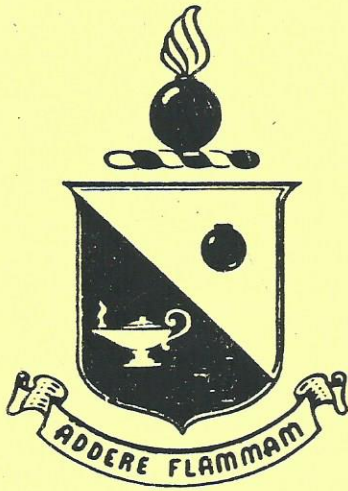


087N-LPX EAA  
087N-LPX EAF  
DEC 1999



# **US ARMY ORDNANCE CENTER AND SCHOOL**

**STUDENT WORK BOOK**

**2 KW Military Tactical  
Generator Set**

**MEP-531A, 120 VAC, 60 Hz  
MEP-501A, 28 VDC**

**ABERDEEN PROVING GROUND, MARYLAND 21005**

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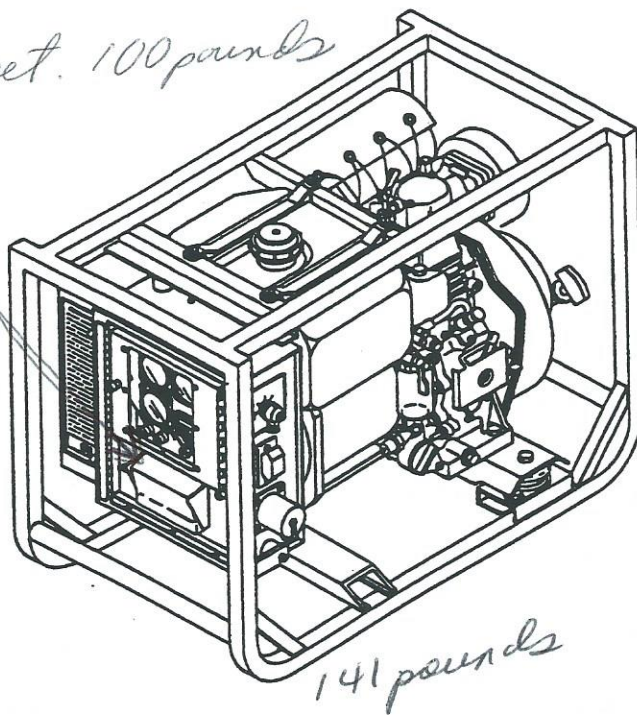
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AS POWER GENERATOR EQUIPMENT OPERATORS AND REPAIRSER WILL HAVE SUFFICIENT KNOWLEDGE TO OPERATE AND PERFORM OPERATOR, UNIT AND DIRECT SUPPORT MAINTENANCE ON THE 2 KW MILITARY TACTICAL GENERATOR SETS. INCLUDING SERVICNG, TROUBLESHOOTING, PREVENTIVE AND CORRECTIVE MAINTENANCE IN THE FIELD AND IN A MAINTENANCE FACILITY.

## GROUNDING PROTECTS YOU AND YOUR EQUIPMENT

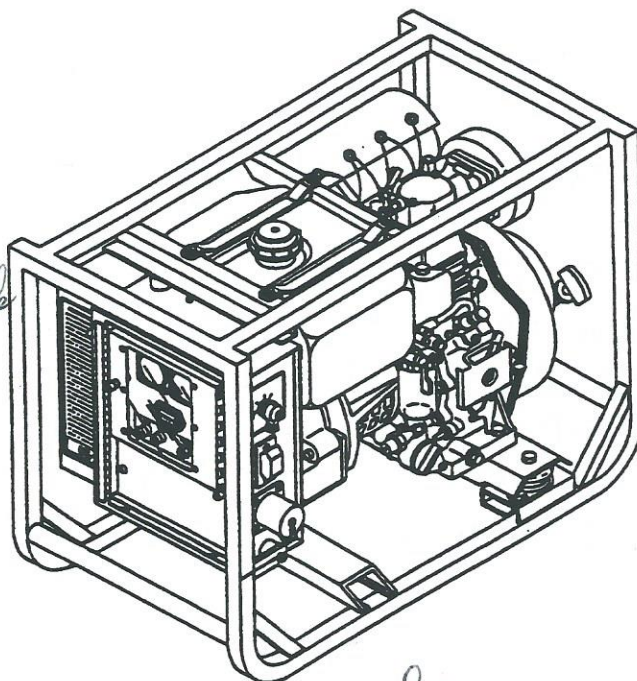
LACK OF EQUIPMENT GROUNDING OR IMPROPER GROUNDING MEANS THAT YOU CAN EXPECT TO BE INJURED. THE EXTENT OF INJURY MAY RANGE FROM MILD TO NEAR-FATAL OR FATAL SHOCK. YOUR EQUIPMENT MAY SUFFER THE SAME FATE AS YOU. IT MAY MEAN A BURNED OUT CIRCUIT OR COMPLETE DESTRUCTION.

Devery  
 ↓  
 Generator larger set. 100 pounds  
 Convenient receptor



MEP-531A - AC  
 120 volts

Belmar  
 ↓  
 Generator small. 80 pounds  
 Transit supresor → uses  
 correct L and N protected  
 circuit.



125 pounds

MEP-501A - DC  
 28 volts

Figure 1 Military Tactical Generator (MTG) Set 2kW

# EQUIPMENT CHARACTERISTICS, CAPABILITIES AND FEATURES

**GENERAL** The 2 KW generator sets, model MEP-501A and MEP-531A are self-contained, skid-mounted, portable units. They are equipped with controls, instruments and accessories necessary for operation as single units. The generator set consist of a diesel engine, direct drive AC alternator, speed governing system, fuel system, 24 VDC auxiliary cold weather starting system, generator control system. The generator sets are portable and require a four person lift.

## NOTE

All locations referenced herein are given facing the control panel (rear) of the generator set.

## LOCATION AND DESCRIPTION OF MAJOR COMPONENTS.

**Diesel Engine.** The generator set is powered by a one cylinder, four cycle, fuel injected, naturally-aspirated, air-cooled diesel engine which occupies the front half of the generator set. The engine is also equipped with a fuel filter, lubricating oil strainer, and a foam covered, dry-paper air filter. A safety device automatically stops the diesel engine during conditions of low engine oil pressure.

**Alternator.** The AC alternator is a single-bearing, drip-proof, synchronous, single phase, air-cooled generator. The DC alternator is a two-pole, revolving field-type AC alternator rectified to DC. Each alternator/generator is coupled directly to the engine crankshaft.

**Control Panel Assembly.** The generator set control panel is located at the rear of the generator set and contains controls and instruments for operating the engine and the alternator.

**Fuel Tank** The 1.6 gals (6.1 l) capacity, 1.2 gals (4.6 l) usable fuel tank is located on top of the generator set just behind the diesel engine. The tank includes a removable strainer element designed to prevent large contaminants from entering the tank through the fill opening. The fuel tank has sufficient capacity to enable the generator set to operate for at least 4.8 hours without refueling while operating at 100% load.

**Skid Base** The skid base supports the generator set.

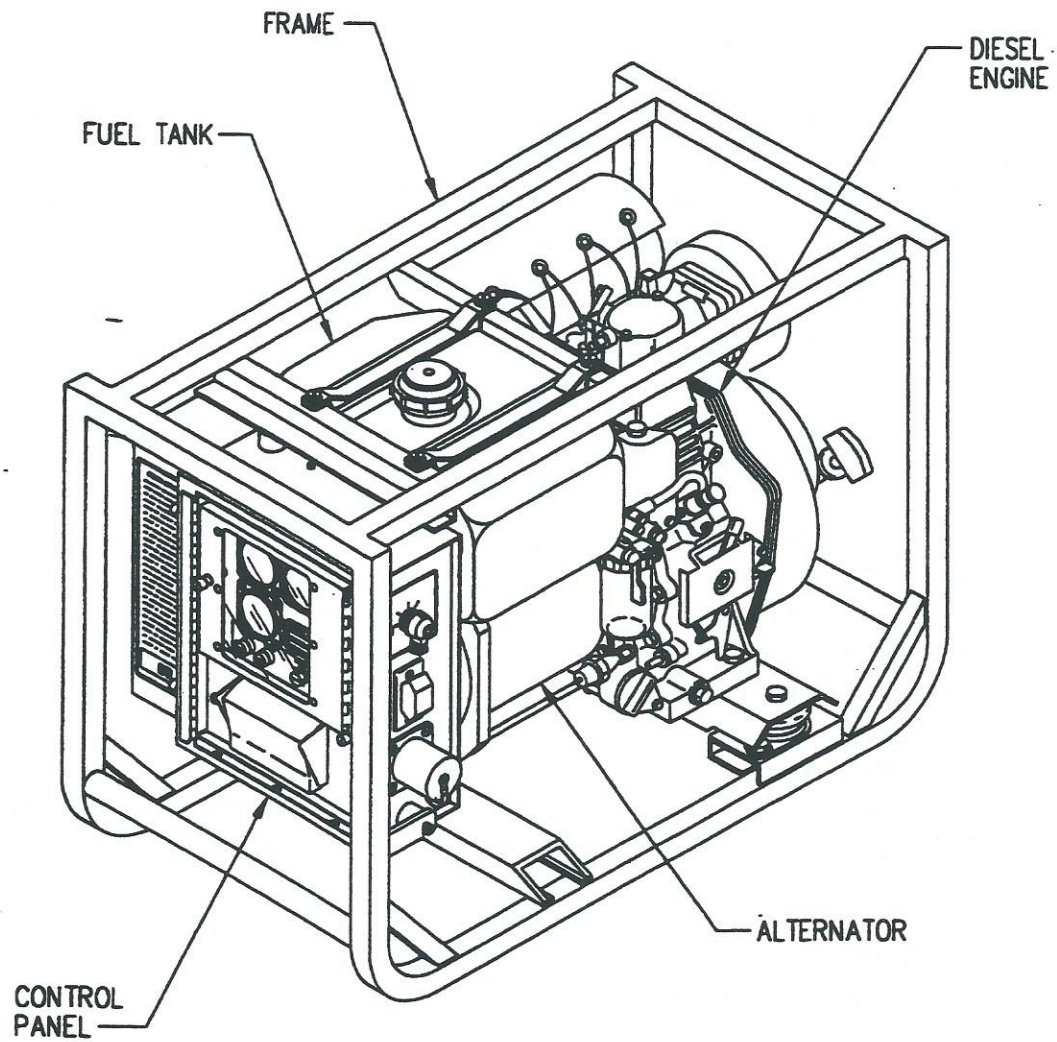


Figure 2 Location of Major Generator Set Components

## Safety Devices

- a. The generator set features a Low Oil Pressure (LOP) shutoff switch and solenoid which are designed to shut down the generator set if the diesel engine loses oil pressure. The LOP switch is located in the engine block (right-rear corner). The solenoid is located in the main control panel.
- b. The convenience receptacle on the MEP-531A (120 VAC, 60 HZ) features a Ground Fault Circuit Interrupter (GFCI) which protects the generator set components from inductive current in the ground circuit originating from the load connected to the convenience receptacle. The convenience receptacle is located on the main control panel.
- c. - The ON-OFF load circuit breaker is designed to take the generator set off line in an overload condition. The circuit breaker is located on the right side of the main control panel. A circuit interrupter is connected between the alternator output and the generator set output terminals to disconnect the generator output from the load and also protect the generator from a short circuit. The circuit interrupter is operated from a current sensor internal to the circuit breaker.
- d. Transient suppressors diodes (MEP-501A, 28 VDC) protect the load circuit from potential damage caused by cross-connecting the positive (+) and negative (-) output terminals of the alternator. The transient suppressors are located in the main control panel.

# EQUIPMENT DATA

## Model Number

2 KW 120 VAC Military Tactical Generator Set  
2 KW 28 VDC Military Tactical Generator Set

MEP-531A  
MEP-501A

## Overall Length

MEP-531A  
MEP-501A

29.5 in. (750 mm)  
29.5 in. (750 mm)

## Overall Width

MEP-531A  
MEP-501A

16 in. (406 mm)  
16 in. (406 mm)

## Overall Height

MEP-531A  
MEP-501A

21.7 in. (550 mm)  
21.7 in. (550 mm)

## Dry Weights

MEP-531A  
MEP-501A

140.2 lb. (63.6 kg)  
123.5 lb. (56.0 kg)

## Diesel Engine

Manufacturer

Yanmar

Model

L48AE-DEG

Type

Single Cylinder, four cycle, naturally-aspirated diesel

Stroke

2.2 in. (55 mm)

Displacement

12.88 cu in (0.2111)

Compression Ratio

19.9-1

Rating

4.2 HP @ 3600 RPM

Engine Operating Speed

No Load

3750 RPM

Full Load (30 RPM)

3600 RPM

Cold Weather Starting System Use When Temperature is 23(F (-5(C) or Below

### **Diesel Engine Cooling System**

Type Air Cooled by Fan Integral with Flywheel

### **Diesel Engine Lubrication System**

|                            |                                 |
|----------------------------|---------------------------------|
| Type                       | Full Flow, circulating pressure |
| Capacity                   | 0.85 qt (0.80 l)                |
| Oil Pump                   | gerotor                         |
| Normal Operating Pressure  | 25-60 PSI                       |
| Filter Type                | Reusable Strainer               |
| Pressure Indicating System | NONE                            |

### **Fuel System**

|                       |                                       |
|-----------------------|---------------------------------------|
| Type of Fuel          | DL-1, DL-2, or JP8                    |
| Fuel Tank Capacity    | 1.6 gal, (6.2 l), 1.2 useable (4.6 l) |
| Fuel Consumption Rate | 0.333 gal./hr (1.26 l/hr) @ 100% load |
| Fuel Tank Consumption | 3.6 Hours @ 100% load                 |

### **Diesel Engine Starting System**

|   |                  |
|---|------------------|
| Manual  | Recoil Mechanism |
| Electric (Power supplied via NATO slave receptacle) | Starting Motor   |
| Manufacturer  | Yanmar           |
| Model   | S114-414A        |
| Rating  | 24 VDC           |

### **Alternator**

#### **MEP-531A:**

|                          |                                   |
|--------------------------|-----------------------------------|
| Manufacturer             | Dewey Electronics Corporation     |
| Type                     | Rotating field Synchronous        |
| Load Capacity            | 2 KW                              |
| Voltage Output           | C single phase                    |
|                          | 2 wire and ground(bound to frame) |
| Cooling                  | Forced Air                        |
| Lubrication Requirements | None                              |
| Drive Type               | Direct Coupling                   |
| Duty Classification      | Continuous                        |

## **Alternator**

### **MEP-501A:**

|                          |                          |
|--------------------------|--------------------------|
| Manufacturer             | Balmar Products Inc.     |
| Type                     | Brush AC Rectified to DC |
| Load Capacity            | 2 KW                     |
| Voltage Output           | 28 VDC                   |
| Cooling                  | Forced Air               |
| Lubrication Requirements | None                     |
| Drive Type               | Direct Coupling          |
| Duty Classification      | Continuous               |

## **Safety Devices**

### **Low Engine Oil Pressure:**

|                       |   |
|-----------------------|---|
| Trip Pressure (Range) | 12-18 PSI   |
| Voltage Rating        | 24 VDC  |
| Current Rating        | 5 amps  |
| Method                | Electrically-operated solenoid with<br>mechanical link to fuel governor |

# **PREVENTIVE MAINTENANCE CHECKS and SERVICES (PMCS)**

Preventive Maintenance Checks and Services (PMCS) are those scheduled procedures which are essential to the efficient operation of the equipment. PMCS prevent possible damage that might occur through neglect or failure to observe warning symptoms on time. Ensure all noted discrepancies are corrected. Always do preventive maintenance in the same order.

## **NOTE**

Within designated intervals, these checks are to be performed in the order listed. If the generator set must be kept in continuous operation, check and service only those items that can be accessed without interrupting operations. Complete checks and services when the generator set is shut down.

## **BEFORE YOU OPERATE**

Perform before (B) PMCS. Observe WARNINGS and CAUTIONS contained in the manual and on plates installed on equipment.

## **WHILE YOU OPERATE**

Perform during (D) PMCS. Observe WARNINGS and CAUTIONS contained in the manual and on plates installed on equipment.

## **AFTER YOU OPERATE**

Perform after (A) PMCS. Observe WARNINGS and CAUTIONS contained in the manual and on plates installed on equipment.

## **REPORTING and CORRECTING DEFICIENCIES**

If your generator set does not perform as required, refer to troubleshooting for possible problem. Any malfunctions, failures, or discrepancies shall be recorded on DA FORM 2404 or DA FORM 5988E and reported to higher level maintenance, refer to DA PAM 738-750.

Instructions on how to fill out the DA Form 2404 In Accordance With (IAW) DA Pam 738-750 (Update 14) is provided on page 9.

Instructions on how to fill out the DA Form 5988E In Accordance With (IAW) DA Pam 738-750 (Update 14) is provided on page 12.

**(1) Organization.** Enter the name of the unit to which the equipment belongs.

**(2) Nomenclature and Model.**

- a. Enter the noun abbreviation and the model of the equipment.
- b. For watercraft, use the noun abbreviation and Hull Design Number.

**(3) Registration/Serial/NSN.**

- a. Enter the serial or registration number. Enter the NSN when no serial or registration number is available.
- b. For watercraft, enter the DA Hull Number.

**(4a) Miles.**

- a. When a deficiency or a shortcoming is found, enter the miles or kilometers on the equipment's odometer at the end of the day's dispatch or operation.
- b. Round to the nearest mile or kilometer. Put the letter "K" before the number if the reading is kilometers.
- c. Leave blank if the item does not have an odometer or if no faults are found.

**(4b) Hours.**

- a. When a deficiency or a shortcoming is found, enter the meter reading at the end of the day's dispatch or operation.
- b. Leave blank if hours do not apply to the equipment or if no faults are found.

**(4c) Rounds Fired.** Leave blank.

**(4d) Hot Starts.** Leave blank.

**(5) Date.** Enter the calendar date the deficiency or shortcoming was found.

**(6) Type Inspection.** Enter "PMCS".

a. Use the same DA Form 2404 for more than 1 day. If you find no faults during the BEFORE OPERATION checks in the PMCS, put the date in column c. If no faults are found DURING or AFTER OPERATION, initial in column e.

b. When no faults are found, this form can be used for more than 1 day even if form was used for concurrent PMCSs, i.e., W/M. Just place the first letter of the type of PMCS performed (W/M) in column d, by that day's date in column c after the PMCS was performed.

**(7) TM Number and TM Date.**

a. Enter the number and date of the PMCS TM. When two TMs cover an item, put the second TM number and date in the second number and date block.

b. When the manual has changes, print "W/C" and the latest change number after the TM number. Then, put the latest change date in the TM date block.

**(8a) Signature.** When a deficiency or shortcoming is found, the operator or supervisor signs and enters rank. A signature in this block keeps the form from being used past current dispatch.

**(8b) Time.** Leave blank or use as needed locally.

**(9a) Signature.** Maintenance supervisor or the commander's designated representative will sign when corrective action is taken.

**(9b) Time.** Leave blank or use as needed locally. For a missile system and missile subsystems reported under AP 700-138, (chapter 4), enter the time when item was found to be NMC.

**(10) Man-Hours Required.** Leave blank or use as needed locally.

**Column a. TM Item No.**

a. Put the PMCS item number that applies to the fault listed in column c. If the PMCS has no item numbers, list the page, paragraph, or sequence number. Circle the number if the fault is listed in the "Equipment is not ready/available if" column or "Not Mission Capable if" column of the PMCS. If the PMCS has no ready/available or not mission capable column, circle the TM item number, page, or paragraph number of any fault that makes the equipment NMC.

b. Pubs or TM sections other than PMCS may be required for safety faults or local dispatching. For example, AR 385-55 lists safety checks that may not be in the PMCS. Those faults will not be counted as NMC for the DA Form 2406 (Materiel Condition Status Report) unless they are in the PMCS "not ready" column or the "not mission capable" column. But, you will list them if you find a problem with one of them.

c. For those faults not covered by the PMCS, leave this column blank.

**Column b. Status.** Enter the status symbol that applies to the fault or deficiency.

**Column c. Deficiencies and Shortcomings.**

a. If you find a fault that can be repaired, stop the PMCS and correct the fault. Do not enter faults that have been repaired on the DA Form 2404. Continue the PMCS to make sure no other faults exist.

b. Briefly describe the fault. Skip one or two lines between faults. This will give maintenance room to note actions they take.

c. When more than one TM covers the equipment, draw a line under the last entry for one TM. Under the line, write the TM number of the manual you will use next. After you finish the PMCS and list all faults you cannot fix, give the form to the maintenance supervisor.

d. When using one DA Form 2404 for more than one item of equipment, enter the serial or administration number for the item with the fault. Write the fault on the line below the serial number.

e. When you list faults not covered by the PMCS, add the pub that covers them; for example, SOP or AR 385-55.

**Column d. Corrective Action.** Explain corrective actions taken.

**Column e. Initial When Corrected.** The mechanic initials any faults that have been fixed. The initials will go on the last line for the entry in column d. The maintenance supervisor will review the faults corrected and those still not fixed to decide what other action is needed. For quality control, the inspector or a designated representative will check all corrected status symbol X faults. The inspector will then initial the status symbol.

Figure 3 Preparation Instructions for DA Form 2404

For use of this form, see DA PAM 738-750 and 738-751; the proponent agency is DCSLOG

## 2. NOMENCLATURE AND MODEL

4a. MILES

**b. HOURS**

**C. BOUND**

d. HOT

15. DATE

## 6. TYPE INSPECTION

7.

### APPLICABLE REFERENCE

TM DATE

TM NUMBER

|         |  |
|---------|--|
| TM DATE |  |
|---------|--|

**COLUMN c - Enter deficiencies and shortcomings.**

**COLUMN e – Individual ascertaining completed corrective action initial in this column.**

**HORIZONTAL DASH "-"** - Indicates that a required inspection, component replacement, maintenance operation check, or test flight is due but has not been accomplished, or an overdue MWO has not been accomplished.

**LAST NAME INITIAL IN BLACK, BLUE-BLACK INK, OR PENCIL** - Indicates that a completely satisfactory condition exists.

**FOR AIRCRAFT - Status symbols will be recorded in red.**

ALL INSPECTIONS AND EQUIPMENT CONDITIONS RECORDED ON THIS FORM HAVE BEEN DETERMINED  
IN ACCORDANCE WITH DIAGNOSTIC PROCEDURES AND STANDARDS IN THE TM CITED HEREON.

**8a. SIGNATURE** *(Person(s) performing inspection)*

186 TIME

9a SIGNATURE (Maintenance Supervisor)

19b. TIME

|                          |       |
|--------------------------|-------|
| 10. MANHOURS<br>REQUIRED | 10.00 |
|--------------------------|-------|

TM  
ITEM  
NO.  
4

**STATUS**

## DEFICIENCIES AND SHORTCOMINGS

### CORRECTIVE ACTION

INITIAL  
WHEN  
CORRECTED  
e

For use of this form, see DA PAM 738-750 and 738-751; the proponent agency is DCSLOG

**Equipment Data Section:**

a. Admin number, Equipment Model, Equipment Noun, Equipment National Stock Number (NSN), Equipment Serial Number, Registration Number, Type Inspection, and the Publication Numbers (with changes) will be retrieved from the equipment data file. No entries from the operator/crew chief are needed in these areas.

b. The operator/crew chief must ensure that data contained in these areas are correct prior to pulling PMCS. If any fields are not current, notify the ULLS operator so he/she can update the data fields through the ULLS Menu process. For more information about these data fields, refer to the ULLS End User Manual ADSM-25-L3N-AWA-ZTH-EUM.

**Type Inspection.**

Operator/crew chief requests the ULLS operator to print an Equipment Maintenance and Inspection Worksheet with the type inspection to be performed. See ULLS End User Manual or chapter 3 of this pamphlet for an explanation of these symbols.

(1) Use the same worksheet for more than 1 day. If you find no faults during the BEFORE OPERATION checks in the PMCS, write the calendar date under the fault description column. If no faults are found DURING or AFTER OPERATION CHECKS, put your initials in the initial column.

(2) When no faults are found, this worksheet can be used for more than 1 day even if the worksheet was used for concurrent PMCSs; that is, W/M. Just place the first letter of the type of PMCS performed (W/M) under the corrective action column by that day's date in the fault description column.

**Signature.** When a deficiency or shortcoming is found, the operator or supervisor signs and enters rank. A signature in this block keeps the form from being used past current dispatch.

**Time.** Leave blank or use as needed locally.

**Signature (For figure 12-3).** Operator's supervisor will sign and enter rank when a fault is found on the PMCS.

**Time.** Leave blank or use as needed locally.

**Initials (Figure 12-3).** The mechanic initials any faults that have been fixed. The mechanic gives it back to maintenance supervisor. Maintenance supervisor will review the faults corrected and those still not fixed to decide what other action is needed. For quality control, the inspector or a designated representative will check all corrected status symbol X faults. The inspector will then initial the status symbol.

**Item Num.**

a. Write the PMCS item number that applies to the fault listed in this column. If the PMCS has no item numbers, list the page, paragraph, or sequence number. Circle the number if fault is listed in the "Equipment is not ready/available if" column or "Not Mission Capable if" column of the PMCS. If the PMCS has no ready/available or not mission capable column, circle the TM item number, page, or paragraph number of any fault that makes equipment NMC.

b. Pubs or TM sections other than PMCS may be required for safety faults or local dispatching. For example, AR 385-55 lists safety checks that may not be in the PMCS. Those faults will not be counted as NMC for Materiel Condition Status Report reporting unless they are in the PMCS "not ready" column or the not mission capable column. But, you will list them if you find a problem with one of them.

c. For those faults not covered by the PMCS, leave this column blank.

**Fault Date.** Enter the calendar date the deficiency or shortcoming was found.

**Fault Status (Figure 12-3).** Enter the status symbol that applies to the fault or deficiency.

**Fault Status (Figure 12-4).** Repair of status symbol X faults cannot be postponed or delayed, but they may be changed to circle X status symbol for limited operation. The commander or the commander's designated representative may change an X status symbol fault to a circle X status symbol. Changing of status symbols should only be done when the equipment is crucial to the mission. No X status symbol faults will be changed to a circle X if it endangers the operator/crew or may cause further damage to the equipment. Circle X conditions will be for one time operation or mission (common sense must be used).

**Fault Description.**

a. If you find a fault that can be repaired, stop the PMCS and correct the fault. Do not enter faults that have been repaired or already listed on the worksheet. Continue the PMCS to make sure no other faults exist.

b. Briefly describe fault. Skip one or two lines between faults. This will give maintenance room to note actions they take.

c. When more than one TM covers the equipment, draw a line under the last entry for one TM. Under the line, write the TM number of the manual you will use next. After you finish the PMCS and list all faults you cannot fix, give the form to the maintenance supervisor.

**Corrective Action (Figure 12-3).** Explain corrective actions taken.

Figure 6 Preparation Instruction for DA Form 5988E

DA FORM 5988-E

INSPECTORS LIC #: \_\_\_\_\_ TIME: \_\_\_\_\_ SIGNATURE: \_\_\_\_\_ TIME: \_\_\_\_\_

PARTS REQUESTED

| FAULT | DOC | NUM | NIIN | NOUN | QTY<br>DUE/REC | STATUS<br>DATE | DATE<br>COMP |
|-------|-----|-----|------|------|----------------|----------------|--------------|
|-------|-----|-----|------|------|----------------|----------------|--------------|

## MAINTENANCE FAULTS

[illegible]

## **SPECIAL INSTRUCTIONS**

The following guidelines have been provided to you in classifying leaks observed while performing PMCS.

**CLASS I** Seepage of fluid as indicated by wetness or discoloration not great enough to form drops.

**CLASS II** Leakage of fluid great enough to form drops but not enough to cause drops to drip from item being checked.

**CLASS III** Leakage of fluid great enough to form drops that fall from item being checked/inspected.

### **CAUTION**

Equipment operation is allowable with minor leakage's (Class I or II). Of course consider the fluid capacity of the item/system being checked/inspected. When in doubt, notify maintenance.

While operating with Class I or Class II leaks, continue to check fluid levels as required in your PMCS. All leaks should be reported to maintenance.

## **USE APPORRIATE TECHNICAL MANUAL WHEN PERFORMING PMCS**

### **Class I**

Dip your finger in a cold cup of coffee and then wipe your finger across your forearm. There will be some dampness, a little stain, but no drops. This is what a Class I leak looks like. On your equipment, wipe the area dry and keep an eye on it.



### **Class II**

Stick your finger in the coffee again, and then hold it over the cup. Notice the drop that refuses to fall, Class II leaks form drops that are not heavy enough to drip. They're most often caused by seal and gasket wear. Clean the spot and check it regularly.



### **Class III**

To see what a Class III leak looks like, slowly tilt your coffee cup over a sink. Watch as a few drops fall into the sink. That's what happens when seals and gaskets are totally worn out. Report Class III leaks and record them on the vehicle's DA Form 2404 or ULLS DA Form 5988-E.

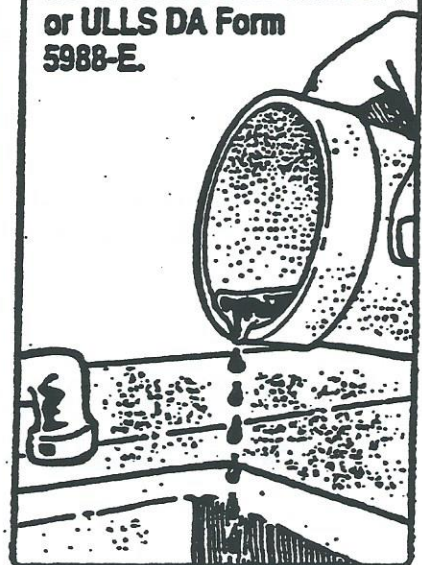


Figure 8 Leakage Classify

# **TECHNICAL PRINCIPLES OF OPERATION**

This section contains functional descriptions of the generator set and explains how the controls and indicators interact with the system.

## **FUEL SYSTEM**

The generator set fuel system (Figure 10) provides filtered and pressurized diesel fuel to the diesel engine. It consists of a fuel tank with removable fuel strainer, fuel lines, fuel filter, fuel injection pump, and a fuel injector.

The diesel fuel is stored in a fuel tank. The tank features a plastic mesh strainer in the fill neck opening and a fuel tank drain valve. The fuel tank supplies fuel via a flexible tube to the fuel filter. The fuel filter removes impurities and water from the diesel fuel before it reaches the diesel engine. The fuel filter is made up of a clear bowl and filter head with a throw-away paper filter. The fuel filter also includes a fuel shutoff valve and two bleed screws for removing air trapped in the fuel system. Another flexible tube connects the fuel filter and the fuel injection pump (part of the diesel engine).

With the engine cranking or running, the fuel flow is controlled by the mechanical governor (part of the diesel engine) and the fuel injection pump. The fuel injection pump pressurizes the fuel and transfers it to the fuel injector (part of the diesel engine). Fuel is sprayed by the injector into the engine combustion chamber where it is mixed with air and ignited. The fuel that is not burned by the engine is returned to the generator set fuel tank via an excess fuel return line.

The diesel engine is shutdown by depressing the engine STOP lever which places the fuel injection pump control rack in the no fuel position.

## **ENGINE AIR INTAKE AND EXHAUST SYSTEM**

The engine air intake and exhaust system (Figure 11) provides filtered air to the diesel engine and an outlet for exhaust gas produced by air/diesel fuel combustion. The system consists of an air intake filter, air intake manifold, exhaust manifold, and muffler with spark arrester.

The air intake cleaner features a washable foam pre-filter and a disposable paper filter element. Air is drawn through the pre-filter and filter element. Airborne dirt is trapped in the pre-filter and air intake filter element. Filtered air passes through the filter, air intake manifold, and open intake valve into the engine combustion chamber where it mixes with pressurized diesel fuel and is combusted. (Figure 9)

Immediately following combustion, hot gases are forced out of the combustion chamber (through the open exhaust valve), and into the exhaust manifold. The exhaust manifold passes the gases into the muffler which deadens the sound by the combustion process. The gases then pass through the muffler and out of the spark arrester which diffuses the gas. A muffler shroud and blanket (wrapped around the muffler), offer some protection to personnel who may inadvertently touch the muffler while the diesel engine is running.

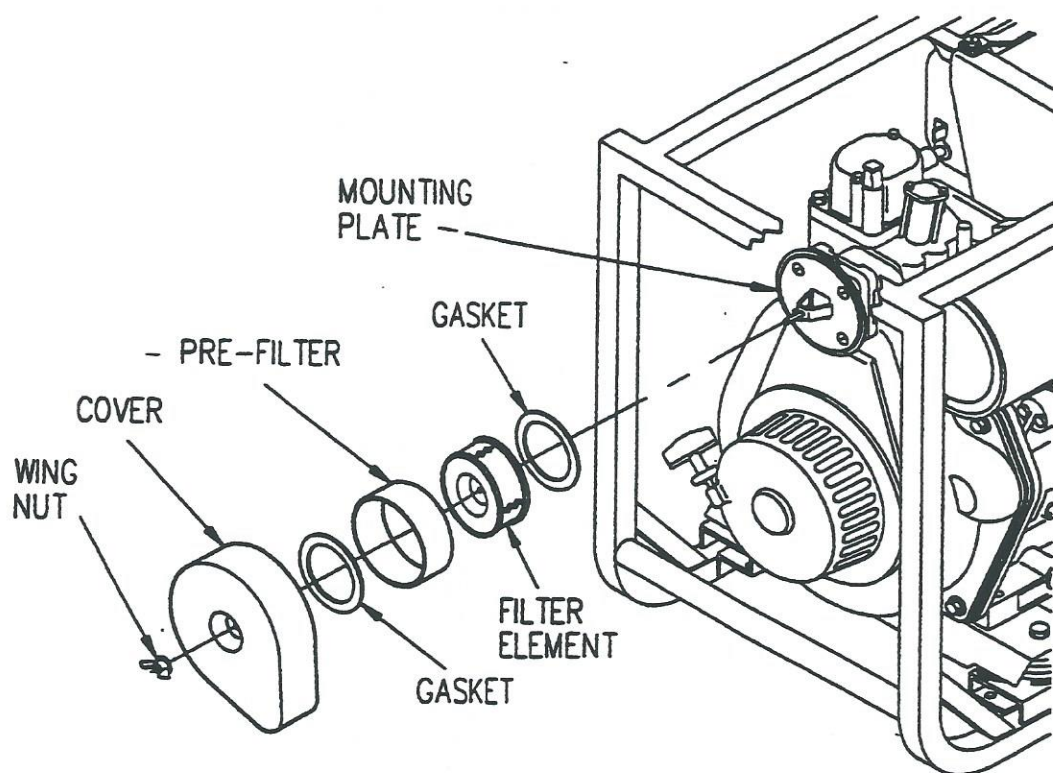


Figure 9 Air Filter Elements

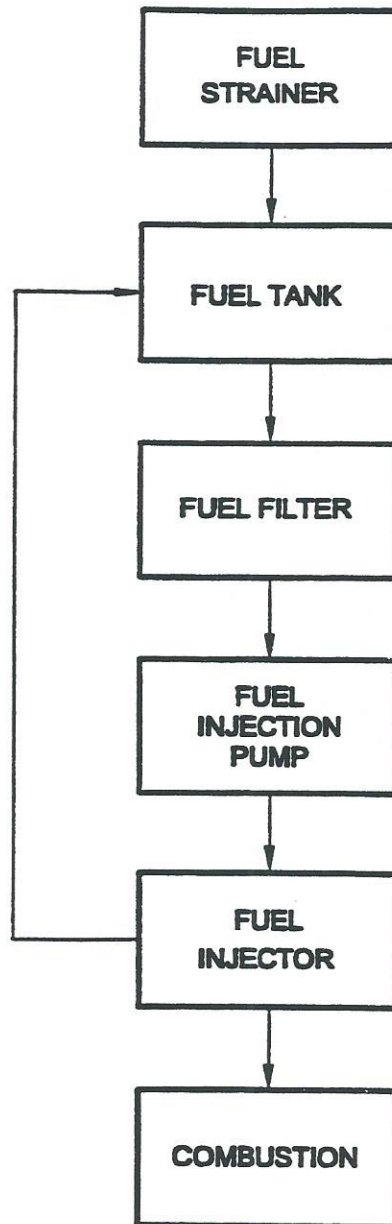


Figure 10 Generator Set Fuel System

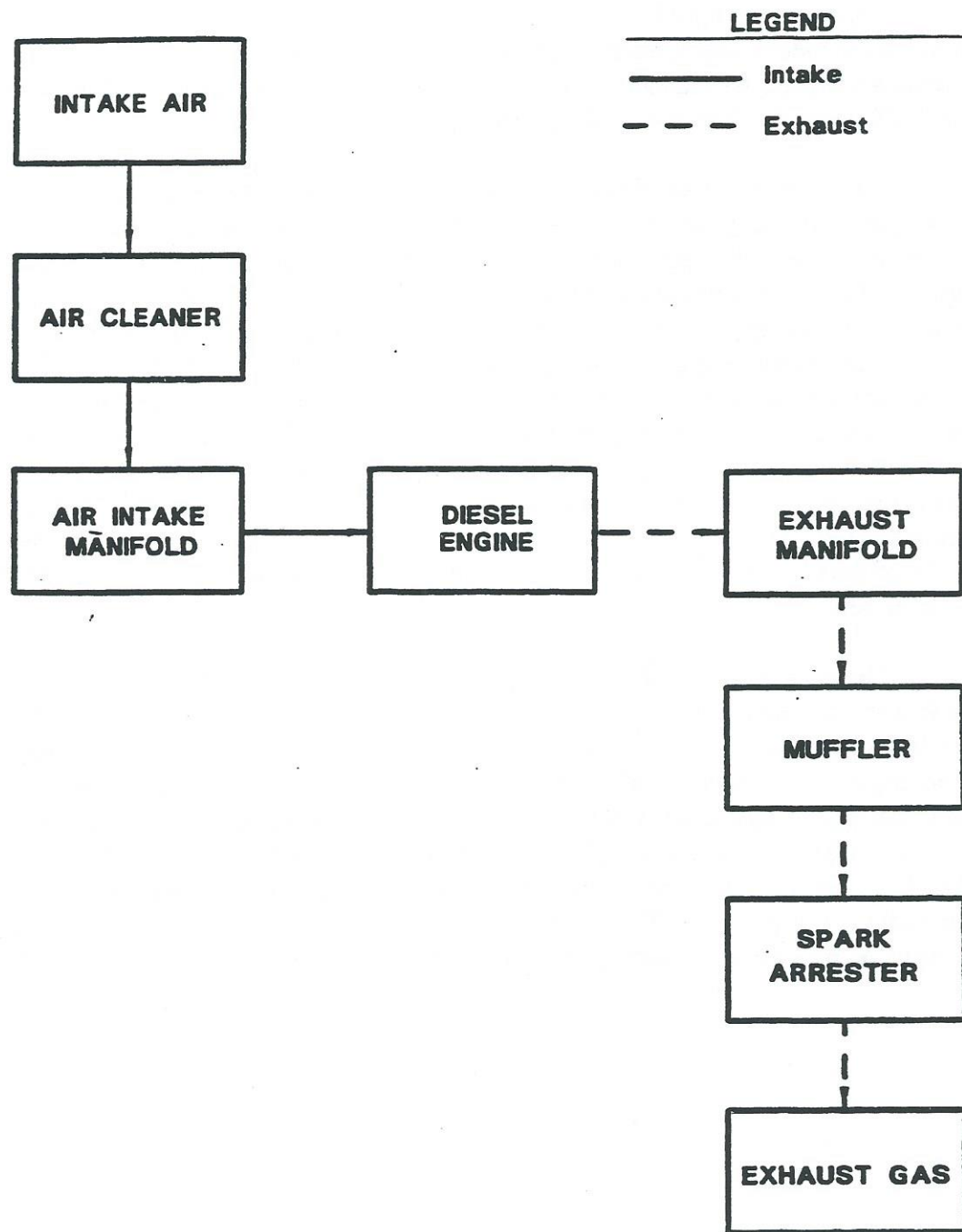


Figure 11 Engine Air Intake and Exhaust System

## **SPEED CONTROL SYSTEM**

Diesel engine speed is maintained by the speed control system (Figure 12) which included the mechanical governor, governor lever, RUN lever, and STOP lever. The system is designed to maintain engine speed under load at a constant rate of between 3570 and 3630 RPM (no load speed of 3750 RPM).

The governor is the flyweight type, with the weights mounted on a gear driven by the engine camshaft gear. The force of the flyweights is transferred through a thrust sleeve and collar to the governor lever which balanced against the tension of the governor spring. The spring is stretched between the governor lever and the engine RUN lever. When the engine speed drops below the governed speed, the resulting decrease in governor flyweight/camshaft rotation places tension on the governor spring. The tension repositions the fuel injection pump rack and increases the stroke of the plunger in the fuel injection pump allowing more fuel to flow to the pump delivery valve. The increase in fuel flow causes the diesel engine to speed up. As the diesel engine recovers to the governed speed, the governor flyweight/camshaft rotation stabilizes and the tension on the governor spring relaxes. This changes the position of the fuel injection pump rack and shortens the stroke of the plunger allowing less fuel to flow to the fuel injector maintaining the engine speed at 3600.

The governor control mechanism features two operator controlled levers. The black diesel engine RUN lever places tension on a spring attached to the governor lever. The tension places the governor lever in a position to allow fuel to the fuel injector for diesel engine start up and to allow the diesel engine to continue running after startup. The red diesel engine shutdown or STOP lever is operated by either depressing the red STOP lever or by the low oil pressure shutdown system. When depressed, the lever trips the RUN lever releasing the tension on the governor spring which places the governor lever in a no fuel or stop position. This action shuts off fuel flow to the fuel injector stopping the combustion process and shutting down the diesel engine.

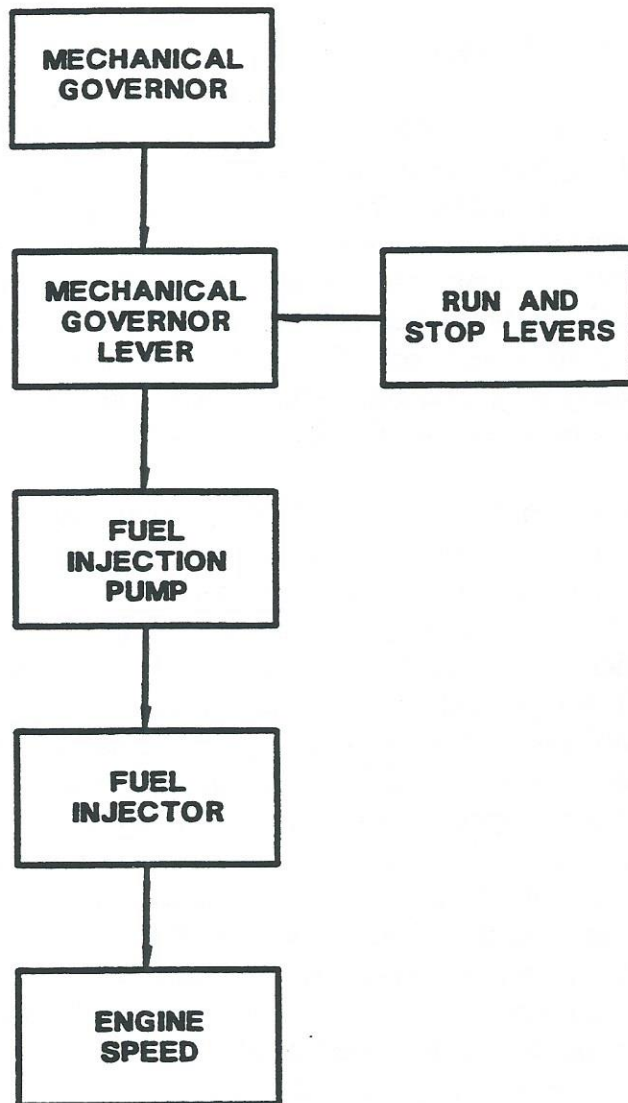


Figure 12 Diesel Engine Governor

# DIESEL ENGINE ELECTRICAL

## STARTING SYSTEM

**Electrical Starting** The diesel engine starting system (Figure 13) can be used to start the diesel engine whenever there is an external 24 VDC power source connected to the NATO slave receptacle. The electrical starting system will be required when starting the diesel engine in extremely cold weather or as a backup to the manual starting system (recoil mechanism failure). The electrical system also provides a means for warming diesel engine intake air which also helps to start the engine in cold weather. The system consists of a NATO slave receptacle (SR1), START PREHEAT/PREHEAT/OFF/START switch (S2), diode (CR1), an engine-mounted starter motor (B1) with solenoid (L5), and two resistance heater elements (HTR1 and HTR2).

When connected to a 24 VDC power source via a power cable, the NATO slave receptacle (SR1) provides power to the START-PREHEAT/PREHEAT/OFF/START switch (S2) at pin B and to the starter solenoid (L5) at pin S. When the operator places switch (S2) in the START position, power is applied through the switch at pin S to the starter solenoid (L5) pin C. This energizes the coil in solenoid (L5) which pulls in the solenoid's plunger and pushes the starter drive pinion attached to the plunger toward the engine flywheel. This movement engages the starter pinion drive with the ring gear teeth on the diesel engine flywheel. As the solenoid plunger pulls in, the power available at solenoid pin S is applied via a jumper to the starter motor (B1) which rotates the starter pinion drive (part of the starter motor) and turns over the fly wheel engaged with the pinion drive to start the diesel engine. Immediately after the diesel engine starts, the generator set operator releases the START-PREHEAT/PREHEAT/OFF/START switch (S2). This opens the solenoid-starter circuit causing the solenoid plunger to release the starter pinion drive disengaging it from the engine fly wheel ring gear. At the same time, the starter motor (B1) is de-energized. The starter pinion will return to its normal position as the starter motor (B1) slows to a stop.

Diode (CR1) protects the diesel engine electrical starting circuit. It prevents any inductive surges in the grounded side of the circuit from damaging the contacts of START-PREHEAT/PREHEAT/OFF/START switch (S2) and the starter solenoid (L5).

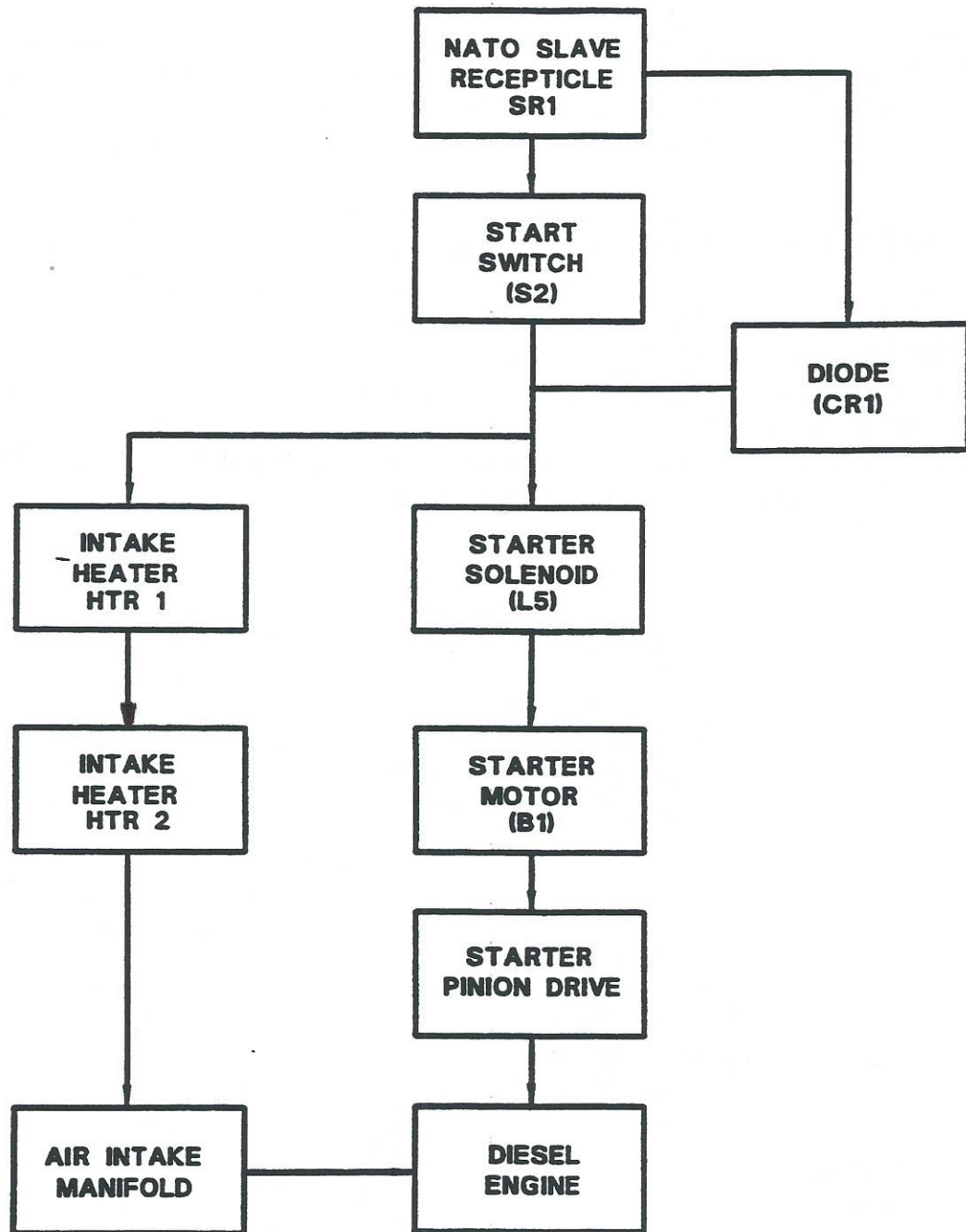


Figure 13 Diesel Engine Electrical Starting System

**Preheat Circuit:** The diesel engine features two 12 VDC resistance type heaters (HTR1 and HTR2) wired in series and located in the engine air intake piping between the air intake manifold and the air cleaner. The heaters warm the air intake piping and manifold in order to warm up the intake air during attempted cold weather starts.

With an external power cable connected to the NATO slave receptacle and the START-PREHEAT/PREHEAT/OFF/START switch (S2) in the preheat position, power exiting switch S2 at pin H energizes the two resistance type heaters (HTR1 and HTR2). Normally, the heaters are allowed to remain energized for several minutes to warm up the air intake piping and manifold in preparation for starting the engine. The heaters are then de-energized just prior to the engine startup sequence. However, during periods of extreme cold, it may be necessary to leave heaters HTR1 and HTR2 on during the start sequence. This is accomplished by placing switch S2 in the PREHEAT-START position so that heaters HTR1 and HTR2 remain energized during the engine startup sequence. (Figure 14)

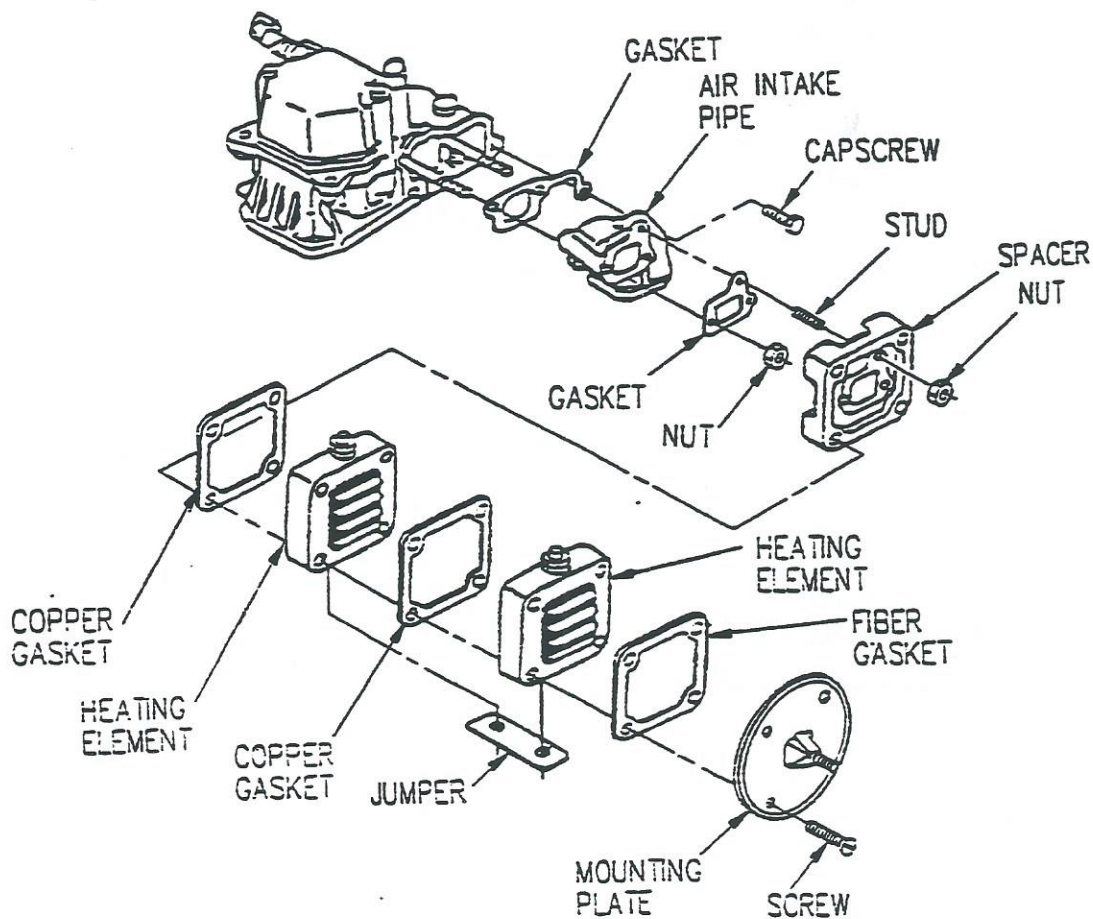


Figure 14 Air Intake Heating Elements and Pipe

# **GENERATOR VOLTAGE REGULATION AND OUTPUT SUPPLY (MEP-531A)**

The generator voltage regulation and output supply system (Figures 15 and 16) senses the load being drawn at the load terminals and adjusts the alternator output accordingly. The system also monitors and adjusts generator set performance and provides power to a GFCI convenience receptacle.

The system consists of the AC alternator (G2), voltage regulator (A1), ON-OFF load circuit breaker (CB1), output load terminals (L and N), GFCI convenience receptacle (J3), AC VOLTS meter (M2), % LOAD meter (M1), Hertz frequency meter (M4), VOLTAGE ADJ. potentiometer (R2), and fuse (F1). Power produced by the AC alternator is supplied to load terminals on the load terminal board and the GFCI convenience receptacle.

## **Voltage Regulation (Figure 15)**

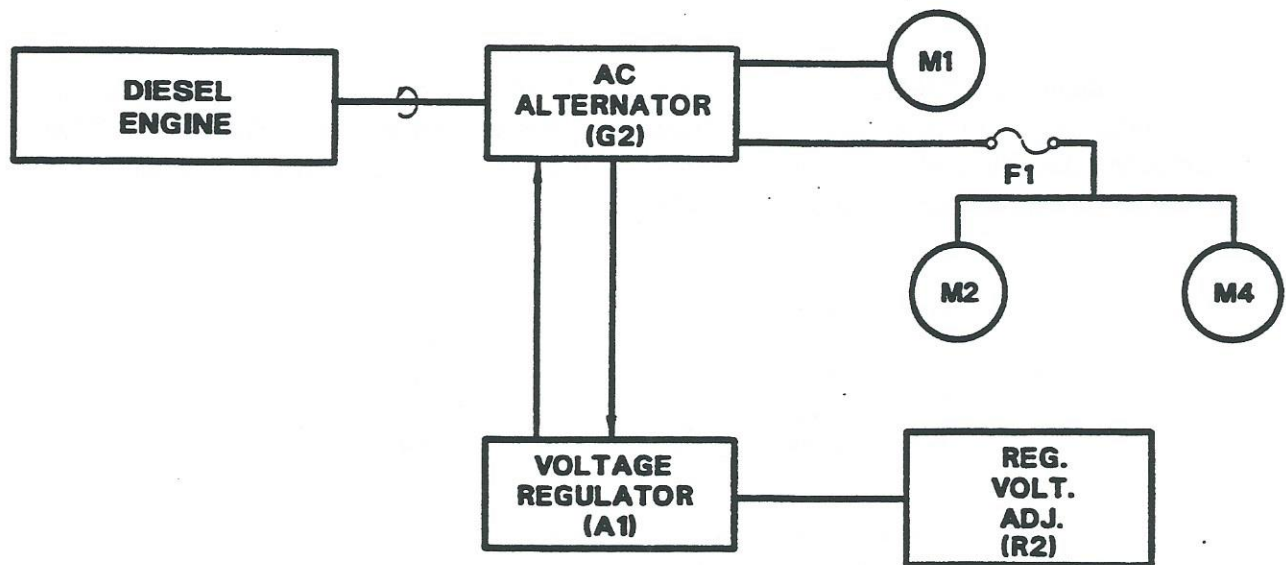
The generator set output voltage is controlled by the voltage regulator (A1). The voltage regulator continuously senses the alternator (G2) output voltage. The voltage regulator (A1) reacts to voltage variations by manipulating the alternator field current to maintain the output voltage. The field current controlled by the voltage regulator is supplied by the alternator excitation windings. The voltage regulator (A1) performs this function using three interactive sub circuits: power input, load sensing, and DC output. The power input circuit draws current from the AC generator (G2) exciter windings through the positive (+) field brushes at A1 pin 3. The load sensing circuit monitors the current being drawn by load at A1 pin E1. As demand increases, the DC output circuit draws current from the input circuit, rectifies it to direct current, and reapplies it to the AC alternator (G2) field A1 via pins F+ and F-.

Starting the diesel engine automatically field flashes the AC alternator (G2) with residual magnetism stored in the rotor. The residual magnetism induces voltage in the power excitation windings at AC alternator (G2) pins + and 2. As the diesel engine speed begins to increase toward its governed no load speed of 3750 rpm, the induced voltage in the power excitation windings increases. The voltage regulator (A1) power input circuit receives current power windings via the positive (+) field brushes at A1 pin

Whenever the voltage in the load sensing circuit matches the set point, the current entering the voltage regulator (A1) at pin 3 is allowed to pass through the power input circuit. Whenever the voltage entering the sensing circuit is lower than the set point (indicating a load increase) the DC output circuit reacts by drawing current from the power input circuit. This current is rectified to DC and reapplied via A1 pins F+ and F- to the AC alternator rotor brushes at G2 pins + and -. The application of direct current to the rotor increases the field magnetism between the AC alternator stator and rotor which in turn, increases the current measured across the alternator power windings. The current measured at both excitation and measured power windings will increase until the voltage entering the voltage regulator (A1) load sensing circuit matches the set point at which point, the alternator output stabilizes and the A1 DC output circuit stops drawing current from the power input circuit.

The voltage regulator (A1) set point can be changed by adjusting the VOLTAGE ADJ. potentiometer (R2). The set point can be changed from 114 to 126 VAC by loosening the locknut and turning the adjustment screw counterclockwise to lower the set point or clockwise to increase the set point. The set point adjustment can be checked with the diesel engine running by observing the needle on VOLTS AC meter (M2).

The generator set performance can be monitored by observing the % load meter (M1), VOLTS AC meter (M2), and HERTZ frequency meter (M4). The % LOAD meter (M1) measures the current being drawn by the load at the load terminals (L and N) and display the value as a percent (0 to 125) of the generator set capacity. The VOLTS AC meter (M2) measures the voltage across the power windings of the AC alternator (G2) and displays the value in VAC from 0 to 150. The HERTZ frequency meter (M4) measures frequency across the power windings in HZ from 55 to 65. Line fuse (F1) protects the VOLTS AC and HERTZ frequency meters from potential over current condition.



**VOLTAGE REGULATION**

M1 - % LOAD  
 M2 - VOLTS METER  
 M4 - HERTZ METER

Figure 15 Generator Voltage Regulation System (MEP-531A)

## OUTPUT SUPPLY

(Figure 16)

The generator set is brought on line by placing the ON-OFF load circuit breaker (CB1) in the ON position. The circuit breaker is a single pole, shunt trip switch with momentary contacts that return it to the neutral, or center position when the toggle switch is released. Load terminals L and N are energized by this momentary contact to bring the generator set on line. The GFCI convenience receptacle (J3) is also energized by ON-OFF load circuit breaker (CB1). The GFCI convenience receptacle (J3) features a ground fault interrupter which protects the generator set components from inductive current in the ground circuit originating from the load connected to the GFCI receptacle (J3).

Placing the ON-OFF load circuit breaker (CB1) momentarily in the OFF position opens the line to the load terminals and takes the generator set off line. The ON-OFF load circuit breaker features a diode (CR2) which protects the generator set components by allowing current to flow in only one direction.

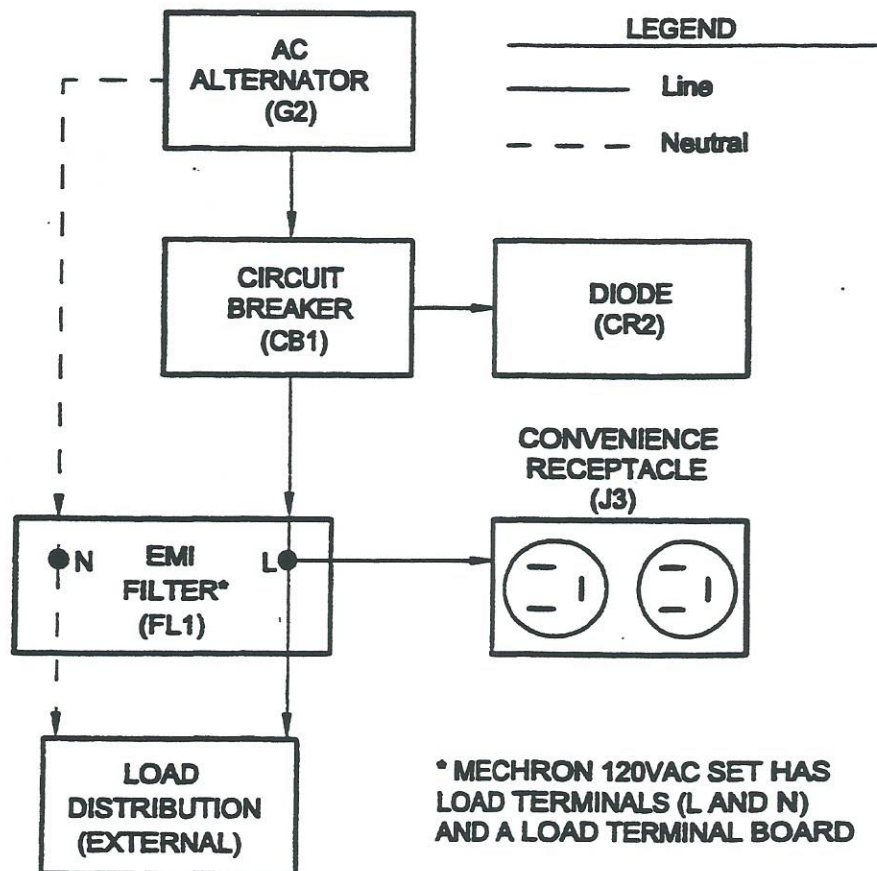


Figure 16 Generator Output Supply System (MEP-531A)

# GENERATOR VOLTAGE REGULATION AND OUTPUT SUPPLY (MEP-501A)

The generator voltage regulation and output supply system (Figures 17 and 19) senses the load being drawn at the load terminals and adjusts the alternator output accordingly. The system also monitors and adjusts generator set performance.

The system consists of the AC alternator (G2), voltage regulator (A1), ON-OFF load circuit breaker (CB1), output load terminals (+ and -), DC VOLTS meter (M2), % LOAD meter (M1), VOLTAGE ADJ. potentiometer (R2). Power produced by the alternator supplies load terminals on the load terminal board.

## **Voltage Regulation** (Figure 17)

The generator set output voltage is controlled by the voltage regulator (A1). The voltage regulator continuously senses the alternator (G2) output voltage. The voltage regulator (A1) reacts to voltage variations by manipulating the alternator field current to maintain the output voltage. The field current controlled by the voltage regulator is supplied by the alternator excitation windings. The voltage regulator (A1) performs this function using three interactive sub circuits: power input, load sensing, and DC output. The power input circuit draws current from the AC generator (G2) exciter windings through the positive (+) field brushes at A1 pin F. The load sensing circuit monitors the current being drawn by load at A1 pins S and A. As demand increases, the DC output circuit draws current from the input circuit, rectifies it to direct current, and reapplies it to the AC alternator (G2) field via A1 pins F and L.

Starting the diesel engine provides the current necessary to field flash the alternator (G2). This current is supplied from the dynamo (G1) to the generator control unit (A2) where it is rectified to direct current. The direct current exits A2 at pin F and is applied to the alternator (G2) field windings. As soon as the generator control unit (A2) detects current at pin VINDC, it disables the flow of current exiting A2 at pin F.

The initial field flash current induces voltage in the power excitation windings at alternator (G2). As the diesel engine speed begins to increase toward its governed no load speed of 3750 rpm, the induced voltage in the power excitation windings increases. The voltage regulator (A1) power input circuit receives current from the power excitation windings via the positive (+) field brushes at A1 pin F. When the voltage in the load sensing circuit matches the set point, the current entering the voltage regulator (A1) at pin F is allowed to pass through the power input circuit. When the voltage entering the sensing circuit is lower than the set point (indicating a load increase) the DC output circuit reacts by drawing current from the power input circuit. This current is rectified to DC and reapplied via A1 pins F and L to the alternator rotor brushes. The application of direct current to the rotor increases the field magnetism between the alternator stator and rotor which in turn, increases the current measured across the alternator power windings. The

current measured at both excitation and measured power windings will increase until the voltage entering the voltage regulator (A1) load sensing circuit A1 pins S and A match the set point at which point, the alternator output stabilizes and the A1 DC output circuit stops drawing current from the alternator excitation windings.

The voltage regulator (A1) set point can be changed by adjusting the VOLTAGE ADJ. potentiometer (R2). The set point can be changed from 26.6 to 32.2 VDC by loosening the locknut and turning the adjustment screw counterclockwise to lower the set point or clockwise to increase the set point. The set point adjustment can be checked with the diesel engine running by observing the needle on VOLTS AC meter (M2).

The generator set performance can be monitored by observing the % LOAD meter (M1), VOLTS DC meter (M2). The % LOAD meter (M1) measures the current being drawn by the load at the load terminals (+ and -) and display the value as a percent (0 to 125) of the generator set capacity. The VOLTS DC meter (M2) measures the voltage across the power windings of the alternator (G2) and displays the value in VDC from 0 to 40. Line fuse (F1) protects the VOLTS DC from possible over current condition.

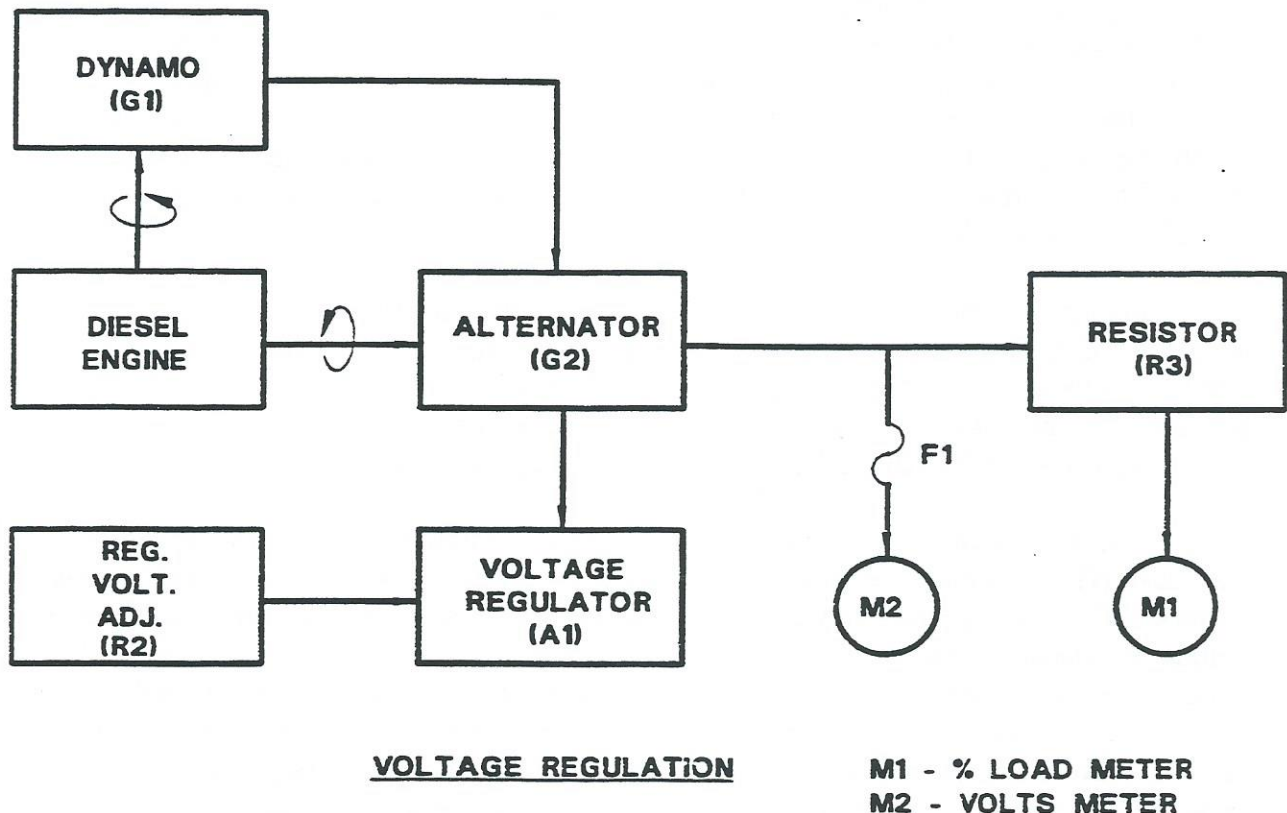


Figure 17 Generator Voltage Regulation System (MEP-501A)

## OUTPUT SUPPLY

(Figure 19)

The generator set is brought on line by placing the ON-OFF load circuit breaker (CB1) in the ON position. The circuit breaker is a single pole, shunt trip switch with momentary contacts that return it to the neutral, or center position when the toggle switch is released. Load terminals L and N are energized by this momentary contact to bring the generator set on line.

Placing the ON-OFF load circuit breaker (CB1) momentarily in the OFF position opens the line to the load terminals and takes the generator set off line.

There is a transient suppression diode assembly consisting of two diodes (CR2 and CR3) at the load terminals (+ and -) on MEP-501A. These diodes protect the load circuit from potential damage resulting from cross-connecting the + and - output terminals on the alternator (G2). The diodes prevent damage by only allowing the current to flow in the generator circuit in one direction.



Figure 18 Transient Suppressor

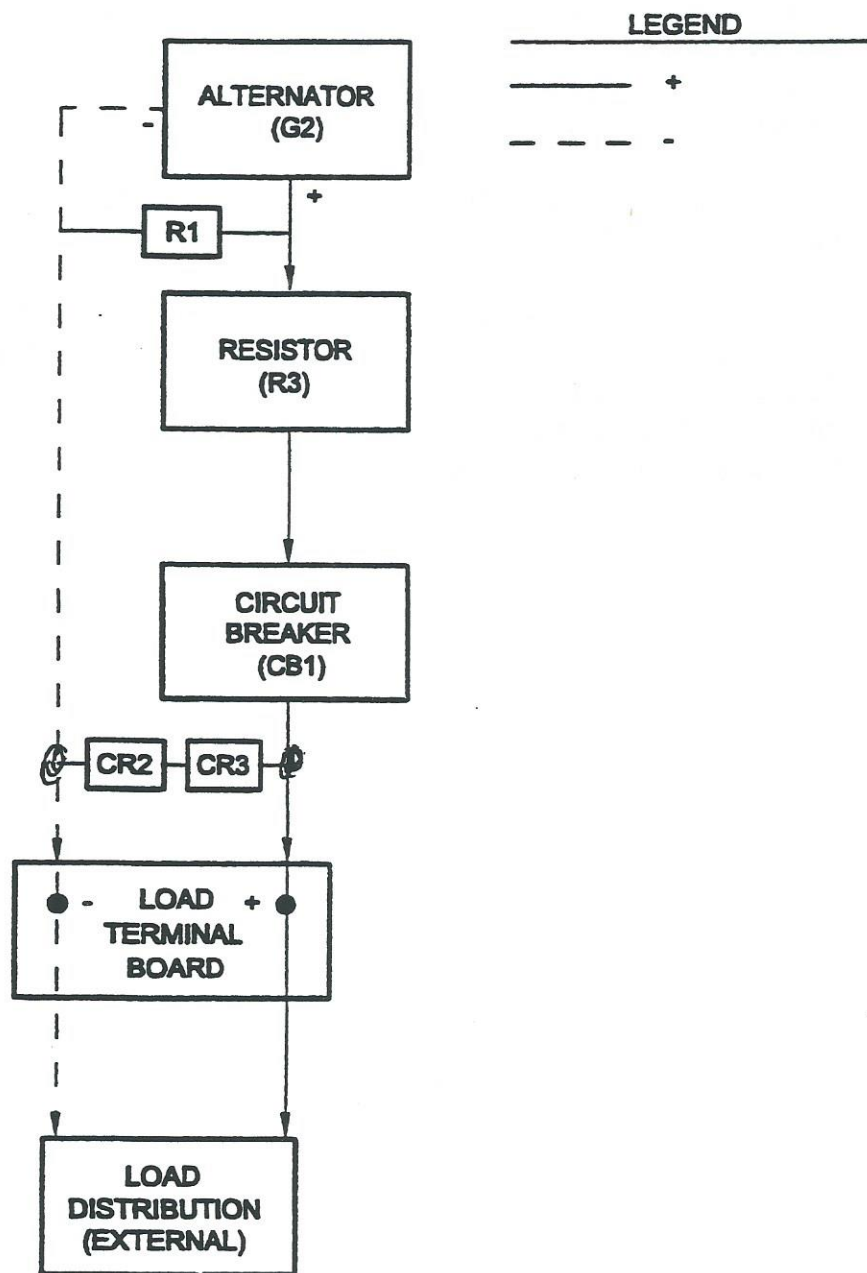


Figure 19 Generator Output Supply System (MEP-501A)

## GENERATOR CONTROL CIRCUIT

The generator control circuit (Figure 20) consists of a 40 - 50 VAC dynamo (G1), the generator control unit (A2), discharge varistor (V1), HOURS meter (M3), and diode (CR2).

The 12 VAC dynamo (G1) generates power for the generator control circuit. The dynamo consists of a stator mounted to the diesel engine block and a dynamo wheel mounted to the engine flywheel. While the diesel engine is running, magnets mounted on the inside surface of the dynamo wheel provide the field magnetism necessary to generate current flow in the stator. The dynamo (G1) generates AC current which is connected via the engine wiring harness to the generator control unit (A2) at A2 pins VMAG1 and MAG2.

The generator control unit (A2) rectifies the dynamo alternating current to direct current which exits at A2 pin VMAG+. This direct current is used to power the HOURS meter (M3) which maintains the cumulative time for generator set operation (e.g., the total time that the diesel engine dynamo generates power). The current is also used to energize the low oil pressure solenoid (L4) at L4 pin Y.

The generator control unit (A2) also detects a short circuit fault condition and trips the load circuit breaker (CB1). Under normal operating conditions, rectified DC current exits A2 at pin VMAG+ and provides current to the load circuit breaker (CB1) trip coil via an auxiliary shunt (part of CB1). When CB1 is closed (connecting the generator set with the load), the auxiliary shut closes enabling current to flow to the trip coil. The trip coil will not energize however since the circuit terminates at the generator control unit (A2) pin STC which is not grounded. While the generator set is operating, generator control unit (A2) continually monitors the flow at A2 pin VINAC (@ VINDC for MEP-501A). When a short circuit occurs (or when the generator set is shutdown), the input at VINAC (or VINDC) drops or goes low. The generator control unit (A2) reacts by grounding the CB1 trip coil circuit at A2 pin STC. When the coil is energized, it opens the load circuit breaker (CB1) to isolate the generator set from the load.

Discharge varistor (V1) is connected across the dynamo wires leading to generator control unit (A2) pins VMAG1 and VMAG2. It protects the generator control unit (A2) from inductive voltage surges generated by the dynamo. It accomplishes this by limiting the peak discharge voltage to a safe value.

Diode (CR2), in MEP-531A, protects generator control unit (A2) by suppressing and spikes generated by the trip coil in circuit breaker (CB1).

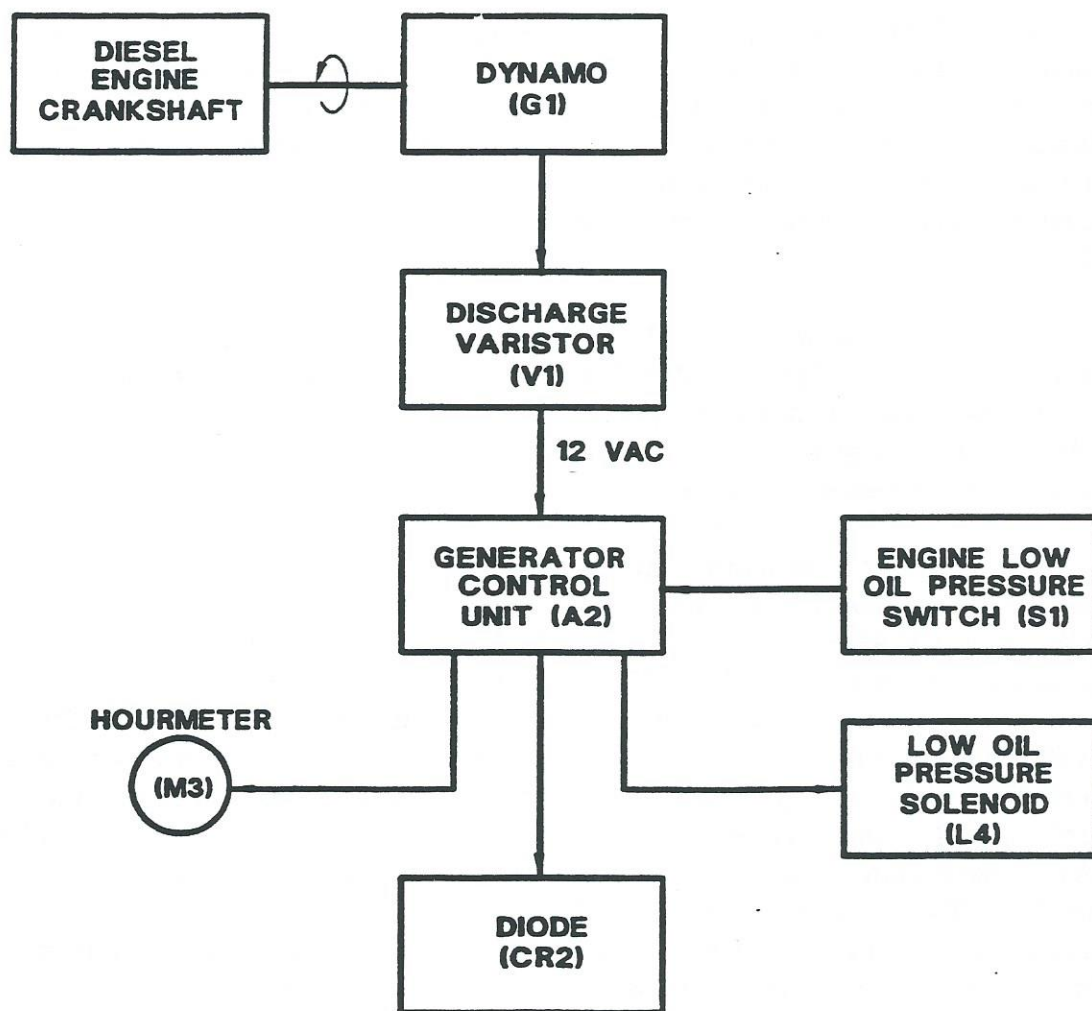


Figure 20 Generator Control Circuit

## LOW OIL PRESSURE PROTECTION

The low oil pressure protection system (Figure 21, 22, 23, and 24) shuts down the diesel engine in the event of low oil pressure in order to protect the engine from further damage. The system consists of a low oil pressure switch (S1) located in the engine block above the oil strainer, a low oil pressure solenoid (L4) mounted in the control panel, and a cable connecting the low oil pressure solenoid to the diesel engine STOP lever.

The generator control unit (A2) rectifies the alternating current supplied by the dynamo (G1) and provides direct current via A2 pin VMAG+ to the low oil pressure solenoid (L4) at pin Y. The circuit is completed at A2 pin LOP SOL which, after a short time delay (approximate 5 to 7 seconds), is allowed to pass through and exit A2 at pin LOP SW.

Under normal startup conditions, the low oil pressure switch (S1) opens at 12 to 18 PSI (82.7 to 124.1 kPa) and stays open as long as the engine oil pressure stays above 15 PSI (103.4 kPa). If a malfunction occurs in the lubrication system causing the oil pressure to drop below the low oil pressure set point, the low oil pressure switch (S1), closes. The low oil pressure solenoid (L4) circuit terminating at A2 pin LOP SW becomes grounded when S1 closes. This energizes the low oil pressure solenoid (L4) coil which momentarily pulls -in the solenoid plunger. The plunger is connected by a push-pull cable to the engine STOP lever. The cable trips the engine STOP lever placing the governor control lever and the fuel injection pump rack in the "no fuel" position to cut off fuel to the diesel engine to shut down the generator set.

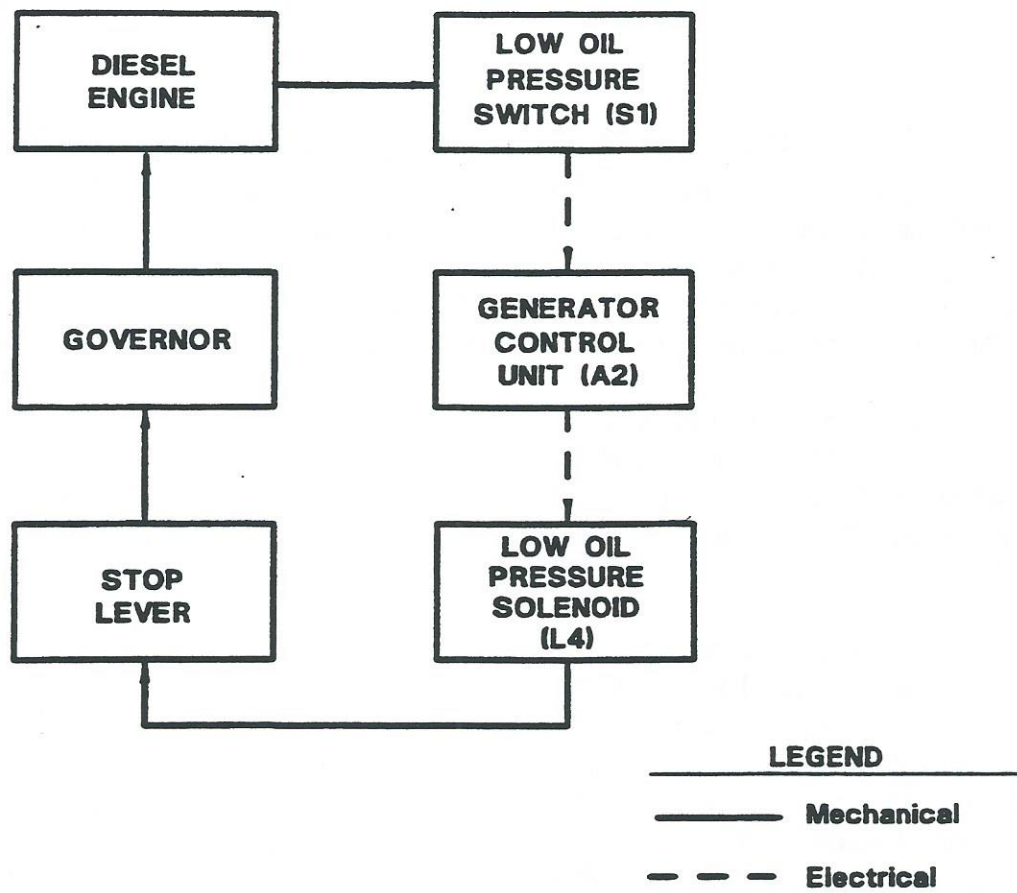


Figure 21 Low Engine Oil Pressure Protection System

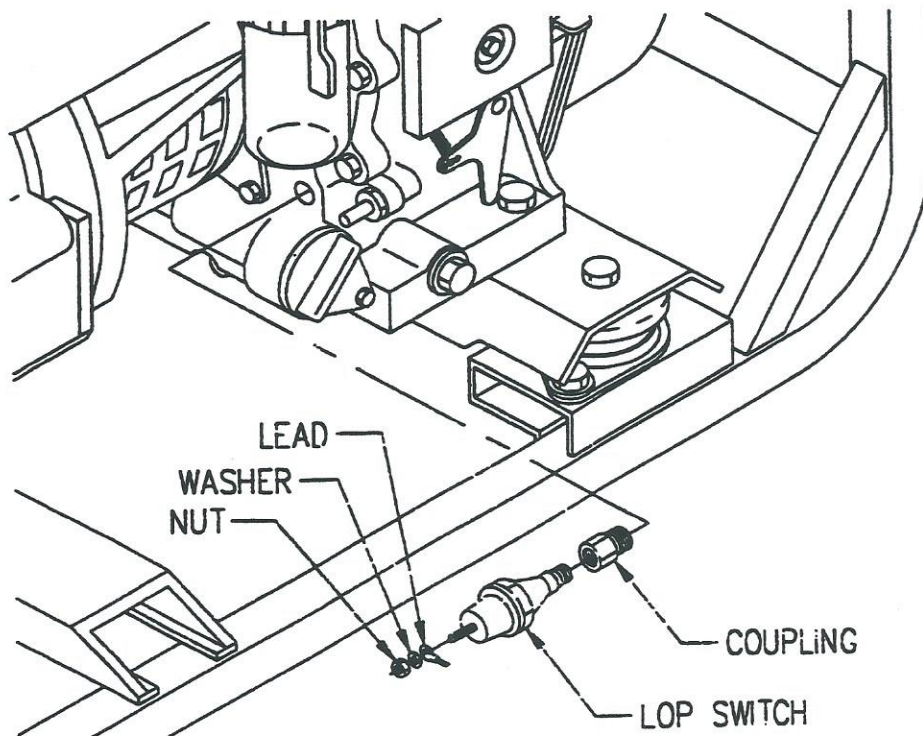


Figure 22 Low Oil Pressure (LOP) Switch

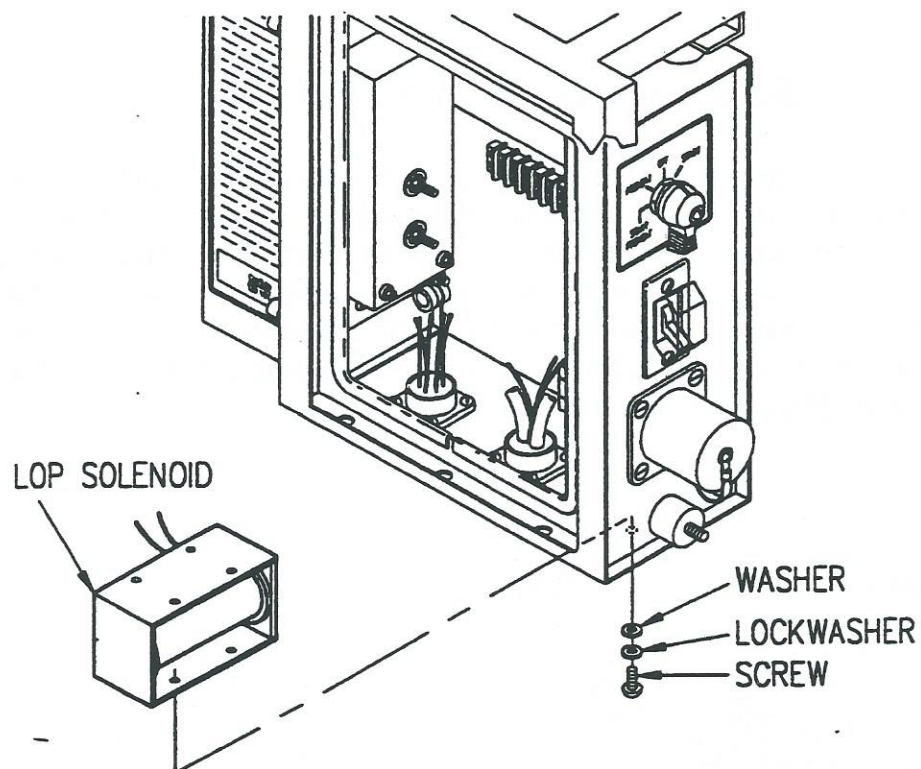


Figure 23 Low Oil Pressure (LOP) Solenoid Assembly

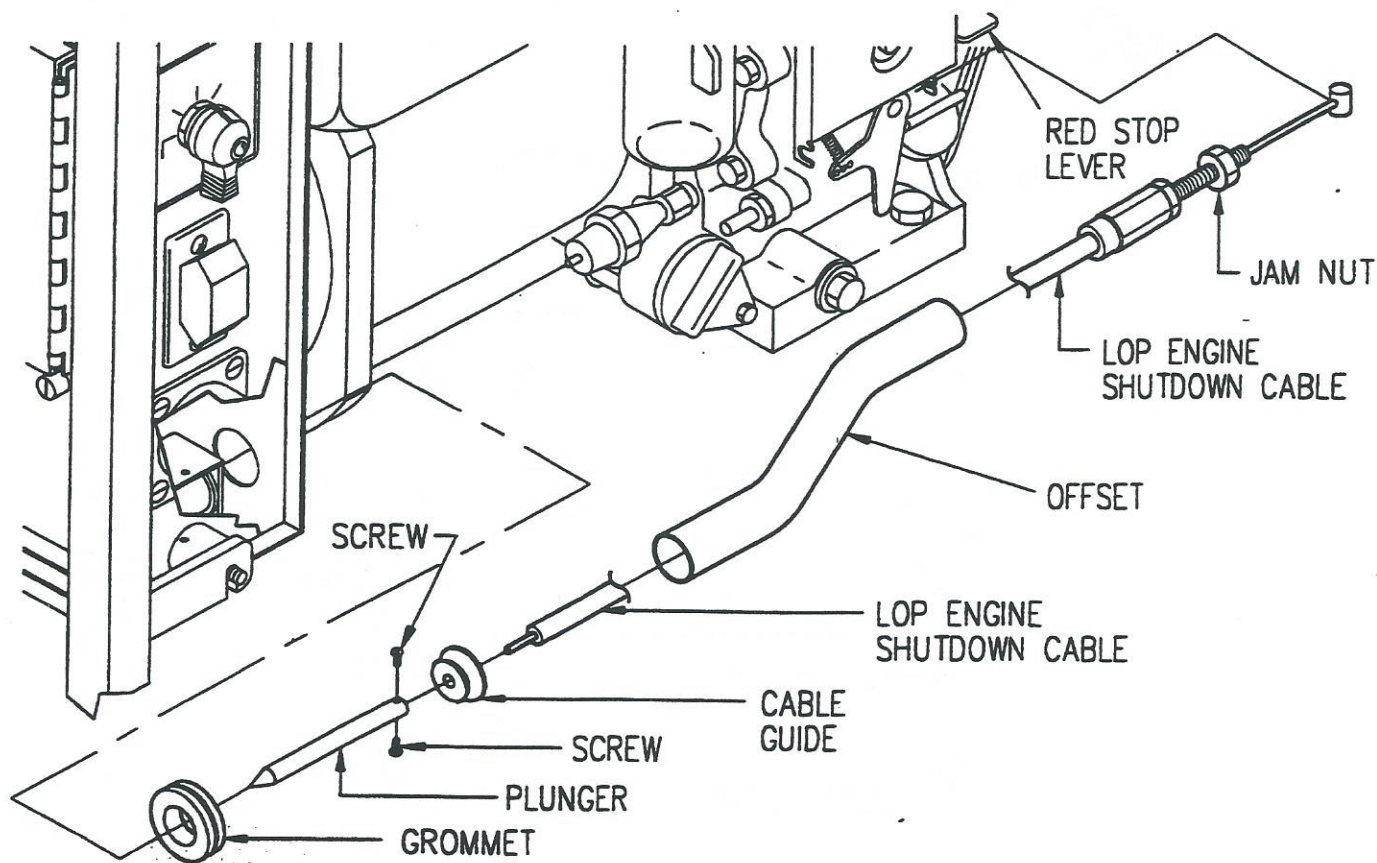


Figure 24 Low Oil Pressure (LOP) Engine Shutdown Cable

## CHANGE DIESEL ENGINE OIL

Change diesel engine oil after every 100 hours of operation. Remove diesel engine oil drain plug, drain oil while engine is still warm and collect oil in an appropriate container for proper disposal. Remove, clean, and install oil strainer. Add 0.85 qt (0.80 l) oil , or until H (Upper Level) on oil dipstick. When checking the diesel engine lube oil level, the generator set must be level. If it is tilted, an incorrect oil level may be indicated. **Do not screw in the dipstick.** Overfilling can cause overheating, increased oil pressure, and severe damage. (Figure 25, 26)

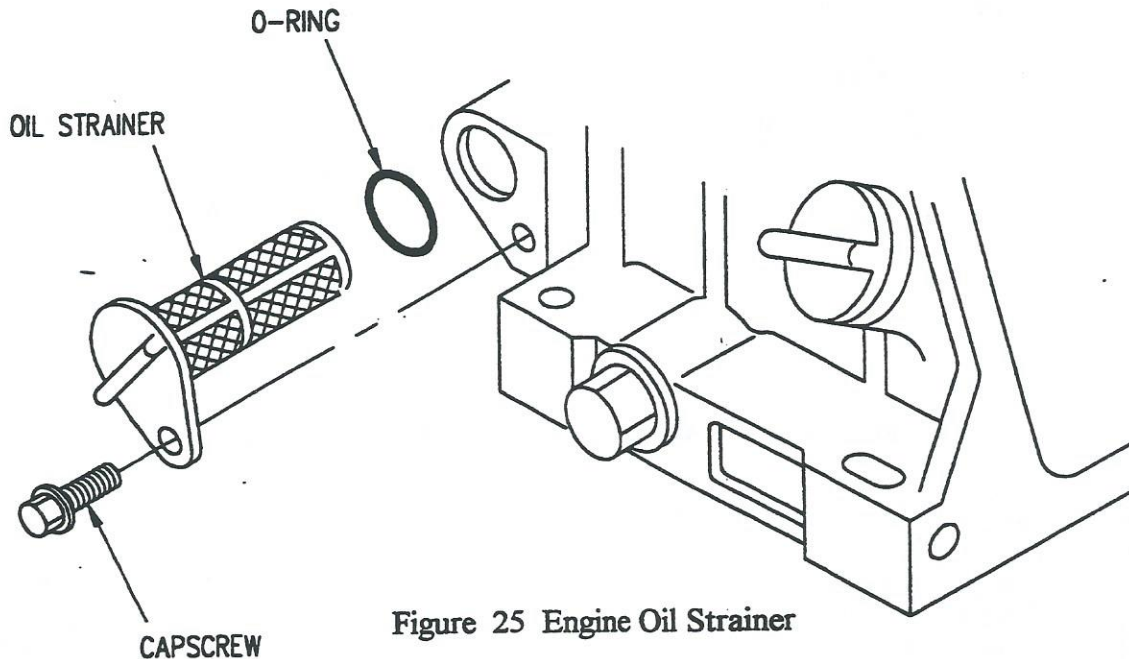


Figure 25 Engine Oil Strainer

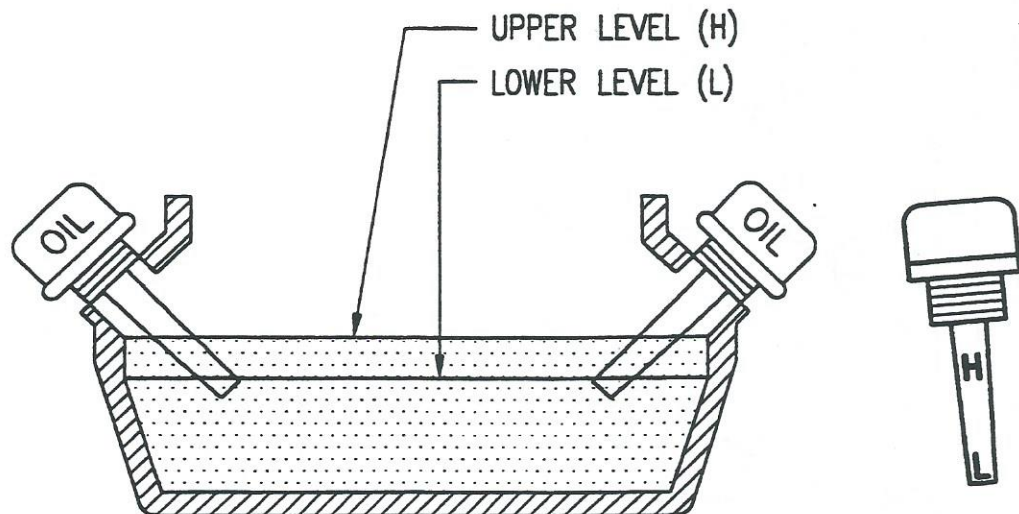


Figure 26 Oil Level

# CONTROLS AND INDICATORS

The operator controls and indicators are identified in Figure 27.

## Operator Controls and Indicators

| Key | Control or Indicator             | Function   |
|-----|----------------------------------|--|
| 1   | Recoil Starter                   | When pulled, turns-over engine flywheel/crankshaft to start diesel engine.   |
| 2   | Air Intake Cover                 | Directs air flow into the engine air intake systems. In cold weather, the cover is position to allow air which has been warmed by the hot muffler to flow into the diesel engine air intake system. Normally, the cover is positioned to allow ambient air to flow into the diesel engine. |
| 3   | Decompression Lever "A"          | When depressed, releases compression in the diesel engine combustion chamber to allow for manually pull starting the engine. Lever automatically returns to its up ("OFF") position when recoil starter rope is pulled.  |
| 4   | RUN Lever (Black)                | Pushed - enables fuel flow to diesel engine fuel injection pump for starting and running generator set.  |
| 5   | STOP Lever (Red)                 | Depressed - Disables fuel flow to diesel engine fuel injection pump to stop engine.  |
| 6   | Fuel Shutoff Valve               | ( O (Open) - Allows fuel to flow from fuel filter to diesel engine fuel injection pump.<br>( C (Closed) - Shuts off fuel flow from fuel filter to fuel injection pump.   |
| 7   | Fuel Filter Bleed Screws (2 ea.) | Bleed air from the generator set fuel system.  |
| 8   | Oil Fill Cap/Dipstick            | Check and add lubrication oil to diesel engine (one on each side of engine).   |

## Operator Controls and Indicators - Continued

| Key | Control or Indicator                                      | Function  |
|-----|---|---|
| 9   | STAR - PREHEAT/<br>PREHEAT/OFF/<br>START Rotary<br>Switch | <p>START - PREHEAT - Selected and held, energizes 24 VDC starting circuit and air intake heaters when 24 VDC power is connected to NATO slave receptacle. When released, spring loaded switch returns to OFF Position.</p> <p>PREHEAT - Selected and held, energizes air intake heaters mounted between air cleaner and diesel engine air intake manifold when 24 VDC power is connected to NATO slave receptacle. When released, spring-loaded switch returns to OFF position.</p> <p>OFF - Disable diesel engine 24 VDC starting circuit.</p> <p>START - Selected and held, energizes 24 VDC diesel engine starting circuit when 24 VDC power is connected to NATO slave receptacle. When released, spring-loaded switch returns to OFF position.</p> |
| 10  | ON-OFF Load<br>Circuit Breaker                            | <p>ON - Closes AC circuit to supply power to load terminals.</p> <p>OFF - Opens AC circuit to shut off power to load terminals.</p>   |
| 11  | NATO Slave<br>Receptacle                                  | Supplies power to diesel engine start and air intake heater circuits when connected to external 24 VDC power source via a NATO power cable.   |
| 12  | VOLTS Meter<br>(AC MEP-531A)<br>(DC MEP-501A)             | Indicates output voltage of generator set. Normal reading for MEP-531A is 120 VAC and for MEP-501A is 28 VDC.   |
| 13  | % LOAD Meter  | Indicates generator set load current as a percent of its rated current. Normal reading is dependent on load demand from 0 to 125 percent.   |

## Operator Controls and Indicators - Continued

| <b>Key</b> | <b>Control or Indicator</b>        | <b>Function</b>  |
|------------|------------------------------------|--|
| 14         | HOURS Meter                        | Indicates total diesel engine operating hours.   |
| 15         | VOLTAGE ADJ.<br>Potentiometer      | Adjusts generator set voltage from 114 to 126 VAC (MEP-531A) or from 26.6 to 32.2 VDC (MEP-501A)   |
| 16         | GFCI Receptacle<br>(MEP-531A only) | Provides 15 amp, 120 VAC power. Receptacle features a Ground Fault Circuit Interrupter (GFCI) which protects the generator set from power surges originating from powered equipment and two grounded convenience receptacle. PRESS TO TEST push-button test the GFCI feature of the receptacle. PRESS TO RESET push-button reset the GFCI breaker. |
| 17         | INST. Fuse                         | Protects the voltmeter (VOLTS) and frequency (HERTZ) meter during an over current contained. A spare fuse is contained in a fuse holder to left of primary fuse.   |
| 18         | HERTZ                              | Indicates generator set output frequency. This determine the engine rpm (MEP-531A only) by multiplying the reading by 60 (e.g. 60 Hertz X 60= 3600 rpm). Normal reading is 60 Hz.  |
| 19         | Load Terminals                     | Provide connection point for load cables. Load terminals "L" and "N" (MEP-531A) and "C" and "C" (MEP-501A) are split lug connectors for ease in connecting load cables.  |
| 20         | Ground Stud                        | Provides location for grounding generator set to suitable ground.  |

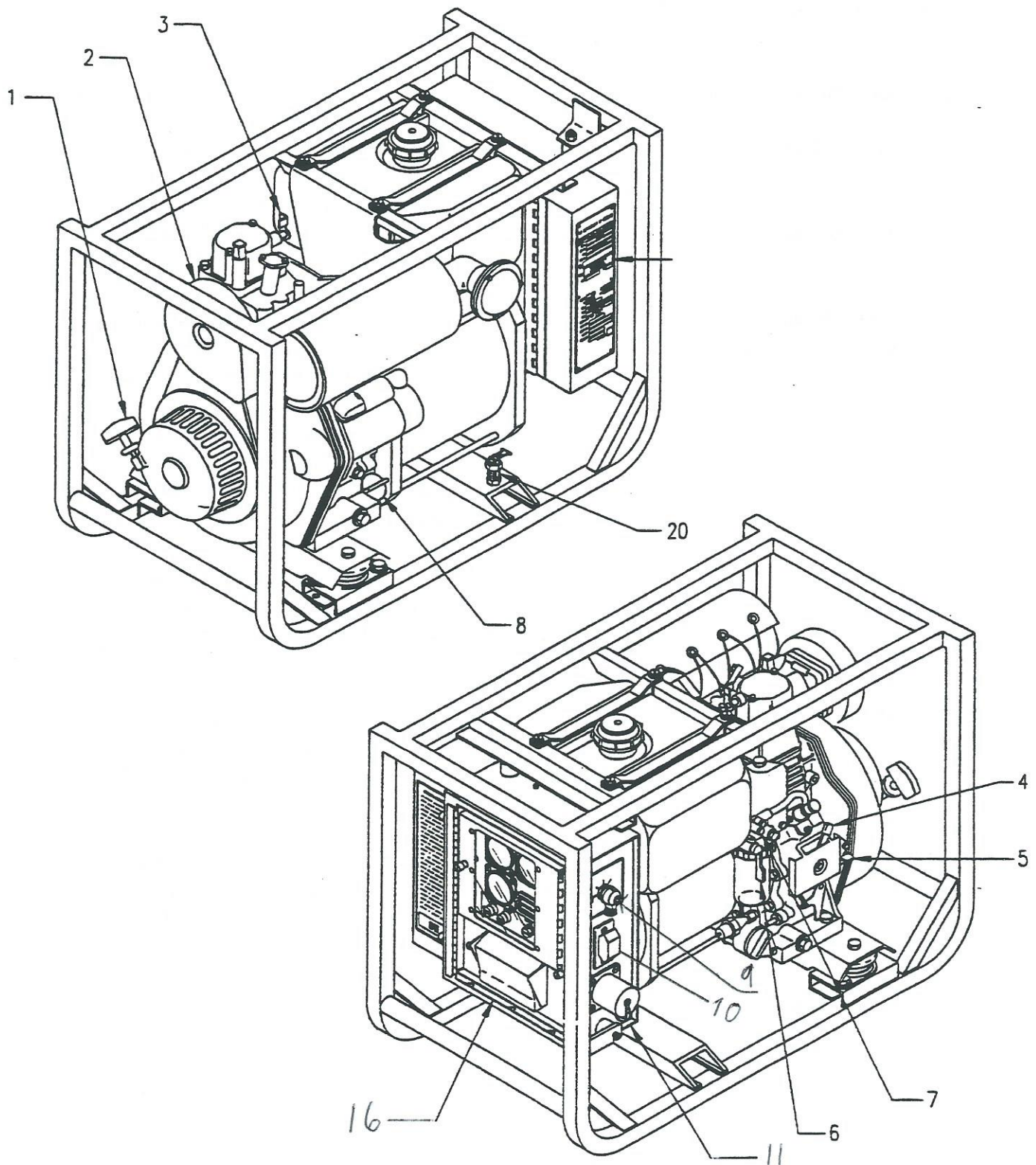


Figure 27 Operator's Controls and Indicators (Sheet 1 of 4)

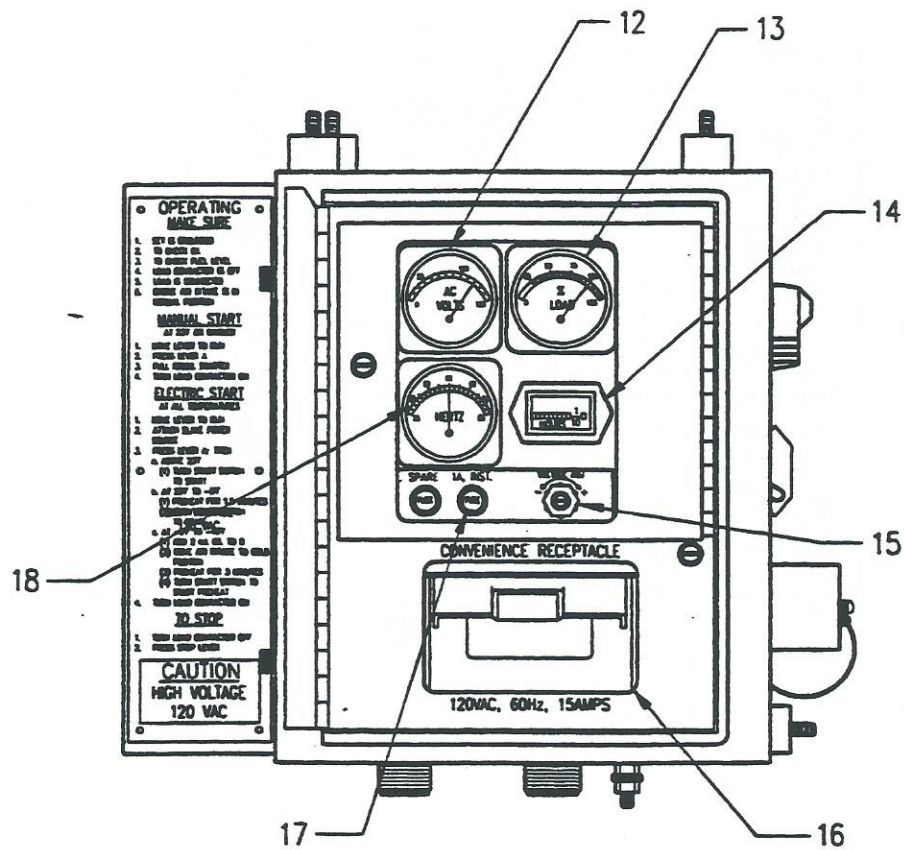
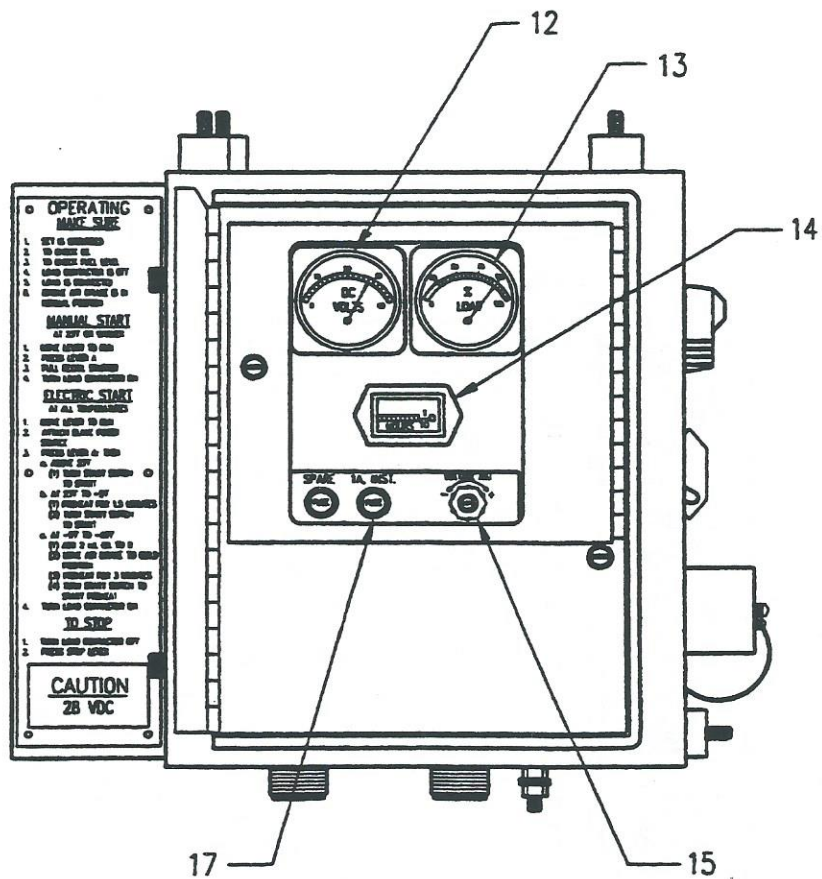
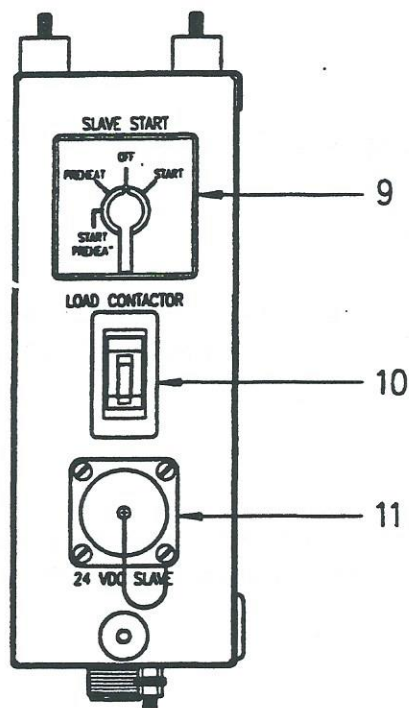


Figure 27 Operator's Controls and Indicators (Sheet 2 of 4)

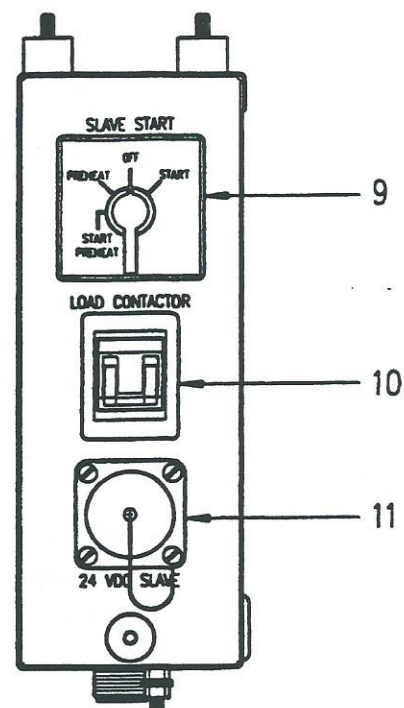


DETAIL A  
MEP-501A

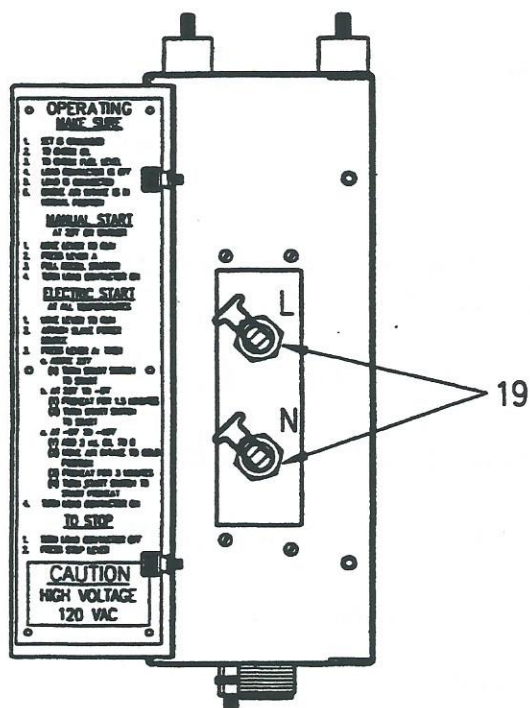
Figure 27 Operator's Controls and Indicators (Sheet 3 of 4)



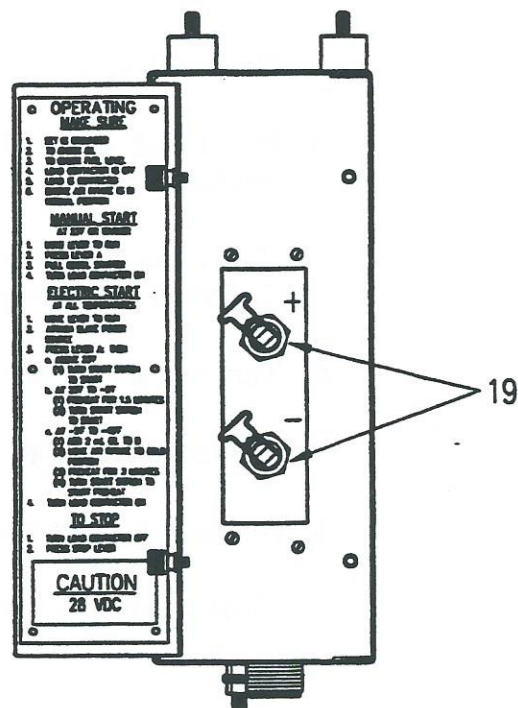
DETAIL B  
MEP-531A



DETAIL B  
MEP-501A



DETAIL C  
MEP-531A



DETAIL C  
MEP-501A

Figure 27 Operator's Controls and Indicators (Sheet 4 of 4)

# OPERATING PROCEDURES

## WARNING

Do not operate the generator set until it has been connected to a suitable ground. Serious injury or death can result from operating an ungrounded generator set.

## WARNING

Never attempt to connect or disconnect load cables while the generator set is running. Failure to observe this warning could result in severe personal injury or death by electrocution.

### Manual Starting (23°F (-5°C) to 122°F (50°C))

1. Ground Generator set. (Figure 27 Item 20)
2. Switch ON-OFF load circuit breaker to OFF. (Figure 27 Item 10)
3. Connect load cables to load terminals. (Figure 27 Item 19)
4. Perform all B (Before) PMCS procedures in accordance with technical manual.
5. Check that air intake cover is in NORMAL operating (summer) position as indicated on top of filter cover. (Figure 28)
6. Turn fuel shutoff valve to ↓ O (open) position. (Figure 32)
7. Pull recoil starter slowly. Stop when it feels tight. (Figure 27 Item 1)
8. Depress decompression lever "A". (Figure 27 Item 3 /Figure 30)
9. Move engine RUN lever to RUN position. (Figure 29)

## CAUTION

A condition known as reverse rotation can occur if the recoil starter rope is pulled out too slowly. If engine rotation reverses, you will hear abnormal noises caused by reverse rotation of the oil pump. **DEPRESS THE ENGINE STOP LEVER IMMEDIATELY.** Failure to do so will cause the engine bearings to seize due to lack of lubrication.

10. Take up the slack in recoil starter rope and pull rope quickly and all the way out.
11. If the engine fails to start , repeat steps 7 thru 10.
12. If engine still fails to start after two attempts, refer to operator trouble shooting tables in technical manual.
13. Check all gauges for proper indication as follows: (Figure 27)

#### **NOTE**

If any gauge indicates an improper value, refer to the operator troubleshooting table in accordance with technical manual.

**VOLTS Meter** Normal reading for MEP-531A is 120 VAC and for MEP-501A is 28 VDC (Item 12)

**% LOAD Meter** Under no load conditions should read 0 percent.  
Normal reading is dependent on demand from 0 to 125 percent. (Item 13)

**HERTZ** Frequency meter for 60 - 63 Hz (MEP-531A) (Item 18)

#### **NOTE**

Under normal conditions, allow the diesel engine to warm-up for five minutes before applying load. If necessary, the load can be applied immediately.

14. Switch ON-OFF load circuit breaker to ON to apply load. (Figure 27 Item 10)
15. Perform all D (During) PMCS procedures in accordance with technical manual.

#### **Electric Starting (23°F (-5°C) to 122° F (50°C)**

1. Ground Generator set. (Figure 27 Item 20)
2. Switch ON-OFF load circuit breaker to OFF. (Figure 27 Item 10)

#### **WARNING**

Never attempt to connect or disconnect load cables while the generator set is running. Failure to observe this warning could result in severe personal injury or death by electrocution.

3. Connect load cables to load terminals. (Figure 27 Item 19)
4. Perform all B (Before) PMCS procedures in accordance with technical manual.
5. Check that air intake cover is in NORMAL operating (summer) position as indicated on top of filter cover. (Figure 28)
6. Turn fuel shutoff valve to ↓ O (open) position. (Figure 32)
7. Connect 24 VDC battery source to NATO slave receptacle. Figure 27 Item 11)
8. Move engine RUN lever to RUN position. (Figure 29)

### CAUTION

Do not crank engine more than 10 seconds without allowing the starter to cool for at least 15 seconds between attempted starts. Over cranking can damage starter.

9. Turn START-PREHEAT/PREHEAT/OFF/START switch to clockwise to start position. Release switch when engine starts. (Figure 27 Item 9)
10. If diesel engine fails to start, repeat steps 8 and 9.
11. If engine still fails to start after two attempts, refer to operator troubleshooting tables in technical manual.
12. Disconnect 24 VDC battery source from NATO slave receptacle. (Figure 27 Item 11)
13. Check all gauges for proper indication as follows: (Figure 27)

### NOTE

If any gauge indicates an improper value, refer to the operator troubleshooting table in accordance with technical manual.

**VOLTS Meter** Normal reading for MEP-531A is 120 VAC and for MEP-501A is 28 VDC (Item 12)

**% LOAD Meter** Under no load conditions should read 0 percent.  
Normal reading is dependent on demand from 0 to 125 percent. (Item 13)

**HERTZ** Frequency meter for 60 - 63 Hz (MEP-531A) (Item 18)

### **NOTE**

Under normal conditions, allow the diesel engine to warm-up for five minutes before applying load. If necessary, the load can be applied immediately.

14. Switch ON-OFF load circuit breaker to ON to apply load. (Figure 27 Item 10)
15. Perform all D (During) PMCS procedures in accordance with technical manual.

### **Electric Starting (Between 23° F (-5°C) to -5°F (-21°C)**

1. Ground Generator set. (Figure 27 Item 20)
2. Switch ON-OFF load circuit breaker to OFF. (Figure 27 Item 10)

### **WARNING**

Never attempt to connect or disconnect load cables while the generator set is running. Failure to observe this warning could result in severe personal injury or death by electrocution.

3. Connect load cables to load terminals. (Figure 27 Item 19)
4. Perform all B (Before) PMCS procedures in accordance with technical manual.
5. Turn fuel shutoff valve to ↓ O (open) position. (Figure 32)
6. Connect 24 VDC battery source to NATO salve receptacle. Figure 27 Item 11)
7. Move engine RUN lever to RUN position. (Figure 29)

### **CAUTION**

Do not crank engine more than 10 seconds without allowing the starter to cool for at least 15 seconds between attempted starts. Over cranking can damage starter.

8. Turn START-PREHEAT/PREHEAT/OFF/START switch to clockwise to start position . Release switch when engine starts. (Figure 27 Item 9)
9. If diesel engine fails to start , repeat steps 8 and 9.

10. If engine still fails to start after two attempts, refer to operator trouble shooting tables in technical manual.
11. Disconnect 24 VDC battery source from NATO slave receptacle. (Figure 27 Item 11)
12. Check all gauges for proper indication as follows: (Figure 27)

**NOTE**

If any gauge indicates an improper value, refer to the operator troubleshooting table in accordance with technical manual.

**VOLTS Meter** Normal reading for MEP-531A is 120 VAC and for MEP-501A is 28 VDC (Item 12)

**% LOAD Meter** Under no load conditions should read 0 percent. Normal reading is dependent on demand from 0 to 125 percent. (Item 13)

**HERTZ** Frequency meter for 60 - 63 Hz (MEP-531A) (Item 18)

**NOTE**

Under normal conditions, allow the diesel engine to warm-up for five minutes before applying load. If necessary, the load can be applied immediately.

13. Switch ON-OFF load circuit breaker to ON to apply load. (Figure 27 Item 10)
14. Perform all D (During) PMCS procedures in accordance with technical manual.

**Electric Starting (Between -5°F (-21°C) to (-25°F (-32°C))**

1. Ground Generator set. (Figure 27 Item 20)
2. Switch ON-OFF load circuit breaker to OFF. (Figure 27 Item 10)

## WARNING

Never attempt to connect or disconnect load cables while the generator set is running. Failure to observe this warning could result in severe personal injury or death by electrocution.

3. Connect load cables to load terminals. (Figure 27 Item 19)
4. Perform all B (Before) PMCS procedures in accordance with technical manual.
5. Turn fuel shutoff valve to ↓ O (open) position. (Figure 32)
6. Connect 24 VDC battery source to NATO salve receptacle. (Figure 27 Item 11)
7. Move engine RUN lever to RUN position. (Figure 29)
8. Turn air intake cover to COLD position. (Figure 31)

## CAUTION

Do not crank engine more than 10 seconds without allowing the starter to cool for at least 15 seconds between attempted starts. Over cranking can damage starter.

9. Turn START-PREHEAT/PREHEAT/OFF/START switch counterclockwise to PREHEAT position for 3 minutes. (Figure 27 Item 9)

## CAUTION

Be sure to install the rubber plug in the cylinder head cover opening after adding oil. Leaving the hole unplugged can lead to premature diesel engine failure as water, dirt, debris entering the hole can damage internal parts.

Do not add more than the specified amount of engine oil through the cylinder head cover.

10. Remove rubber plug "B" in cylinder head cover and add 2 ml ( $\frac{1}{4}$  to  $\frac{1}{2}$  teaspoon) of clean engine oil, MIL-L2104, 15W40. Install rubber plug. (Figure 33)

## CAUTION

Do not crank engine more than 10 seconds without allowing the starter to cool for at least 15 seconds between attempted starts. Over cranking can damage starter.

11. Turn START-PREHEAT/PREHEAT/OFF/START switch counterclockwise to START-PREHEAT position. Release switch when engine starts.  
(Figure 27 Item 9)
12. If diesel engine fails to start , repeat steps 9 and 11.
13. Disconnect 24 VDC battery source from NATO slave receptacle.  
(Figure 27 Item 11)
14. Check all gauges for proper indication as follows: (Figure 27)

## NOTE

If any gauge indicates an improper value, refer to the operator troubleshooting table in accordance with technical manual.

**VOLTS Meter** Normal reading for MEP-531A is 120 VAC and for MEP-501A is 28 VDC (Item 12)

**% LOAD Meter** Under no load conditions should read 0 percent. Normal reading is dependent on demand from 0 to 125 percent.  
(Item 13)

**HERTZ** Frequency meter for 60 - 63 Hz (MEP-531A) (Item 18)

## NOTE

Under normal conditions, allow the diesel engine to warm-up for five minutes before applying load. If necessary, the load can be applied immediately.

15. Switch ON-OFF load circuit breaker to ON to apply load. (Figure 27 Item 10)
16. Perform all D (During) PMCS procedures in accordance with technical manual.

## Stopping Procedures

1. Switch ON-OFF load circuit breaker to OFF position and allow engine to run approximately 3 minutes with no load. (Figure 27 Item 10)
2. Press engine STOP lever. (Figure 29)
3. Turn fuel shutoff valve to ↑ C (closed) position. (Figure 32)
4. Perform all A (After PMCS procedures in accordance with technical manual.

## Preparation for Movement

1. Shut down generator set in accordance with stopping procedures.
2. Disconnect load cables.
3. Disconnect ground cable and remove ground rods.
4. Secure all generator access doors and panels.

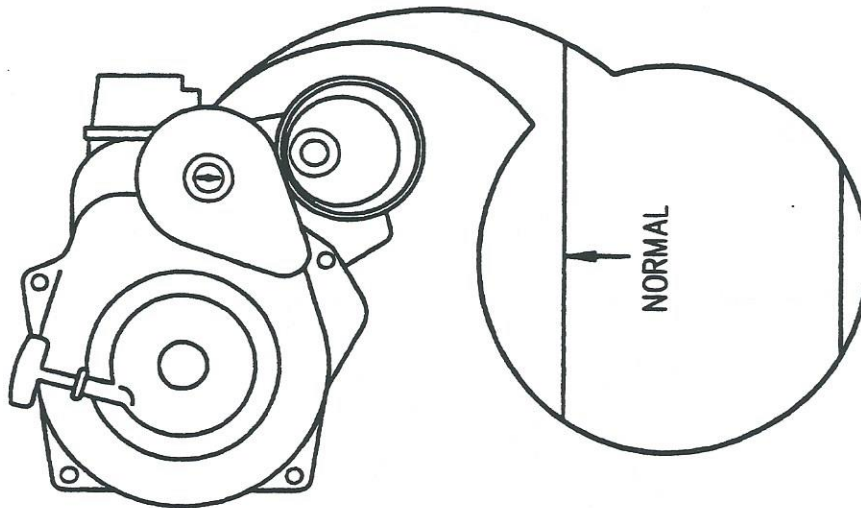


Figure 28 Air Intake Cover, Normal Operation

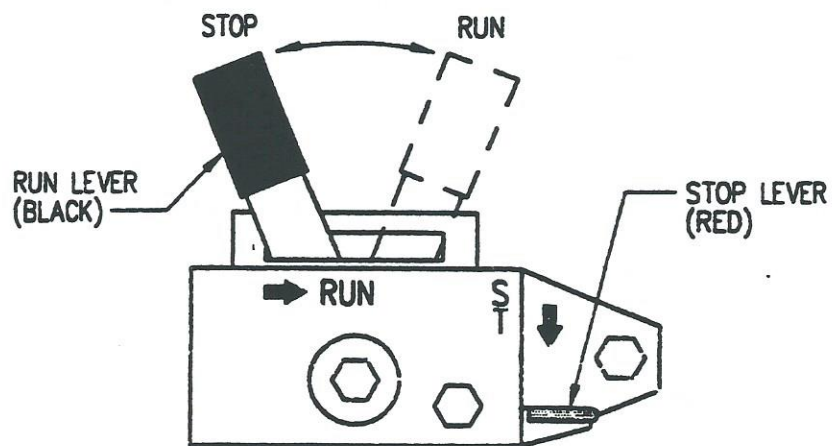


Figure 29..Engine RUN and Stop Controls

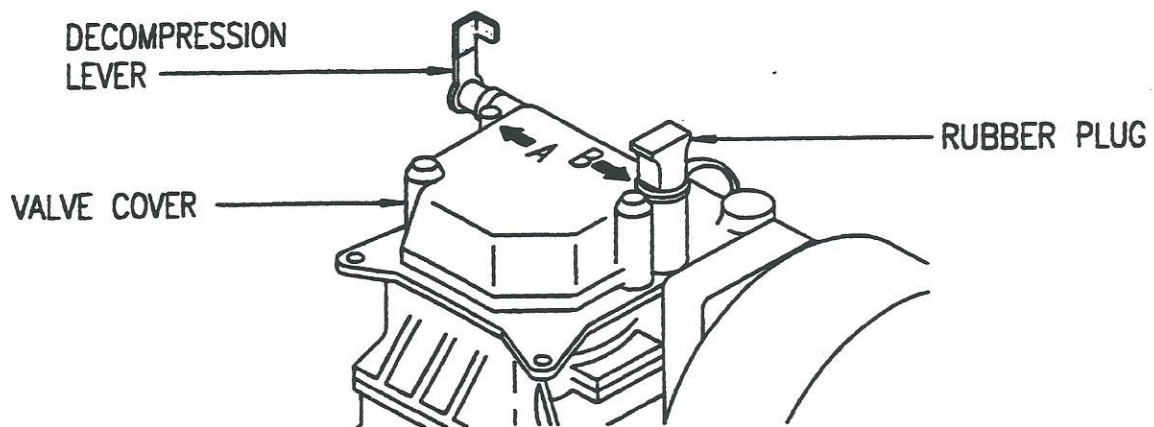


Figure 30 Depression Lever "A"

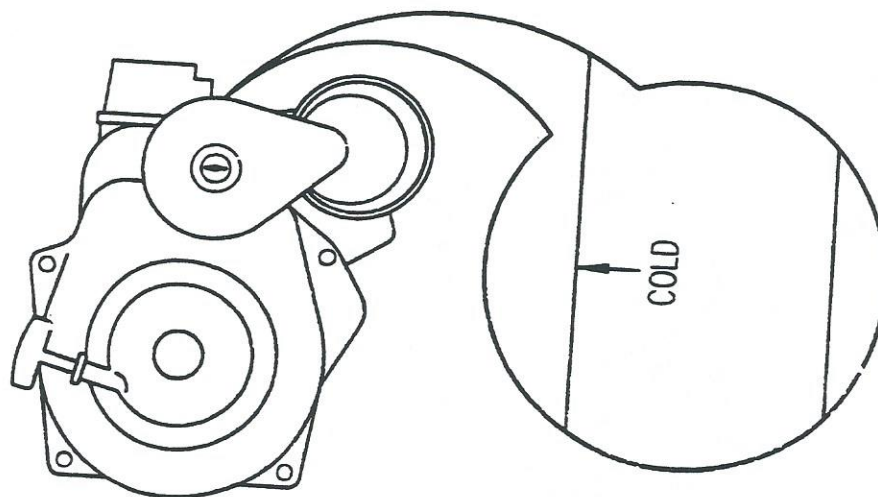


Figure 31 Air Intake Cover, Cold Operation

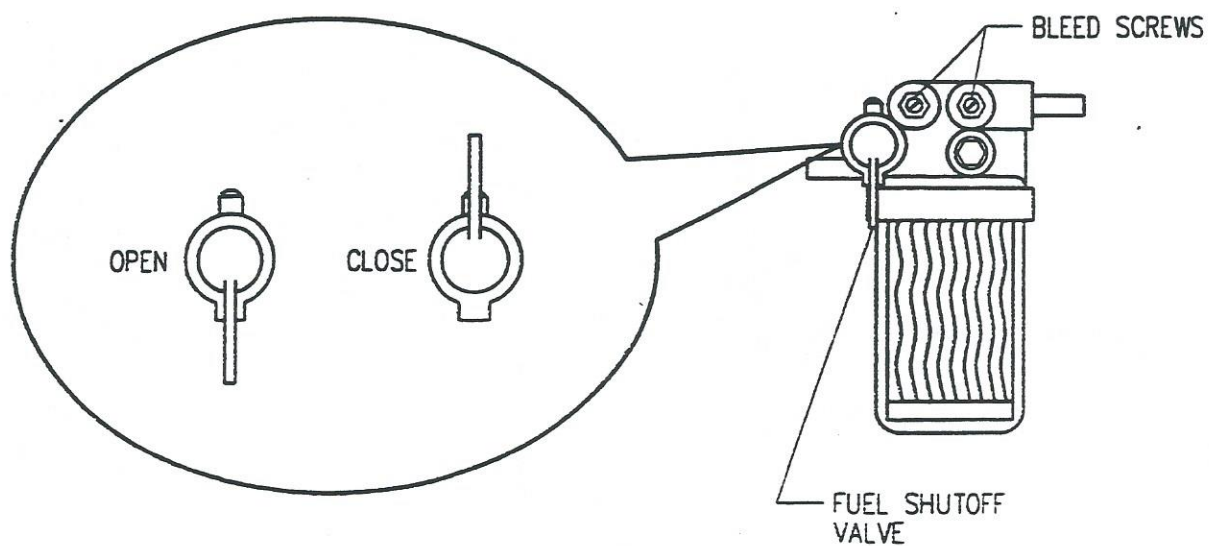


Figure 32 Fuel Filter

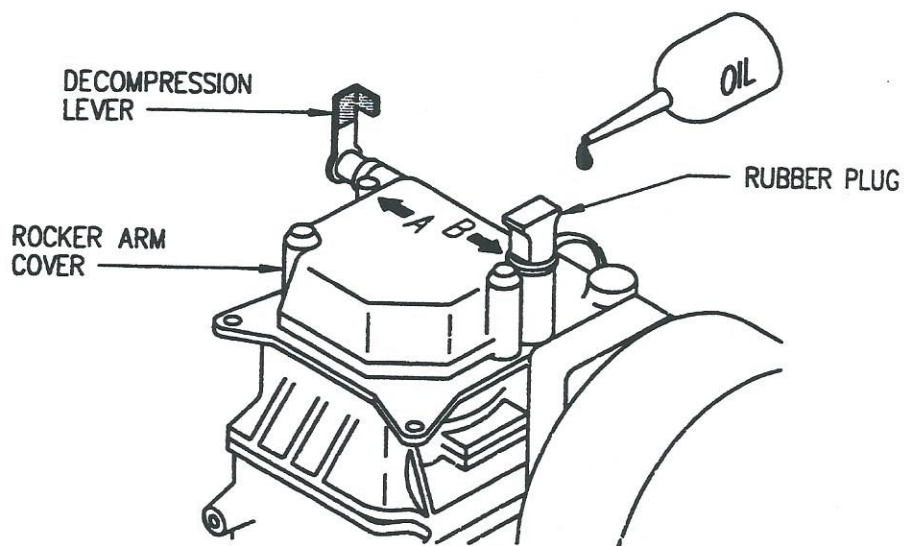


Figure 33 Adding Oil – Cylinder Head Plunger

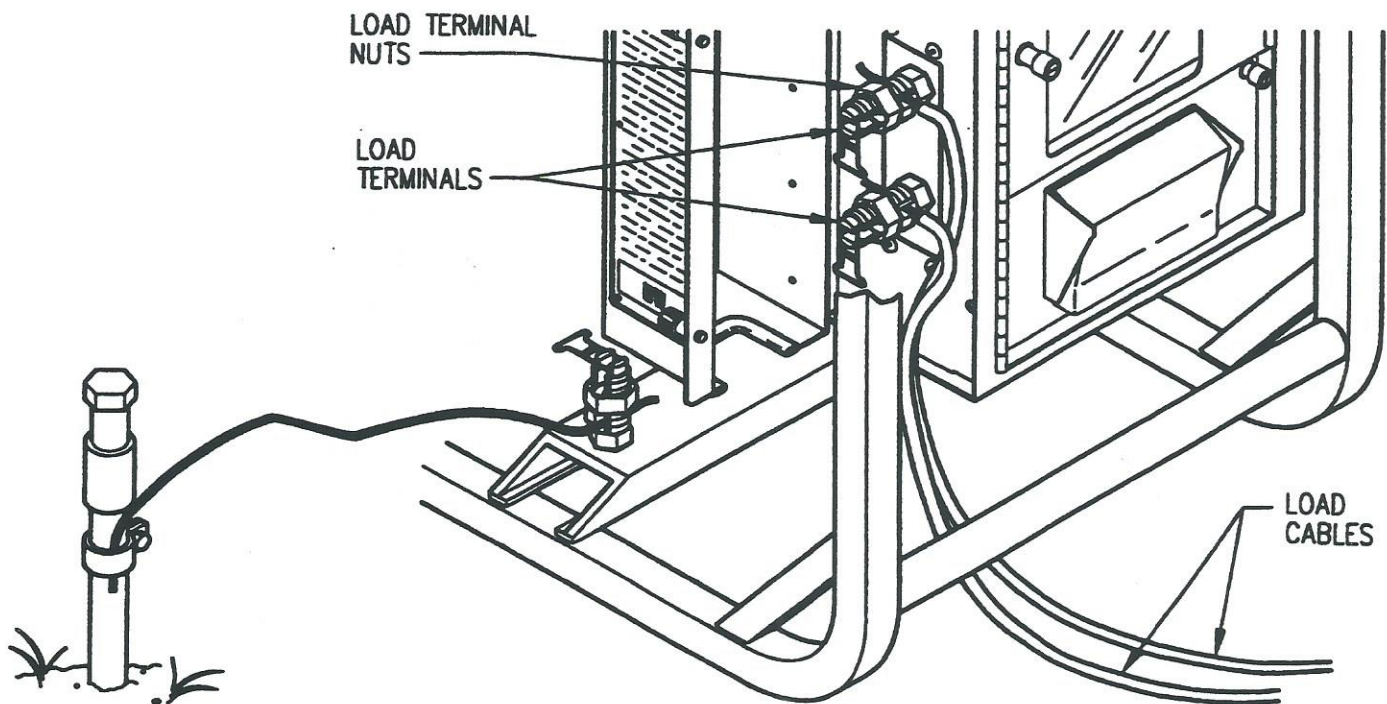


Figure 34 Ground and Load Terminals

# HOW TO FIX A GENERATOR SET MALFUNCTION

**Determining the Cause.** Find the cause of a malfunction, troubleshooting, is the first step in fixing the generator set and returning it to operation. Follow these simple steps to determine the cause of the problem.

- a. Turn to the Table of Contents in the manual.
- b. Locate "Troubleshooting" under the chapter that covers your level of maintenance. Turn to the page indicated.
- c. For operator troubleshooting, follow the instruction in the references.
- d. For troubleshooting at the unit maintenance level, find the malfunction listing in the troubleshooting symptom index. Follow the instruction indicated by the symptom index.

**Preparing for a Task.** Be sure that you understand the entire maintenance procedure before beginning any maintenance task. Make sure that all parts, materials, and tools are handy. Read all steps before beginning. Prepare to do the task as follows:

- a. Carefully read the entire task before starting. It tells you what you will need and what you have to start the task. **DO NOT START THE TASK UNTIL:**
  - (1) You know what is needed
  - (2) You have everything you need
  - (3) You understand what to do
- b. If parts are listed, they can be drawn from technical supply. Before you start the task, check to make sure you can get the needed parts. National Stock Numbers (NSNs) and part numbers for the generator set parts are listed in the Repair Parts and Special Tools List (RPSTL) manual.
- c. If expendable/durable supplies or materials are needed, get them before starting the task. Refer to Appendix for correct nomenclature and NSN.

**How to do the Task** Before starting read the entire task. Be sure that you understand the entire procedure before you begin the task. As you read, remember the following:

- a. **PAY ATTENTION TO WARNINGS, CAUTIONS, AND NOTES.**
- b. Use the **GLOSSARY** if you do not understand the special abbreviations or unusual terms used in this manual.
- c. The following are standard maintenance practices. Instructions about these practices are usually not included in task steps. When standard maintenance practices do not apply, the task steps will tell you. The standard maintenance practices are:
  - (1) Tag electrical wiring before disconnecting it.
  - (2) Discard used performed packing, retainers, gaskets, cotter pins, lockwashers, and similar items. Install new parts to replace discard items.
  - (3) Coat packing before installation, in accordance with task instructions.
  - (4) Disassembly procedures describe the disassembly needed for total authorized repair. You may not need to disassemble an item as far as described in the task. Follow the disassembly steps only as far as needed to repair/replace worn or damaged parts.
  - (5) Clean the assembly, subassembly, or part before inspecting it.
  - (6) Before installing components having mated surfaces, inspect the mating surfaces to make sure they are in serviceable condition.
  - (7) Hold the bolt (or screw) head with a wrench (or screwdriver) while tightening or loosening a nut on the bolt (or screw).
  - (8) Torque to the special torque cited when the task instructions include the words "torque to." Use standard torque's at all other times.
  - (9) When a cotter pin is required, align the cotter pin holes within the allowable torque range.
  - (10) Inspect for foreign objects after performing maintenance.

FLUKE 12 MULTIMETER

 **0.0.0.0** mV~  
 **0.0.0.0** mV=  
 **0.0.0.0** M $\Omega$   
 MAX  MIN   LoZ   $\mu$ F

SELECT

=

M

RANGE





**11/12**  
**MULTIMETER**

USERS MANUAL

**FLUKE**

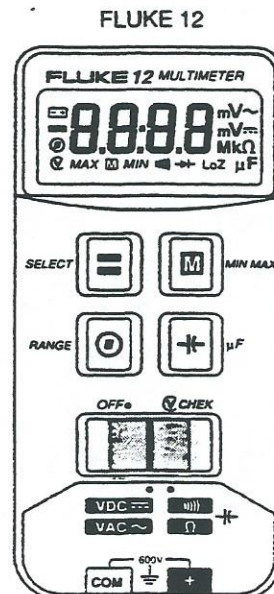
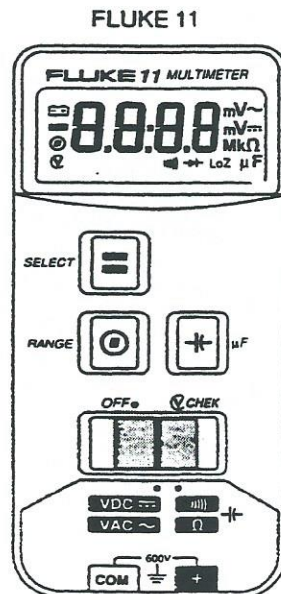
# 11/12

## MULTIMETER

USERS MANUAL

PN 900191  
 July 1991 Rev. 1 12/93  
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 All product names are trademarks of their respective companies

# FLUKE®



✓CHECK, ✓CHECK Alert, MIN MAX Alert, Input Change Alert, and Overload Alert are trademarks of the Fluke Corporation.

## READ FIRST: SAFETY INFORMATION

This meter has been designed and tested in accordance with IEC Publication 1010. To ensure that the meter is used safely, follow all safety and operating instructions in this manual. If the meter is not used as described in this manual, the safety features of the meter might be impaired.

- Do not use the meter if the meter or test leads look damaged, or if you suspect that the meter is not operating properly.
- Turn off power to the circuit under test before cutting, unsoldering, or breaking the circuit. Small amounts of current can be dangerous.
- Do not apply more than 600V rms between a terminal and earth ground.
- Use caution when working above 60V dc or 30V ac rms. Such voltages pose a shock hazard.
- When using the probes, keep your fingers behind the finger guards on the probes.
- Disconnect the live test lead before disconnecting the common test lead.

4

## SYMBOLS

The following international electrical symbols are used in this manual:

 Important Safety Information in Manual

 Not Applicable to Identified Model

~ AC

≡ DC

 Diode

 Capacitor

 Ground

 Double Insulation

## DISPLAY

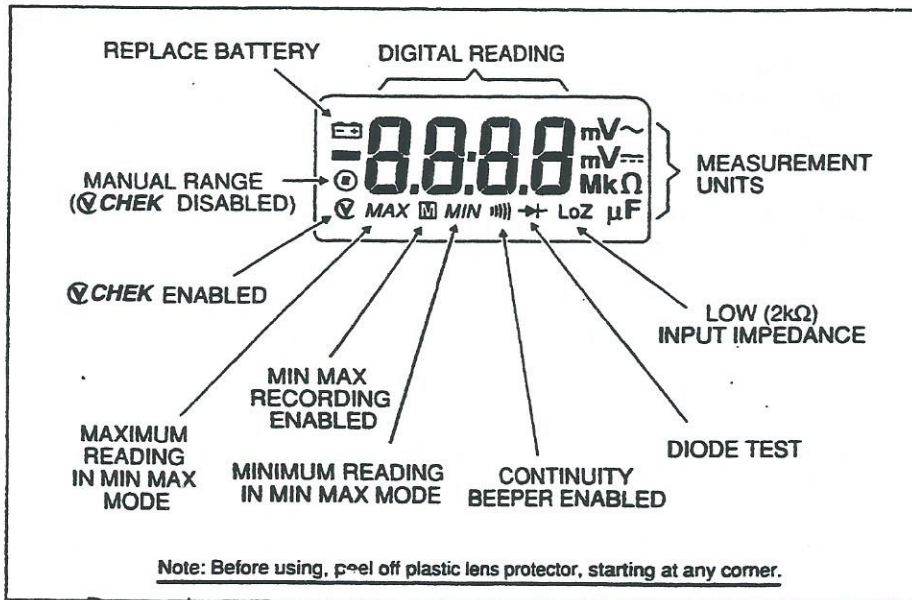


Figure 1. Display

6

## OPERATING FEATURES

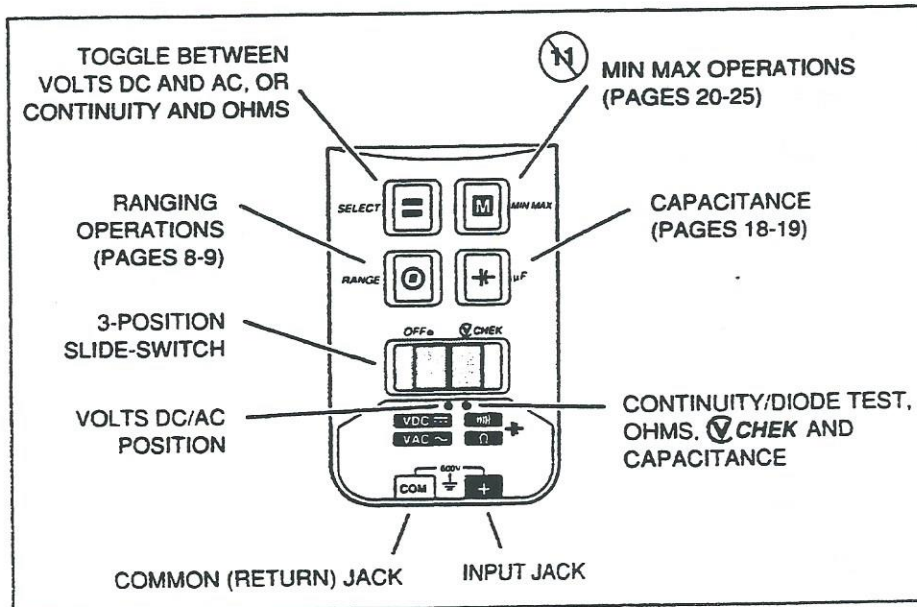


Figure 2. Operating Features

7

## STANDBY MODE

In Standby mode, the display goes blank to preserve battery life. The meter beeps and enters Standby if it is ON but inactive for more than 45 minutes. Press any pushbutton to resume operation. Standby is not allowed if the meter is in the MIN MAX mode.

## [⊙] INPUT RANGES

The input range determines the highest value the meter will measure. Most functions have more than one range (see SPECIFICATIONS). If the range is too low, the display shows OL (overload). If the range is too high, the display will show fewer digits of resolution.

8

## Autoranging

The meter defaults to autorange when you turn it on. In autorange, the meter selects the range automatically.

## Manually Selecting a Range

The meter also has a manual range mode. In manual range, you select and lock the meter in a range. To manually select a range:

1. Press [⊙]. The meter is locked in the range it is in, and ⊙ is displayed. In manual range,  $\checkmark$  *CHEK* is disabled.
2. Press [⊙] to step through the ranges. NOTE: The 4000 mV range, which can only be entered in manual range, is convenient when using accessories.
3. To return to autorange, press [⊙] for 2 seconds (until ⊙ is no longer displayed), or change the measurement function.

## MEASURING VOLTAGE

1. Insert the test leads in the jacks.
2. To select a voltage function, put the slide-switch in the middle position. See Figure 3.

To toggle between dc and ac, press [=].

3. Touch the probes to the test points, and read the display. The meter beeps an Overload Alert™ when OL (overload) is displayed.

In manual range, you can toggle the meter between a high or low input impedance mode by moving the slide-switch between the voltage and continuity/ohms positions. (See "CHECK AND HOW TO USE IT".) In the continuity/ohms position, the input impedance of the meter is  $2\text{ k}\Omega$ , and LoZ is displayed to indicate that the meter is in the low input impedance mode. In the volts position, the input impedance is  $5\text{ M}\Omega$  in ac and  $10\text{ M}\Omega$  in dc.

10

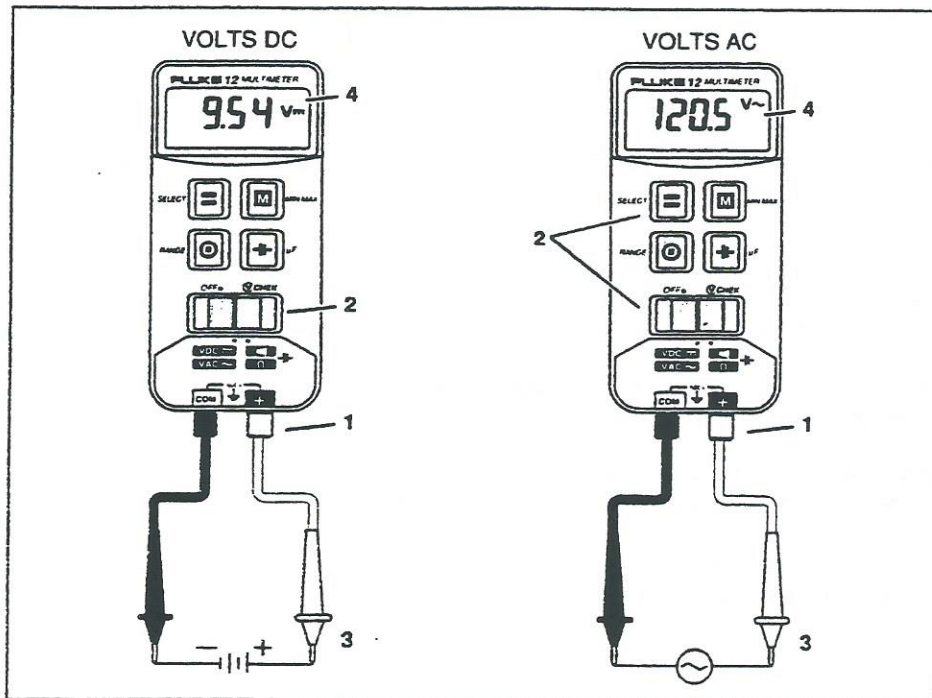


Figure 3. Measuring Voltage

11

## TESTING CONTINUITY AND MEASURING RESISTANCE

1. Insert the test leads in the jacks, and turn off power to the circuit under test. External voltage across the components causes invalid readings.
2. Put the slide-switch in the continuity/ohms position (Figure 4).

To toggle between the continuity/diode and ohms functions, press [=].

3. Touch the probes to the test points.

In ohms, read the resistance on the display.

In continuity test, the beeper sounds continuously if continuity exists (resistance  $< 25\Omega$ ). Opens and shorts longer than  $250\mu s$  are detected. On the Fluke 12, short-to-open and open-to-short transitions can be captured and visually displayed. See "Capturing Continuity Intermittents".

If the meter detects a voltage greater in magnitude than about 4.5V and the meter is not in the manual range mode, the meter automatically changes to the voltage measurement function. (See "CHECK AND HOW TO USE IT".)

12

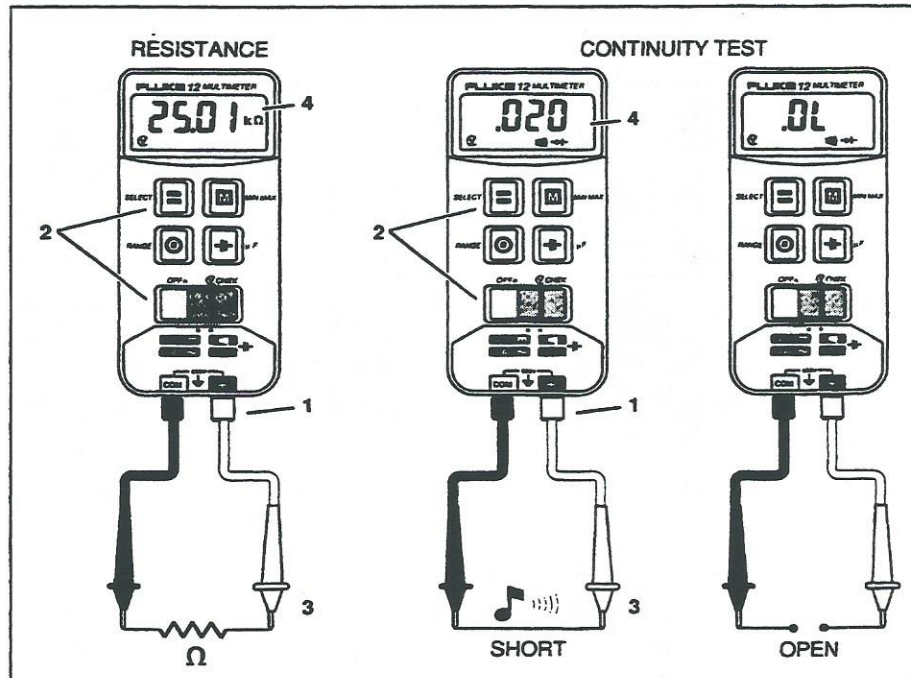


Figure 4. Continuity and Resistance Measurements

13

## TESTING DIODES

1. Insert the test leads in the jacks.
2. Put the slide-switch in the continuity/ohms position. The meter selects either the continuity/diode ()))  $\rightarrow$   $\leftarrow$ ) or ohms ( $\Omega$ ) function.

If ohms is selected, press [=] to toggle to the continuity/diode function. To toggle the beeper on or off in continuity/diode test, press [C]. ))) is displayed when the beeper is enabled.

3. Touch probes to the diode (Figure 5A). A forward-voltage drop of about 0.6V (typical for a silicon diode) causes the meter to beep once.
4. Reverse probes (Figure 5B). If the diode is good, OL is displayed. If the diode is shorted (Figure 5C), the beeper sounds continuously in at least one direction.

If the diode is open, OL is displayed in both directions.

14

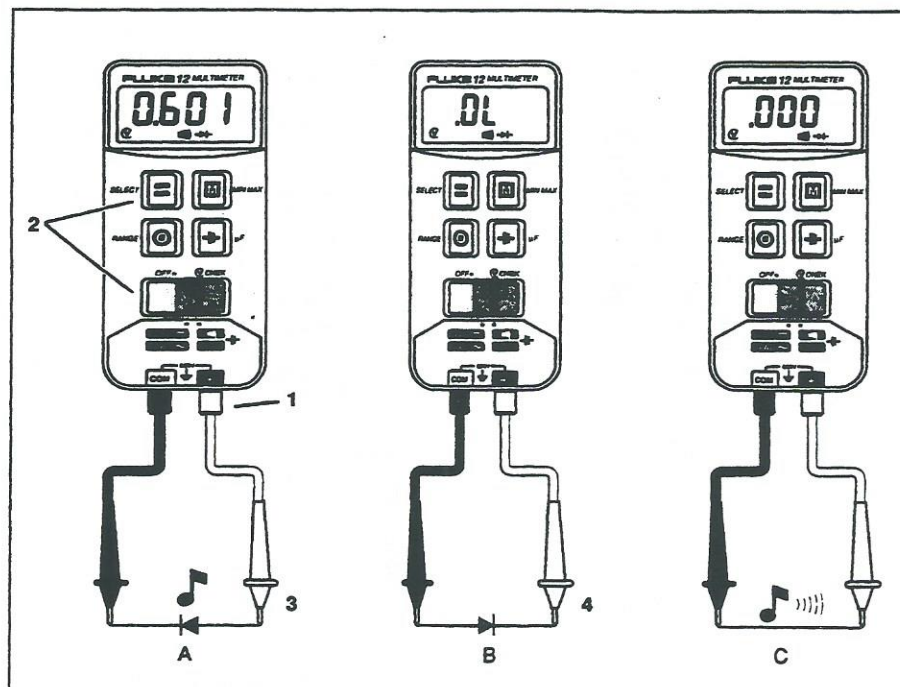


Figure 5. Testing Diodes

15

## **⚡CHEK AND HOW TO USE IT**

**⚡CHEK** is a subset of the continuity/ohms function. In **⚡CHEK**, the meter is designed to automatically display an ac or dc voltage when the meter detects a voltage greater in magnitude than about 4.5V and the meter is not in the manual range mode. **THIS WILL NOT HARM THE METER.** **⚡CHEK** is always enabled (and **⚡** is displayed) when the meter is in the continuity/ohms function unless the meter is in one of the following:

- The manual range mode (i.e., **⊖** is displayed)
- The MIN MAX mode (i.e., **M** is displayed)
- The capacitance function (i.e.,  $\mu F$  is displayed)

In **⚡CHEK**, the meter has a low input impedance ( $\sim 2\text{ k}\Omega$ ). When a voltage is displayed, **LoZ** is also displayed to remind you of this, and the beeper momentarily sounds a **⚡CHEK Alert™**. To disable the **⚡CHEK** Alert in the ohms function, press and hold down **[=]** while turning the meter on.

Use **⚡CHEK** only on power supplies and other power sources that have a low output impedance. Do not use **⚡CHEK** to measure voltage in electronic circuitry unless a  $2\text{-k}\Omega$  load will not damage the circuit. See † on page 30.

|    |                |             |                   |      |
|----|----------------|-------------|-------------------|------|
| 16 | Manual Title:  | 11/12 Users | Supplement Issue: | 1    |
|    | Part Number:   | 900191      | Issue Date:       | 1/98 |
|    | Print Date:    | July 1991   |                   |      |
|    | Revision/Date: | 1, 12/93    |                   |      |

### **Change #1**

On page 16, after the third bullet, add:

#### **⚠ Warning**

**Repetitive transients on a dc bus will cause ⚡CHEK to select ac volts, even though a hazardous dc voltage may be present. To avoid a misleading display and possible electric shock, manually select the proper volts function for measurements on these circuits.**

## **DISABLING ⚡CHEK WITH FUNCTION LOCK**

To lock the meter in either the continuity/diode or ohms function, and disable **⚡CHEK**:

1. Put the slide-switch in the continuity/ohms position. The meter selects the continuity/diode or ohms function. Press **[=]** to toggle between the continuity/diode and ohms functions.
2. Press **[⊖]** to put the meter in manual range. **⊖** is displayed. The meter is locked in the selected function and **⚡CHEK** is disabled.

In continuity/diode test, press **[⊖]** to toggle the beeper on and off.

In ohms, press **[⊖]** to manually select a range.

To remove the function lock and reenable **⚡CHEK**, press **[⊖]** for 2 seconds, press **[=]**, or move the slide-switch.

## [⇄] MEASURING CAPACITANCE

First, turn off power to the circuit, and disconnect and discharge the capacitor.

1. Insert test leads, and move the slide-switch to ⇄. (See Figure 6.)
2. Press [⇄]. The capacitance function is selected and  $\mu\text{F}$  is displayed.
3. Touch the probes to the capacitor. When measuring polarized capacitors, be sure to connect the positive to  $\oplus$  and the negative to COM. Capacitor dielectric absorption can cause measurement errors. If more discharge is necessary, the meter displays "dISC" while the capacitor is discharging.

To exit capacitance, Press [⇄] or [⏏], or move the slide-switch to another position.

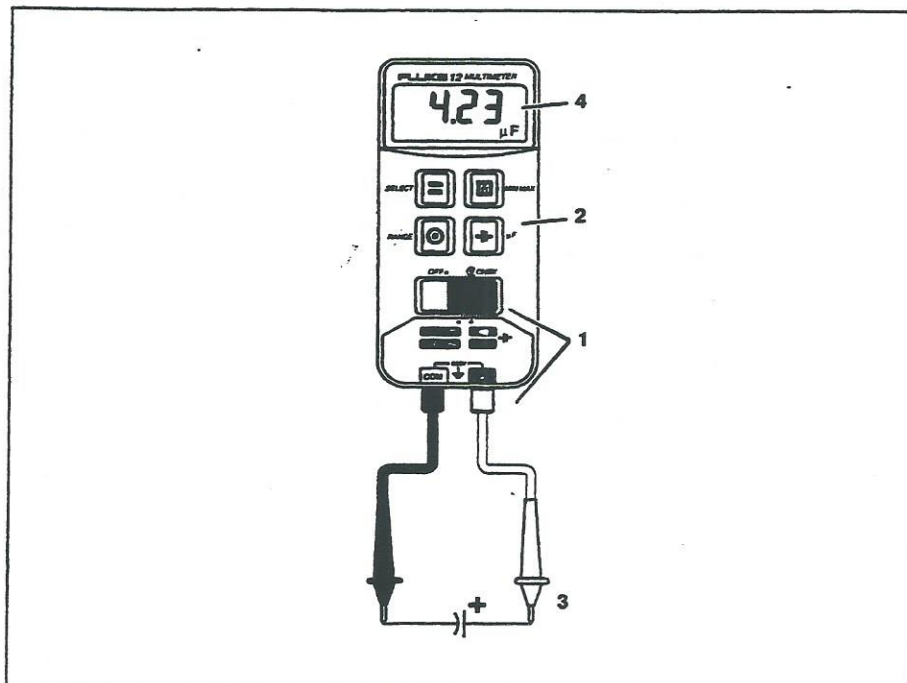


Figure 6. Measuring Capacitance

## [⇄] MEASURING CAPACITANCE

First, turn off power to the circuit, and disconnect and discharge the capacitor.

1. Insert test leads, and move the slide-switch to ⇄. (See Figure 6.)
2. Press [⇄]. The capacitance function is selected and  $\mu\text{F}$  is displayed.
3. Touch the probes to the capacitor. When measuring polarized capacitors, be sure to connect the positive to  $+$  and the negative to COM. Capacitor dielectric absorption can cause measurement errors. If more discharge is necessary, the meter displays "dISC" while the capacitor is discharging.

To exit capacitance, Press [⇄] or [⏏], or move the slide-switch to another position.

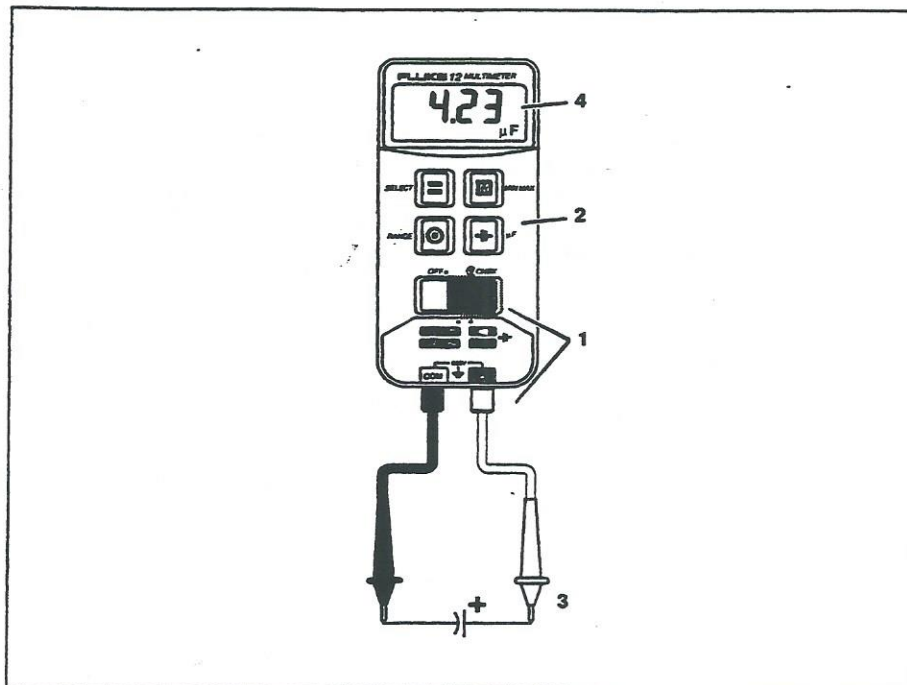
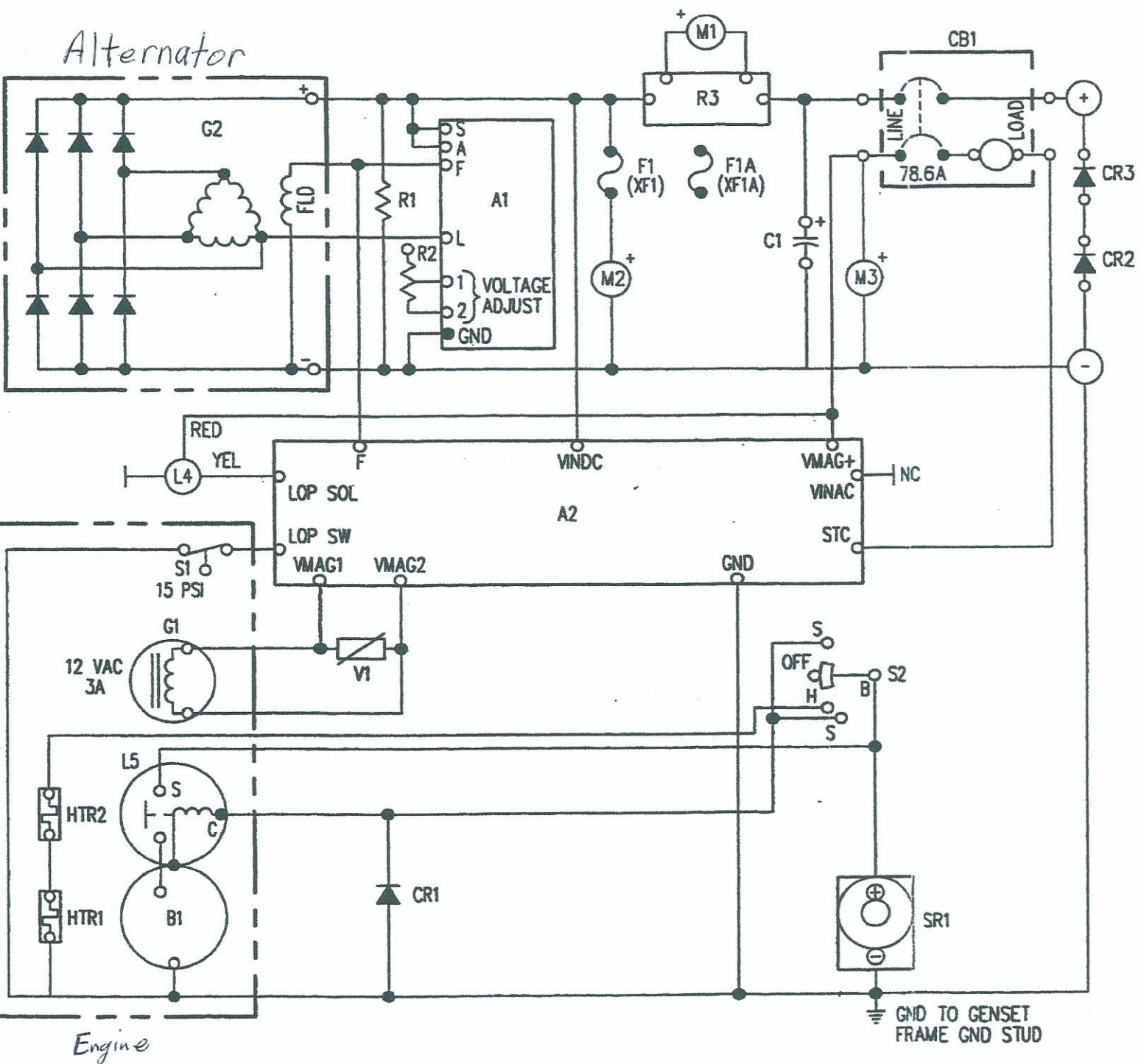


Figure 6. Measuring Capacitance



| REF<br>DESIGNATOR | DESCRIPTION   |
|-------------------|---|
| A1                | REGULATOR, VOLTAGE, 28 VOLT                           |
| A2                | CONTROL, GENERATOR, 2 KW                              |
| B1                | MOTOR, STARTER, 24 V DC, PART OF ENGINE               |
| C1                | CAPACITOR, 1000 uF 63 VDC                             |
| CB1               | CIRCUIT BREAKER, 2 POLE                               |
| CR1               | DIODE   |
| CR2, CR3          | DIODE, TRANSIENT SUPPRESSION                          |
| F1                | FUSE  |
| F1A               | FUSE, SPARE   |
| G1                | DYNAMO, 12 VAC, 3A, PART OF ENGINE                    |
| G2                | ALTERNATOR, 2 KW, 28 V DC, 3600 RPM                   |
| HTR1, HTR2        | HEATER, ENGINE PREHEAT, PART OF ENGINE                |
| -                 | TERMINAL, NEGATIVE OUTPUT OF GENSET                   |
| +                 | TERMINAL, POSITIVE OUTPUT OF GENSET                   |
| L4                | SOLENOID, LOW OIL PRESSURE                            |
| L5                | SOLENOID, STARTER MOTOR, PART OF ENGINE               |
| M1                | METER, INDICATION, CURRENT                            |
| M2                | METER, OUTPUT VOLTAGE                                 |
| M3                | METER, TIME TOTALIZING                                |
| R1                | RESISTOR, POWER, 20 $\Omega$ , 50 W. 1%               |
| R2                | POTENTIOMETER, VOLTAGE ADJUSTMENT                     |
| R3                | RESISTOR, SHUNT 0-89.3A                               |
| S1                | SWITCH, LOW OIL PRESSURE                              |
| S2                | SWITCH, START, PREHEAT, SPRING RETURN TO OFF POSITION |
| SR1               | CONNECTOR, PLUG, ELECTRICAL, INTERVEHICLE POWER CABLE |
| V1                | VARISTOR, DISCHARGE                                   |
| XF1, XF1A         | FUSE HOLDER   |

S2

|     | START WITH<br>PREHEAT | PREHEAT | OFF | START |
|-----|-----------------------|---------|-----|-------|
| B-H | X                     | X       |     |       |
| B-S | X                     |         |     | X     |

Figure 37 Electrical Schematic, MEP-501A

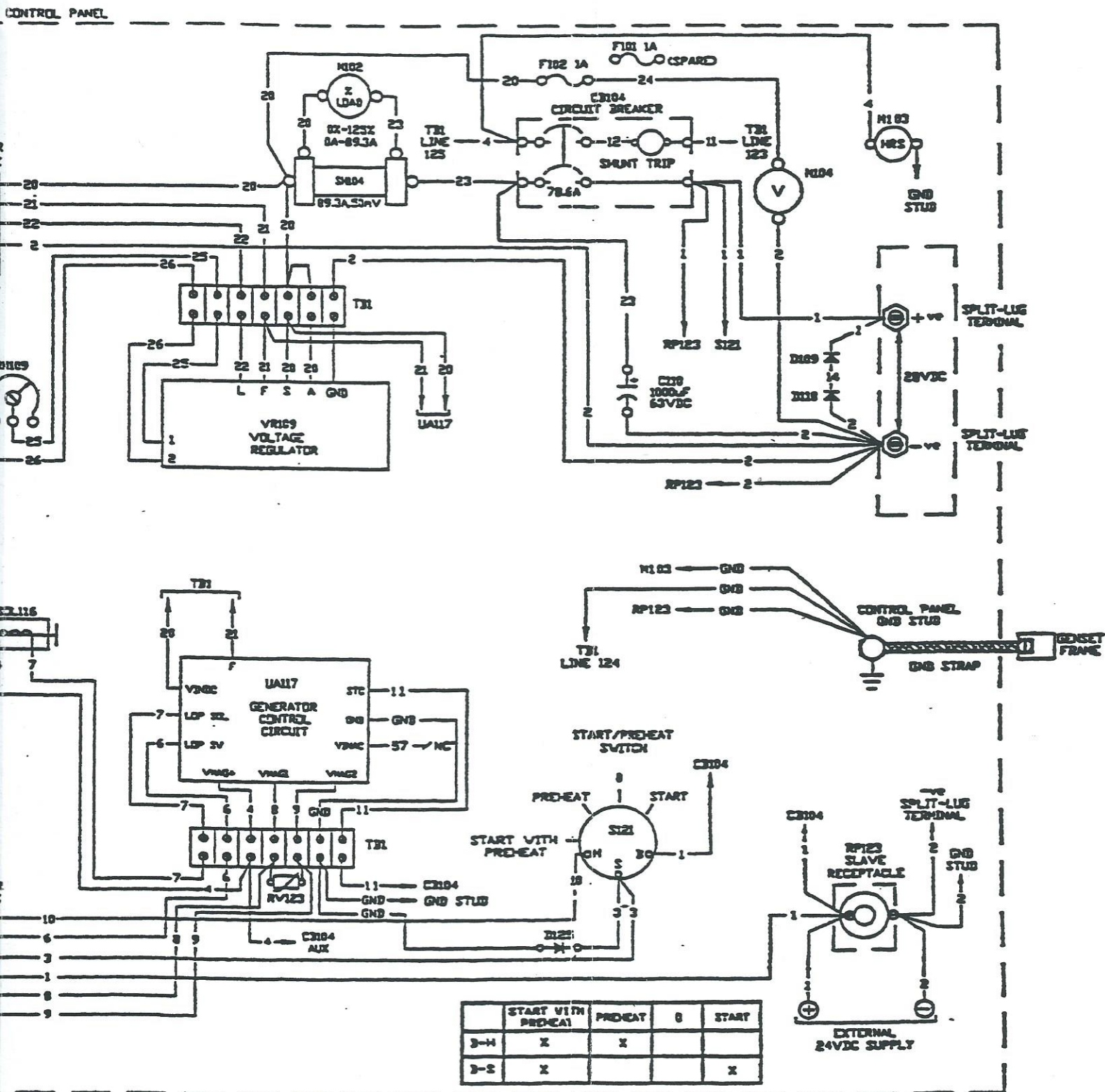
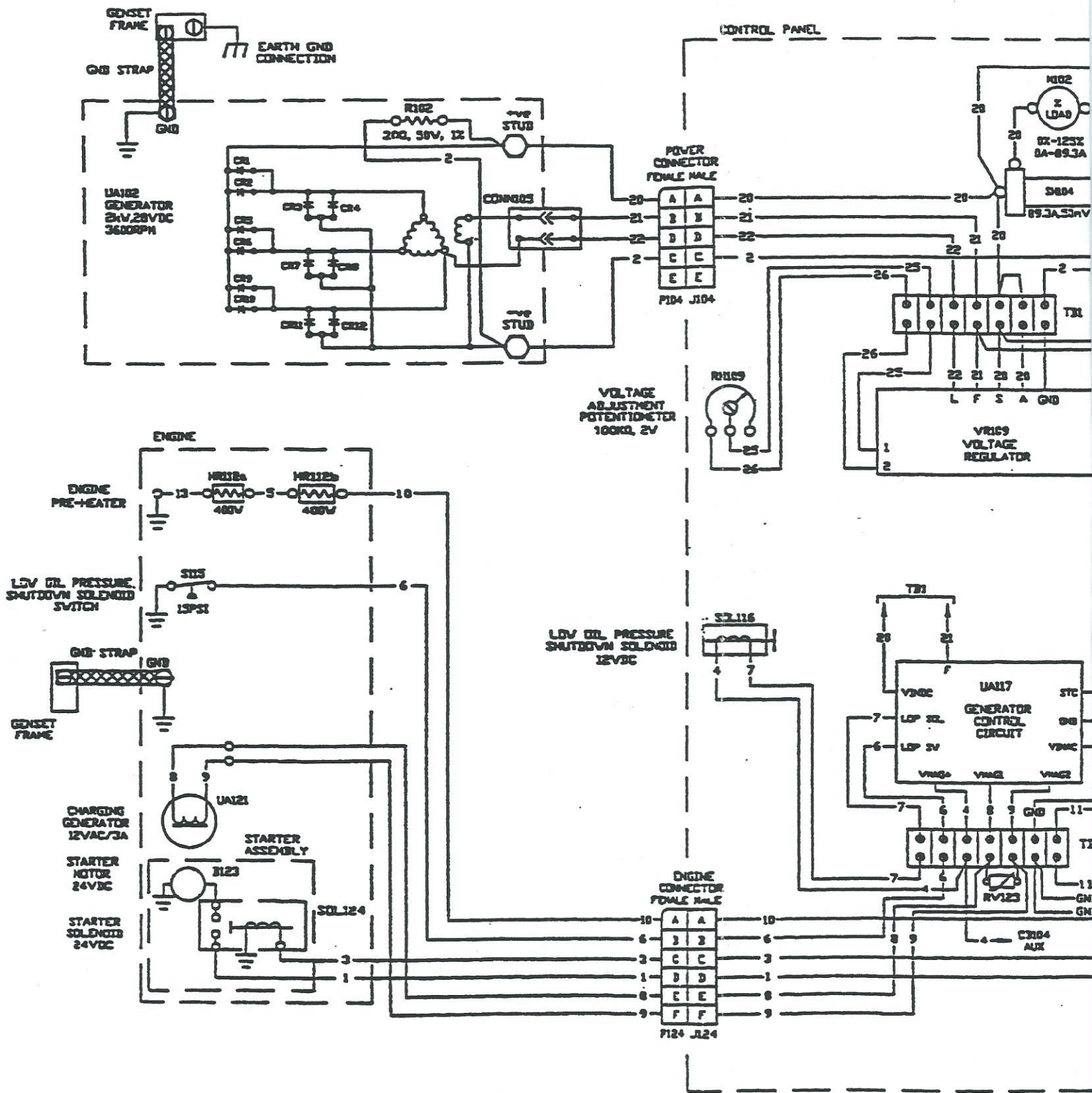
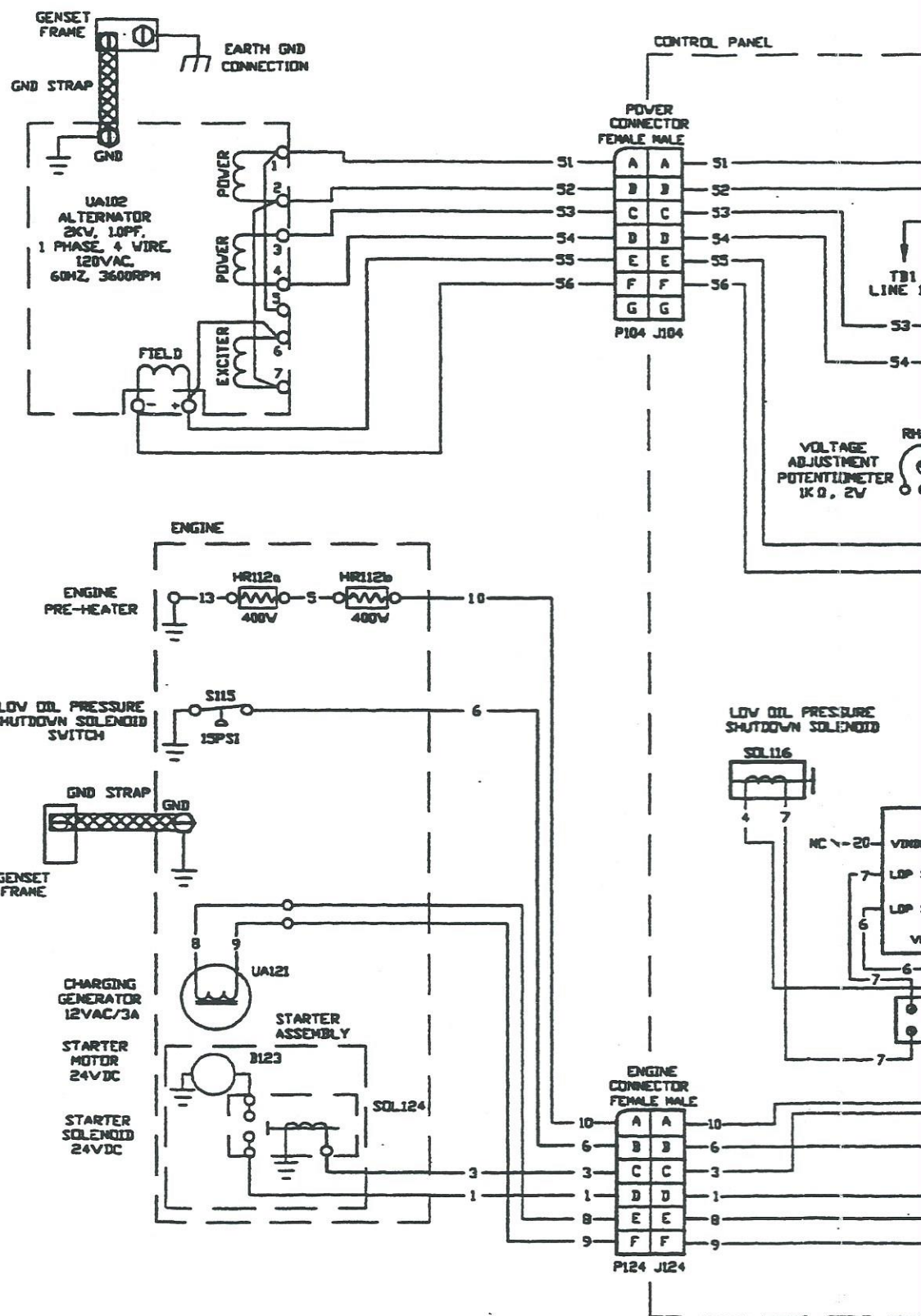
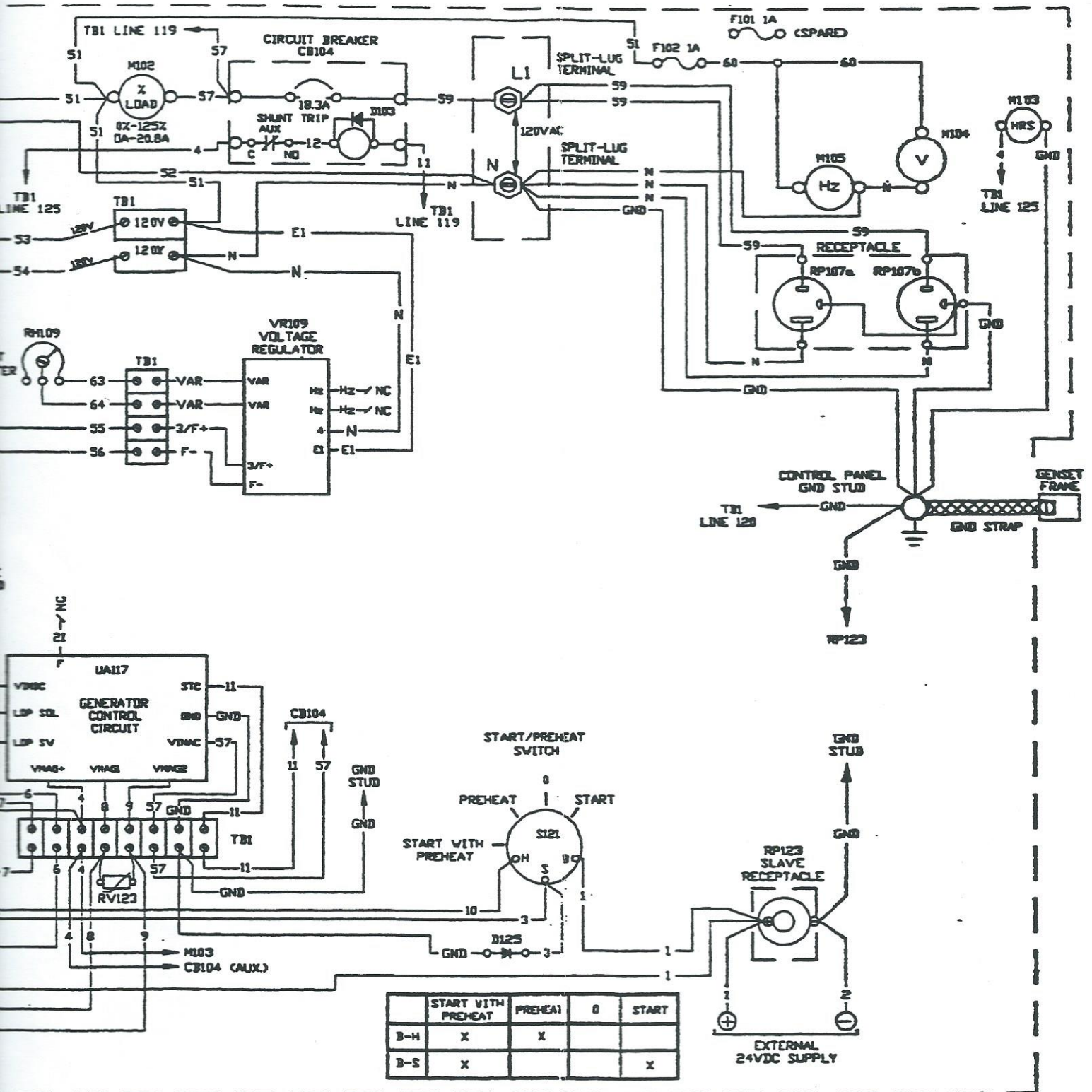


Figure 39  
Generator Set Schematic, Mechcon 28 VDC



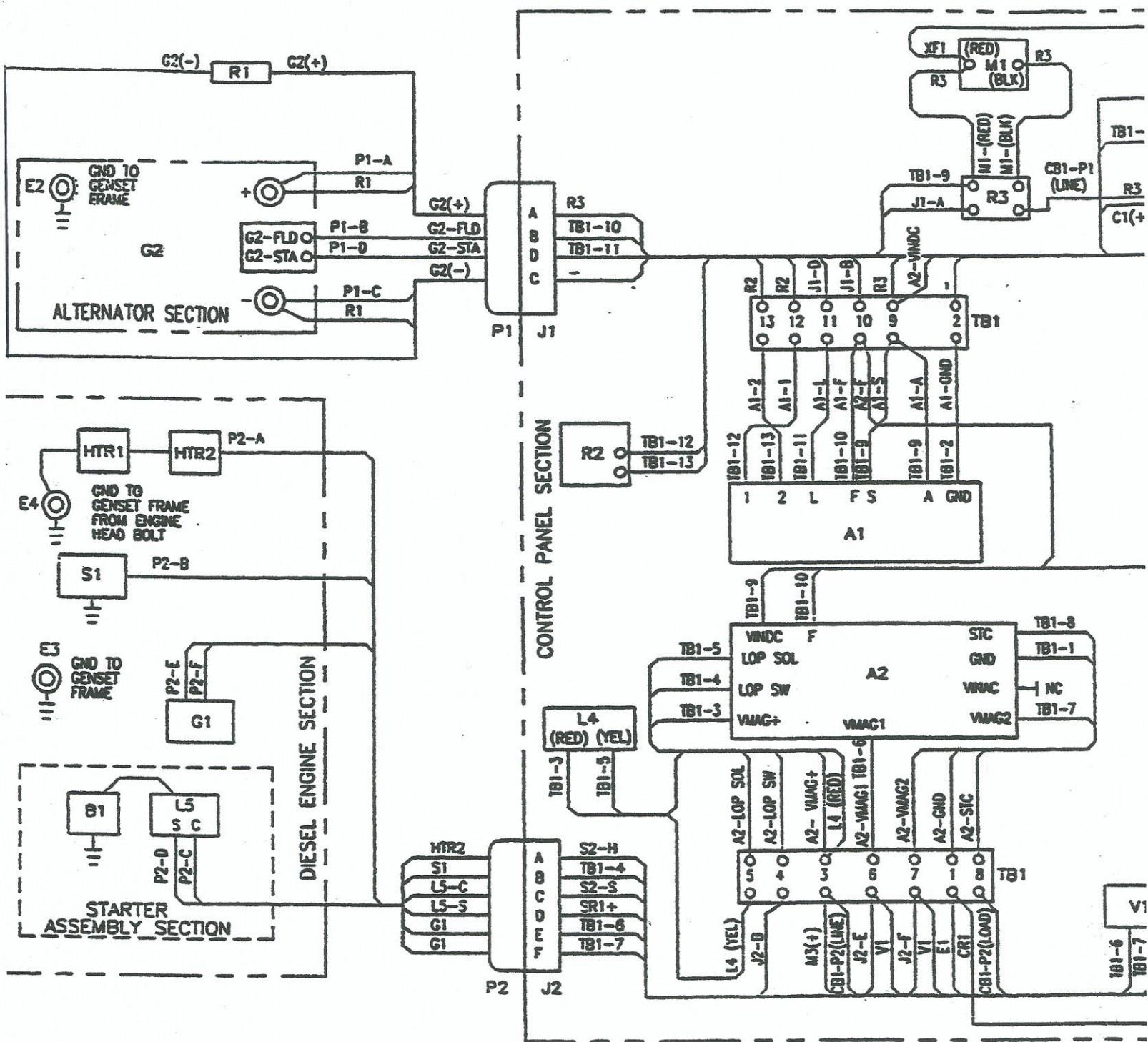
|        |   |
|--------|---|
| B123   | STARTER MOTOR, 24 VDC                   |
| CB104  | CIRCUIT BREAKER, 18.3 A                 |
| D103   | DIODE FLYWHEEL                          |
| D125   | DIODE FLYWHEEL                          |
| F101   | SPARE FUSE, 1 A                         |
| F102   | INSTRUMENT FUSE, 1 A                    |
| HR112a | PREHEATER, 400 W                        |
| HR112b | PREHEATER, 400 W                        |
| J104   | CONNECTOR, MALE POWER                   |
| J124   | CONNECTOR, MALE ENGINE                  |
| L1     | TERMINAL LUG, 120 VAC                   |
| M102   | LOADMETER, 0-125% (0-20.8 A)            |
| M103   | HOURLMETER, 0-9999 HRS                  |
| M104   | VOLTMETER, 0-40 VDC                     |
| M105   | FREQUENCY METER, 55-65 HZ               |
| N      | TERMINAL LUG, NEGATIVE                  |
| P104   | CONNECTOR, FEMALE POWER                 |
| P124   | CONNECTOR, FEMALE ENGINE                |
| RH109  | VOLTAGE ADJUST POTENTIOMETER<br>1 K OHM |
| RP107  | DUPLEX RECEPTACLE                       |
| RP123  | SLAVE RECEPTACLE                        |
| RV123  | VARIATOR                                |
| S115   | LOW OIL PRESSURE SWITCH                 |
| S121   | START/PREHEAT SWITCH                    |
| SOL116 | LOW OIL PRESSURE SOLENOID               |
| SOL124 | STARTER SOLENOID                        |
| TB1    | TERMINAL BLOCK                          |
| UA102  | ALTERNATOR, 120 VAC                     |
| UA117  | CONTROL CIRCUIT                         |
| UA121  | DYNAMO, 12 VAC 3 A                      |
| VR109  | VOLTAGE REGULATOR                       |

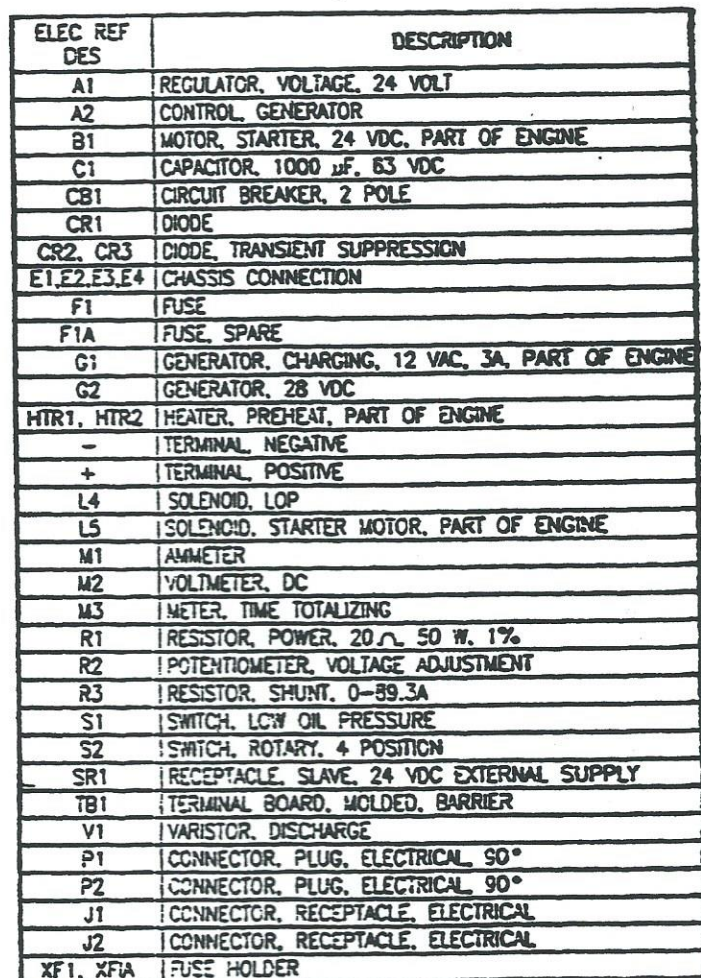




Generator Set Schematic, Mechcon 120 VAC

Figure 40





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