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**GENERATOR SET
DIESEL ENGINE DRIVEN
4.5kW (5.6kVA) 240V AC,
SINGLE PHASE, 50 Hz
(AIR LOG 4169A)**

OPERATING INFORMATION

REPRINTED INCORPORATING AMDT 1

BY COMMAND OF THE DEFENCE COUNCIL

Ministry of Defence

**PUBLICATIONS AUTHORITY
Directorate General of Defence Quality Assurance
Royal Arsenal West, Woolwich, SE18 6ST**

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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 PUBLICATIONSRelated 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 | | | | 4 | | 5 | | | | 6 | 7 | | 8 | |
| | 1 | 2 | 3 | 1 | 2 | 1 | 2 | 3 | 4 | | 1 | 2 | 1 | 2 |
| LEVEL | | | | | | | | | | | | | | |
| 1 USER/OPERATOR | 101 | 201 | 201 | 411 | 411 | 201 | 201 | * | * | 601 | * | * | * | * |
| 2 UNIT MAINTENANCE | * | * | 302 | * | * | 512 | 522 | 532 | * | * | 712 | 712 | * | * |
| 3 FIELD MAINTENANCE | * | * | 302 | * | * | 512 | 522 | 532 | * | * | * | * | * | * |
| 4 BASE MAINTENANCE | * | * | * | * | * | * | * | * | * | * | * | * | * | * |

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| 1.0 Purpose & 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-001-001 must be made to ensure the availability of the listed publications.

Associated Publications

| <u>Code No.</u> | <u>Type</u> | <u>Title</u> |
|-----------------|-------------|--|
| 2815-B-641 | AESP | 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

DESCRIPTION

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- 3 Generator Set On/Off Loading
- 4 Lifting (WARNING)
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- 6 Mounting onto Two and a Half Tonne Trailer

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INTRODUCTION

GENERAL

1 This generator set is a chassis mounted diesel driven alternator that can be man handled over short distances. The engine/alternator assembly is enclosed in a demountable acoustic cover.

Role and Purpose

2 The generator set is designed for field use and can be deployed on trailer, or free-standing. The generator set provides 240V 50Hz (nominal) single phase and is rated at 4.5kW (5.6 kVA at 0.8 power factor). It is designed for operation with the acoustic cover in place (use without the acoustic cover is not recommended). Two generator sets of this type can be connected in parallel for greater output power.

Generator Set On/Off Loading (Fig 1)

3 The generator set can be on/off loaded from a trailer using a crane with the appropriate slings.

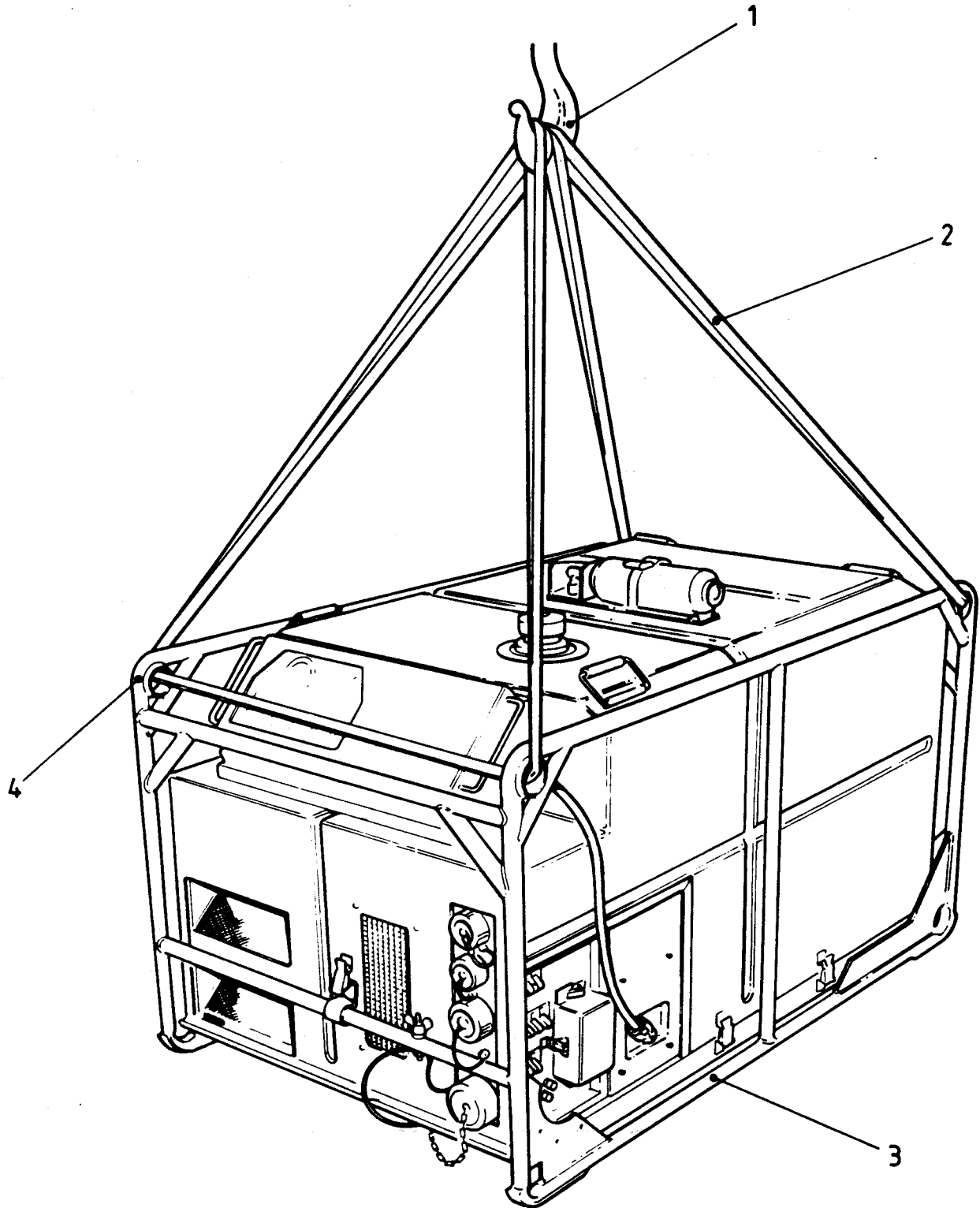
Lifting (Fig 1)

4 Before lifting the generator set ensure that all external stowed items are properly secured or stowed. All doors and other apertures must be closed and properly secured. The acoustic cover must be correctly fitted and secured by means of the quick release toggle catches.

WARNING ...

THE SAFE WORKING LOAD (SWL) OF THE SLINGS MUST BE NOT LESS THAN 2.0 TONNES.

4.1 Using two lifting slings the generator set can be lifted by crane or helicopter.



- 1. Hook (from mobile crane)
- 2. Lifting Slings (SWL 2 tonnes minimum)
- 3. Tubular Chassis of Generator Set
- 4. Lifting Points (4 off)

Fig 1 Generator Set Lifting Arrangements

Mounting onto Three-Quarter Tonne Trailer (Fig 2)

5 The Generator set can be mounted onto the FV2380/1 Mk.II trailer using the Air-Log Ltd. Parts Kit No. 4-4169-1-121 the contents of which are listed in TABLE 1. The generator set is mounted in accordance with the instructions contained in figure 3.

TABLE 1 PARTS KIT FOR MOUNTING TO FV2380/1 MK II

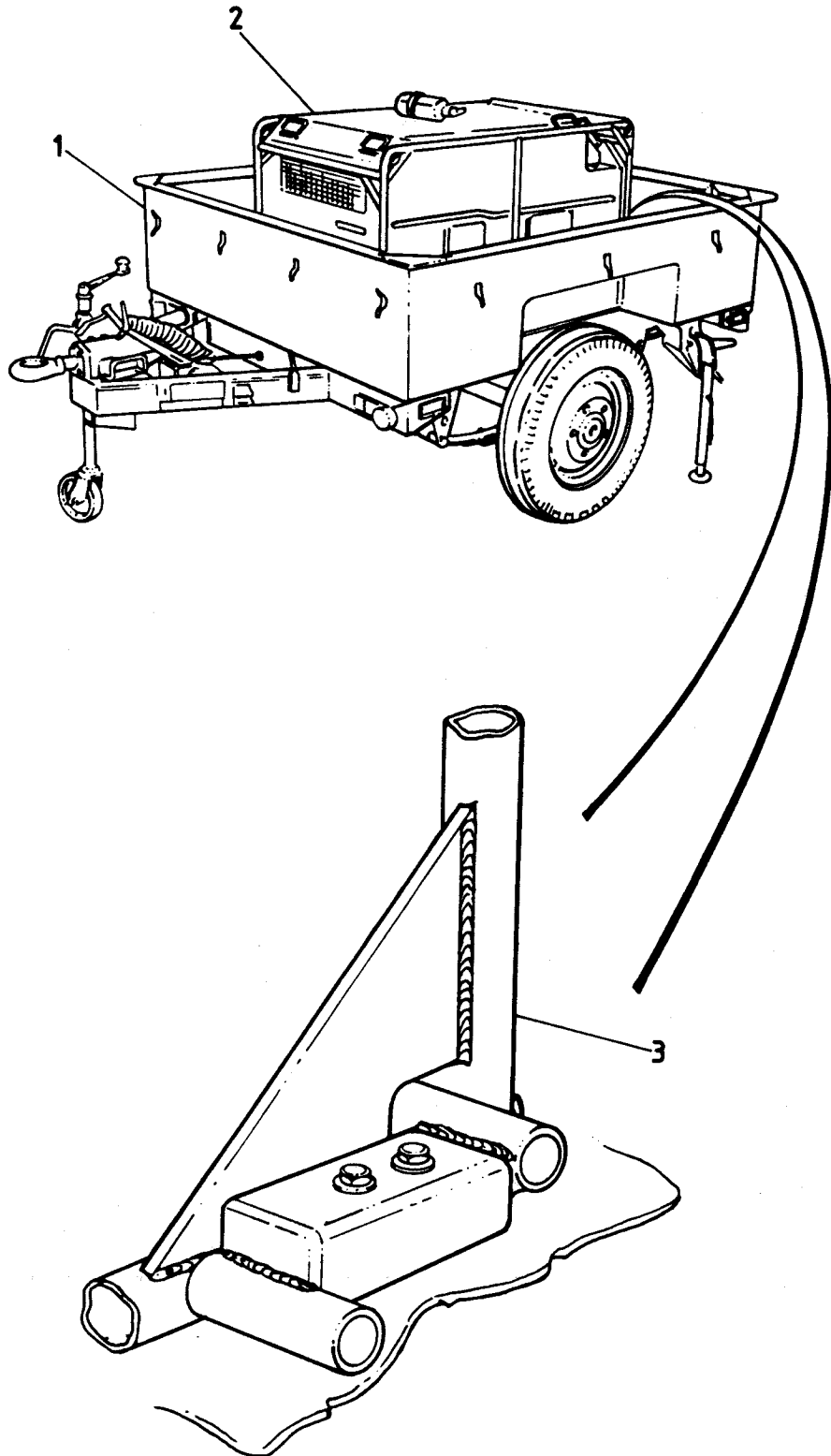
| Item | Item Identity | Part No. | NSN | Qty |
|------|---|--------------|-----|-----|
| 1 | Clamp Assy. | 1-4169-1/118 | | 4 |
| 2 | Plate, Small | 4-4169-1/120 | | 4 |
| 3 | Bolt, 3/8" UNF x 3" Hex Ltd. to BS1768 | | | 8 |
| 4 | Nut, Stiff, Ordinary, 3/8" UNF to BS1768 | | | 8 |
| 5 | Washer, 3/8" dia. to BS1768 | | | 16 |

Mounting onto Two and a Half Tonne Trailer (Fig 4)

6. The generator set can be mounted onto the FV2406 Mk. II trailer using the Air-Log Ltd. Parts Kit No. 4-4169-1-122 the contents of which are listed in TABLE 2. The generator set is mounted in accordance with the instructions contained in figure 5.

TABLE 2 PARTS KIT FOR MOUNTING TO FV2406 Mk II

| Item | Item Identity | Part No. | NSN | Qty |
|------|---|--------------|-----|-----|
| 1 | Clamp Assy. | 1-4169-1/118 | | 8 |
| 2 | Plate, Small | 4-4169-1/120 | | 4 |
| 3 | Bolt, 3/8" UNF x 4" Hex to BS1768 | | | 16 |
| 4 | Nut, Stiff, Ordinary, 3/8" UNF to BS1768 | | | 16 |
| 5 | Washer, 3/8" dia. to BS1768 | | | 32 |



- 1. FV2380/1 Mk II
- 2. Generator Set
- 3. Clamp Assy. 4 off
(see fig. 3 for
mounting detail)

SIMILAR IN FOUR POSITIONS

Fig 2 Generator Set - Method of Mounting to
Three-quarter Tonne Trailer Type FV2380/1 Mk. II

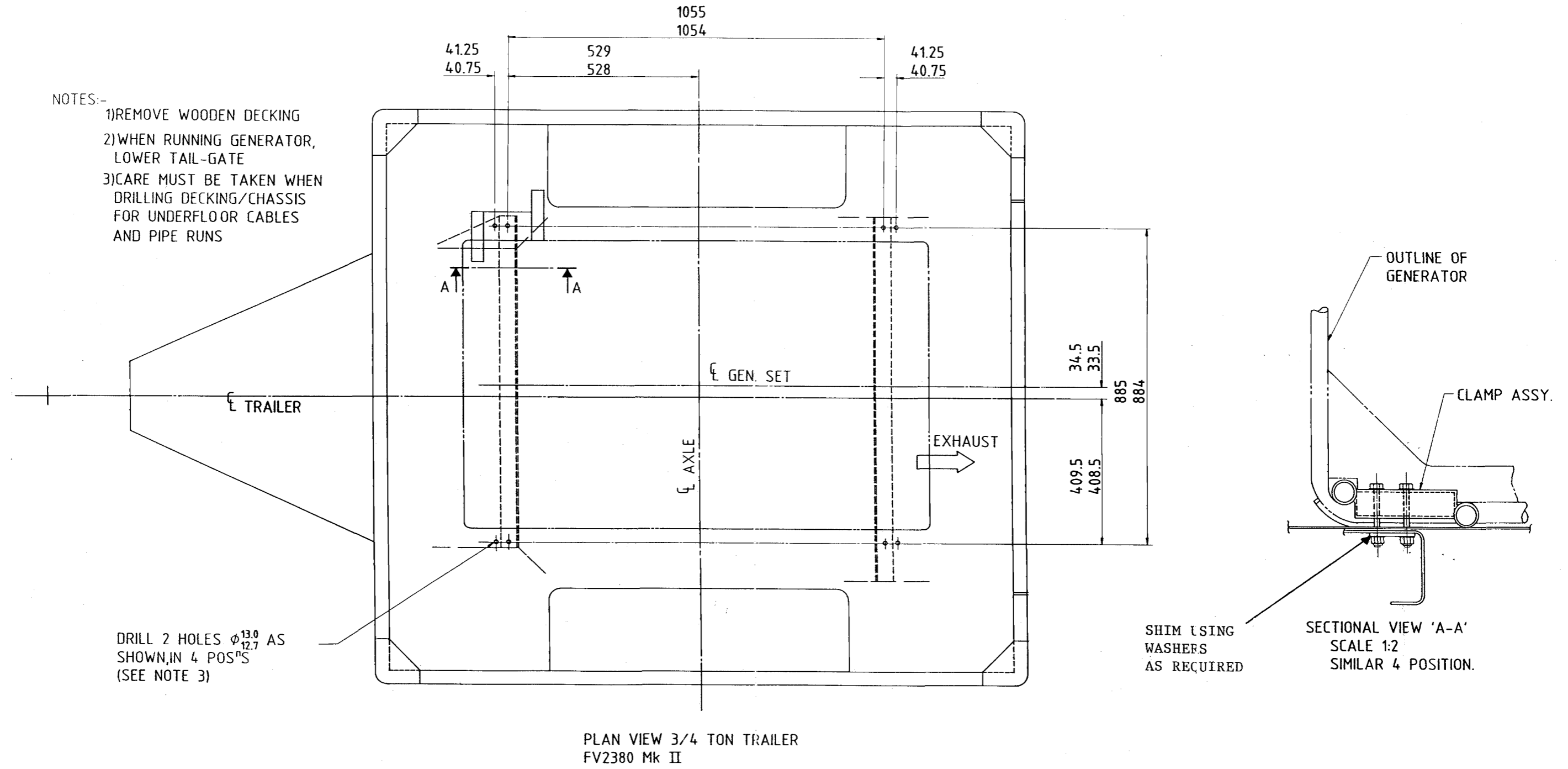
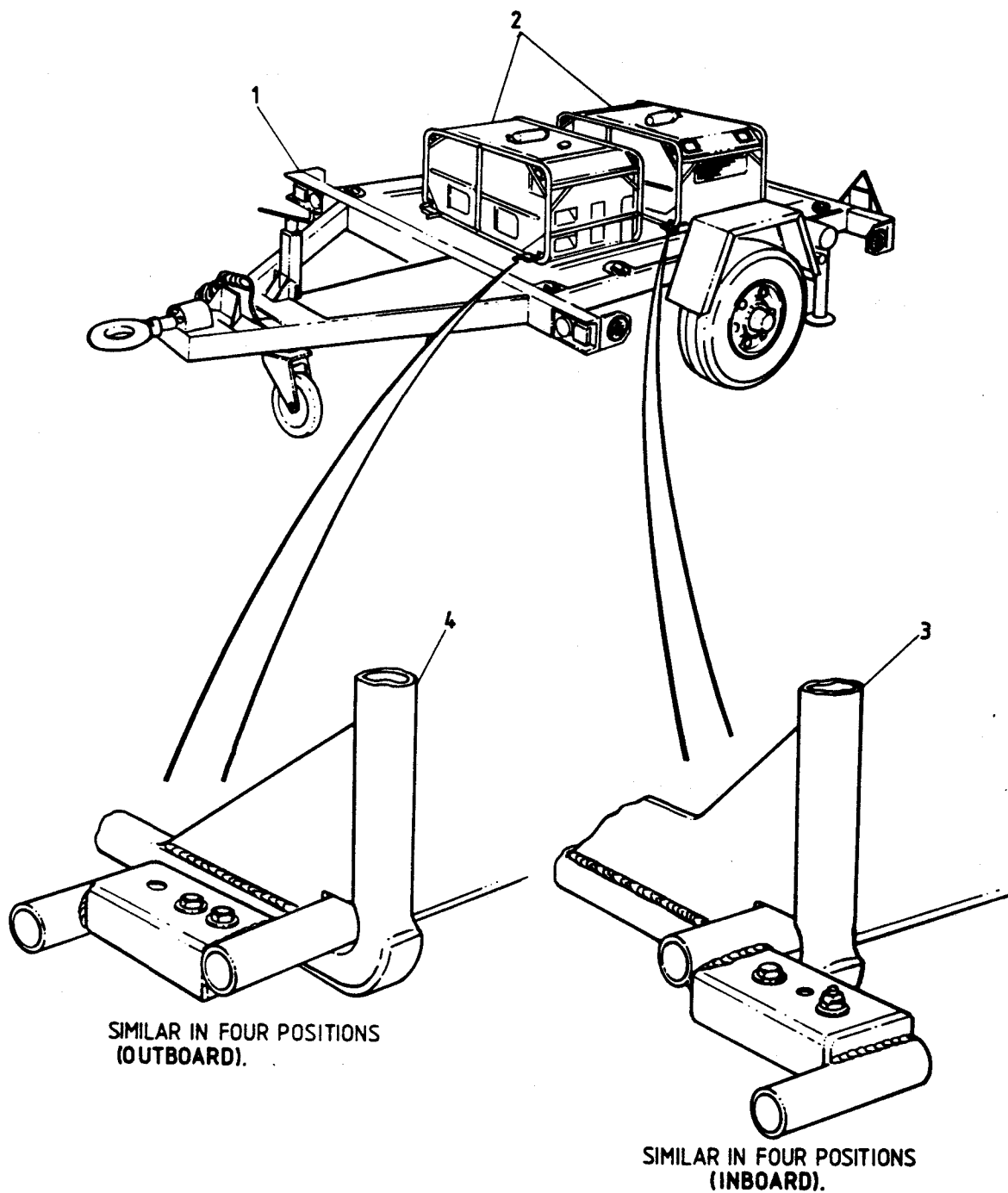


Fig 3 Mounting Data for FV2380/1 Mk. II



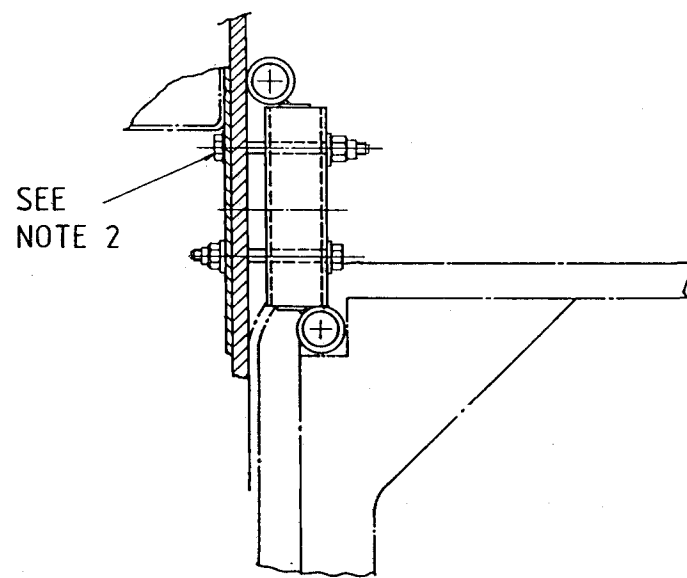
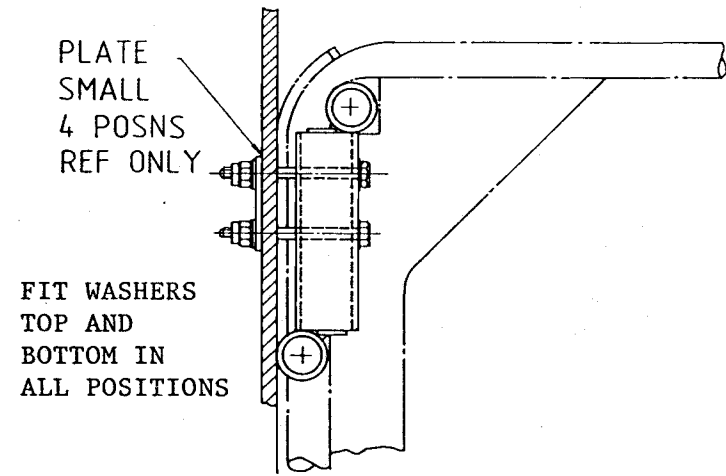
1. FV2406 Mk II
2. Correct positions for two generators
3. Clamp Assy. 4 off; for inboard mounts*
4. Clamp Assy. 4 off; for outboard mounts*

* see Fig. 5 for mounting detail.

Fig 4 Generator Set - Method of Mounting to
Two-and-a-half Tonne Trailer Type FV2406 Mk. II

- NOTES:-
- 1) CARE MUST BE TAKEN WHEN DRILLING DECKING /CHASSIS FOR UNDERFLOOR CABLES AND PIPERUNS
 - 2) ASSEMBLE BOLTS FROM THE UNDERSIDE AT THESE POSITIONS ONLY.

SECTIONAL VIEW ON ARROWS 'A-A'
SCALE 1:2



SECTIONAL VIEW ON ARROWS 'B-B'
SCALE 1:2

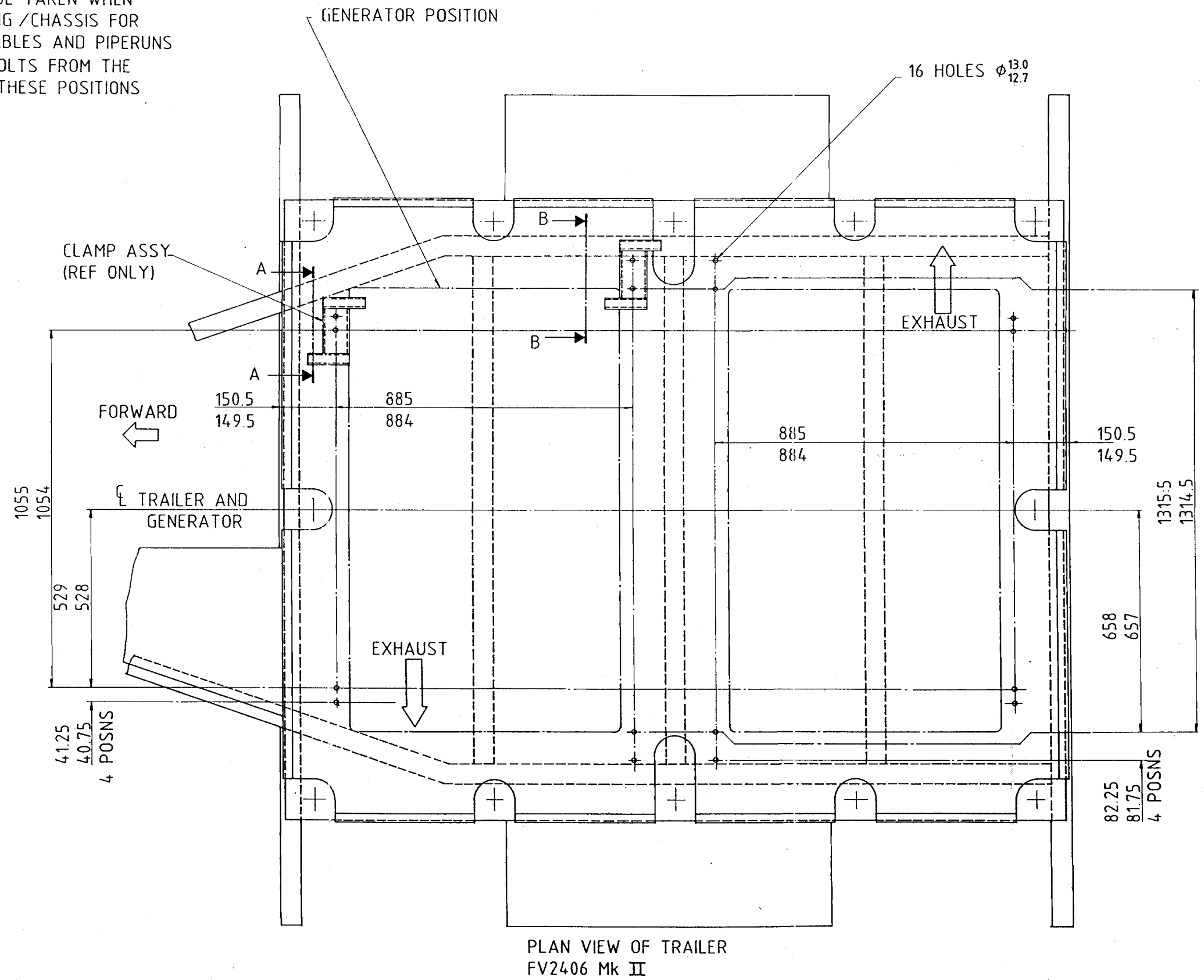


Fig 5 Mounting Data for FV2406 Mk. II

GENERAL DESCRIPTION

DESCRIPTION (Fig 6)

7 The generator set consists of an air-cooled twin-cylinder diesel engine coupled to an alternator. The generator is mounted into a tubular steel frame and is enclosed by a demountable glass reinforced plastic (GRP) enclosure which is held in place by seven quick-release fasteners. The tubular steel frame houses a 25 litres (5.5 gallons) fuel tank that provides an on-load running time of 12 hours. Engine and alternator cooling is accomplished by an integral engine fan, plus an additional fan driven from the engine shaft. External air for engine cooling is drawn through an inlet on the engine side of the GRP enclosure and is expelled with exhaust gas through louvres on the opposite side of the enclosure. A second inlet provides air for cooling the alternator.

STARTING

WARNING ...

THIS GENERATOR SET CONTAINS FEED THROUGH FILTER CAPACITORS. BEFORE USING THE GENERATOR ENSURE THAT IT IS CORRECTLY EARTHED.

8 Normal starting is accomplished by means of an electric starter motor which is driven by a starter battery mounted on the floor panel. Emergency starting is accomplished by means of a rope and pulley. The control box containing the starter switch can be remotely deployed using the 10m remote cable, or it can be left mounted within the tubular frame.

OUTPUT

9 Generator output is obtained from a single 50A socket, two 25A sockets, one 13A socket or from stand-off terminals. All output sources are protected by electro-mechanical circuit breakers.

NOTE: The above current ratings apply to the sockets and not to the output that can be drawn from them.

SPECIFICATION

10 The physical and operational parameters are defined as follows:

| | |
|--------|--|
| Size | Length 1310mm |
| | Width 800mm |
| | Height 840mm |
| Weight | 270kg dry (nominal) |
| Engine | Petter AD2, twin cylinder air-cooled diesel. |
| | Normal start, electric motor. |
| | Emergency start, rope and pulley. |
| | Fuel tank capacity 25 litres (5.5 gallons). |

Cooling, air-cooled twin fan off engine shaft.

Engine oil - DEF STAN 01-5 according to environment
(3.8 litres).

Exhaust, local or remote extension tubes.

Fuel input, is automatically controlled by engine
start-up switch.

Alternator

Allam, 4.5Kw

Output 240V single phase (220 to 252V adjustable)

50Hz at 3000 rpm

Control Console Mounted on the GRP enclosure. Can be deployed up to 10m
from generator.

Protection

When the generator set is running the following
protection circuits are operational:

Over current
Over voltage
Reverse Power
Over/Under Frequency
Air Cooling Over Temperature
Oil Over Temperature
Oil Pressure Low

ENGINE

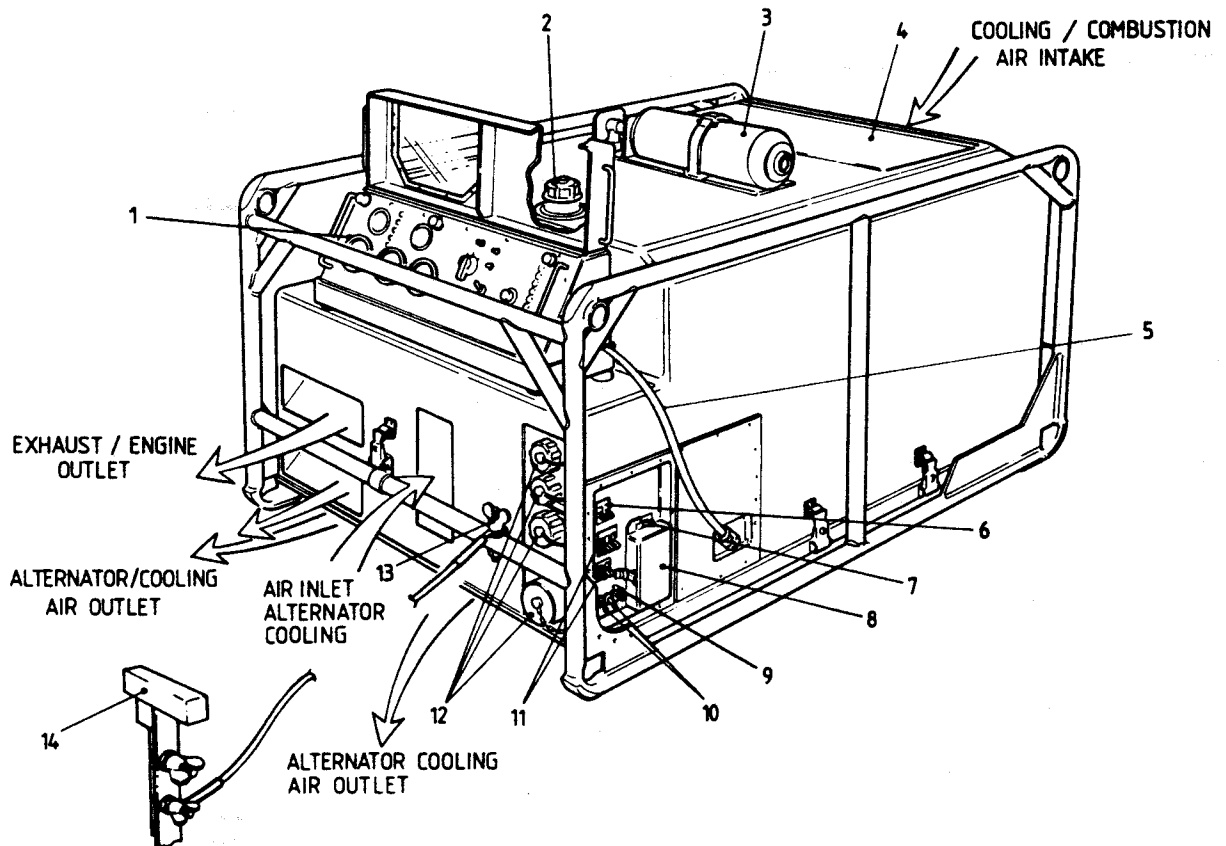
11 This is a Petter AD2 twin cylinder air-cooled diesel engine of 734cc capacity; bore and stroke are 80.0 x 73.0mm respectively. The cylinders are vertical in-line north/south configuration. The engine is included in the MOD type approval list DEF-STAN 28-2. The AD2 has many components common to the AC2 and the AC1 engines. The flywheel is of the high inertia type producing good cyclic regularity. The drive from the AD2 engine is taken from the flywheel end which is coupled to the alternator. The whole of the generator set is enclosed in a demountable glass reinforced ply (GRP) acoustic cover held in place by means of seven quick release fasteners.

Cooling (Fig 6)

12 The engine is air cooled by means of twin fans run from the engine output shaft. Cooling and combustion air for the engine enters the acoustic cover, through the grill at the rear end, and is forced out through louvres at the front end. Cooling air for the alternator enters the acoustic cover through the centre-mounted grill at the front end and is expelled from underneath the chassis at the front end.

CAUTION

When the generator set is deployed the air inlet/outlet areas must be free from obstructions.

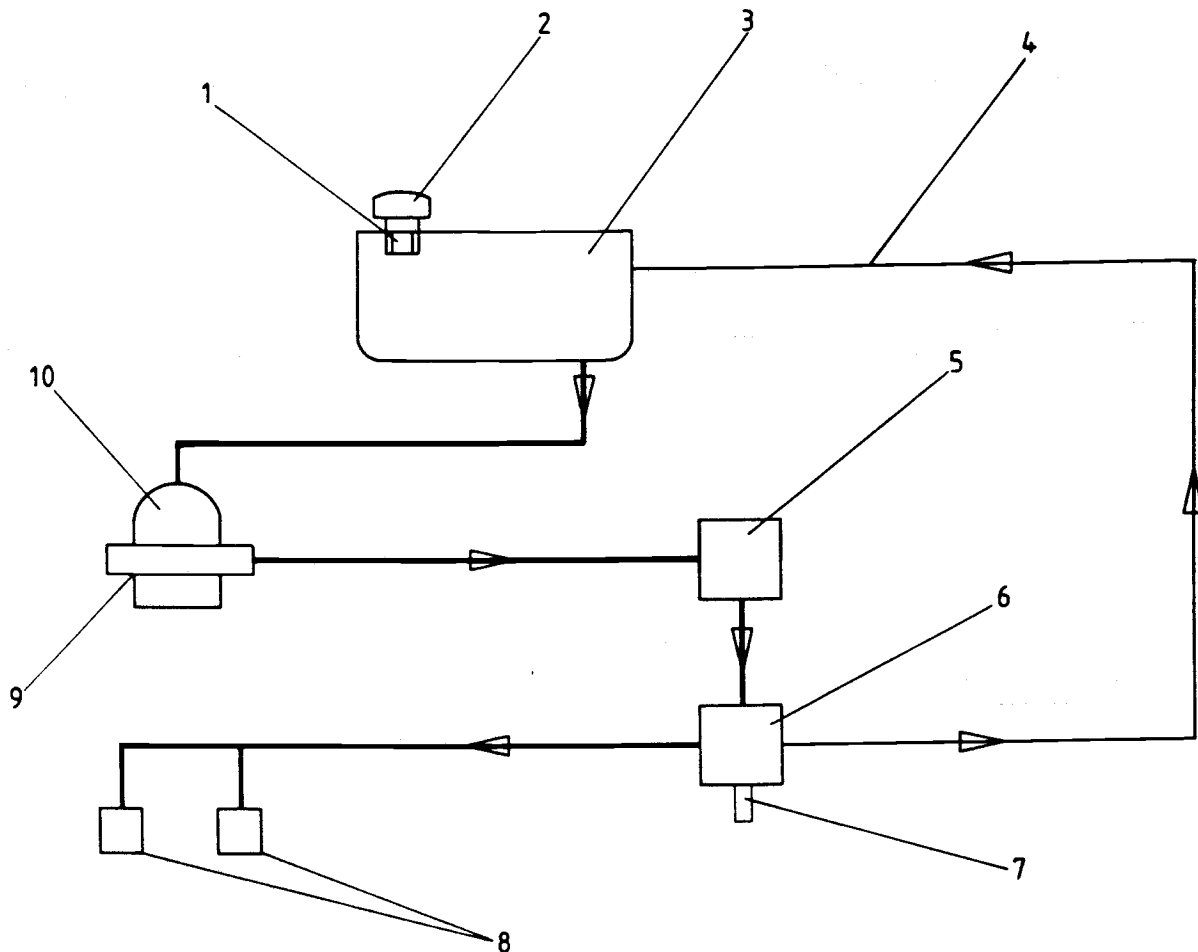


- | | |
|-------------------------------------|---|
| 1. Output Panel Control Box | 8. Emergency Output Terminals Cover |
| 2. Fuel Filler Cap | 9. Synchro Lamp and Switch |
| 3. Fire Extinguisher (BCF) | 10. Single/Parallel Mode Switches (2 off) |
| 4. Stowage Compartment | 11. Output ON/OFF Switches |
| 5. 3/4 m Cable | 12. Output Sockets |
| 6. Generator Output Switch | 13. Earth (Ground) Connector |
| 7. Emergency Terminals Switch (30A) | 14. Earth Spike and earth lead |

Fig 6 Generator Set, Diesel Driven 4.5kW (5.6kVA)
240V Single Phase, 50Hz - General View

Fuel System (Fig 7)

13 The fuel system for the generator set is shown in Figure 7 block schematic diagram. The fuel tank capacity is 5.5 gallons (25 litres) providing an on-load running time of 12 hours (nominal). The fuel system is automatically bled and, for normal use, no preparation is needed before using the engine. The fuel actuator is automatically operated when the starter switch is operated.

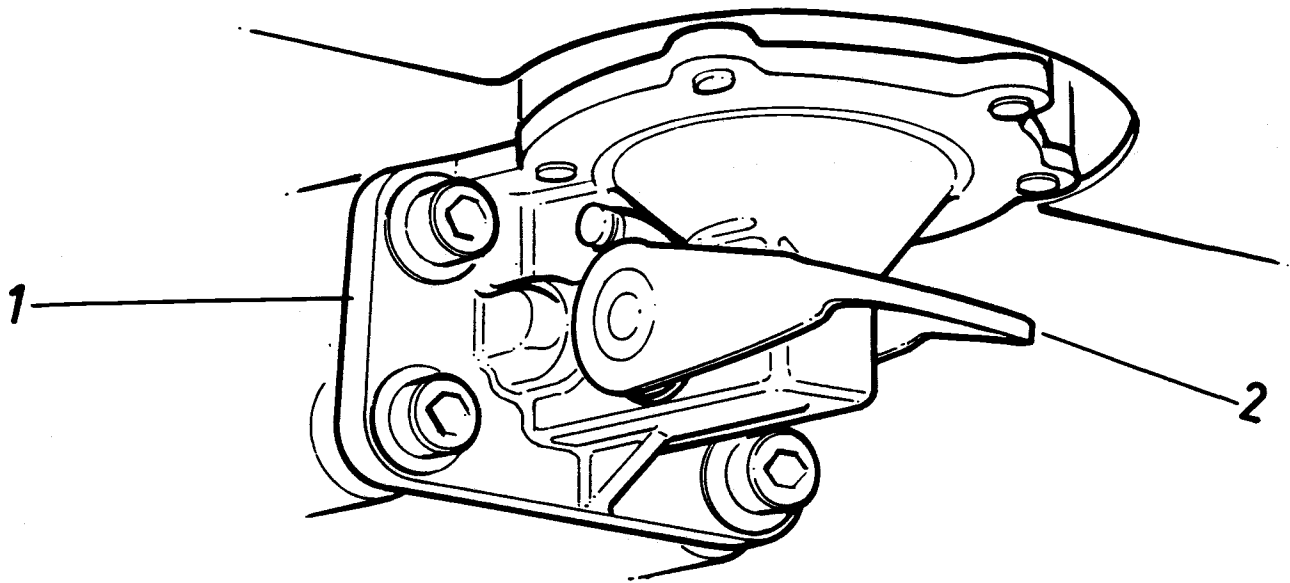


- | | |
|---------------------------|--|
| 1. Fuel Tank Inlet Filter | 6. Fuel Flow Regulator |
| 2. Fuel Tank Filler Cap | 7. Mechanical Actuator (Controlled from Electronic Governor) |
| 3. Fuel Tank | 8. Fuel Injectors |
| 4. Fuel Bleed Pipe | 9. Fuel Pump Hand Primer |
| 5. Fuel Filter Bowl | 10.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

Fig 7 Fuel System Block Diagram

Fuel System Bleeding

14 The fuel system automatically bleeds, but if the fuel system is allowed to run dry it will be necessary to operate the hand primer (Fig 8) approximately twenty times to prime the fuel system.



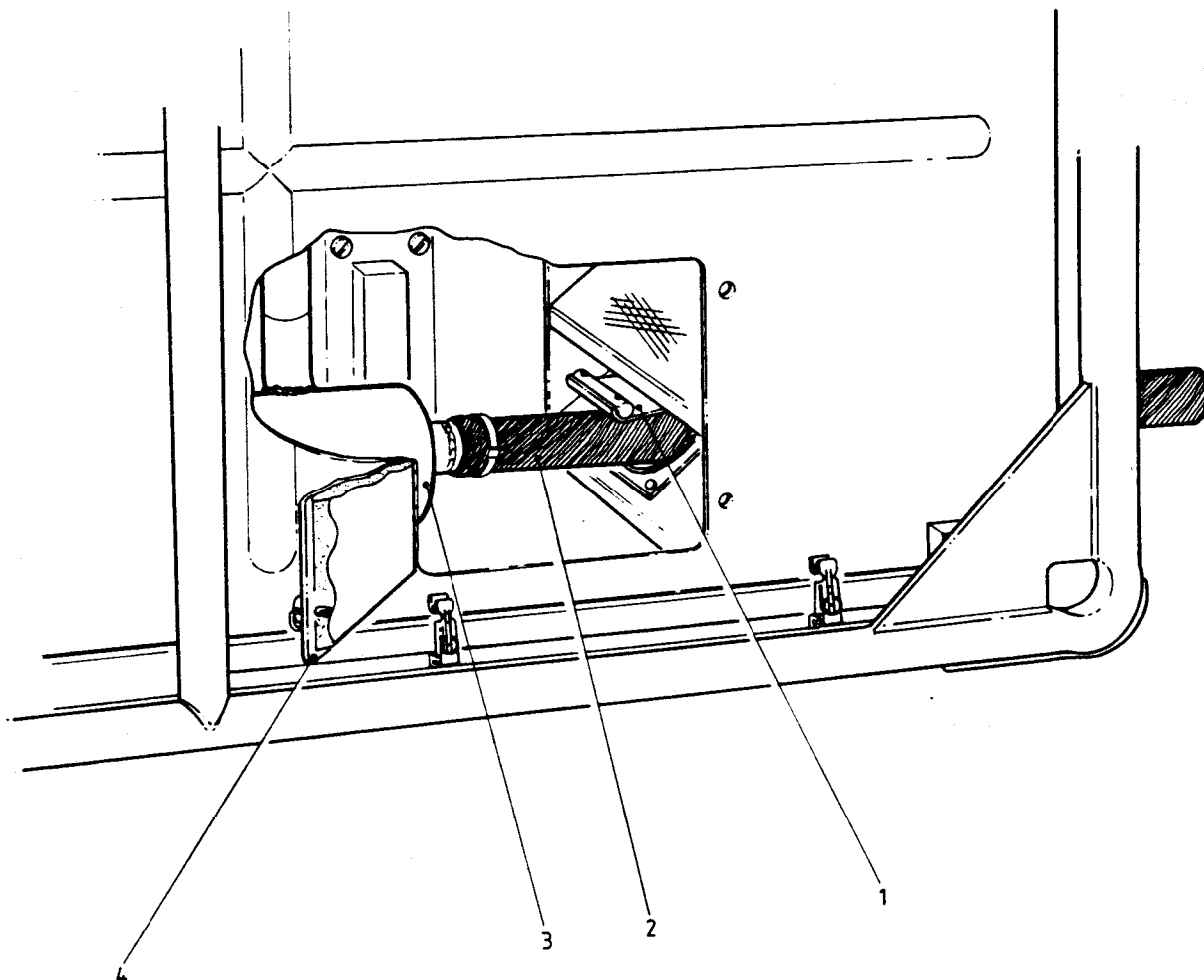
1. Fuel Pump Assembly

2. Fuel Pump Hand Primer

Fig 8 Fuel Pump Hand Primer

Exhaust System (Fig 9)

15 The exhaust system consists of an insulated expansion box, attached by means of a clamp, to the combined down pipe and silencer box. The exhaust gasses are output through a louvre at the front of the GRP acoustic cover. Additionally there are five 1.2 metre extension tubes that enable the exhaust gasses to be output up to six metres from the generator set. All five extension tubes are covered externally with heat resistant material. Three of the five extension tubes are rigid and are manufactured from aluminium alloy. The two remaining tubes are made from flexible coiled steel and can be bent by hand. All five extension tubes are a taper fit and no clamps are necessary during deployment. The first extension tube is passed through the lower rear louvre in the GRP acoustic cover. This action raises the extension exhaust access flap. The operator needs to open the EXHAUST ACCESS hatch on the right side of the acoustic cover and to fit the first extension tube onto the silencer box outlet. The exhaust system extension tubes (three rigid and two flexible) are supplied as unstowed items.



- | | |
|-------------------------|-------------------------|
| 1. Exhaust Access Flap | 3. Expansion Box |
| 2. First Extension Tube | 4. Exhaust Access Hatch |

Fig 9 Exhaust Silencer

Engine Speed Control - Governing

16 There are two methods of engine speed control; mechanical and electronic. The mechanical method consists of a mechanical governor built into the engine assembly during manufacture. This mechanical governor is preset to 3300 rpm and is used as a back-up safety feature to prevent engine runaway in the event of a failure of the electronic governor.

17 The principal method of engine speed control is by means of the electronic governor unit. This unit (Fig 10) is mounted in a metal box adjacent to the engine pulley. Access is by removing the six countersunk screws that secure the lid to the metal box. The unit can be extended out on the wiring for adjustment purposes. There are three preset potentiometers preset to govern the engine speed to 3000 rpm. These control SPEED, GAIN, and STABILITY. Normally no adjustments are necessary as the adjustments are factory preset during production and testing of the generator.

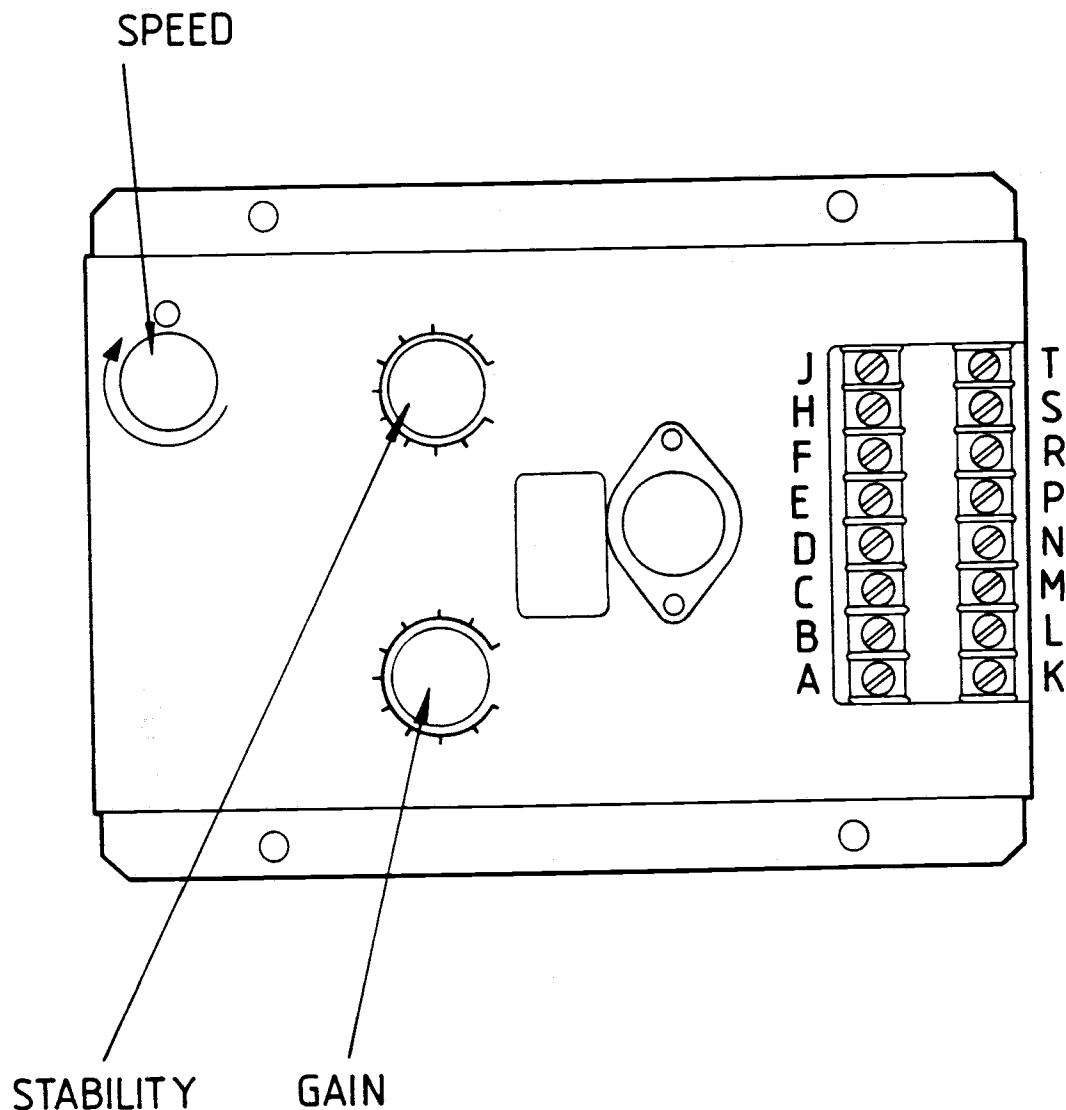


Fig 10 Electronic Governor Unit

ALTERNATOR - GENERAL INFORMATION

18 The alternator is driven by the close-coupled Petter AD2 diesel engine. The speed of the engine is electronically governed to 3000 rpm to produce an output of 240 V 50 Hz. The output of the generator is related to the speed of rotation. Slight adjustments to the engine speed can be made from the output panel control box so that the engine speed can be trimmed under all load conditions with reference to the frequency meter (50 Hz).

19 This is a brushless, compound, self-exciting unit consisting (Fig. 11) of two main components, the rotor and the stator. The rotor contains exciter and field windings connected by diodes. The stator houses the main output winding and exciter field winding. There are no sliding parts. The bearings are permanently lubricated for life, therefore no maintenance is needed for the alternator, except to ensure that cooling air inlets/outlets are not obstructed.

Operation

20 The basic compounding regulation of the alternator is improved by a permanently connected automatic voltage regulator operating in conjunction with transformer T1 and the diode bridge D3 to maintain the output voltage within fine limits for all changes of load within the specified rating. The alternator output is connected to U2 and V2 terminals on the terminal block.

21 Transformer T2 provides for phase quadrature compensation when two generators are run in parallel (switch S4 open). During normal single generator operation, switch S4 is left closed so that the input side of transformer T2 is a short circuit. The 240 V (nominal) 50 Hz output from V2 and W1 on the termination block is taken via filters and circuit breaker CB1 to the output connectors and emergency output terminals.

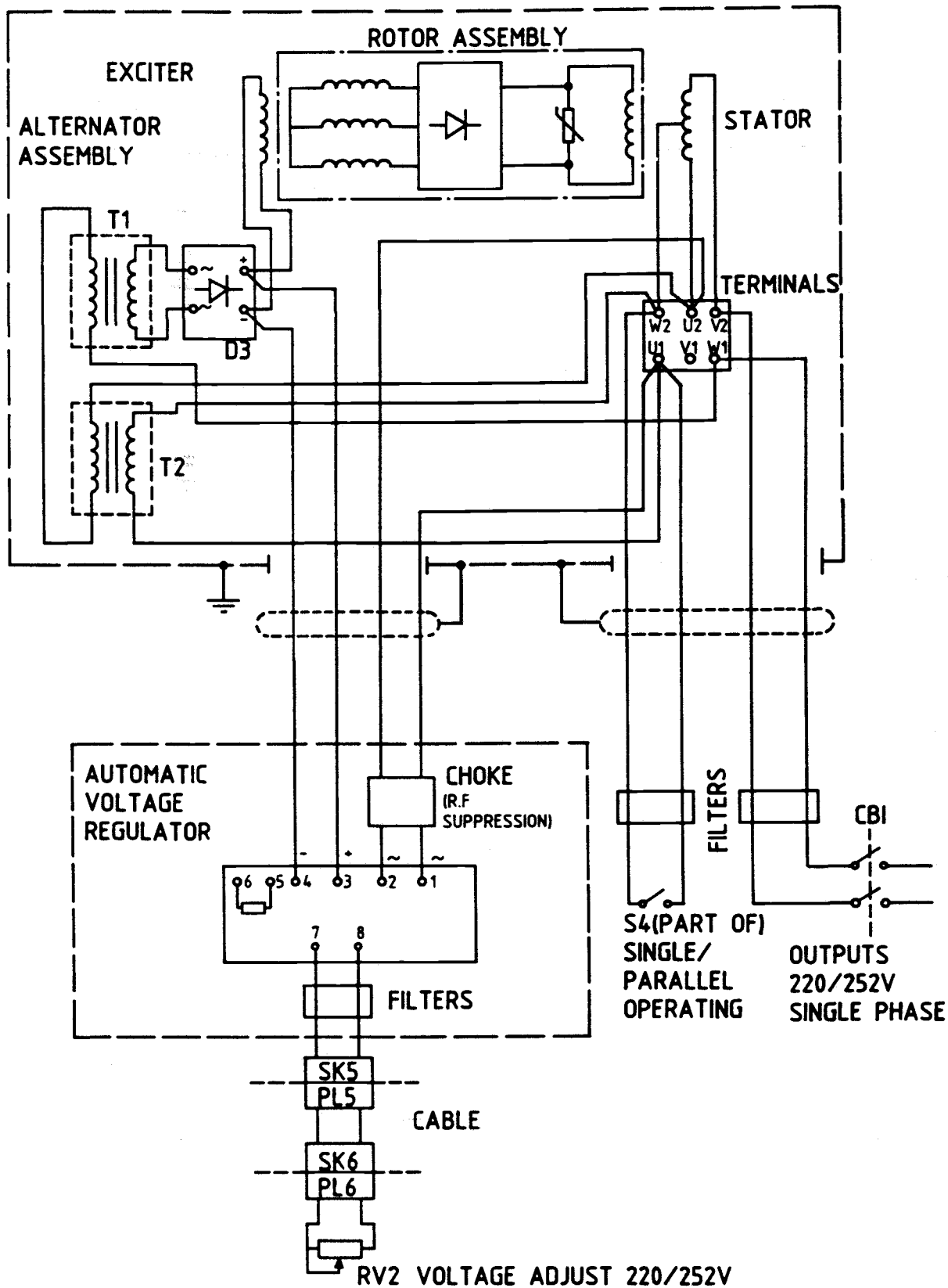


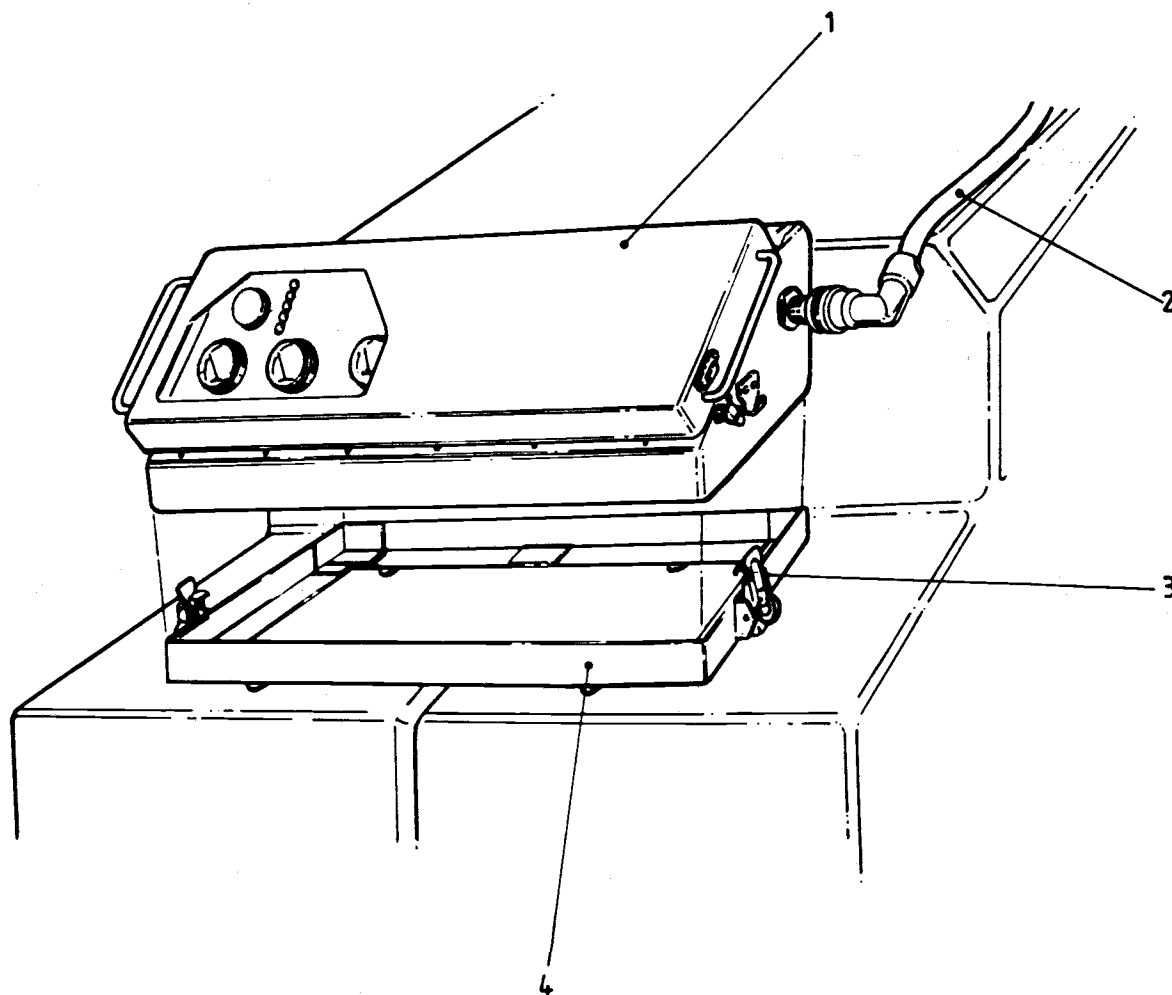
Fig 11 Alternator - Schematic Circuit

OUTPUT PANEL CONTROL BOX (Fig 12)

22 The output panel control box is normally mounted onto the control box mounting tray which is attached to the acoustic cover. The control box attaches to the tray by means of two quick-release fasteners. Normally the control box is connected to the generator set by means of the three-quarter metre interconnecting cable. The cable is terminated at each end by a plug and socket arrangement. A similarly terminated 10-metre extension cable is supplied with the generator set. The switches and indicators on the control box front panel are protected by a hinged lid which is held closed by means of two quick release catches.

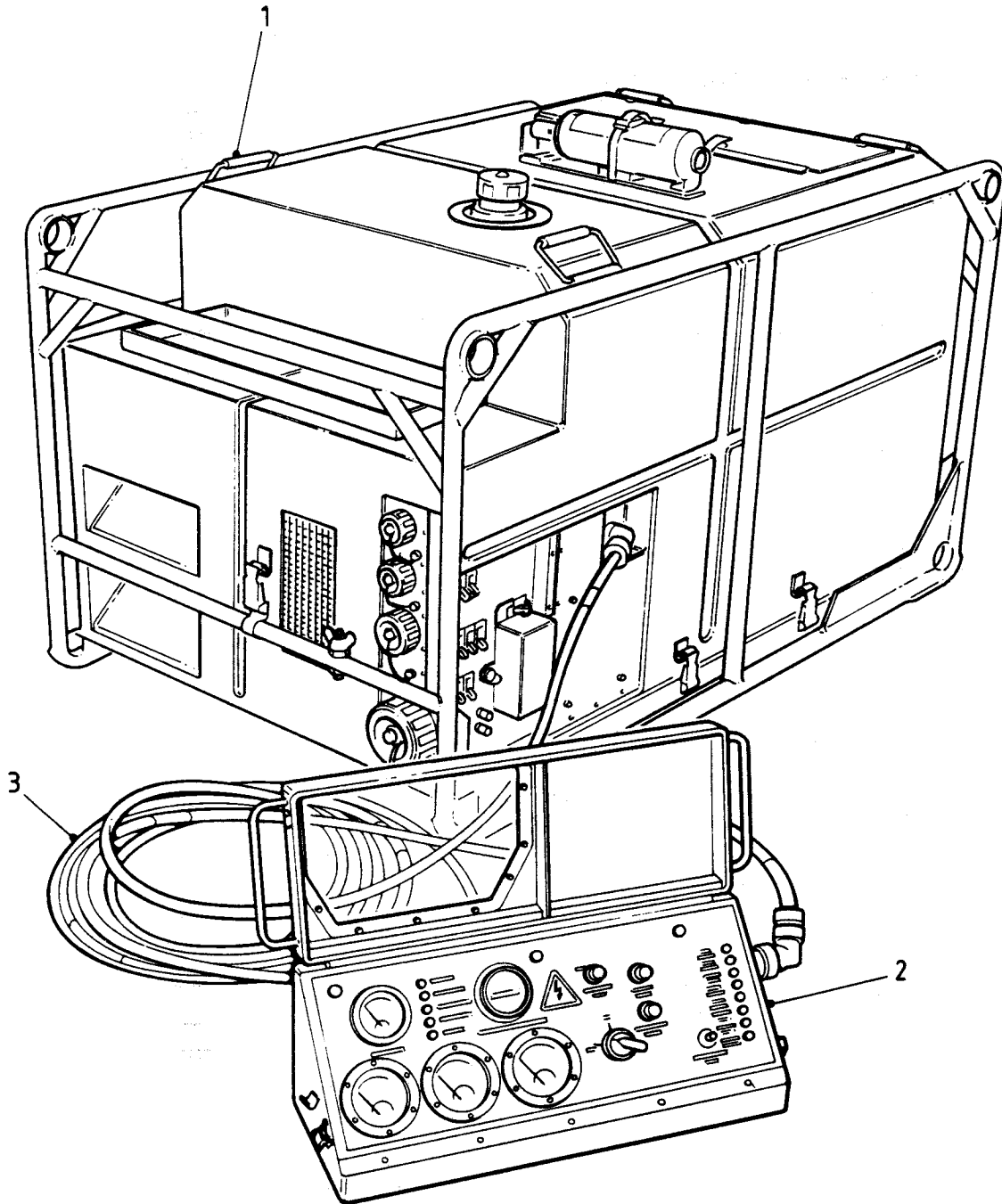
Remote Deployment

23 The output panel control box can be released from the mounting tray and remotely deployed (Fig 13) by changing the three quarter meter cable for the 10-metre cable.



- | | |
|----------------------------|---|
| 1. Control Box | 3. Mounting Tray Quick Release Fastener |
| 2. Remote Cable (10 Metre) | 4. Control Box Mounting Tray |

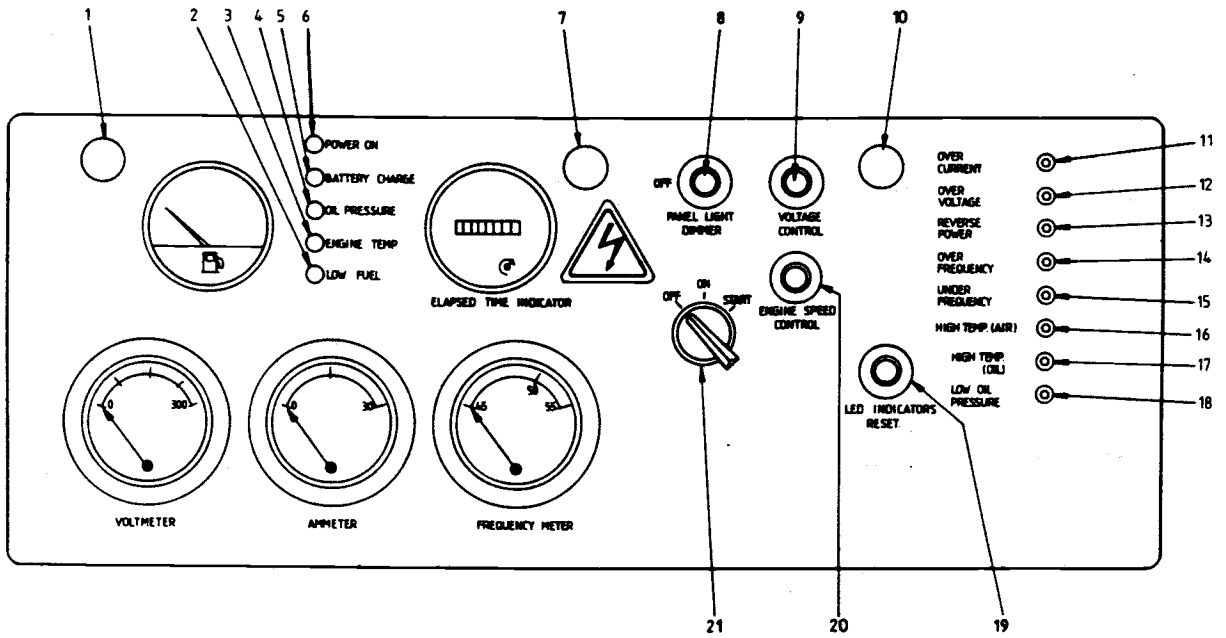
Fig 12 Output Panel Control Box



- 1. Generator Set
- 2. Output Panel Control Box

- 3. 10 Metre Extension Cable

Fig 13 Output Panel Control Box - Demounted



- | | |
|---|------------------------------------|
| 1. Panel Lamp | 12. Over Voltage Indicator |
| 2. Low Fuel Indicator | 13. Reverse Power Indicator |
| 3. Engine Temperature (Excessive) Indicator | 14. Over Frequency Indicator |
| 4. Oil Pressure (Low) Indicator | 15. Under Frequency Indicator |
| 5. Battery Charge (Failed) Indicator | 16. High Air Temperature Indicator |
| 6. Power On Indicator | 17. High Oil Temperature Indicator |
| 7. Panel Lamp | 18. Low Oil Pressure Indicator |
| 8. Panel Lamps Dimmer Control | 19. LED Indicators Reset Button |
| 9. Voltage Control | 20. Engine Speed Control |
| 10. Panel Lamp | 21. OFF/ON/START switch |
| 11. Over Current Indicator | |

Fig 14 Controls and Indicators - Output Panel Control Box

Controls and Indicators - Output Panel Control Box (Fig 14)

24 The function of the controls on the output panel control box and indicators are defined in TABLE 3.

TABLE 3 CONTROLS AND INDICATORS - OUTPUT PANEL CONTROL BOX

| Item No. | Item Identity | Description |
|----------|--------------------|---|
| 1 | PANEL LAMP | One of three panel lamps that illuminate the front panel. Controlled by the PANEL LIGHT DIMMER control/switch. |
| 2 | LOW FUEL | This red indicator lamp illuminates when the fuel level is low, in the integral fuel tank. |
| 3 | ENGINE TEMP | This red indicator lamp illuminates when the sensed air temperature in the engine housing exceeds 110°C. The lamp will operate before the engine over temperature shutdown circuit becomes operational. |
| 4 | OIL PRESSURE | This red indicator lamp extinguishes when the generator is running and the oil pressure is above 15 psi. |
| 5 | BATTERY CHARGE | This red indicator lamp extinguishes when the generator is running and the battery charger is operating. |
| 6 | POWER ON | This red indicator lamp is illuminated when 240V 50Hz is being generated. |
| 7 | PANEL LAMP | One of three panel lamps that illuminate the front panel. Controlled by the PANEL LIGHT dimmer control/switch. |
| 8 | PANEL LIGHT DIMMER | Operating the dimmer control varies the intensity of the three panel lamps and the lamps in the meters on the control box front panel. This dimmer control also contains an ON/OFF switch. |
| 9 | VOLTAGE CONTROL | Varies the output voltage when the generator is running under different load conditions. Normally set for 240V on the front panel VOLTMETER. |
| 10 | PANEL LAMP | One of three panel lamps that illuminate the front panel. Controlled by the PANEL LIGHT dimmer control/switch. |

TABLE 3 CONTROLS AND INDICATORS - OUTPUT PANEL CONTROL BOX (Continued)

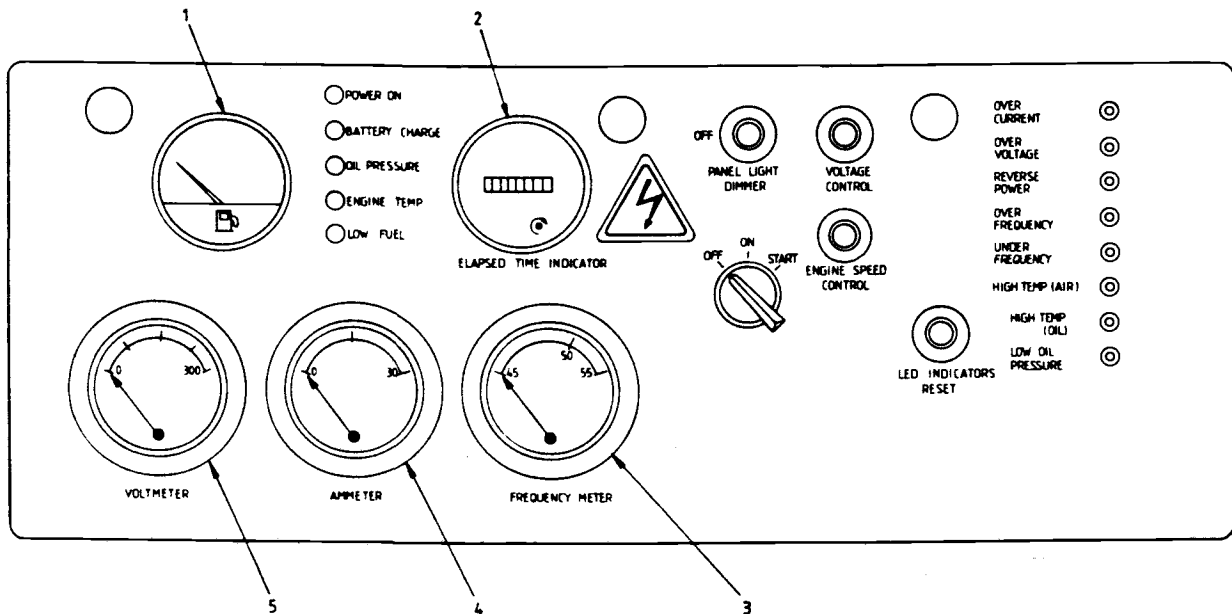
| Item No. | Item Identity | Description |
|----------|-----------------|---|
| 11 | OVER CURRENT | This red LED indicator lamp is illuminated when an output current overload occurs (three times maximum output current) for more than five seconds. When this LED indicator lamp is illuminated the load is automatically disconnected. Can be reset by operating the LED INDICATORS RESET button. |
| 12 | OVER VOLTAGE | This red LED indicator lamp is illuminated if the output voltage exceeds 264V for more than five seconds. When this LED indicator is illuminated the load is automatically disconnected. Can be reset by operating the LED RESET button. |
| 13 | REVERSE POWER | This red LED indicator lamp is part of the reverse power protection circuit which is operational when two generators of this type are connected in parallel. The REVERSE POWER LED indicator lamp is illuminated if the output from one generator exceeds a predetermined level for more than five seconds and is detrimental to the second generator. When this LED indicator lamp is lit, the load is automatically disconnected. Can be reset by operating the LED RESET button. |
| 14 | OVER FREQUENCY | This red LED indicator lamp is illuminated if the generator frequency exceeds 55Hz for more than five seconds. When this LED indicator lamp is lit, the load is automatically disconnected and the generator is shut down. Can be reset by operating the LED RESET button. |
| 15 | UNDER FREQUENCY | This red LED indicator lamp is illuminated if the generator frequency falls below 45Hz for more than five seconds. When this LED indicator lamp is lit, the load is automatically disconnected and the generator is shut down. Can be reset by operating the LED RESET button. |

TABLE 3 CONTROLS AND INDICATORS - OUTPUT PANEL CONTROL BOX (Continued)

| Item No. | Item Identity | Description |
|----------|----------------------|--|
| 16 | HIGH TEMP (AIR) | This is the high air temperature red LED indicator lamp which is illuminated when the sensed air temperature in the engine housing exceeds 120°C for more than five seconds. When this LED indicator lamp is illuminated the load is automatically disconnected and the generator is shut down. Can be reset by operating the LED RESET button. |
| 17 | HIGH TEMP (OIL) | This is the high oil temperature red LED indicator lamp which is illuminated when the temperature of the engine lubricating oil exceeds a preset danger level for more than five seconds. When this LED indicator lamp is illuminated the load is automatically disconnected and the generator is shut down. Can be reset by operating the LED RESET button. |
| 18 | LOW OIL PRESSURE | This is the low oil pressure red LED indicator lamp which is illuminated when the pressure of the engine lubricating oil falls below the preset danger level for more than five seconds. When this LED indicator lamp is illuminated the load is automatically disconnected and the generator is shut down. Can be reset by operating the LED RESET button. |
| 19 | LED INDICATORS RESET | This push-button is used to reset a tripped protection circuit indicated by any of the LED indicator lamps 11 to 18 being illuminated. |
| 20 | ENGINE SPEED CONTROL | Provides fine control of engine speed. Permits precise setting of the output frequency with reference to the FREQUENCY METER (48 to 52Hz nominal). |
| 21 | OFF/ON/START | This is a 3-position function switch that controls the stop/start/running modes of the generator set: OFF. With the switch in the OFF position the generator is switched off and all electrical circuits are disconnected. |

TABLE 3 CONTROLS AND INDICATORS - OUTPUT PANEL CONTROL BOX (Continued)

| Item No. | Item Identity | Description |
|------------|---------------|---|
| 21 (Contd) | | <p>ON. With the switch in the ON position, battery 12V dc is ON to the control circuits. When the engine is running the switch is set to the ON position by spring-return action from the START position.</p> <p>START. When the switch is moved to the START position, a relay located in the battery charger enclosure, is energised to supply battery volts to the starter motor solenoid to initiate engine startup. When the switch is released it returns to the ON position (normal running position).</p> |



- | | |
|---------------------------|--------------|
| 1. Fuel Gauge | 4. Ammeter |
| 2. Elapsed Time Indicator | 5. Voltmeter |
| 3. Frequency Meter | |

Fig 15 Meters and Dials - Output Panel Control Box

Meters and Dials - Output Panel Control Box (Fig 15)

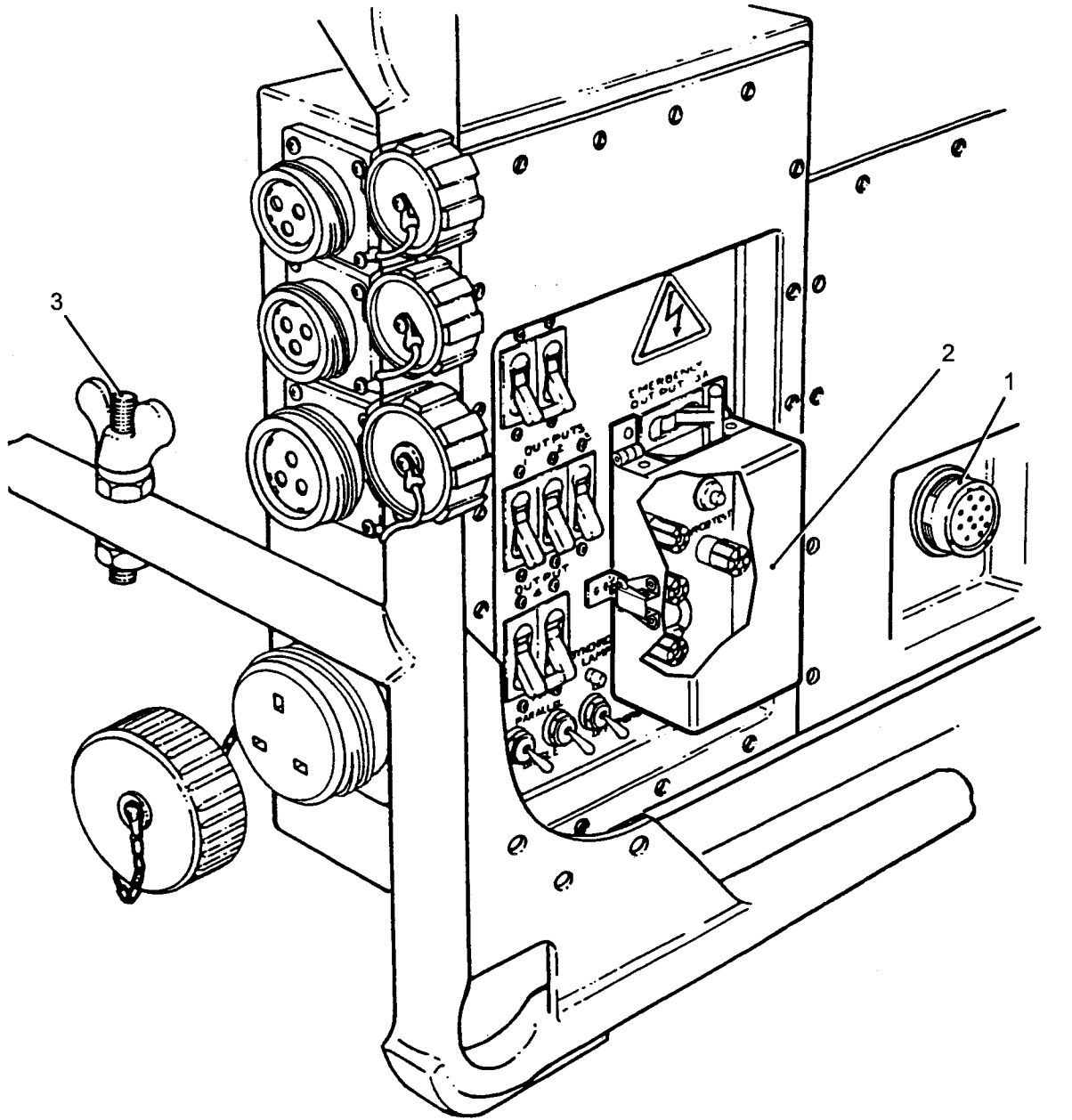
25 The functions of the meters and dials on the output panel control box are defined in TABLE 4.

TABLE 4 METERS AND DIALS - OUTPUT PANEL CONTROL BOX

| Item No. | Item Identity | Remarks |
|----------|------------------------|--|
| 1 | FUEL GAUGE | An analogue meter that shows the amount of fuel held in the integral fuel tank. Full indication is 25 litres (5.5 gallons). |
| 2 | ELAPSED TIME INDICATOR | This is an electrically driven elapsed time indicator that provides a digital readout, in hours, of the engine running time. |
| 3 | FREQUENCY METER | Provides an indication of the generator output frequency on a scale of 45 to 55 Hz. |
| 4 | AMMETER | Provides an analogue indication of the current load on the generator on a 0 to 30A scale. |
| 5 | VOLTMETER | Provides an analogue indication of the generator output voltage on a 0 to 300V scale. |

FIXED BOX (Fig 16)

26 The fixed box is mounted to the front right-hand side of the chassis assembly. The fixed box contains the output connectors for the generator set, emergency output terminals, output circuit breakers, single/parallel running mode switch, single/parallel running mode synchronising lamps and a residual current circuit breaker test button. All of these items are accessible through cut-outs in the GRP acoustic cover. Table 5 and figure 17 define the functions of the fixed box controls and indicators; table 6 and figure 18 define the functions of the output controls and terminals.



1. 41-Way Socket Connector (mates with corresponding plug connector on the interconnecting cable).
2. Emergency Output Terminals Hinged Cover.
3. Earth Ground Point Connection.

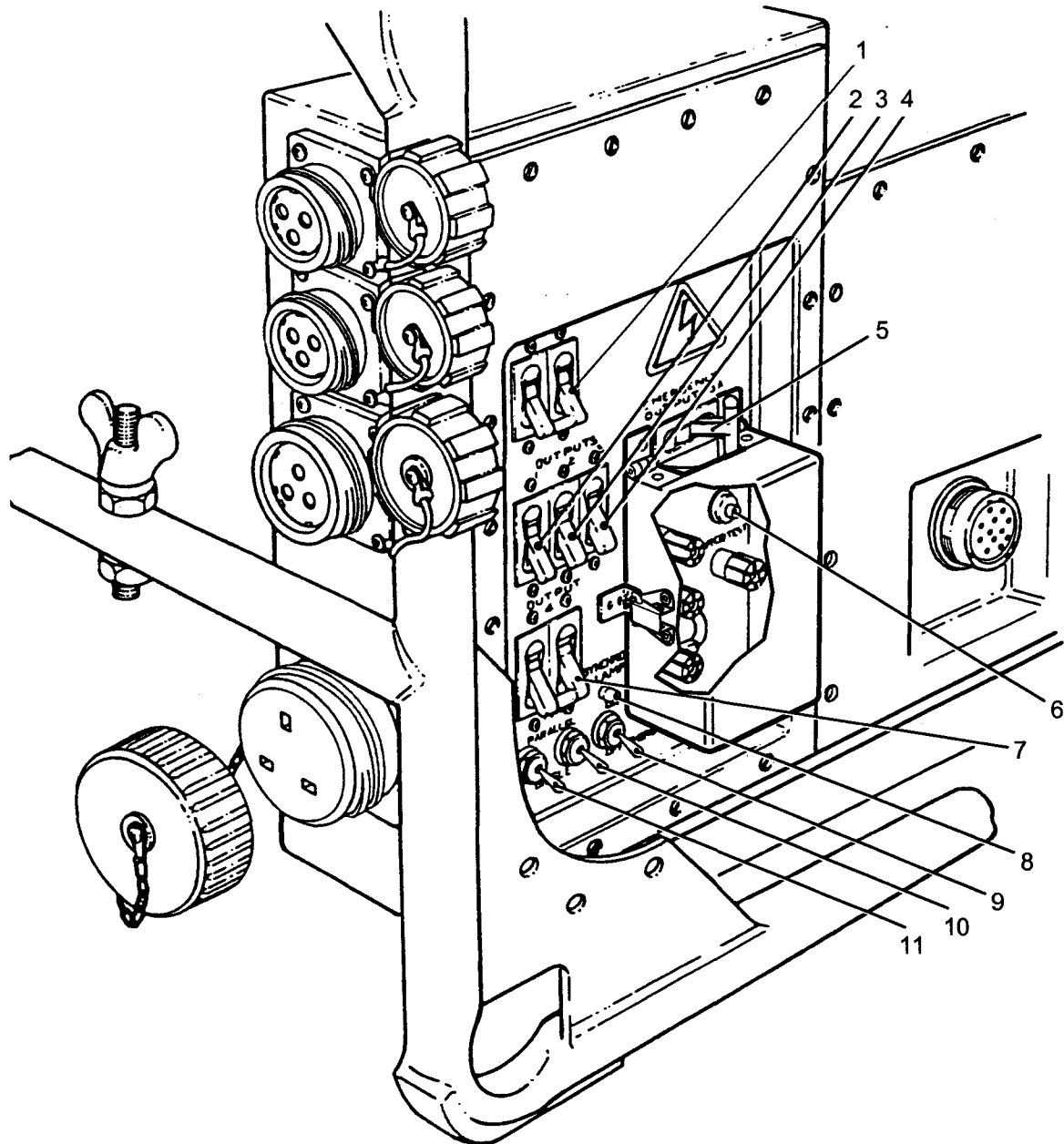
Fig 16 Fixed Box - General View

TABLE 5 CONTROLS AND INDICATORS - FIXED BOX

| Item No. | Item Identity | Description |
|----------|------------------|---|
| 1 | POWER ON/OFF | This circuit breaker is rated at 50A. When set to the ON (up) position the output from the generator is available at the output sockets/terminals. When set to the OFF (down) position the generator output is isolated from the output sockets/terminals. |
| 2 | OUTPUT 1 | This circuit breaker is rated at 30A. In the ON (up) position, 240V 50Hz is available at the 30A output socket, OUTPUT 1. In the OFF (down) position the 30A output socket is isolated from the generator output. |
| 3 | OUTPUT 2 | This circuit breaker is rated at 15A. In the ON (up) position, 240V 50Hz is available at the 15A output socket, OUTPUT 2. In the OFF (down) position the OUTPUT 2 socket is isolated from the generator output. |
| 4 | OUTPUT 3 | This circuit breaker is rated at 15A. In the ON (up) position, 240V 50HZ is available at the 15A output socket, OUTPUT 3. In the OFF (down) position OUTPUT 3 socket is isolated from the generator output. |
| 5 | EMERGENCY OUTPUT | This switch controls the output to the emergency terminals located under the EMERGENCY TERMINALS hinged cover (2 Figure 16). When the cover is opened the switch is mechanically set to the OFF position. |
| 6 | RCB TEST | This is the test button for the residual current circuit breaker associated with OUTPUT 4, When the button is pressed, the circuit breaker trips. |
| 7 | OUTPUT 4 | This circuit breaker is rated at 15A. In the ON (up) position, 240V 50Hz is available at the 13A socket, Output 4. In the OFF (down) position OUTPUT 4 socket is isolated from the generator output. A residual current sensor (earth leakage) is connected to this circuit breaker; sensitivity is 30mA. |

TABLE 5 CONTROLS AND INDICATORS - FIXED BOX (Continued)

| Item No. | Item Identity | Description |
|----------|------------------------|--|
| 8 | SYNCHRO Lamp | Provides an indication of synchronised speed of two generators when they are being connected in parallel. |
| 9 | SYNCHRO LAMP ON/OFF | This switch is normally in the OFF position for single generator deployment. The switch is used to assist phasing/synchronisation when two generators are connected in parallel; in this event the switch is set to the ON position and the SYNCHRO lamp is made operational. The switch is used in conjunction with the PARALLEL/SINGLE 'A' and PARALLEL/SINGLE 'B' switches. |
| 10 | PARALLEL/SINGLE 'B' | This switch is normally in the OFF position for single generator deployment. In parallel generator deployment, the switch is set to ON and is used in conjunction with the SINGLE/PARALLEL 'A' switch and the SYNCHRO LAMP ON/OFF lamp. |
| 11 | PARALLEL/SINGLE 'A' | This switch is normally in the OFF position for single generator deployment. In parallel generator deployment, the switch is set to ON and is used in conjunction with the SINGLE/PARALLEL 'B' switch and the SYNCHRO LAMP ON/OFF switch. |

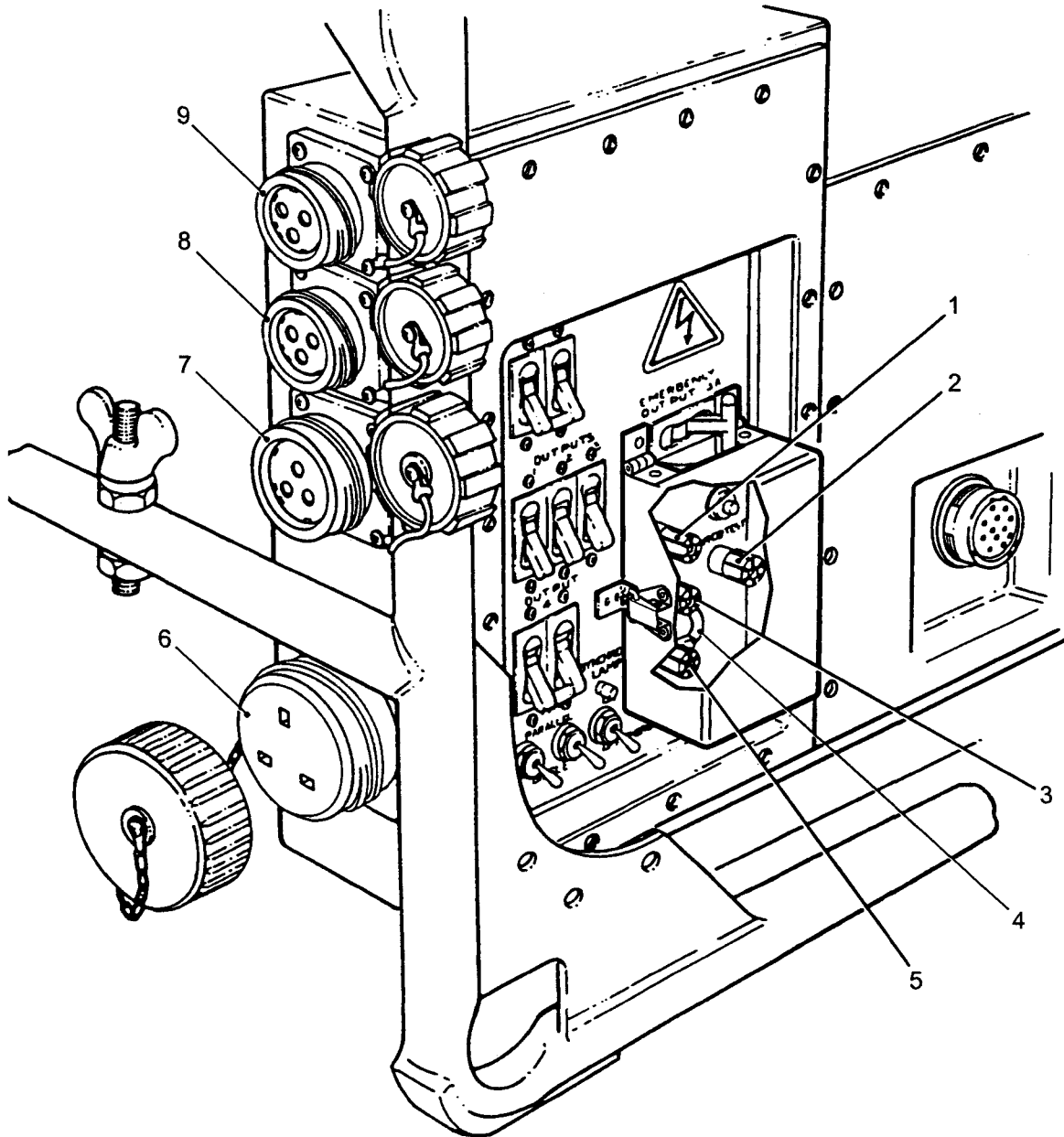


- | | |
|---------------------------------|--------------------------------|
| 1. POWER ON/OFF Circuit Breaker | 7. OUTPUT 4 Circuit Breaker |
| 2. OUTPUT 1 Circuit Breaker | 8. SYNCHRO Lamp |
| 3. OUTPUT 2 Circuit Breaker | 9. SYNCHRO LAMP ON/OFF switch |
| 4. OUTPUT 3 Circuit Breaker | 10. PARALLEL/SINGLE 'B' switch |
| 5. EMERGENCY OUTPUT 13A switch | 11. PARALLEL/SINGLE 'A' switch |
| 6. RCB Test Button | |

Fig 17 Controls and Indicators - Fixed Box

TABLE 6 OUTPUT CONNECTORS AND TERMINALS - FIXED BOX

| Item No. | Item Identity | Remarks |
|----------|--|--|
| 1 | LINE Terminal Emergency Connection | This is the line output from the generator set. It is exposed when the emergency terminals hinged cover (2) (Figure 16) is released. |
| 2 | STOWAGE Terminal | The earth link (4) from the earth terminal connection (5) can be connected to the stowage terminal, when it is not necessary to connect the earth link to the neutral terminal (3). It is exposed when the emergency terminals hinged cover (2) (Figure 16) is released. |
| 3 | NEUTRAL Terminal Emergency Connection | This is the neutral output from the generator set. It is exposed when the emergency terminals hinged cover (2) (Figure 16) is released. |
| 4 | Wire Link/Strap | This removable wire link/strap is normally connected between the NEUTRAL terminal (3) and the EARTH terminal (5). |
| 5 | EARTH Terminal Emergency Connection | This terminal is connected to the generator set chassis and for normal use the EARTH terminal is connected to the NEUTRAL terminal (3) by means of the wire link/strap (4). |
| 6 | OUTPUT 4 Socket | This is a square pin socket connector of similar figuration to a domestic 13A socket. |
| 7 | OUTPUT 1 Socket | This is a round pin socket connector rated at 30A. |
| 8 | OUTPUT 2 Socket | This is a round pin socket connector rated at 15A. |
| 9 | OUTPUT 3 Socket | This is a round pin socket connector rated at 15A. |

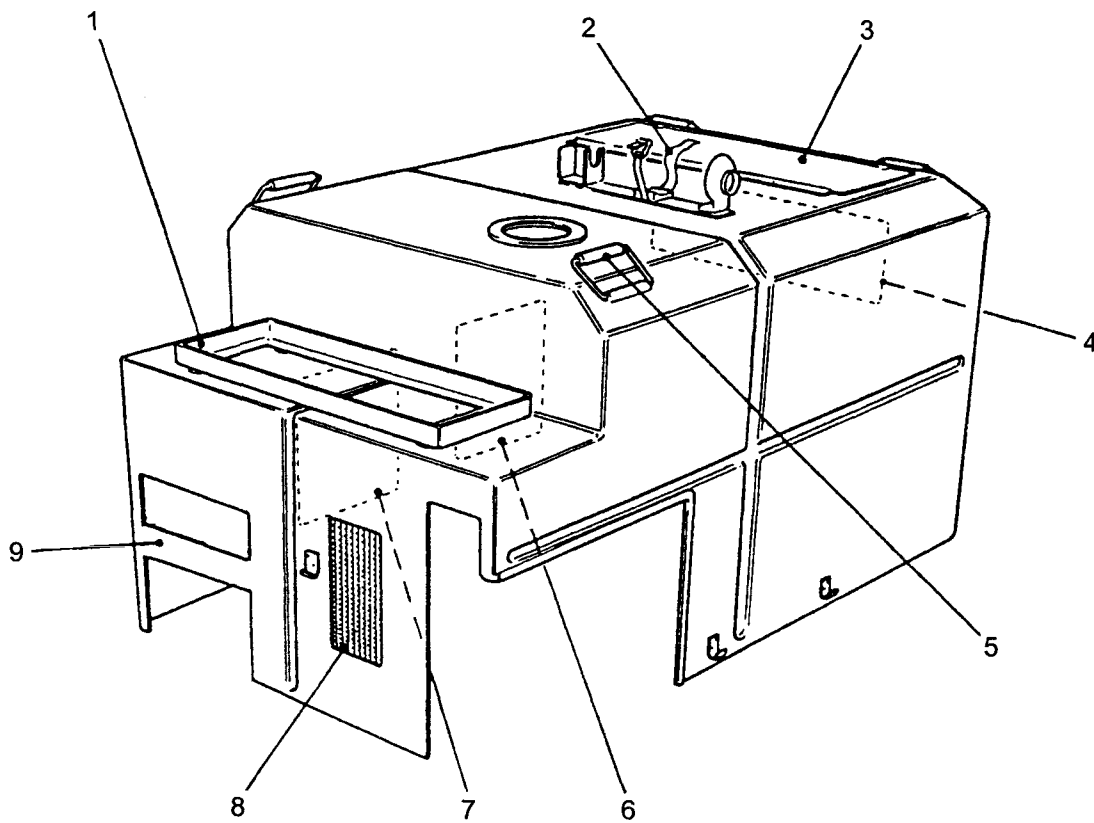


- | | |
|--|------------------------------------|
| 1. LINE Terminal Emergency Connection | 6. OUTPUT 4 Socket Connector (13A) |
| 2. STOWAGE Terminal | 7. OUTPUT 1 Socket Connector (30A) |
| 3. NEUTRAL Terminal Emergency Connection | 8. OUTPUT 2 Socket Connector (15A) |
| 4. Wire Link/Strap | 9. OUTPUT 3 Socket Connector (15A) |
| 5. EARTH Terminal Emergency Connection | |

Fig 18 Output Connectors and Terminals - Fixed Box

ACOUSTIC COVER (Fig 19)

27 This demountable GRP acoustic cover is held in place by means of seven quick-release fasteners. Lifting the cover free from the generator set for maintenance purposes is a 2-man task. The acoustic cover contains ventilation louvres, access hatches, a stowage compartment, a mounting tray for the output panel control box, and a retaining strap for the BCF fire extinguisher.



- | | |
|---|-------------------------------------|
| 1. Output Panel Control Box Mounting Tray | 6. Engine Oil Access Hatch |
| 2. BCF Fire Extinguisher Securing Strap | 7. Exhaust System Access Hatch |
| 3. Stowage Compartment Access Hatch | 8. Air Inlet for Alternator Cooling |
| 4. Cooling Air Inlet | 9. Cooling Air Outlet Ducts |
| 5. Lifting Handle (4 off) | |

Fig 19 Acoustic Cover - General View

Chapter 2

PREPARATION FOR USE

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- 1 GENERAL
- 3 Siting (CAUTION)
- 5 EARTHING (WARNING)
- 6 Earth Terminal Emergency Connection
- 7 PRE-START CHECKS (CAUTION)
- 13 START-UP PROCEDURE (NOTE)
- 16 Running Status Check
- 18 Normal Shutdown Procedure
- 19 Emergency Shutdown
- 20 EMERGENCY START
- 24 RUNNING TWO GENERATORS IN PARALLEL (CAUTION)
- 32 Transferring the Load
- 33 Returning to Single Generator Operation (CAUTION)

Table

- 1 Generator Set Controls - Startup Positions

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GENERAL

1 If the engine sump oil is at the correct level on the dipstick (measured on level ground) then the generator set is able to operate continuously for 30 hours, if deployed at any angle to a maximum of 25 degrees from horizontal, in any direction.

2 After 30 hours of continuous running the engine sump oil level must be checked with the generator set in the horizontal position. The sump oil must be topped up to the correct level on the dipstick before further use.

SITING

3 For trailer mounted generator sets, the trailer should be chocked up so that the generator set is as level as possible and is within 25 degrees of horizontal.

CAUTION

Ensure all air outlets and intakes are clear of obstructions.

4 For non-trailer mounted sets, level ground should be chosen whenever possible. Clear away any scrub and rocks so that the alternator cooling air can be forced out from underneath the front end of the chassis assembly. Ensure that there are no rocks or roots or vegetation protruding into the generator set from underneath. If necessary chock up one or more corners of the generating set to accomplish, as near as possible, a horizontal deployment which is clear of ground obstructions. Ensure that the cooling air intake and outlets are clear of obstructions by at least a 1/2 meter (20 inches). Do not deploy the generator directly on boggy or saturated ground.

EARTHING

WARNING

THIS GENERATOR SET CONTAINS FEED THROUGH FILTER CAPACITORS. BEFORE USING THE GENERATOR SET ENSURE THAT IT IS CORRECTLY EARTHED.

5 An earth spike is supplied with the generator set. This is normally kept in the stowage compartment on top of the acoustic cover. Before the generator set is used, the earth spike must be driven into the ground and the earth braid must be attached to the earth ground point connection on the chassis assembly or to the appropriate trailer earth point, for trailer-mounted sets.

EARTH TERMINAL EMERGENCY CONNECTION

6 For normal operation of the generator set, the earth terminal emergency connection is connected to the neutral terminal emergency connection by means of the wire link/strap. These are the two lower terminals underneath the emergency output terminals hinged cover plate.

PRE-START CHECKS

7 Set all the output circuit breakers to their OFF (down) positions. Set the SINGLE/PARALLEL switch to SINGLE.

8 Check that the engine sump oil is at the correct level on the dipstick. An access hatch is positioned on the left-hand side of the acoustic cover, towards the rear.

- 9 Check that there is adequate diesel fuel in the integral tank.
- 10 Make the following checks of the acoustic cover:
- 10.1 Check that the seven securing toggle catches are closed.
 - 10.2 Check that the two air intake louvres are clear of obstructions.
 - 10.3 Check that the air outlet louvre is clear of obstructions.
- 11 If required, deploy the extension exhaust tubes through the access hatch located in the bottom outlet louvre of the acoustic cover.
- 12 If the output panel control box is to be remotely deployed remove the three quarter metre cable and connect in its place the 10-metre extension cable. Undo the two quick-release fasteners holding the output panel control box on the mounting tray. Remotely deploy the output panel control box.

CAUTION

If the output panel control box is sited on the mounting tray, it must be secured with the two quick-release fasteners.

START-UP PROCEDURE

- 13 On the output panel control box, set the controls as follows:

TABLE 1 GENERATOR SET CONTROLS - START-UP POSITIONS

| Control | Position |
|--|------------------------------|
| OFF/ON/START | OFF |
| VOLTAGE CONTROL | Mid-Position (not mandatory) |
| ENGINE SPEED CONTROL | Mid-Position (not mandatory) |
| SYNCHRO LAMP ON/OFF Switch (Fixed Box) | OFF |
| PARALLEL/SINGLE 'A' Switch (Fixed Box) | SINGLE |
| PARALLEL/SINGLE 'B' Switch (Fixed Box) | SINGLE |

Note

When the ambient temperature is 0°C (32°F) or below, the pre-heaters must be used to assist engine starting. Operate the pre-heater switch for 30 seconds before proceeding with start up. The pre-heater switch is located on the engine housing behind the engine oil access hatch.

- 14 Rotate the OFF/ON/START switch to the ON position, check that the BATTERY CHARGE and the OIL PRESSURE indicators are illuminated. Further rotate the switch to the START position and hold the switch in this position until the engine fires. When the engine fires, release the switch which will return to the ON position. (If the engine fails to turn over due to a flat battery, refer to EMERGENCY START-UP PROCEDURE). Allow one minute warm up before connecting load.

- 15 On the output panel control box, adjust the voltage and speed controls for the voltage and frequency required.

RUNNING STATUS CHECK

16 Check the POWER ON indicator lamp and the three panel lamps are illuminated. The brightness of the PANEL lamps can be controlled by the PANEL LIGHT DIMMER. No other indicator lamps should be illuminated.

CONNECTING THE LOAD TO THE GENERATOR

17 Connect the load to the appropriate output connector or to the emergency output terminals. Switch on the POWER ON/OFF contact breaker. Set the appropriate circuit breaker to the ON (up) position.

NORMAL RUNNING ACTIVITIES

18 During normal running the following activities can be carried out:

- 18.1 Top up the fuel tank (provided the acoustic cover is in place.)
- 18.2 Adjust VOLTAGE CONTROL for load variations.
- 18.3 Adjust ENGINE SPEED CONTROL to fine tune the frequency.

NORMAL SHUT DOWN PROCEDURE

19 Switch OFF the appropriate contact breaker for the output socket (or terminals) in use. Switch OFF the POWER ON/OFF circuit breaker. After one minute set the OFF/ON start switch to the OFF position.

EMERGENCY SHUT DOWN

20 Set the battery OFF/ON/START switch to the OFF position.

EMERGENCY START

21 Emergency start is by rope and pulley arrangement from the front end of the engine output shaft; it is a 2-man operation. To use the emergency start, the acoustic cover must be removed. Emergency start is accomplished with the battery OFF/ON/START switch set to the ON position.

Air Temperature Above 0°C (32°F)

22 When the air temperature is above 0°C carry out the following procedure; two operators are required:

22.1 The first operator must hold open the decompression lever of the cylinder that is nearest to the alternator, (this is the green lever on the head of the assembly adjacent to the air cleaner). The same operator must also hold open the mechanical actuator arm to the fuel flow regulator.

22.2 The second operator must rotate the rope start pulley by hand, anticlockwise until compression is felt. Bounce the engine against compression approximately ten times to prime the fuel injection system.

22.3 The second operator must engage the rope in the pulley notch and wind it around the pulley approximately two-and-a-half turns (the pulley rope is normally kept in the stowage compartment on the acoustic cover).

22.4 To start the engine the second operator must pull the rope sharply until it unwinds completely and turns the engine over compression. As the engine fires the first operator must release the decompression lever and release the mechanical actuator. If the engine does not fire, repeat the procedure.

Air Temperature 0°C (32°F) and Below

23 Where the air temperature is 0°C (32°F) or below, carry out the following procedure; two operators are required:

23.1 The first operator must decouple the plastic ball joint on the mechanical actuator linkage to the fuel flow regulator, this will allow him to move the actuator to the full throttle position for the cold start procedure. The same operator must hold open the decompression lever of the cylinder that is nearest to the alternator (this is the green lever on the head assembly adjacent to the air cleaner).

23.2 The second operator must operate the preheater switch for at least 30 seconds, even if the battery is considered to be flat.

23.3 The second operator must rotate the rope start pulley by hand, anticlockwise until compression is felt. Bounce the engine against compression approximately ten times to prime the fuel injection system.

23.4 The second operator must engage the rope in the pulley notch and wind it around the pulley approximately two-and-a-half turns (the pulley rope is normally kept in the stowage compartment on the acoustic cover).

23.5 To start the engine the second operator must pull sharply until it unwinds completely and turns the engine over compression. As the engine fires, the first operator must release the decompression lever and move the mechanical actuator from the full throttle position then re-engage the ball joint on the linkage. If the engine does not fire, repeat the procedure.

RUNNING TWO GENERATORS IN PARALLEL

CAUTION

Both Generator sets must be of the same type for parallel running.

24 On both generator sets, ensure that OUTPUT circuit breaker 1,2,3,4 are at their OFF (down) position and that the POWER ON/OFF circuit breaker is at the ON (up) position. Set the PARALLEL/SINGLE 'A' and 'B' switch to SINGLE and the SYNCHRO LAMP ON/OFF switch to OFF.

25 Ensure that the output lines from both generators are correctly paired.

26 Run up generator 1 in the normal way and switch in the load (not exceeding 4.5 kW) on the OUTPUT circuit breakers.

- 27 On both generator sets set the PARALLEL/SINGLE 'A' and 'B' switches to PARALLEL then set the SYNCHRO LAMP ON/OFF switches to ON.
- 28 Start up generator 2 and adjust the ENGINE SPEED CONTROL so that the frequency matches that of generator 1. Trim the VOLTAGE CONTROL to match the voltage of generator 1.
- 29 Adjust the ENGINE SPEED CONTROL on generator 2 until the SYNCHRO lamp cycle is at its lowest (lamp extinguished). At this point switch-on the required OUTPUT circuit breakers for generator 2.
- 30 Adjust the load sharing by trimming the ENGINE SPEED CONTROL on one generator only. Do not adjust voltage control.
- 31 Switch - OFF the SYNCHRO LAMPS ON/OFF switches on both generators.

Transferring the Load

- 32 It is possible to transfer the load from one running generator to a second running generator, provided they are synchronised and the load does not exceed the nominal full load value for the incoming generator:
 - 32.1 Adjust the ENGINE SPEED CONTROL of the second generator until it is carrying all the load. Set the output circuit breakers on the first generator to OFF; do not adjust the voltage control.
 - 32.2 Adjust the voltage control and the engine speed control on the second generator as required.

Returning to Single Generator Operation

CAUTION

When the total loading for parallel generators exceeds 4.5 kW the load must be reduced to less than 4.5 kW before returning to single generator operation.

- 33 On outgoing generator, set all output circuit breakers to OFF then set POWER ON/OFF circuit breaker to OFF.

CAUTION

If parallel running is required again after shutdown of the generator, the full parallelling procedure must be followed.

Chapter 3

USER MAINTENANCE

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- 1 INTRODUCTION (WARNING)
- 2 ROUTINE MAINTENANCE TASKS
- 3 Preliminary Tasks
- 4 Servicing the Fuel Strainer Filter
- 5 Replacing the Air Filter
- 6 Replacing the Oil Filter
- 7 Replacing the Fuel Filter
- 8 GENERATOR BATTERY
- 9 Routine Maintenance
- 10 Battery Charge - General
- 11 Boost Charging - General (CAUTION)
- 12 REPLACEABLE LAMPS
- 13 PROTECTION DEVICES
- 14 LUBRICATION - MECHANICAL COMPONENTS
- 15 COOLING
- 16 USER FAULT FINDING
- 17 FUNCTIONAL TEST
- 18 Operational Status

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| 2 Generator Fail Lamp Analysis | 11 |

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| 4 Fuel Filter Assembly | 7 |
| 5 Generator Battery Assembly | 8 |
| 6 Indicator Lamp Filament Bulb and Lens | 9 |
| 7 Start-up Failure Analysis Flow Chart | 10 |

WARNING

WHEN REMOVING/REPLACING THE ENGINE/ALTERNATOR FROM THE CHASSIS, PREVENT INJURY TO PERSONNEL BY USING ADEQUATE SUPPORT DURING THE LIFTING OPERATIONS.

INTRODUCTION

1 User maintenance between major overhauls consists of a number of routine tasks carried out at pre-defined intervals. These pre-defined intervals are determined by the number of hours that the generator set has been operational, as defined in Cat. 601. Special tools are not needed for user maintenance tasks. Table 1 defines recommended spares for field use.

TABLE 1 RECOMMENDED SPARES FOR FIELD USE

| Item No. | Description | Man. | Part No. | NATO Stock No. |
|----------|---------------------------------------|----------------------|-------------|----------------|
| 1 | Element Pack Air Cleaner | Petter | ADZ12 | |
| 2 | Element Pack Oil Filter | Petter | AAZ11 | |
| 3 | Element Pack Fuel Filter | Petter | AAZ10 | |
| 4 | Decarbonising Joints Set | Petter | ADZZ | |
| 5 | Rocker Box Joint (2 per engine) | Petter | 350031 | |
| 6 | Oil Filler Cap | Petter | 257007 | |
| 7 | Oil Filler Cap Seal | Petter | JA45 | |
| 8 | Fuel Filler Cap | F.P.T. Industries | FT-A3-21812 | |
| 9 | Fuel Filler Strainer Filter | F.P.T. Industries | FT-A3-21829 | |
| 10 | Plastic Piping (used on engine) | Petter | 671110 | |
| 11 | Injector Nozzle (2 per engine) | Petter | 300740 | |
| 12 | Oil Sump Gasket | Petter | 294512 | |

TABLE 1 RECOMMENDED SPARES FOR FIELD USE Continued

| Item No. | Description | Man. | Part No. | NATO Stock No. |
|----------|--|------------|--------------|----------------|
| 13 | Lampholder (4 per gen. set) | Peter Gray | LS7-BE-W-Red | |
| 14 | Filament Lamp (4 per gen. set) | Peter Gray | 525CD | |
| 15 | Lampholder - clear with waterproofing washers (5 per gen. set) | Peter Gray | LS9-W-9 | |

ROUTINE MAINTENANCE TASKS

2 In order to carry out the routine maintenance tasks, the generator set must be out of use with the engine not running.

Preliminary Tasks

3 Ensure that the starter switch is in the OFF position.

3.1 Release the interconnecting cable from the output panel control box.

3.2 Release the output panel control box from the mounting tray and place it clear of the acoustic cover.

3.3 Undo the seven quick-release fasteners that secure the acoustic cover to the chassis assembly. Lift the acoustic cover clear of the chassis assembly; this is a 2-man task. On completing routine maintenance tasks replace and secure the acoustic cover, the output panel control box, and the interconnecting cable.

Servicing the Fuel Strainer Filter (Fig. 1)

4 Release the fuel tank filler cap (2)

4.1 Extract the fuel strainer filter (1) by hand from filler neck of fuel tank. This is a wire mesh device with a foam surround. The foam surround is retained by four bolts and should not be removed.

4.2 Check fuel strainer filter for dirt particles. If contaminated, flush out in diesel fuel until clean then refix in neck of tank. Replace fuel strainer filter if damaged.

- 1 Fuel Strainer Filter
- 2 Fuel Filler Cap
- 3 Fuel Filler Cap Retaining Chain
- 4 Fuel Tank Body
- 5 Fuel Tank Filler Neck

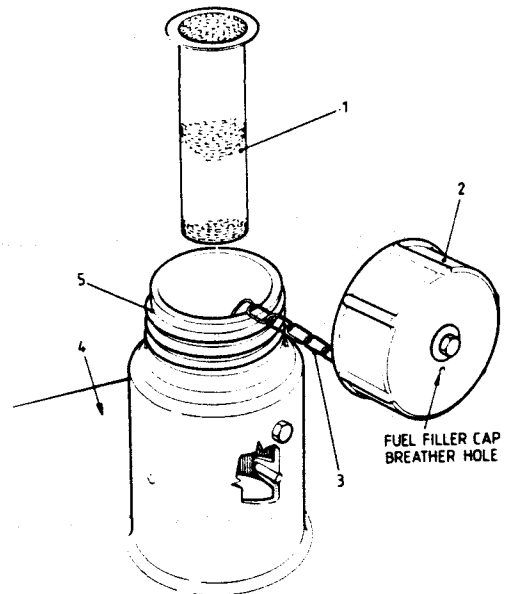


Fig. 1 Fuel Tank Filler Neck and Fuel Strainer Filter

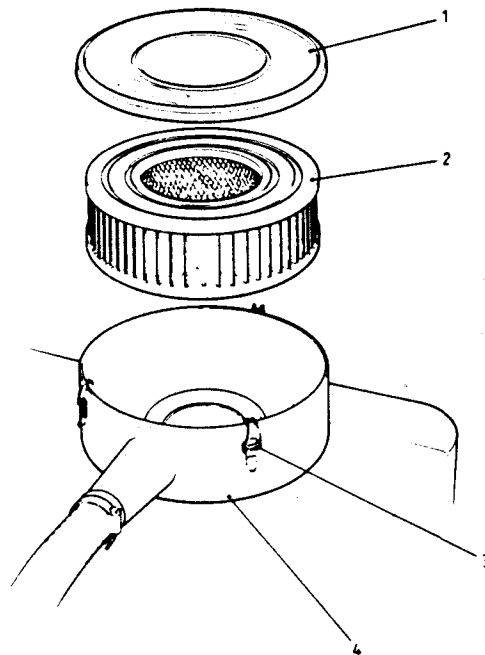
Replacing the Air Filter (Fig. 2)

5 Release the three quick release fasteners (3) and lift off the air filter assembly top cover (1).

5.1 Remove the air filter element (2) and throw away if dirty.

5.2 Insert new air filter into air filter assembly container (4).

5.3 Position air filter assembly top cover onto air filter assembly container. Secure top cover with the three quick release fasteners.



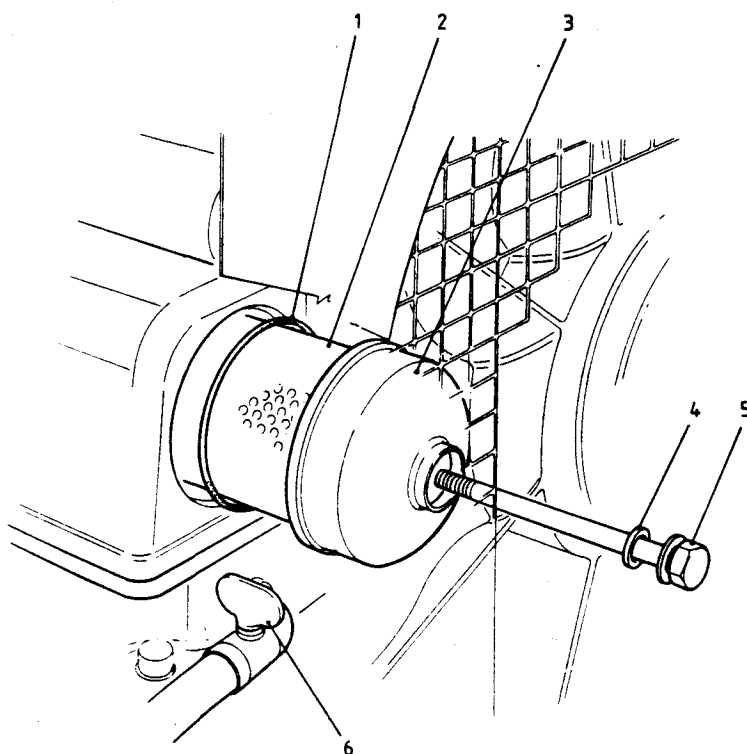
- | | |
|---------------------------------|---------------------------------|
| 1 Air Filter Assembly Top Cover | 3 Quick Release Fastener |
| 2 Air Filter Element | 4 Air Filter Assembly Container |

Fig. 2 Air Filter Element Assembly

Replacing the Oil Filter (Fig. 3)

6 The oil filter assembly is positioned at the front end of the engine and is secured to the engine assembly by means of a single hexagonal bolt. Change the oil filter when the engine sump oil is changed. The blades of the cooling fan are staggered for easy removal of the oil filter assembly. If necessary, turn the fan to best advantage, with the engine decompressed.

6.1 Remove the hexagonal bolt (5) and withdraw the oil filter assembly consisting of the joint washer (4), filter end cap (3), filter element (2) and filter seal (1). Replace these items from the servicing kit and assemble the items in the reverse order. Secure the items within the engine assembly by means of the hexagonal bolt (5).



- | | | | |
|---|--------------------|----|-----------------------------------|
| 1 | Oil filter seal | 4 | Oil filter joint washer |
| 2 | Oil filter element | *5 | Oil filter assembly securing bolt |
| 3 | Oil filter end cap | 6 | Sump oil drain tap |

* Torque setting for item 5 is 10 lb.ft. (13.5 Nm)

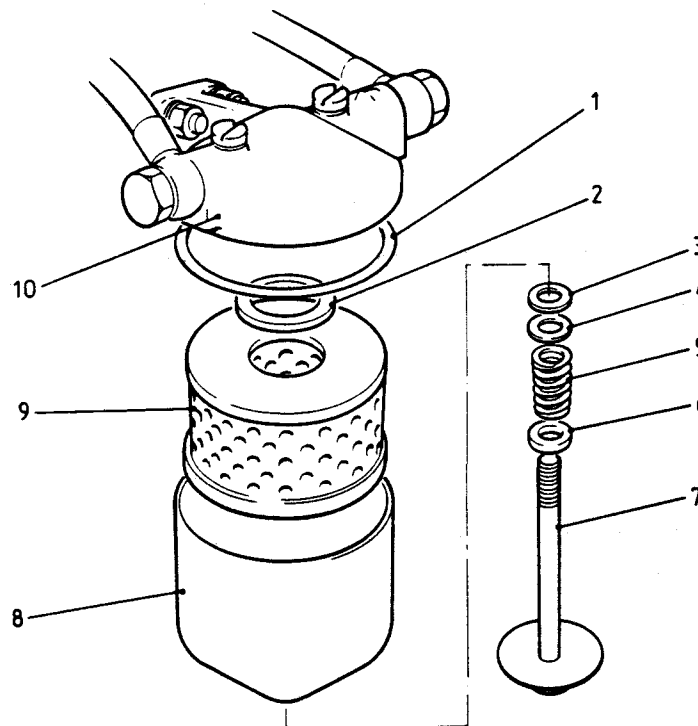
Fig. 3 Oil Filter Element Assembly

Replacing the Fuel Filter (Fig. 4)

7 The fuel filter is contained in the fuel filter bowl which is bolted to the side of the engine housing. The fuel filter element is secured within the filter bowl by means of a single hexagonal bolt.

7.1 Undo the hexagonal bolt (7) and release the fuel bowl (8) from the fuel filter assembly head (10).

7.2 Replace items (1), (2), (3), (4), (5), (6) then secure the filter bowl assembly with the hexagonal bolt (7).



| | | | |
|---|---|----|---|
| 1 | Fuel Filter Bowl, Seal | 5 | Fuel Filter Element Centre Bolt, Spring |
| 2 | Fuel Filter Element, Joint Washer | 6 | Fuel Filter Element Centre Bolt, Lower Seal |
| 3 | Fuel Filter Element Centre Bolt, Upper Seal | *7 | Fuel Filter Element, Bolt |
| 4 | Fuel Filter Element Centre Bolt, Washer | 8 | Fuel Filter Element, Bowl |
| | | 9 | Fuel Filter Element |
| | | 10 | Fuel Filter Assembly, Head |

* Torque setting for item 7 is 8 lb.ft. (10.75 Nm)

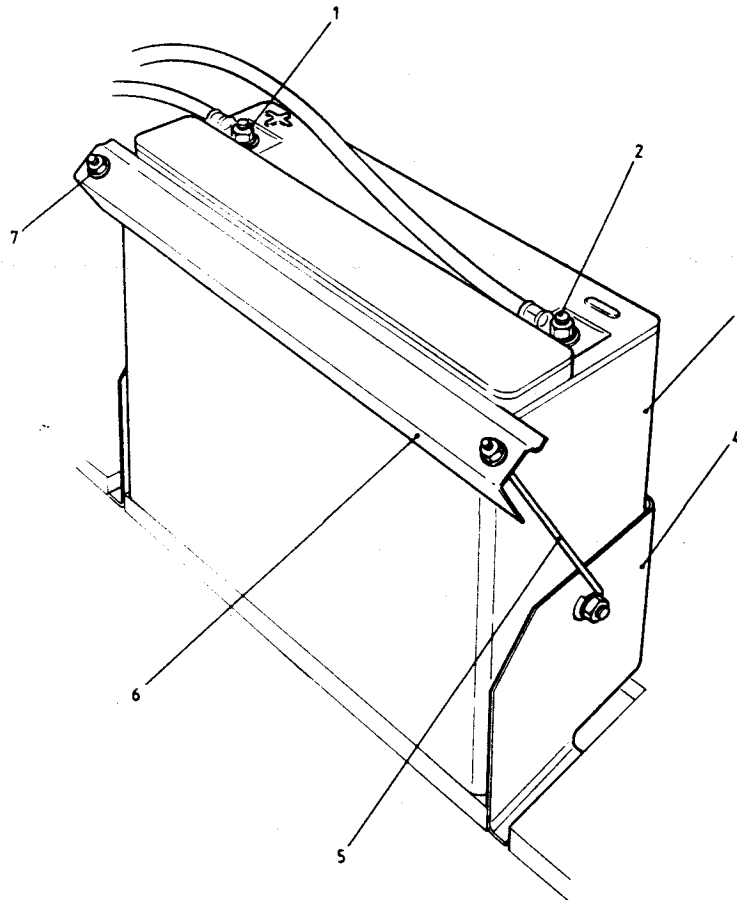
Fig. 4 Fuel Filter Assembly

GENERATOR BATTERY (Fig. 5)

8 The battery is a high quality sealed lead acid type of 12 volts potential and 35 ampere hour capacity. the physical size of the battery is approximately 10 inches (25cm) long x 4 inches (10cm) wide x 8 inches (20cm) high. The battery is located within the chassis assembly, adjacent to the engine. To obtain access to the battery, the generator set should be switched off (engine not running) and the acoustic cover removed (this is a 2-man task).

Routine Maintenance

9 Battery maintenance is minimal and no topping up is needed. The battery should be periodically examined for signs of physical damage and the terminals should be checked for signs of corrosion. The terminals should be checked periodically for signs of a good electrical connection; if necessary the terminals can be scraped clean and a light smear of pure petroleum jelly (vaseline) applied. Note that when disconnecting the battery terminals, the negative terminal is connected to chassis (ground) and should be disconnected first. When reconnecting the battery, the negative terminal should be connected last.



- | | | | |
|---|--|---|----------------------------|
| 1 | Battery Positive Terminal | 5 | Stay |
| 2 | Battery Negative Terminal | 6 | Battery Retaining Arm |
| 3 | Battery (12 volts, 35 ampere hour) maintenance free | 7 | Retaining Arm Securing Nut |
| 4 | Battery Housing | | |

Fig. 5 Generator Battery Assembly

Battery Charge - General

10 A fully charged battery will retain at least 80 percent of its charge for 12 months if left stowed on the generator set in a United Kingdom type of environment. The battery will retain its performance within an operational temperature band of -31°C to $+70^{\circ}\text{C}$.

10.1 The generator set delivers a charge to the battery of 2 amperes (nominal). If the generator set has been cold started more than ten times for running periods of only one to two hours duration or more than five times for running periods of less than one hour duration, then the battery will be in a partially discharged state and it is advisable to boost charge the battery to ensure that it is in a state of operational readiness. The boost charge can be applied in two ways:-

10.1.1 By running the generator set continuously for not less than six hours.

10.1.2 By removing the battery from the generator set and applying a boost charge from an external battery charger as described in para. 11.

Boost Charging - General

CAUTION

A motor vehicle type booster charger must not be used. This could cause catastrophic damage to the battery.

11 If a boost charge is to be applied, the battery should first be removed from the generator set. A BOOST CHARGE MUST ONLY BE APPLIED FROM A CONSTANT VOLTAGE SOURCE as follows:

11.1 Normal overnight boost charge at 14.7 volts maximum, with a maximum charging current of 5 amperes (3 amperes nominal).

11.2 Extra boost charge at 15 volts and 35 amperes maximum (30 amperes nominal). This can be used for a battery which is discharged to less than 50 percent capacity.

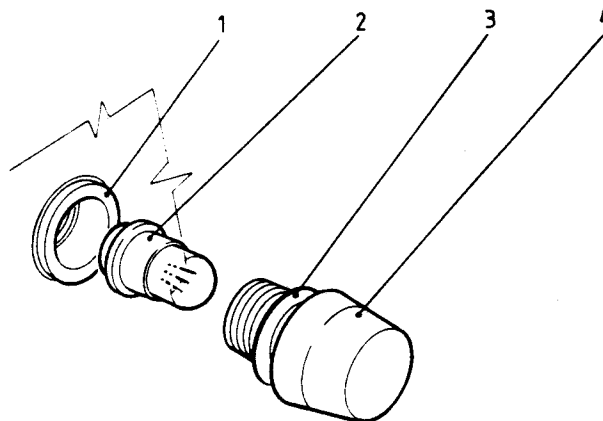
REPLACEABLE LAMPS (Fig. 6)

12 The lens and the filament bulb can be replaced on the five red lens indicators and three panel lamps on the output panel control box, and also the SYNCHRO lamp on the fixed box.

12.1 To replace a filament bulb, unscrew and remove the lens and withdraw the filament bulb. Replace the bulb and screw in the lens.

PROTECTION DEVICES

13 There are no fuses associated with the generator set. Output connectors and terminals can be isolated by means of their associated circuit breakers. Output connector 4 circuit includes a residual current circuit breaker. The circuit breaker operation can be tested before use by operating the RFC TEST button which is located on the fixed box, beneath the emergency output terminals hinged cover.



- | | | | |
|---|-----------------|---|-------------------|
| 1 | Lampholder Body | 3 | Waterproof Washer |
| 2 | Filament Bulb | 4 | Lens |

Fig. 6 Indicator Lamp Filament Bulb and Lens

LUBRICATION - MECHANICAL COMPONENTS

14 Periodically lubricate the mechanical control linkages. This can be done using a few drops of clean engine oil at the time the engine oil is changed. Wipe away any surplus oil.

COOLING

15 The engine is air cooled. Cooling air for the engine is drawn into the acoustic cover by twin fans driven by the engine. Cooling air enters the acoustic cover through the rear grill and is expelled at the front. Cooling air for the alternator is drawn into the acoustic cover through the centre-mounted grill at the front. These grills should be cleared of foreign matter such as dead leaves, paper and so on, before the engine is started.

USER FAULT FINDING

16 Provided that the routine maintenance tasks are carried out at the recommended intervals, the generator set should run for many hundreds of hours without failure. In order to assist the user in diagnosing operational problems that could occur, the output panel control box contains warning indicator lamps that illuminate if certain operational parameters are exceeded. Some of these warning lamp circuits are coupled to a generator shutdown circuit that will shut down the generator to prevent damage should the operational parameters be exceeded. The function of these lamp circuits is defined in chapter 1. Action to be taken if the lamps indicate a fault condition is defined in table 2.

Note ...

In some circumstances more than one lamp may be illuminated. Start up failure and possible causes are defined in the flowchart (Fig. 7).

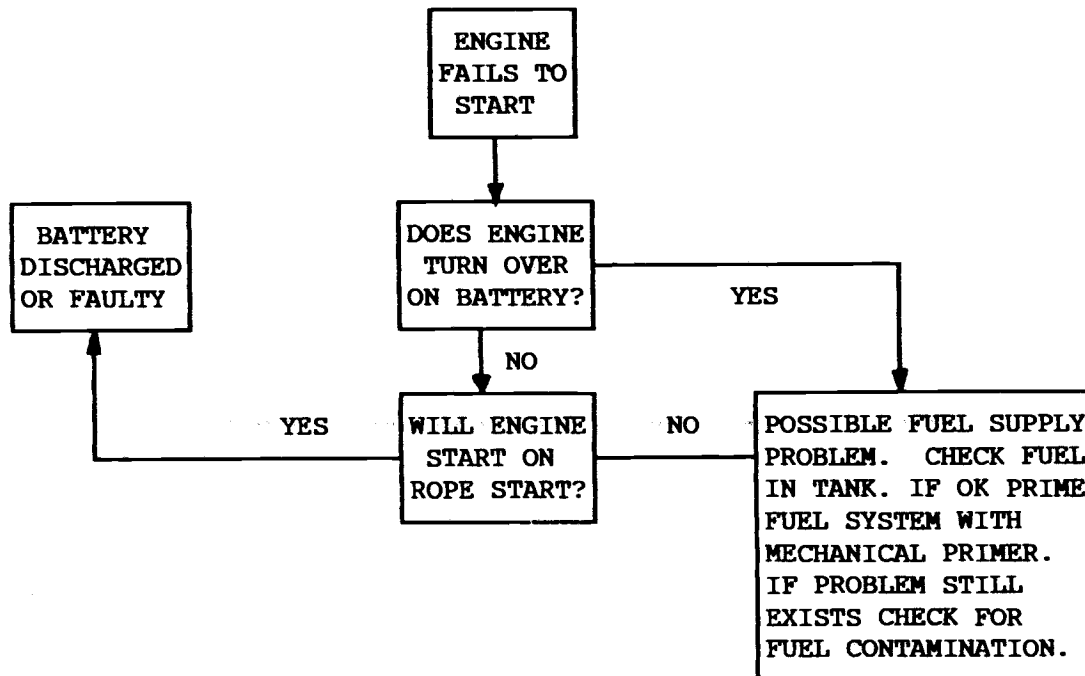


Figure 7 Start up Failure Analysis Flowchart

TABLE 2 - GENERATOR FAIL LAMPS ANALYSIS

| Lamp Definition and Status | Cause of Failure | Correcting Action | Remarks |
|---|--|--|--|
| POWER ON, red lamp has extinguished. | 1 The filament lamp has failed. | Check the filament lamp. Change if failed. | |
| | 2 Alternator output failure. | Check output voltmeter reading. If low or zero suspect failure in the alternator or control box. Switch OFF engine. | Check for broken or loose wires on control box terminals at front of chassis assembly. If OK refer to next level of servicing. |
| BATTERY CHARGE red lamp is illuminated. | A failure has occurred in the battery charger circuit. | Check battery terminals are tight. check for broken wires. If all OK the battery charging circuit has failed. | Refer to next level of servicing. |
| OIL PRESSURE red lamp is illuminated. | The oil pressure has dropped below 15 psi. | Switch-OFF the engine. Check oil level. If OK check grade of oil is correct for the operating environment. | If oil is OK suspect worn big end bearings. Refer to next level of servicing. |
| ENGINE TEMP red lamp is illuminated. | If this lamp is illuminated the engine shutdown circuit will shutdown the engine. This is because the engine temperature has exceeded 110 degrees C. | Remove acoustic cover and allow engine to cool down. Check that the air input/output ducts on the acoustic cover are clear. Operate the LED INDICATORS RESET button. | If the air ducts are free from obstructions, suspect overloading of the generator. Disconnect some of the outputs or run two generators in parallel. |
| LOW FUEL red lamp is illuminated. | Low fuel in tank. | Top up the tank. | |

TABLE 2 GENERATOR FAIL LAMPS ANALYSIS (Continued)

| Lamp Definition and Status | Cause of Failure | Correcting Action | Remarks |
|---|---|--|--|
| OVERCURRENT white lamp is illuminated. | The output load is three times what it should be and to protect the alternator, the output has been shut down. | Remove some of the output load then operate the LED INDICATORS RESET button. | If operating with a heavy load consider connecting two generators in parallel. |
| REVERSE POWER white lamp is illuminated. | Two generators are running in parallel and the output from one is exceeding the operational parameters for running the generators in parallel and the outputs of one or both generators have shut down automatically. | Isolate the loads on both generators using the output circuit breakers. Operate the LED INDICATORS RESET button on both generators. Run up both generators in accordance with chapter 2. | The generators have become unsynchronised. Possibly due to a large load being disconnected from one of the generators. |
| OVER FREQUENCY white lamp is illuminated. | The frequency is not within the operational parameters and the load has been disconnected automatically. | The engine speed has risen, possibly because a heavy load has been disconnected. Isolate the output load and investigate the problem. Operate the LED INDICATORS RESET button. | Investigate cause and run up engine to speed. Adjust ENGINE SPEED CONTROL if necessary to trim engine speed when loaded. |
| UNDER FREQUENCY white lamp is illuminated. | The frequency is not within the operational parameters and the load has been disconnected automatically. | The engine speed has fallen. This could be due to an engine fault (misfiring). Isolate the output load and investigate the problem. Operate the LED INDICATORS RESET button. | Investigate cause and run up engine to speed. Adjust ENGINE SPEED CONTROL if necessary to trim engine speed when loaded. |

TABLE 2 GENERATOR FAIL LAMPS ANALYSIS (Continued)

| Lamp Definition and Status | Cause of Failure | Correcting Action | Remarks |
|--|---|---|---|
| HIGH TEMP. (AIR) white lamp is illuminated. | The cooling air to the generator has exceeded 120 degrees C and the engine has shutdown. | Remove the acoustic cover and let the engine cool down. Isolate the output load. Operate the LED INDICATORS RESET button. Clear any obstructions in the air ducts of the acoustic cover. | Provided the ventilation ducts and grills are not obstructed, this is unlikely to occur during normal operation. |
| HIGH TEMP. (OIL) white lamp is illuminated. | The temperature of the lubricating oil within the engine has reached a dangerous level and the engine has been automatically shut down. | Remove the acoustic cover and let the engine cool down. Isolate the output load. Operate the LED INDICATORS RESET button. Check the oil level and ensure it is on the correct level mark on the dipstick. Check that you have the correct oil type for the operational environment. | If this problem continues suspect a faulty oil temperature sensor. If the problem is due to operational conditions, change the oil more frequently because its film strength can break down with excessive temperature. |
| LOW OIL PRESSURE white lamp is illuminated. | The oil pressure has fallen below the accepted danger level and the engine has been automatically shut down. | Remove the acoustic cover and let the engine cool down. Isolate the output load. Operate the LED INDICATORS RESET button. Check the oil level and ensure it is on the correct level mark on the dipstick. | If the problem continues, possibly the engine is faulty or the oil pressure sensor is faulty. Refer to next level of servicing. Check for the correct type of oil for the operational environment. |

FUNCTIONAL TEST

17 To test the generator set after a repair, or at any other time, the generator should be started from cold in the normal manner and should run within ten seconds of the starter being operated and 240V 50 Hz must be available as indicated on the panel meters.

Operational Status

18 Operational status of the machine should be indicated as follows:

18.1 With the generator running normally the POWER ON lamp only should be illuminated; any other lamp will indicate a fault condition.

18.2 Note the positioning of the ENGINE SPEED CONTROL and with the generator outputs isolated, verify that movement of the engine speed control anticlockwise, then clockwise, causes the engine speed to decrease and increase accordingly. Reset the engine speed control to the noted position; this normally corresponds with the FREQUENCY METER indicating 50Hz.

18.3 Note the position of the VOLTAGE CONTROL and with the generator outputs isolated verify that movement of the voltage control anticlockwise, the clockwise, causes the VOLTMETER indication to decrease and increase accordingly. Reset the voltage control to the noted position; this is normally 240V.

Chapter 4

DESTRUCTION OF EQUIPMENT

CONTENTS

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| | DESTRUCTION OF EQUIPMENT TO PREVENT ENEMY USE |
| 1 | MANDATORY DIRECTIVE |
| 3 | Degree of damage |
| 5 | Spare parts |
| 6 | MEANS AND PROCEDURES |
| 8 | Mechanical |
| 9 | Burning (WARNING) |
| 10 | Gunfire (WARNING) |
| 11 | PRIORITIES |

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| 1 | Priorities for destruction | 3/4 |

DESTRUCTION OF EQUIPMENT TO PREVENT ENEMY USE

MANDATORY DIRECTIVE

1 Destruction of the equipment when subject to capture by the enemy, will be undertaken by the user arm, ONLY WHEN, in the judgement of the unit commander concerned, such action is necessary in accordance with order of, or policy established by the Army or Divisional Commanders.

2 The reporting of the destruction of the equipment is to be done through command channels.

Degree of Damage

3 The degree of damage inflicted, to prevent the equipment being used by an enemy, shall be as follows:

3.1 Methods of destruction should achieve such damage to equipment and essential spare parts that it will not be possible to restore the equipment to a usable condition in the combat zone either by repair or by cannibalisation.

3.2 Classified equipment must be destroyed in such degree as to prevent, whenever possible, duplication, or determination of operation or function by the enemy.

3.3 Any classified documents, notes, instructions, or other written material pertaining to function, operation, maintenance or employment, including drawings or parts lists, must be destroyed in a manner to render them useless to the enemy.

4 In general, destruction of essential parts, followed by burning will usually be sufficient to render the equipment useless. However, selection of the particular method of destruction requires imagination and resourcefulness in utilisation of the facilities at hand under the existing conditions. Time is usually critical.

Spare Parts

5 The same priority, for destruction of component parts of a major item necessary to render the item inoperable, must be given to the destruction of similar components in spare parts storage areas.

MEANS AND PROCEDURES

6 If destruction is ordered, due consideration should be given to:-

6.1 Selection of a point of destruction that will cause greatest obstruction to enemy movement and also prevent hazard to friendly troops from fragments or ricocheting projectiles which may occur incidental to the destruction by gunfire.

6.2 Observance of appropriate safety precautions.

7 The following information is for guidance only. Of the several means of destruction, those most generally applicable are as follows:

Mechanical

8 This requires an axe, pick, crowbar or similar implement. The equipment should be destroyed in accordance with the priorities given in Table 1 - PRIORITIES.

Burning

WARNING ...

DUE CONSIDERATION SHOULD BE GIVEN TO THE HIGHLY INFLAMMABLE NATURE OF GASOLINE AND ITS VAPOUR. CARELESSNESS IN ITS USE MAY RESULT IN PAINFUL BURNS.

9 This requires gasoline, oil or other flammables:

9.1 Remove and empty the portable fire extinguishers.

9.2 If quantities of combustibles are limited, smash all vital elements, such as switches, instruments and control levers.

9.3 Place ammunition and charges in and about the equipment so that the greatest damage will result from the explosion.

9.4 Pour gasoline and oil over the equipment. Ignite by means of an incendiary grenade fired from a safe distance, by a flame thrower, by a combustible train of suitable length or other appropriate means. Take cover immediately.

Gunfire

WARNING ...

FIRING ARTILLERY AT RANGES OF 500 YARDS OR LESS, AND FIRING GRENADES OR ANTI-TANK ROCKETS SHOULD BE FROM COVER.

- 10 When destroying the equipment by gunfire, proceed as follows:
- 10.1 Remove and empty the portable fire extinguishers.
 - 10.2 Smash all vital elements as outlined in sub-paragraph 2.
 - 10.3 Destroy the equipment by gunfire, using tank guns, self-propelled guns, artillery, rifles, using rifle grenades or launchers using anti-tank rockets.

PRIORITIES

- 11 The priorities for destruction should be considered as follows:
- 11.1 Priority must be given to the destruction of classified equipment and associated documents.
 - 11.2 When lack of time and/or means prevents complete destruction of equipment, priority is to be given to the destruction of essential parts, and the same parts are to be destroyed on all like equipment.
 - 11.3 A guide to priorities for destruction of the equipment is shown in Table 1 - PRIORITIES.

TABLE 1 PRIORITIES FOR DESTRUCTION

| Priority | Container fitted equipment |
|----------|--|
| 1 | Any classified equipment held for repair/test. |
| 2 | Automatic Test Equipment (ATE) System. |
| 3 | Manual Test Equipment (MTE) Station. |
| 4 | Air Conditioning Units (AC60). |
| 5 | NBC Unit. |
| 6 | Portable generator. |