	SCREENS OF WIRES NO. 323 AND 324	LOCAL EARTH POINT	With wire No. 322
326	--	--	--	--	} Not fitted
327	--	--	--	--	
328	16 AWG	GREY	FL17 - A	ENGINE 12V NEGATIVE STUD	With wires No's 290 303, 329 and 344
329	20 AWG	PINK	RL3 - 85	ENGINE 12V NEGATIVE STUD	With wires No 290, 303, 328, 344 from end with wire No. 263
330	16 AWG	GREY	RL3 - 87	START SOL - 1	With wire No's 301, 302, 334, 335, 343, from end with wire No. 264
331	16 AWG	GREY	RL3 - 30	START SOL - 2	
332	--	--	--	--	} Not fitted
333	--	--	--	--	
334	16 AWG	GREY	START SOL - 1	S7 - 1	From end with wires No's 301, 302, 330, 335 and 343
335	16 AWG	GREY	START SOL - 1	S7 - 4	From end with wires No's 301, 302, 330, 334 and 343
336	16 AWG	GREY	START SOL - 3	S7 - 3	From end with wire No. 337
337	16 AWG	GREY	START SOL - 3	S7 - 6	From end with wire No. 336
338	16 AWG	GREY	S7 - 2	HEATER PLUG - 2	
339	16 AWG	GREY	S7 - 5	HEATER PLUG - 1	
340 to 342	--	--	--	--	} Not fitted
343	16mm ²	GREY	BATT +VE	START SOL - 1	
344	16mm ²	GREY	BATT -VE	ENGINE 12V NEGATIVE STUD	With wires No. 290 303, 328 and 329

TABLE 2 INTERCONNECTING CABLE WIRES

FIXED BOX END PL5	REMOTE BOX END SK6	FIXED BOX END PL5	REMOTE BOX END SK6
A	A	a	a
B	B	b	b
C	C	c	} Not used
D	D	d	
E	E	e	e
F	F	f	f
G	G	g	g
H	H	h	h
J	J	i	i
K	K	j	j
L	L	k	k
M	M	m	m
N	N	n	n
P	P	p	} Not used
R	R	q	
S	S	r	
T	T	s	
U	U	t	
V	V		
W	W		
X	X		
Y	Y		
Z	Z		

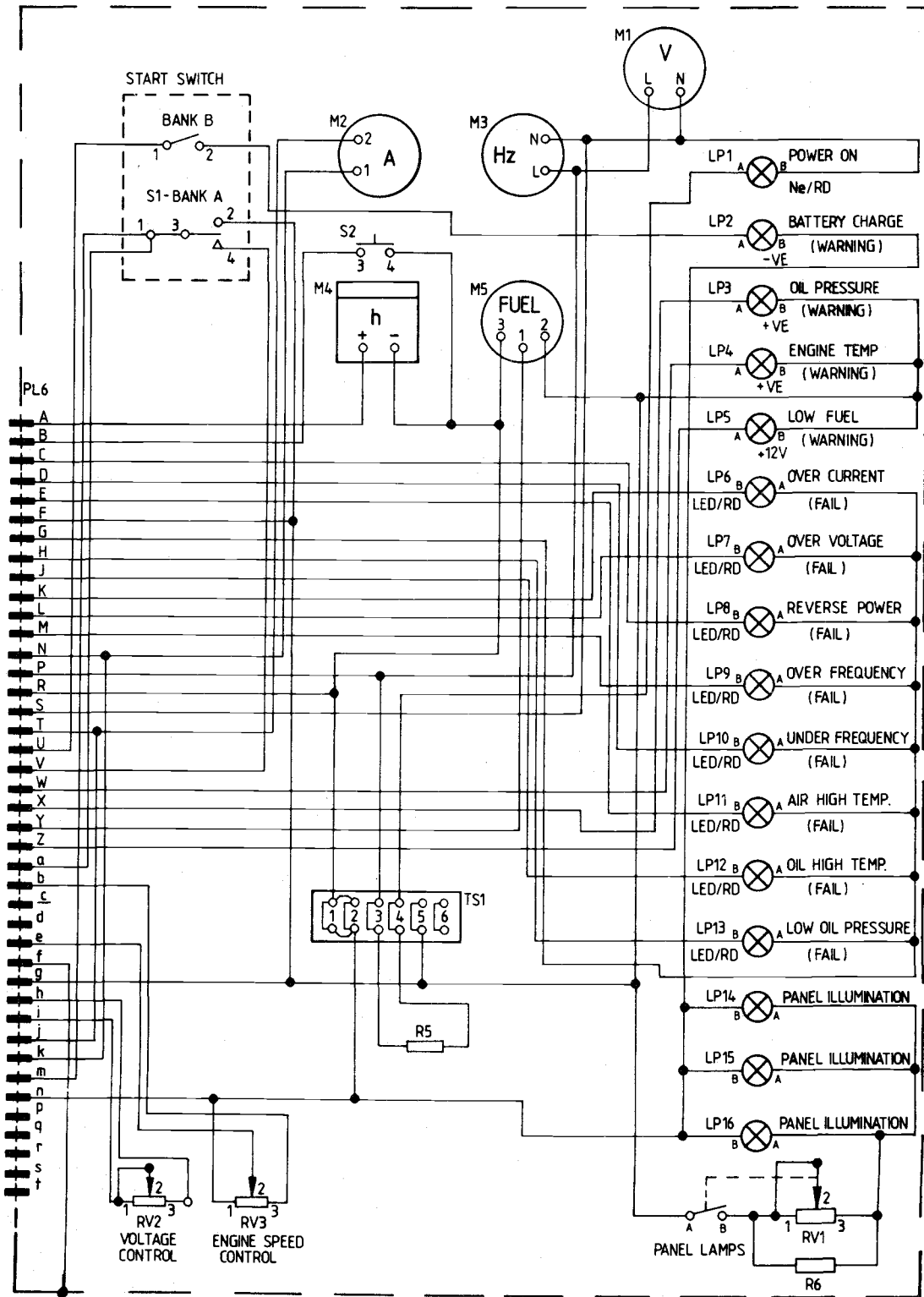


Fig 2 Remote Box Circuit Diagram

TABLE 3 REMOTE BOX WIRES

WIRE No. (1)	SIZE (2)	COLOUR (3)	FROM (4)	TO (5)	ROUTE/REMARKS (6)
1	20 AWG	PINK	PL6 - A	M4 +VE	
2	"	"	" - B	S2 - 3	
3	"	"	" - C	LP8 - B	
4	"	"	" - D	LP10 - B	
5	"	"	" - E	LP11 - B	
6	"	"	" - F	S1 BANK A- 2	With wires No. 30 and 95
7	"	"	" - G	LP13 - A	
8	"	"	" - H	LP13 - B	
9	"	"	" - J	LP12 - B	
10	"	"	" - K	LP6 - B	
11	"	"	" - L	LP7 - B	
12	"	"	" - M	LP9 - B	
13	"	"	" - N	M2 - 1	With wire No. 34
14	"	"	" - P	M1 - L	With wire No. 88
15	"	"	" - R	TS1 - 1A	With wire No. 45
16	"	"	" - S	M1 - N	With wire No. 89
17	"	"	" - T	M2 - 2	With wire No. 33
18	"	"	" - U	S1 BANK B- 1	
19	"	"	" - V	S1 BANK A- 4	
20	"	"	" - W	LP4 - A	
21	"	"	" - X	LP3 - A	
22	"	"	" - Y	M5 - 1	
23	"	"	" - Z	LP5 - A	
24	"	"	" - a	S1 BANK A- 1	With wire No. 99
25	20 AWG	PINK	PL6 - b	RV3 - 3	
26	--	--	" - c	--	} Not used
27	--	--	" - d	--	
28	20 AWG	PINK	PL6 - e	RV3 - 2	
29	"	"	" f	CASE EARTH STUD	
30	"	"	" g	S1 BANK A- 2	With wires No. 6 and 95
31	"	"	" - h	RV2 - 3	
32	"	"	" - i	RV2 - 2	With BTC link wire No. 97
33	"	"	" - j	M2 - 2	With wire No. 17
34	"	"	" - k	M2 - 1	With wire No. 13
35	"	"	" - m	S1 BANK A- 3	With wire No. 99
36	20 AWG	PINK	PL6 - n	TS1 - 2A	With wire No. 46
37	--	--	" - p	--	} Not used
38	--	--	" - q	--	
39	--	--	" - r	--	
40	--	--	" - s	--	
41	--	--	PL6 - t	--	
42					
to	--	--	--	--	} Not fitted
44					
45	20 AWG	PINK	TS1 - 1A	M4 - -VE	From end with wire No. 15

TABLE 3 REMOTE BOX WIRES (CONT'D)

WIRE No. (1)	SIZE (2)	COLOUR (3)	FROM (4)	TO (5)	ROUTE/REMARKS (6)
46	20 AWG	PINK	TS1 - 2A	S2 - 4	With wire 98 from end with wire No. 36
47	20 AWG	PINK	TS1 - 5A	M5 - 2	
48	"	"	TS1 - 5A	LP5 - B	With BTC wire No. 62
49	"	"	TS1 - 1B	TS1 - 2B	With wire No. 51
50	"	"	TS1 - 1B	LP16 - B	With wire No. 80
51	"	"	TS1 - 2B	M5 - 3	From end with wire No. 49
52	"	"	TS1 - 3B	M3 - L	With wire No. 88
53	"	"	TS1 - 4B	LP1 - A	
54	20 AWG	PINK	TS1 - 5B	RV1 - A	With wire No. 95
55					
to	--	--	--	--	} Not fitted
57					
58	20 AWG	PINK	S1 BANK B- 2	LP2 - A	
59	20 AWG	PINK	LP14 - B	LP2 - B	From end with wire No. 79
60	--	--	--	--	Not fitted
61	24 SWG	TINNED COPPER BRAID	LP3 -B	LP4 - B	
62	24 SWG	TINNED COPPER BRAID	LP4 - B	LP5 - B	With wire No. 48
63	--	--	--	--	} Not fitted
64	--	--	--	--	
65	20 AWG	PINK	LP6 - A	LP7 - A	
66	"	"	LP7 - A	LP8 - A	
67	"	"	LP8 - A	LP9 - A	
68	"	"	LP9 - A	LP10 - A	
69	"	"	LP10 - A	LP11 - A	
70	"	"	LP11 - A	LP12 - A	
71	20 AWG	PINK	LP12 - A	LP13 - A	With wire No. 7
72					
to	--	--	--	--	} Not fitted
74					
75	20 AWG	PINK	LP14 - A	LP15 - A	
76	20 AWG	PINK	LP15 - A	LP16 -A	With wire No. 94
77	--	--	--	--	
78	--	--	--	--	Not fitted
79	20 AWG	PINK	LP14 - B	LP15 - B	From end with wire No. 59
80	20 AWG	PINK	LP15 - B	LP16 - B	With wire No. 50
81					
82	--	--	--	--	} Not fitted
83					
84	20 AWG	PINK	LP1 - B	M3 - N	With wire No. 89

TABLE 3 REMOTE BOX WIRES (CONT'D)

WIRE No. (1)	SIZE (2)	COLOUR (3)	FROM (4)	TO (5)	ROUTE/REMARKS (6)
85	--	--	--	--	} Not fitted
86	--	--	--	--	
87	--	--	--	--	
88	20 AWG	PINK	M1 - L	M3 - L	
89	20 AWG	PINK	M1 - N	M3 - N	With wire No. 52 from end with wire 14
90	--	--	--	--	} Not fitted
91	--	--	--	--	
92	24 SWG	TINNED COPPER BRAID	RV1 - 1	RV1 - B	
93	24 SWG	TINNED COPPER BRAID	RV1 - 1	RV1 - 2	With R6 end A
94	20 AWG	PINK	RV1 - 3	LP16 - A	With wire No. 76 from end with R6 end B
95	20 AWG	PINK	RV1 - A	S1 BANK A- 2	With wires 6 and 30 from end with wire 54
96	--	--	--	--	} Not fitted
97	24 SWG	TINNED COPPER BRAID	RV2 - 1	RV2 - 2	
98	20 AWG	PINK	RV3 - 1	S2 - 4	From end with wire 32
99	20 AWG	PINK	S1 - 1	S1 - 3	With wire No. 46 from end with wire 24
100	--	--	--	--	} Not fitted
101	--	--	--	--	
102	20 AWG	GREEN/YELLOW	CASE EARTH STUD	FIXED BOX EARTH STUD	