

**ARMY TM 9-6115-464-12**  
**AIR FORCE TO-35C2-3-445-1**  
**NAVY NAVFAC P-8-624-12**

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**TECHNICAL MANUAL**

**Operator And Unit Maintenance Manual**

**GENERATOR SET, DIESEL ENGINE  
DRIVEN, TACTICAL**

**SKID MTD, 15 KW, 3 PHASE, 4 WIRE, 120/208  
AND 240/416 VOLTS**

<u>DOD MODEL</u>	<u>CLASS</u>	<u>HERTZ</u>	<u>NSN</u>
MEP-004A	UTILITY	50/60	6115-00-118-1241
MEP-103A	PRECISE	50/60	6115-00-118-1245
MEP-113A	PRECISE	400	6115-00-118-1244

**INCLUDING OPTIONAL KITS**

<u>DOD MODEL</u>	<u>NOMENCLATURE</u>	<u>NSN</u>
MEP-005-AWF	WINTERIZATION KIT, FUEL BURNING	6115-00463-9083
MEP-005-AWE	WINTERIZATION KIT, ELECTRIC	6115-00-463-9085
MEP-004-ALM	LOAD BANK KIT	6115-00-291-9201
MEP-005-AWM	WHEEL MOUNTING KIT	6115-00-463-9094
	APPLICATIONS KIT	6115-01-096-9015
MEP-015-ASK	ACOUSTIC SUPPRESSION KIT	6115-01-233-8274

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This manual supersedes TM 5-6115-464-12, 31 January 1975, including all changes.

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AIR FORCE AND NAVY**

**30 July 1993**



CHANGE

HEADQUARTERS, DEPARTMENTS OF  
 THE ARMY, THE AIR FORCE, AND THE NAVY  
 WASHINGTON D.C., 31 MARCH 1997

NO. 2

# OPERATOR AND UNIT MAINTENANCE MANUAL

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HEADQUARTERS DEPARTMENTS OF  
THE ARMY, THE AIR FORCE AND THE NAVY  
WASHINGTON, D.C., 28 FEBRUARY 1995

## OPERATOR AND UNIT MAINTENANCE MANUAL

### **Generator Set, Diesel Engine Driven, Tactical Skid Mounted, 15 kW, 3 Phase, 4 Wire, 120/208 and 240/416 Volts**

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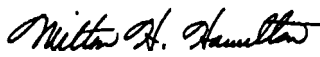
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NAVFAC P-8-624-12  
C1

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**All specific cautions and warnings contained in this manual shall be strictly adhered to. Otherwise, severe injury, death and/or damage to the equipment may result.**

#### **HIGH VOLTAGE**

is produced when this generator set is in operation.

#### **DEATH**

or severe burns may result if personnel fail to observe safety precautions. Do not operate this generator set until the ground terminal stud has been connected to a suitable ground. Disconnect the battery ground cable before removing and installing components on the engine or in the electrical control panel system. Do not attempt to service or otherwise make any adjustments, connections or reconnections of wires or cables until generator set is shut-down and completely de-energized.

#### **DANGEROUS GASES**

Batteries generate explosive gas during charging; therefore, utilize extreme caution, do not smoke, or use open flame in vicinity when servicing batteries. Use only Slave Receptacle (SR1) when extra cranking power is required, as incorrect method of slaving could cause arcing at battery terminals. Exhaust discharge contains noxious and deadly fumes. Do not operate generator sets in enclosed areas unless exhaust discharge is properly vented to the outside. When filling fuel tank, maintain metal-to-metal contact between filler nozzle and fuel tank. Do not smoke or use an open flame in the vicinity. Use extreme care, should a selenium rectifier malfunction, to avoid inhalation of poisonous fumes.

#### **LIQUIDS UNDER PRESSURE**

are generated as a result of the generator set. Do not expose any part of the body to a high pressure leak in the fuel or hydraulic system of the generator set. Relieve pressure from radiator before removing radiator cap.

#### **NOISE**

operating level of this generator can cause hearing damage. Ear protectors, as recommended by the medical or safety officer, must be worn when working near this set.

#### **CAUTION**

#### **DAMAGE**

to the equipment may result if personnel fail to observe the cautions contained in this manual. If generator set is shut down by the operation of a safety device, do not attempt to operate the unit until the cause has been determined and eliminated.

#### **HEAT**

If acoustic suppression kit is installed, do not allow personnel to open or close exhaust discharge door when unit is hot. Serious burns or personnel injury may result.





Hot refueling of generators while they are operating poses a safety hazard and should not be attempted. Hot engine surfaces and sparks produced from the engine and generator circuitry are possible sources of ignition. Severe Injury, death to personnel and/or damage to the equipment may result.

#### **ROTATING PARTS**

Severe injury may result from contact with moving or rotating components such as fan blades, pulleys, and belts. Do not attempt to service or make any adjustments in the vicinity of such components while generator set is in operation. Do not operate without all guards in place.



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**REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS**

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual directly to: Commander, US Army Aviation and Troop Command, ATTN: AMSAT-I-MP, 4300 Goodfellow Blvd., St. Louis, MO 63120-1798. A reply will be furnished directly to you.

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## HOW TO USE THIS MANUAL

This manual provides information for use in operating and maintaining the generator set. Maintaining the generator set includes preventive maintenance checks and services, observation of symptoms and trouble, troubleshooting procedures, and maintenance procedures to correct a malfunction.

You must familiarize yourself with the maintenance procedures before beginning the maintenance tasks. Any maintenance task that is not described within this manual is considered a task that must be performed by a higher level of maintenance.

To help you become familiar with this new manual as quickly as possible, spend some time looking through the pages. The manual has a new look that is very different from the look of the manuals you've been using. You'll find that it's a lot easier to use and you'll be able to find what you're looking for a lot faster. We eliminated many words and put in illustrations to show you how to repair, replace, inspect, test, or service those item(s) and component(s) that are the responsibility of the Operator or Unit level technician. The following instructions provide a general description of the entire manual, special features and characteristics, and detailed information on how to use this manual.

## MANUAL CONTENT

1. This manual consists of the following:
  - a. Cover page index
  - b. Warning pages
  - c. Table of contents
  - d. How to use this manual
  - e. Chapters 1 through 5
  - f. Appendixes A through E
  - g. Index
  - h. Wiring diagrams and schematics
2. Further explanation of the manual contents follows.
  - a. Chapter 1. Introduction. Contains general information, equipment description and data, along with principles of operation regarding the complete generator set.
  - b. Chapter 2. Operating Instructions. Contains operating instructions, both under normal and unusual conditions, and preventive maintenance checks and services (PMCS).
  - c. Chapter 3. Operator Maintenance Instructions. Contains detailed maintenance procedures for the operator. This chapter also contains lubrication instructions.
  - d. Chapter 4. Unit Maintenance Instructions. Contains detailed maintenance procedures for the unit maintenance technician. Also included are instructions for service upon receipt of equipment, movement to a new work site, unit preventive maintenance checks and services (PMCS), troubleshooting procedures, radio interference suppression, and preparation for shipment and storage.
  - e. Chapter 5. Material Used in Conjunction with the Generator Set. This chapter contains Operator and Unit Preventive Maintenance Checks and Services (PMCS), Operator and Unit Troubleshooting Procedures and Maintenance Functions for Material used with the generator set.
  - f. Appendix A contains references to all forms and publications referred to in this manual.
  - g. Appendix B contains the Maintenance Allocation Chart (MAC).
  - h. Appendix C contains Repair Parts and Special Tools List (RPSTL).
  - i. Appendix D contains Expendable and Durable Items List (EDIL).



- j. Appendix E contains the Additional Authorization List (AAL).
  - k. An Index lists all subjects in the manual in alphabetical order,
  - l. Wiring diagrams and schematics (foldouts), located in the back of the manual, are valuable aids in troubleshooting. An explanation of their use follows:
    - (1) Some of the wiring diagrams are too large for all the information to be included on a single sheet. These are separated into more than one sheet. The sheets are numbered accordingly. For example, FO-1 (sheet 2) and FO-1 (sheet 3) are numbered to indicate a continuation of FO-1.
    - (2) Individual wire numbers are shown at each item location. There is also a symbol that indicates where that wire terminates. Some wires continue to another sheet; they are indicated as to the sheet it is continued to or from.
    - (3) Both the AC and the DC systems are shown in FO-1. All of the schematics are titled to aid in the identification of functions.
    - (4) Further wire aids are included in some troubleshooting malfunctions and some maintenance functions. These are all reflected on the schematics.
3. The intent of this new format is to provide you with a manual that will let you do your job quickly, easily and with a minimum of confusion. The maintenance tasks in Chapter 4 are arranged in modules. Each module contains all the information you need to do a complete task. The illustrations associated with the task will be on the same page or a facing page where possible, making it easy for you to match the illustrations with the text.







## Chapter 1 INTRODUCTION

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### Section I. GENERAL INFORMATION

#### 1-1 SCOPE.

- a. This manual is published for the information and guidance of personnel to whom the 15 KW Diesel Engine Driven Generator Set is issued. It contains instructions for operation and unit maintenance of 50/60 Hz (Mode I) Tactical Utility (Class 2) 50/60 Hz (Mode I) Tactical Precise (Class 1) and 400 Hz (Mode II) Tactical Precise (Class 1) models of the generator set. Also included are descriptions of major components and their functions in relation to other components.
- b. Appendix A contains a list of reference publications applicable to this manual. Appendix C contains a list of maintenance and operating supplies. Appendix B contains the Maintenance Allocation Chart which determines level of maintenance responsibility for Army users. Appendix E lists additional items that are authorized.

#### NOTE

Air Force users shall accomplish maintenance at user level consistent with their capability in accordance with policies established by AFR 66-1.

1-2 LIMITED APPLICABILITY. Some portions of this publication are not applicable to all services. These portions are prefixed to indicate the service(s) to which they pertain, (A) for Army, (F) for Air Force, and (N) for Navy. Portions not prefixed are applicable to all services.

#### 1-3 MAINTENANCE FORMS AND RECORDS.

#### NOTE

This manual is used by Army, Air Force, and Navy personnel. Use of forms as directed in this manual will be accomplished only by personnel of that service to which such forms apply.

- a. (A) Maintenance forms and records used by Army personnel are prescribed by DA Pam 738-750.
- b. (F) Maintenance forms and records used by Air Force personnel are prescribed in AFR-66-1 and the applicable TO-00-20 Series Technical Orders.
- c. (N) Navy users should refer to their service peculiar directives to determine applicable maintenance forms and records to be used.

1-4 REPORTING OF ERRORS. Reports of errors, omissions, and recommendations for improvement of this publication by the individual user is encouraged. Reports should be submitted by various service personnel as follows:

- a. (A) Army - Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual direct to: Commander, US Army Aviation and Troop Command, ATTN: AMSAT-I-MP, 4300 Goodfellow Blvd., St. Louis, MO 63120-1798.
- b. (F) Air Force. AFTO Form 22 in accordance with TO-00-5-1.
- c. (N) Navy. By letter direct to: Naval Construction Battalion Center (Code 157411), Port Hueneme, CA 93043-5000.

1-5 (A) HAND RECEIPT. Hand receipt for the End/Component of End Item (COEI), Basic Issue Items (BII) and Additional Authorization List (AAL) Items are published in a Hand Receipt Manual. The Hand Receipt Manual numerical designation is the same as the related Technical Manual with the letters HR added to the number. These manuals are published to aid in property accountability and are available through: Commander, U.S. Army Adjutant General Publications Center, 2800 Eastern Blvd., Baltimore, MD 21220-2896.



1-6 **DESTRUCTION OF MATERIEL TO PREVENT ENEMY USE.** Destruction of the generator set to prevent enemy use will be in accordance with the requirements of TM 750-244-3 (Procedures for Destruction of Equipment to Prevent Enemy Use) for U.S. Army.

1-7 **SHIPMENT AND STORAGE.**

- a. (F) Preparation for shipment and storage of the generator set for U.S. Air Force will be in accordance with TO 35-1 -4.
- b. (A) Shipment and storage for the US Army will be in accordance with TB 740-97-2.

1-8 **EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR'S).** (A) EIR's can and must be submitted by anyone who is aware of an unsatisfactory condition with the equipment design or use. It is not necessary to show a new design or list a better way to perform a procedure, just tell why the design is unfavorable or why the procedure is difficult. EIR's may be submitted on SF 368. Mail directly to US Army Aviation and Troop Command, ATTN: AMSAT-BE-SEA, 4300 Goodfellow Blvd., St. Louis, MO 63120-1798.

1-9 **LEVELS OF MAINTENANCE.** The user shall refer to the Maintenance Allocation Chart (MAC) (Appx B) for tasks and categories of maintenance to be performed.

## **Section II. EQUIPMENT DESCRIPTION AND DATA**

### **1-10 DESCRIPTION.**

- a. General. The generator sets, models MEP-004A, MEP-103A, and MEP-113A (Figure 1-1 and Figure 1-3) are fully enclosed, self-contained, skid mounted, portable units. They are equipped with controls, instruments, and accessories necessary for operation as single unit or in parallel with one or more units of the same class and mode. Each set is equipped with engine oil pan heating elements and necessary connections for field installation of winterization kits. Lifting devices for hoisting the generator set are located at the top of the lifting frame and center support assembly. Tubular cross members, that will accept a chain, have been provided at the front and rear of the skid base assembly to permit towing for short distances. Mobility of the units may be obtained by mounting on trailers or equipping with a wheel mounting kit. To extend the capability of the generator sets, they have also been designed to accept and operate with the following optional kits:
  - (1) Fuel Burning Winterization Kit (paragraph 5-3).
  - (2) Electric Winterization Kit (paragraph 5-9).
  - (3) Wheel Mounting Kit (paragraph 5-15)
  - (4) Load Bank Kit (paragraph 5-20).
  - (5) Applications Kit (paragraph 5-26).
  - (6) Acoustic Suppression Kit (paragraphs 2-27 and 5-29).
  - (7) Automatic Transfer Panel 50/60 Hz. Monitors 50/60 Hz primary power and automatically starts and transfers the load to a standby generator set in the event of abnormal primary power fluctuation or failure. Continues sensing primary power and upon satisfactory resumption, will return the load to the primary power source, shut-off and recycle the generator set to a standby condition. (See Appendix A for manual.)
  - (8) Automatic Transfer Panel 400 Hz. Monitors 400 Hz power and automatically starts and transfers the load from an operating 400 Hz generator set to a like standby set in the event the operating set load contactor opens due to a faulty condition. (See Appendix A for manual.)
  - (9) Remote Control Box. Permits starting and stopping of the generator set from a remote location. (See Appendix A for manual.)
  - (10) Auxiliary Fuel Burning Winterization. Provides dependable external source of battery power for starting of the generator set in ambient temperatures from -25°F to -65°F. (See Appendix A for manual.)
  - (11) Auxiliary Electric Winterization. Provides a dependable external source of battery power for starting a generator set in ambient temperatures from -25°F to -65°F. (See Appendix A for manual.)
  - (12) Acoustic Suppression Kit. Provides noise suppression to lower sound to 70 dB(A) at 7 meters. (Refer to paragraph 1-11.)



- b. Engine. Power source of the generator set is a four cylinder, four cycle, fuel injected, liquid-cooled diesel engine. The engine electrical system contains a cranking motor, two 12-volt batteries in series, and a battery charging alternator with integral rectifier and voltage regulator. The engine is also equipped with a fuel filter and strainer assembly, a secondary fuel filter, a lubricating oil filter, and an air cleaner. Cooling water is circulated through the engine by a water pump. Safety devices automatically stop the engine during conditions of high coolant temperature, low oil pressure, no fuel, over-speed, or over-voltage.
- c. Generators. The alternating current generators are single bearing, drip-proof, synchronous, brushless, three phase, fan cooled generators. Rated voltages are maintained by excitation of the generator-exciter field by a static exciter mounted on the relay table. The cooling fan, located at the front of the generator, impels cooling air which enters the generator and passes over the windings. Safety devices are provided to protect the generator in the event of short circuit, overload, under-voltage, under-frequency, reverse power, and over-voltage.
- d. Control Cubicle. The generator set control cubicle is located at the rear top of the generator set and contains controls and instruments for operating the engine and the generator. The control panel is grounded to protect the operator from electrical shock in the event of a short in the equipment. The generator section of the control panel contains meters for monitoring generator output, adjusting knobs for increasing and decreasing frequency (Class 1 only) and voltage, and a circuit breaker switch for interrupting all output from the generator set. Also included on the generator control panel are an operations switch and synchronizing lights for operating the set as a single unit or in parallel with other units. The engine section of the control panel contains switches for priming, starting, and stopping the engine and meters for monitoring set fuel level, oil pressure, and coolant temperature. Also included is an ammeter for the battery charging alternator.
- e. Electric/Electro-Hydraulic Governing System (Precise Sets Only). The electric governing system senses speed and load electrically and provides the controls and load responses necessary for effective single unit or parallel operation. The system consists of a rheostat for frequency adjustment, a load measuring unit for sensing load changes, and a governor control unit which signals the actuator for rapid governor response. The MEP-103A and some MEP-113A generator sets use an electro-hydraulic governing system, which includes a hydraulic actuator, a hydraulic pump, and a hydraulic sump. Other MEP-113A sets use an electric-magnetic actuator.
- f. Mechanical Governing System (Utility Sets Only). The mechanical governing system provides the controls and load responses necessary for efficient single unit, or parallel, operation of utility generator sets. Engine rpm and set frequency are controlled by the mechanical governor, an integral part of the fuel injection pump, which actuates the fuel metering valve. Adjustment of engine rpm and set frequency is accomplished by use of a manual speed control located adjacent to the control cubicle. This control is a knob type device which permits rapid frequency adjustment, locking in any position, and vernier adjustment for finer control.



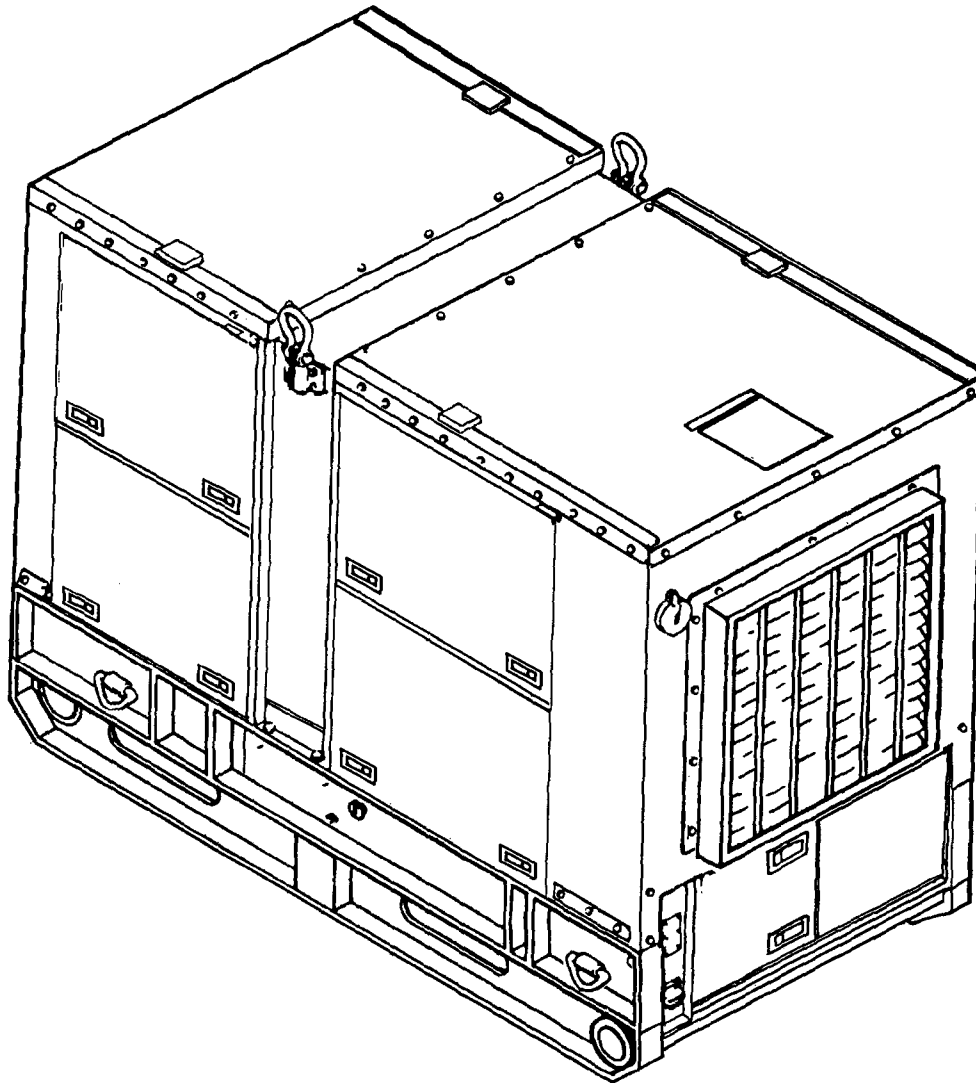


Figure 1-1. Engine Generator Set, Right-Front, Three-Quarter View



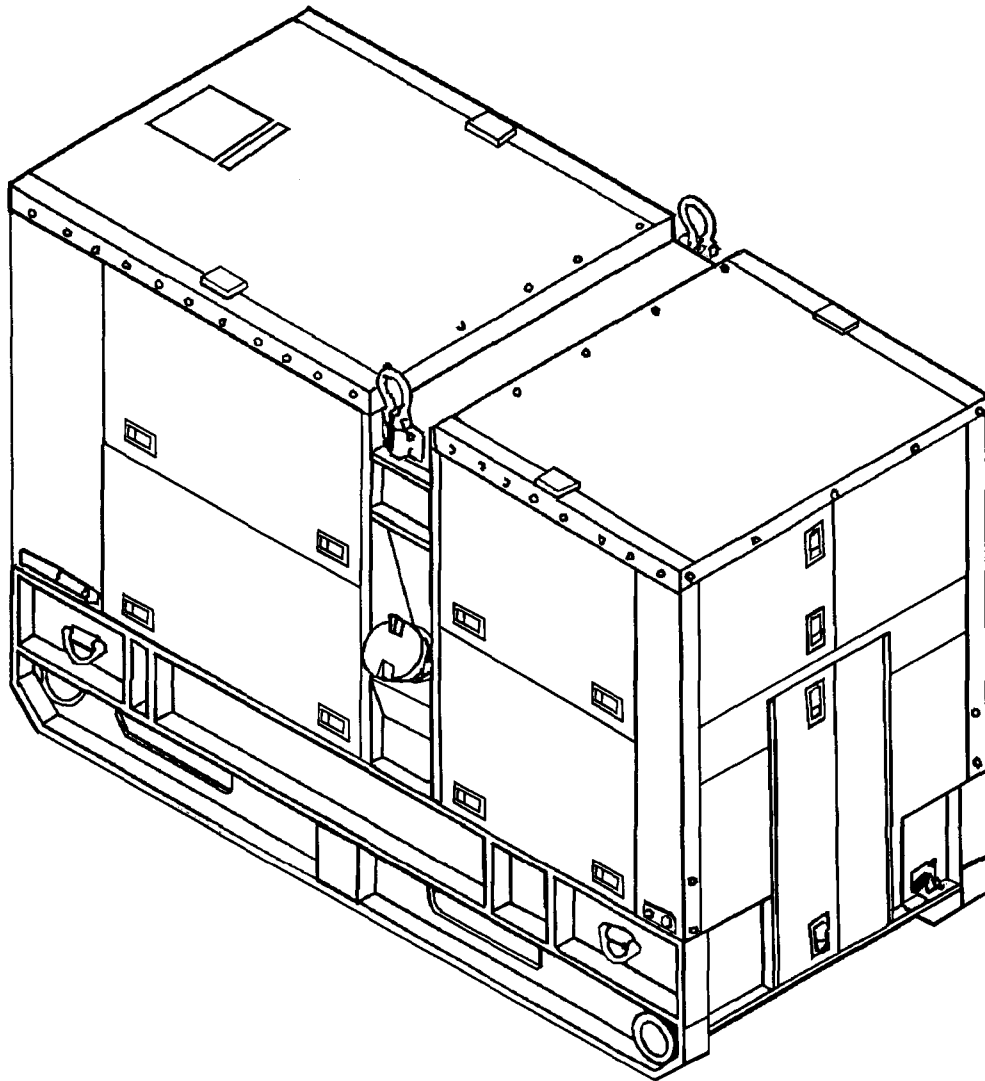
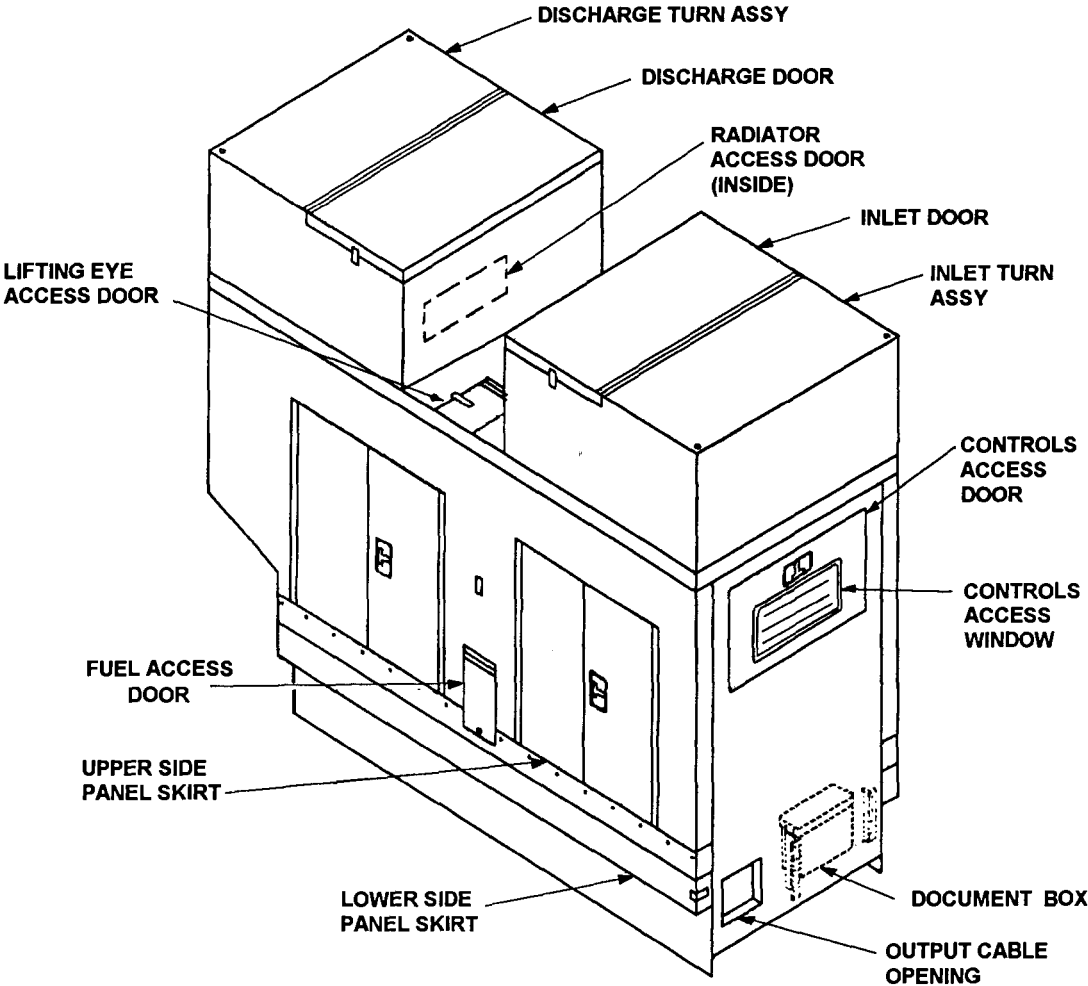


Figure 1-2. Engine Generator Set, Left-Rear, Three-Quarter View





SHIPPING DIMENSIONS AND WEIGHTS			
	50/60 Hz	400 Hz	Acoustic Suppression Kit (Not Installed)
Weight	3766 lb	3891 lb	1292 lb
Length	98.1 in.	98.1 in.	98.1 in.
Height	75.8 in.	75.8 in.	75.8 in.
Width	41.4 in.	41.4 in.	41.4 in.

Figure 1-3. Acoustic Suppression Kit



1-11 IDENTIFICATION AND TABULATED DATA.

- a. Identification. There are eleven major identification and instruction plates on the generator set.
- (1) Generator Set Identification Plate. Located at the top left side of the front housing assembly. Specifies nomenclature, model number, serial number, stock number, contract number, engine serial number, manufacturer, and shipping weight and dimensions.
  - (2) Generator Set Rating Plate. Located at top left side of front housing adjacent to generator set identification plate. Specifies kilowatt capacity relative to altitude and temperature, hertz rating, rated voltages and phases, voltage adjustment ranges, power factor, type, class, mode and size.
  - (3) Fuel System Diagram Plate. Located on inside face of left side generator compartment access door. Contains diagram of fuel system.
  - (4) Operating Instruction Plate. Located on inside face of right hand control panel-access door. Specifies prestart checks, starting sequence, stopping sequence, and instructions for parallel operation.
  - (5) Schematic and Troubleshooting Diagram Plates. Troubleshooting plate is located on inside face of right and left engine compartment doors. A schematic diagram plate is located on the inside of the battery doors of the power generation and control circuits.
  - (6) Winterization System Diagram and Caution Plates (furnished with Winterization Kit). Installed on inside face of left rear upper control and lower left vent door. Specifies installation and operation of winterization systems. Also includes cautions pertinent to operation of winterization kits.
  - (7) Lifting and Tie-Down Attachment Information Plate. Located on lower right gear generator compartment door. Specifies center of gravity, tie-down location, lifting shackle location and capacity and direction of travel.
  - (8) Battery Reconnection Instruction Plate. Located inside face of battery compartment access door. Contains diagram of battery installation and specifies cautions to be observed when replacing batteries.
  - (9) Generator Identification Plate. Located on upper right side of generator housing. Specifies nomenclature, part number, style, rated rpm, frequency, serial number, kva rating, P/F, ampere rating, voltage, and manufacturer.
  - (10) Engine Identification Plate. Located on left side of engine block. Specifies manufacturer, manufacturer's specification, model number, serial, date of manufacture, bore, stroke, displacement, maximum continuous speed, maximum set continuous brake horsepower, lube oil pressure, firing order, intake and exhaust valve tappet clearances, and military specification.
  - (11) Voltage Reconnection Plate. Located on terminal guard over voltage reconnection board. Contains instructions for reconnecting the generator from 120/208 to 240/416 volts and reconfiguration back to 120/208 volts.
- b. Tabulated Data.
- (1) Engine Generator Set (End Item).

Model Numbers:

50/60 Hz Tactical Utility . . . . .	MEP-004A
50/60 Hz Tactical Precise . . . . .	MEP-103A
400 Hz Tactical Precise . . . . .	MEP-113A



DOD Drawing Numbers:

MEP-004A .....	70-004
MEP-103A .....	70-103
MEP-113A .....	70-113

Overall Dimensions and Weights:

Overall length (MEP-004A, MEP-103A, and MEP-113A) .....	70 inches
Over all width (MEP-004A, MEP-103A, and MEP-113A) .....	36 inches
Over all height (MEP-004A, MEP-103A, and MEP-113A) .....	55 inches

Dry Weights (less kits and optional equipment):

MEP-004A .....	2450 pounds
MEP-103A .....	2450 pounds
MEP-113A .....	2500 pounds

(2) Engine:

Manufacturer .....	White Engines, Inc. Hercules Engine Div.
Model .....	D-198-ERX51
DOD drawing number .....	72-2222
Type .....	4 cylinder, four cycle, liquid cooled diesel
Rated horsepower at 1500 RPM .....	35 continuous
Rated horsepower at 1800 RPM .....	41 continuous
Rated horsepower at 2000 RPM .....	45 continuous
Altitude degradation, 5000 to 8000 ft. ....	3% per 1000 feet
Firing order .....	1,2,4,3
Winterization kit use .....	When temperature is -25°F or below
Valve tappet clearance adjustment:	
Hot .....	0.015 Inch

(3) Cooling System:

Type .....	Pressurized radiator and centrifugal pump
Capacity .....	18.6 qts.
Normal operating temperature .....	170°F (75.7°C) to 200°F (93.3°C)
Temperature transmitter voltage rating .....	24Vdc
Resistance (ohms) at temperature °F (°C):	
2360 ± 236 .....	120 (48.9)
710 ± 35.5 .....	200 (93.7)
310 ± 24.8 .....	280(133)

(4) Lubrication System:

Type system .....	Full flow, circulating pressure
Oil pump type .....	Positive displacement gear
Normal operating pressure .....	30-60 psig
Oil filter type .....	Full flow, replaceable element
Pressure transmitter Voltage rating .....	24Vdc
Resistance (ohms) at pressure (psi):	
15.0 .....	30
30.0 .....	60
Lubrication system capacity .....	8.0 quarts



(5) Hydraulic System (Electro-Hydraulic Governor Equipped Precise Sets Only):

Hydraulic pump type . . . . . positive displacement gear  
Hydraulic filter type . . . . . Full flow, replaceable element  
System capacity . . . . . 1 gallon

(6) Fuel System:

Fuel tank capacity . . . . . 15.0 gallons  
Fuel transfer pumps:  
Voltage rating . . . . . 24Vdc  
Delivery pressure . . . . . 7 psig (max)  
Delivery rate . . . . . 18 gallons per hr. (max)  
Fuel level switch (day tank):  
Type . . . . . Float  
Current . . . . . 3.0 amp at 6 to 32 Vdc  
Pressure . . . . . 0 to 150 psi  
Over travel:  
High . . . . . 0.06 inch (min)  
Low . . . . . 0.12 inch (rein)  
Fuel injection nozzle holder cracking pressure . . . . . 2500 - 2950 psig

(7) Engine Electrical System:

Batteries . . . . . Two 12 volt (MS35000-3) connected in series  
Starter Assembly:  
Manufacturer . . . . . Delco Remy, Inc.  
Model . . . . . 1113188  
Rating:  
Voltage . . . . . 24 Vdc  
Drive type . . . . . Positive indexing with over run clutch  
Battery Charging alternator:  
Manufacturer . . . . . Prestolite  
Model . . . . . ANJ-7001  
Rating . . . . . 35 amp at 24 Vdc  
Operating temperature range . . . . . -65°F to 175°F (-53.9°C to 79.4°C)  
Current output . . . . . 0 to 35 amperes at 1900 to 4000 rpm  
Protective fuse . . . . . Buss, AGS, 40 amp

(8) Generator (50/60 Hz Tactical Utility and Tactical Precise):

Manufacturer . . . . . Electric-Machinery Mfg. Co.  
DOD drawing number . . . . . 72-2400  
Type . . . . . Rotating field synchronous, brushless  
Load capacity:  
1500 rpm . . . . . 12.5 kw at 50 Hz  
1800 rpm . . . . . 15 kw at 60 Hz  
Current rating:  
1500 rpm . . . . . 43 amp at 120/208 Vac 21.5 amp at 240/416 Vac  
1800 rpm . . . . . 52 amp at 120/208 Vac 26 amp at 240/416 Vac  
Power factor . . . . . 0.8  
Cooling . . . . . Impeller fan  
Lubrication requirements . . . . . None  
Drive type . . . . . Direct coupling  
Duty classification . . . . . Continuous



(9) Generator (400 Hz Tactical Precise):

Manufacturer ..... Electric-Machinery Mfg.  
 DOD drawing number ..... 72-2450  
 Type ..... Rotating field synchronous, brushless  
 Load capacity (2000 rpm) ..... 15 kw at 400 Hz  
 Current rating (2000 rpm) ..... 52 amps at 120/208 Vac or 26 amps at 240/416 Vac  
 Power factor ..... .0.8  
 Cooling ..... Impeller fan  
 Lubrication requirements ..... None  
 Drive type ..... Direct coupling  
 Duty classification ..... Continuous

(10) Electro-hydraulic Governing System (MEP-103A and Some MEP-113A):

Type system ..... Closed loop feedback  
 Load measuring unit:  
 Manufacturer ..... Electromagnetic Industries, Inc.  
 Model No ..... 69-500  
 DOD drawing number ..... 69-785  
 Governor control unit:  
 Manufacturer ..... Electromagnetic Industries, Inc.  
 Model No.  
 50/60 Hz ..... 69-700  
 400 Hz ..... 69-800  
 DOD drawing number ..... 69-784  
 Hydraulic actuator unit:  
 Manufacturer ..... Electromagnetic Industries, Inc.  
 Model No. .... 69-600-3  
 DOD drawing number ..... 69-790

(11) Electric Governing System (MEP-113A only):

Type system ..... Closed loop feedback  
 Load measuring unit:  
 Manufacturer ..... Electromagnetic Industries, Inc.  
 Model No. .... 69-500  
 DOD drawing no. .... 69-785  
 Governor control unit:  
 Manufacturer ..... United Technologies  
 Model no. .... CU 671C-7  
 DOD drawing no. .... 81-4903  
 Electric actuator:  
 Manufacturer ..... United Technologies  
 Model no. .... AGB-130-D4  
 DOD drawing no. .... 81 -705

(12) Safety Devices:

(a) Low oil pressure switch:

Voltage rating ..... 28Vdc  
 Current rating ..... 10 amps  
 Trip pressure ..... 17±3 psig



(b) Coolant high temperature switch:

Voltage rating . . . . . 28Vdc  
Current rating . . . . . 10 amps  
Trip temperature . . . . . 220°F±3°F (104.8°C±1.5°C)

(c) Speed switch:

Type . . . . . Centrifugal. manual reset  
Over speed trip . . . . . 120 to 122.5 percent continuous engine speed, 2400 to 2450 rpm,  
engine speed is 1200 to 1225 rpm, switch speed).

Element trip and reset:

- S9-1. Trip - 290-310 rpm. Reset -190 -310 rpm
- S9-2. Trip-590-610 rpm 50/60 Hz) 825-850 rpm (400 Hz). Reset-490-510 rpm (50/60 Hz) 725-750 rpm  
(400 Hz)
- S9-3. Trip - 1200-1250 rpm. Reset-Manual

(13) Nut and Bolt Torque Data:

Intake manifold mounting nuts. . . . . 35 lb-ft  
Exhaust manifold mounting nuts . . . . . 35 lb-ft  
Low oil pressure switch . . . . . 20 lb-ft  
Oil filter . . . . . 27 ±2 lb-ft  
Oil pressure transmitter . . . . . 20 lb-ft  
Fuel injector mounting screws . . . . . 30-40 lb-ft  
Fuel filter . . . . . 17 ±2 lb-ft  
Over temperature switch . . . . . 12-15 lb-ft  
Coolant temperature transmitter. . . . . 12-15 lb-ft

(14) Optional Equipment:

(a) Fuel burning winterization kit:

DOD drawing number . . . . . 72-2837  
Operating temperature . . . . . -25°F (-31.7°C) to -65°F (-53.9°C)  
Operating voltage . . . . . 24Vdc  
Operating current:  
Starting . . . . . 17.5 amperes  
Running . . . . . 7.5 amperes  
Fuel consumption . . . . . 20 to 23 cc/min.  
Duty cycle . . . . . Continuous

(b) Electric winterization kit:

DOD drawing number . . . . . 72-2836  
Operating voltage . . . . . 208 to 240 volts, 50/60 or 400 Hz single phase  
Operating current . . . . . 14.6 to 12.5 amperes  
Operating temperature . . . . . 130°F (54.4°C) to 155°F (67.4°C)

(c) Wheel mounting kit:

DOD drawing number . . . . . 72-2833  
Capacity maximum . . . . . 3500 lbs.  
Towing speed (maximum) . . . . . 5 MPH



(d) Load bank kit:

DOD drawing number . . . . . 72-2803  
Load rating . . . . . 7.5 KW  
Operating voltage . . . . . 120/208 or 240/416 Vac 3 Phase 4 wire

(e) Applications kit:

MERADCOM drawing number. . . . . 13220E8189  
Load rating . . . . . 840 watts  
Operating voltage . . . . . 24 Vdc

(f) Acoustic suppression kit:

Model number . . . . . MEP-004AAS  
Weight increase to generator set. . . . . 1292 lb.  
Cube of generator set with kit installed . . . . . 178.2 cubic feet

- (15) Fuel System Diagram. Refer to Figure 1-7.
- (16) Hydraulic System Diagram. Refer to Figure 1-12.
- (17) AC and DC, 15 and 30KW, 50/60 and 400 Hz, Precise and Utility, Wiring Diagram, Dwg. No. 72-2205. Refer to figure FO-1.
- (18) AC Schematic Diagram, 15 and 30 KW, Precise Generator Sets, Dwg. No. 72-2200. Refer to figure FO-2.
- (19) DC Schematic Diagram, 15 and 30 KW, Precise Generator Sets, Dwg. No. 72-2269. Refer to figure FO-3.
- (20) AC Schematic Diagram, 15 and 30KW, Utility Generator Sets, Dwg. No. 72-2295. Refer to figure FO-4.
- (21) DC Schematic Diagram, 15 and 30KW, Utility Generator Sets, Dwg. No. 72-2277. Refer to figure FO-5.
- (22) Shipping Dimensions and Weights. Refer to Figure 1-3.

**1-12 DIFFERENCES BETWEEN MODELS.** The primary differences between the models of the generator sets covered in this manual are as follows:

- a. Models MEP-004A and MEP-103A are equipped with a 50/60 Hz generator. Model MEP-113A is equipped with a 400 Hz generator.
- b. Models MEP-103A and some MEP-113A use an electro-hydraulic governor. Other Models MEP-113A use an electric governor. Model MEP-004A uses a mechanical governor which is integral with the fuel injection pump.
- c. The control cubicle of all three models have a frequency adjust rheostat, but it is functional only on models MEP-103A and MEP-113A. Model MEP-004A accomplishes frequency adjustment through the manual speed control.
- d. All three models use the same special relay box, but models MEP-103A and MEP-113A are also equipped with a precise relay box. The two precise relay boxes are identical with the exception that the precise relay box of model MEP-103A contains a frequency selector switch whereas the precise relay box of model MEP-113A does not.
- e. Models MEP-103A and MEP-004A use the same exciter regulator assembly and crosscurrent transformer. These components are different on model MEP-113A.
- f. Differences in performance characteristics are given in Table 1-1.



**Table 1-1. Differences in Performance Characteristics**

	MEP 004A	MEP 103A	MEP 113A
1. Voltage regulation:			
(a) Dip with application of rated load.	20% (max)	15% (max)	12% (max)
(b) Rise with rejection of rated load.	20% (max)	15% (max)	12% (max)
(c) Dip with application of simulated motor load.	40% (max)	30% (max)	25% (max)
(d) Adjustment range Vac	50 Hz: 380-426 60 Hz: 395-480	50 Hz: 380-426 60 Hz: 395-480	400 Hz: 395-458
2. Frequency:			
(a) Regulation	2.0 to 3.0% of rated frequency	0.25% of rated frequency	0.25% of rated frequency
(b) Short term steady state stability	Within 2.0% bandwidth	Within 0.5% bandwidth	Within 0.5% bandwidth
(c) Long term steady state stability	Within 3% bandwidth	Within 1% bandwidth	Within 1% bandwidth
(d) Undershoot with application of	4% of rated frequency (max)	1.5% of rated frequency (max)	1.5% of rated frequency (max)
(e) Recovery time after application of rated load	3 seconds (max)	1 second (max)	1 second (max)
(f) Overshoot with rejection of	3% of rated frequency (max)	1.5% of rated frequency (max)	1.5% of rated frequency (max)
(g) Recovery time after rejection of rated load	3 second (max)	1 second (max)	1 second (max)
(h) Drift (60° F temperature change)	1% rated frequency (max)	0.5% rated frequency (max)	0.5% rated frequency (max)
(i) Approximate adjustment range)	58 to 62 Hz for 60 Hz operation (48 to 52 Hz for 50 Hz operation)	58 to 62 Hz for 60 Hz operation (48 to 52 Hz for 50 Hz operation)	390 to 410 Hz



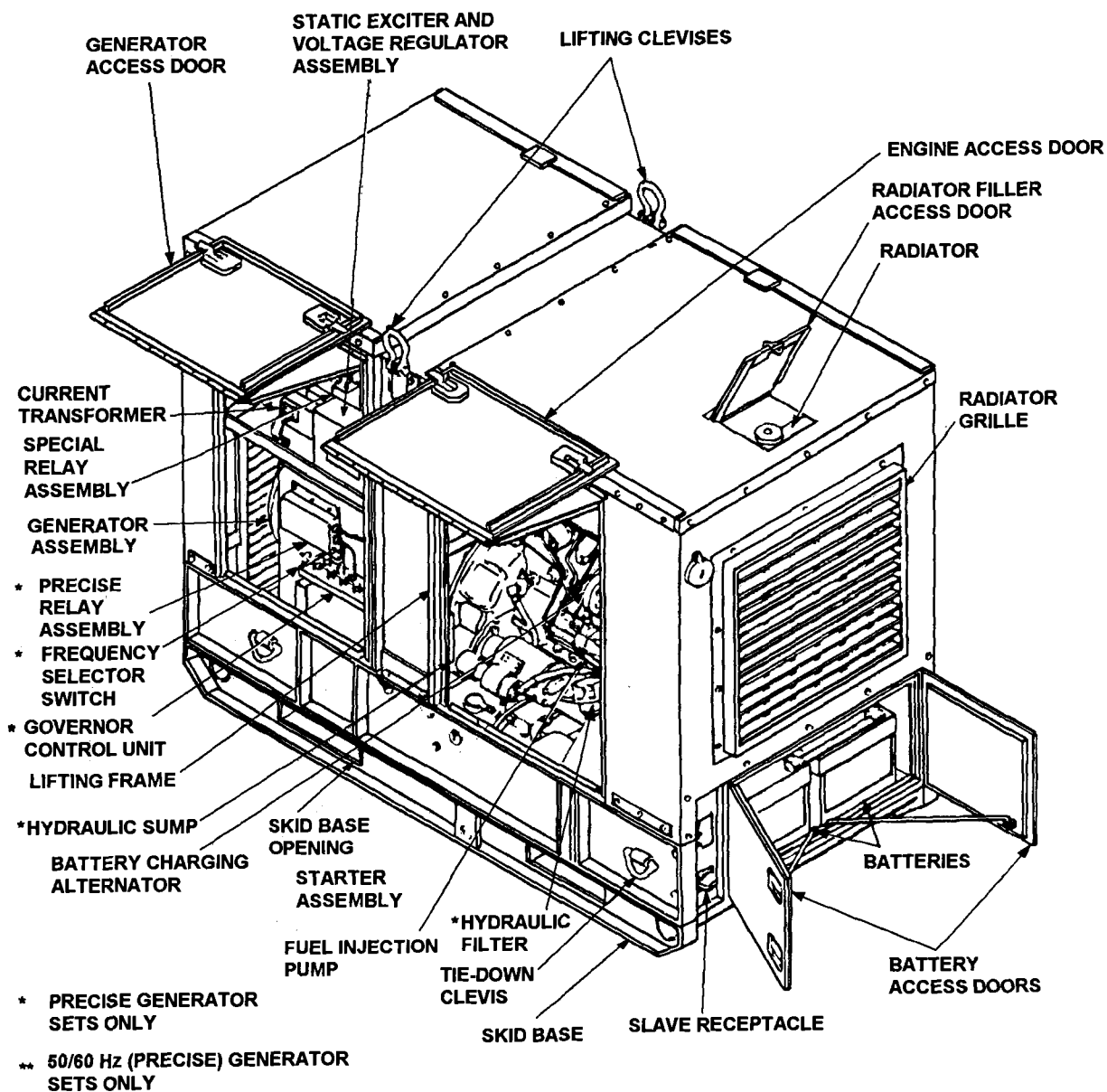
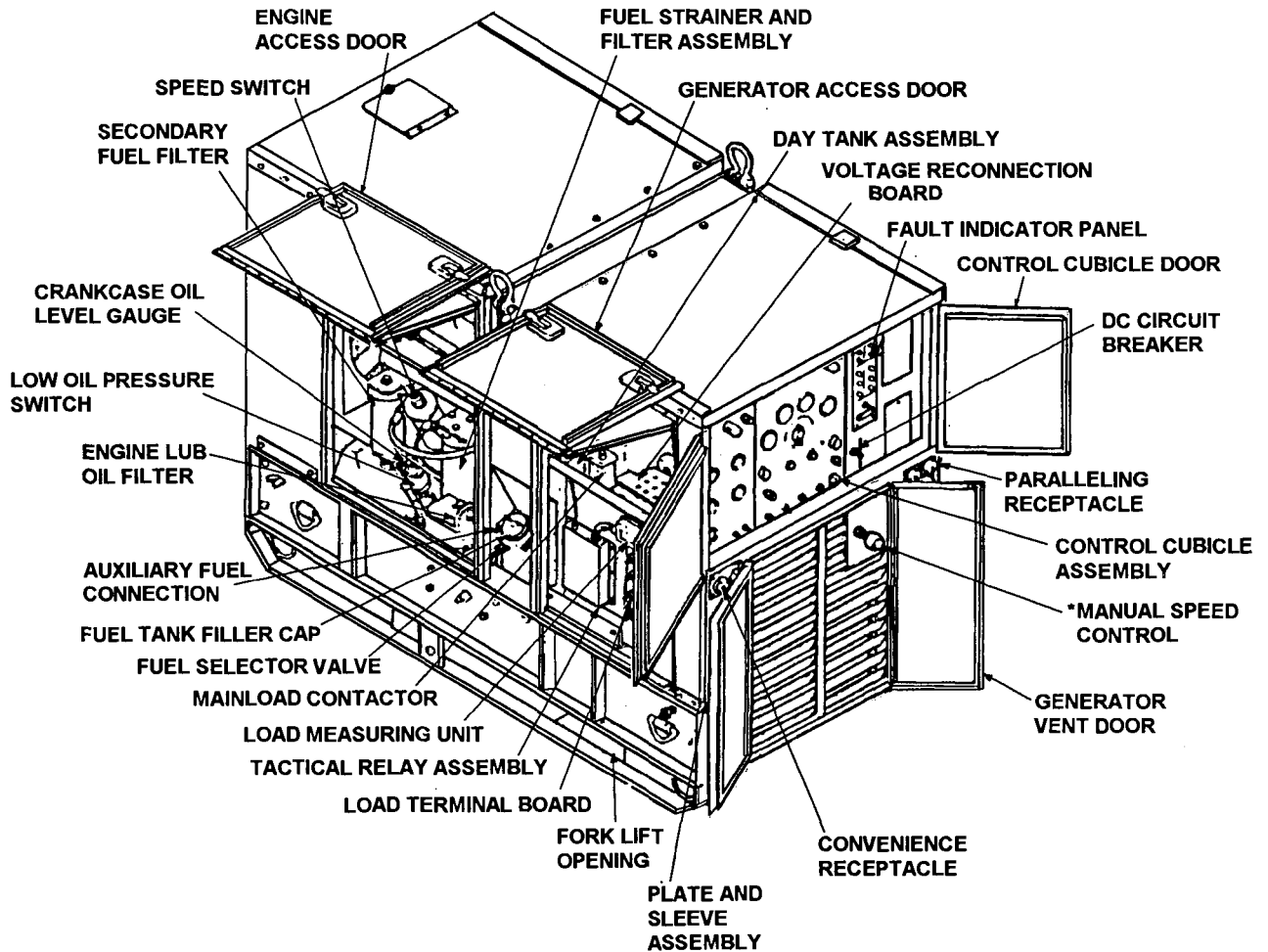


Figure 1-4. Engine Generator Set, Right-Front, Three-Quarter Internal View





\* NOT OPERATIONAL  
ON PRECISE SETS

SHIPPING DIMENSIONS AND WEIGHTS				
WEIGHT		50/60 Hz UTILITY	50/60 Hz PRECISE	400 Hz PRECISE
	CRATED	3090 lbs (1401.6 kg)	3090 lbs (1401.6 kg)	3140 lbs (1424.3 kg)
	UNCRATED	2450 lbs (1111.3 kg)	2450 lbs (1111.3 kg)	2500 lbs (1133.9 kg)
LENGTH	CRATED	84 in (213.4 cm)	84 in (213.4 cm)	84 in (213.4 cm)
	UNCRATED	70 in. (177.8 cm)	70 in. (177.8 cm)	70 in. (177.8 cm)
HEIGHT	CRATED	68-3/16 in. (173.2 cm)	68-3/16 in. (173.2 cm)	68-3/16 in. (173.2 cm)
	UNCRATED	55 in. (139.7 cm)	55 in. (139.7 cm)	55 in. (139.7 cm)
WIDTH	CRATED	44.75 in. (113.7 cm)	44.75 in. (113.7 cm)	44.75 in. (113.7 cm)
	UNCRATED	36 in. (91.44 cm)	36 in. (91.44 cm)	36 in. (91.44 cm)

Figure 1-5. Engine Generator Set, Left-Rear, Three-Quarter Internal View



### Section III. PRINCIPLES OF OPERATION

1-13 INTRODUCTION. This section contains functional descriptions of the 15 kw generator set and explains how the controls and indicators interact with the system.

#### 1-14 ENGINE STARTING SYSTEM.

- a. The engine starting system (Figure 1-6) consists of two 12-volt batteries, a starting motor and a 24-volt battery charging alternator. With the START/RUN/STOP switch at START position, battery power is supplied to the starting motor through a relay and solenoid switch. The starting motor engages the engine flywheel causing the engine to turn over. After the engine starts, the starting circuit is de-energized when the START/RUN/STOP switch is set to RUN position. The generator set engine is stopped by positioning the START/RUN/STOP switch to STOP.
- b. The batteries are charged by the alternator that is belt driven by the engine. Generator set control system power is also supplied by the alternator. The battery charging ammeter is a dial indicator type gauge which measures DC current flow to and from the battery. It is calibrated in 1 ampere increments from -10 to +20. Normal indication of the meter is dependent upon the state of the battery. A low charge such as exists immediately after engine starting, will result in high reading. When enough charge has been restored to the battery the indicator should move near 0.

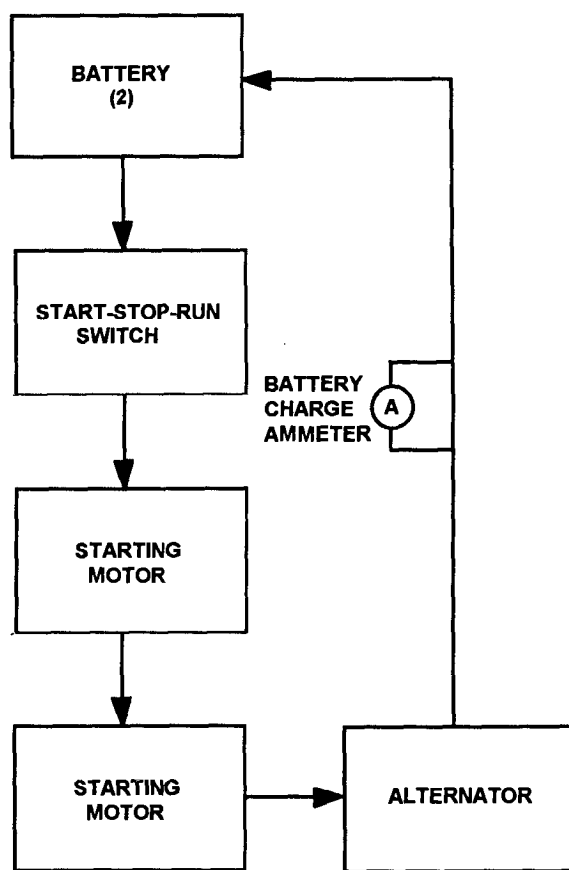


Figure 1-6. Engine Starting System



## 1-15 FUEL SYSTEM.

- a. The fuel system (Figure 1-7) consists of piping, fuel tank, transfer pumps, fuel filters, strainer assembly, heater fuel valve, fuel solenoid, day tank, secondary filters, injection pump, and injectors. Fuel is drawn from the generator day tank by the transfer pump when the START/RUN/STOP switch is in the RUN position. After reaching the transfer pump, fuel passes through a fuel filter and strainer where water is removed. Then the fuel goes through a filter where small impurities are removed. Then the fuel goes through the fuel solenoid into the day tank and passes through the secondary fuel filter to remove impurities. The fuel also goes to an injection pump where it is pressurized and forced through the injectors into the combustion chamber, where it is mixed with air and ignited. The unused fuel is returned to the generator day tank via an excess fuel return line.
- b. The Auxiliary Fuel System consists of a main fuel tank piping and fuel selector valve. When the START/RUN/STOP switch is set to RUN, it actuates the fuel transfer pumps and transfers fuel from the auxiliary tank to the generator fuel system. The fuel level gauge is a liquid quantity indicator gauge which is calibrated 1/4 increments of tank quantity from E (empty) to F (full). The fuel level gauge indicates the level of fuel in the main fuel tank. The fuel selector valve is a three-way valve. It selects either the integral tank or the auxiliary source for fuel. It also serves as a shutoff valve.

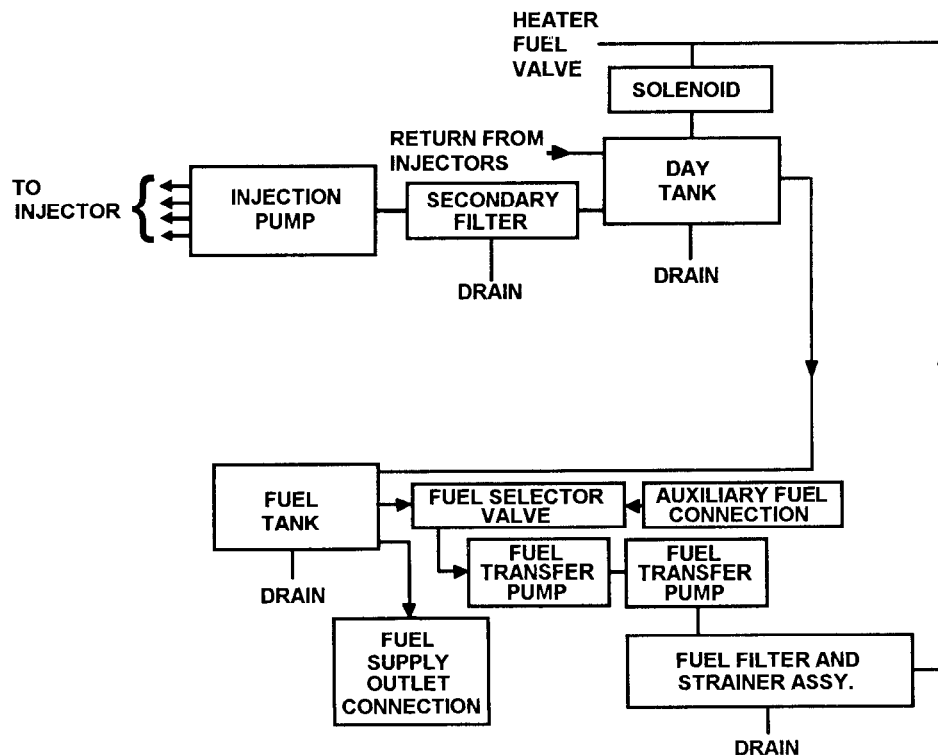


Figure 1-7. Fuel System Diagram



**1-16 ENGINE COOLING SYSTEM.** The engine cooling system (Figure 1-8) consists of a radiator, hoses, thermostat, water pump, a belt driven fan, cooling jacket and oil cooler. The water pump forces coolant through passages (cooling jackets) in the engine block and cylinder head where the coolant absorbs heat from the engine. When the engine reaches normal operating temperature, the thermostat opens and the heated coolant flows through the upper radiator hose assembly into the radiator tubes. The cooling fan circulates air through the radiator where the coolant temperature is reduced. The coolant high temperature indicator is an indicator lamp with a red lens. It illuminates when the coolant temperature rises above  $217 \pm 3^{\circ}\text{F}$  and the high coolant temperature protective device actuates. The coolant temperature gauge is a dial indicator type gauge which is calibrated in degrees Fahrenheit from 120 to 240. Normal operation indication is  $170^{\circ}\text{F}$  ( $76.7^{\circ}\text{C}$ ) to  $200^{\circ}\text{F}$  ( $93.3^{\circ}\text{C}$ ).

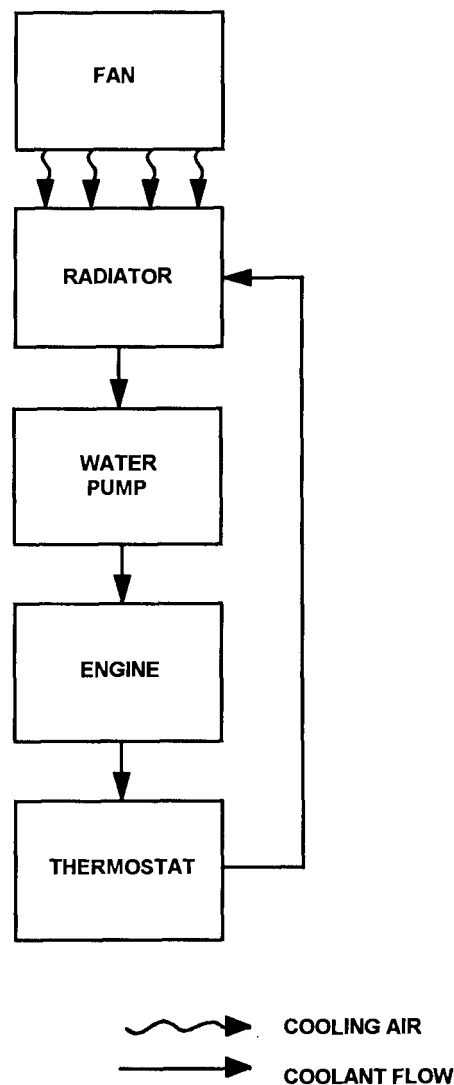
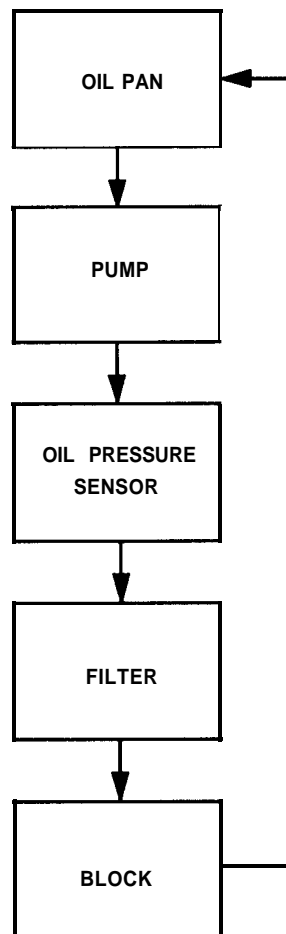


Figure 1-8. Engine Cooling System



**1-17 ENGINE LUBRICATION SYSTEM.** The Engine Lubrication System (Figure 1–9) consists of an oil pan, dipstick, pump, pressure sensor, filter, and oil level sensor. The oil pan is a reservoir for engine lubricating oil. The dipstick indicates oil level in the oil pan. A pump draws oil from the oil pan and through a screen removing large impurities. The oil then passes through a canister type filter where small impurities are removed. From the filter, oil is distributed to the engine's internal moving parts. After passing through the engine block, the oil returns to the oil pan. The engine pressure gauge is a dial indicator type gauge which is calibrated in psig from 0 to 60. It measures engine lubrication oil pressure. Normal indication is from 20 to 55 psig. The engine will shut off automatically if the oil pressure drops below 20 psi.



**Figure 1–9. Engine Lubrication System**



#### 1-18 AIR INTAKE AND EXHAUST SYSTEM.

- a. The air intake and exhaust system (Figure 1-10) consists of a filter, restriction indicator, intake manifold, breather tube, exhaust manifold, muffler, and piping. Ambient air is drawn into an air filter where it passes through the filter element. Airborne dirt is removed and trapped in the filter. The air cleaner assembly is equipped with a condition transducer. The condition transducer measures the vacuum created by the air cleaner condition indicator or when the filter needs servicing. Filtered air is drawn out of the filter through air intake tubes to the air intake manifold where it passes into the combustion chambers and is mixed with fuel from the injectors.
- b. The engine exhaust gases are expelled into the exhaust manifold. The exhaust manifold channels the gases into the muffler that deadens the sound of the exhaust gases. The gases pass from the muffler through the exhaust piping and are vented upward from the generator set housing. The breather tube provides an escape route for gases which accumulate in the crankcase during engine operation. The gases pass through the breather, located in the engine valve cover, and are expelled into the air cleaner housing through the breather tube.

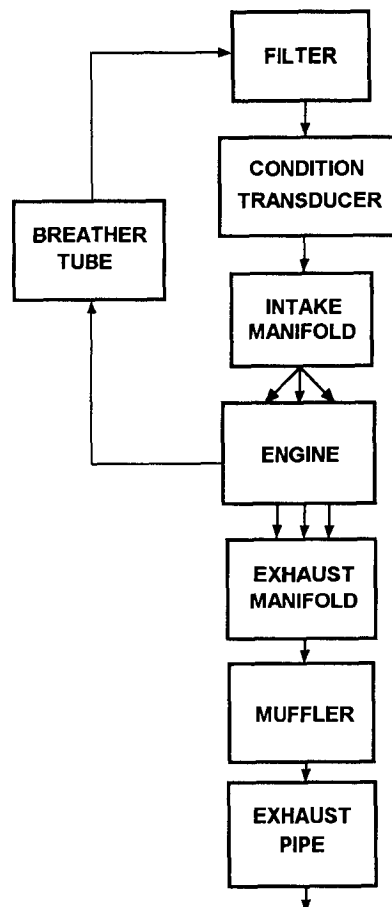


Figure 1-10. Air Intake and Exhaust System



**1-19 OUTPUT SUPPLY SYSTEM.** The Output Box contains four output terminals (Figure 1-11), L1, L2, L3, L0. Power generated by the generator set is supplied to the output terminals through the voltage reconnection board. The voltage reconnection board allows the generator to supply 120/208 or 240/416 Vac to the output terminals. The CKT BKR switch closes and opens the main load contactor. This enables or interrupts the power output terminals. It selects current in each phase, three line-to-line voltages, and three line-to-neutral voltages which are indicated on the ammeter and voltmeter.

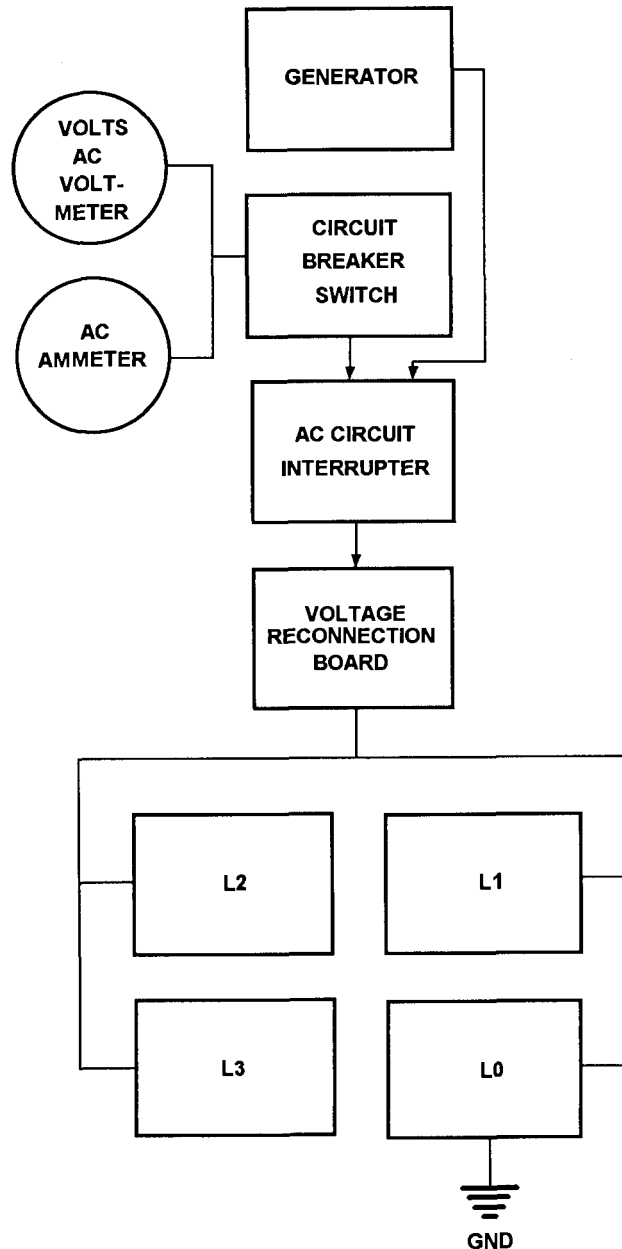
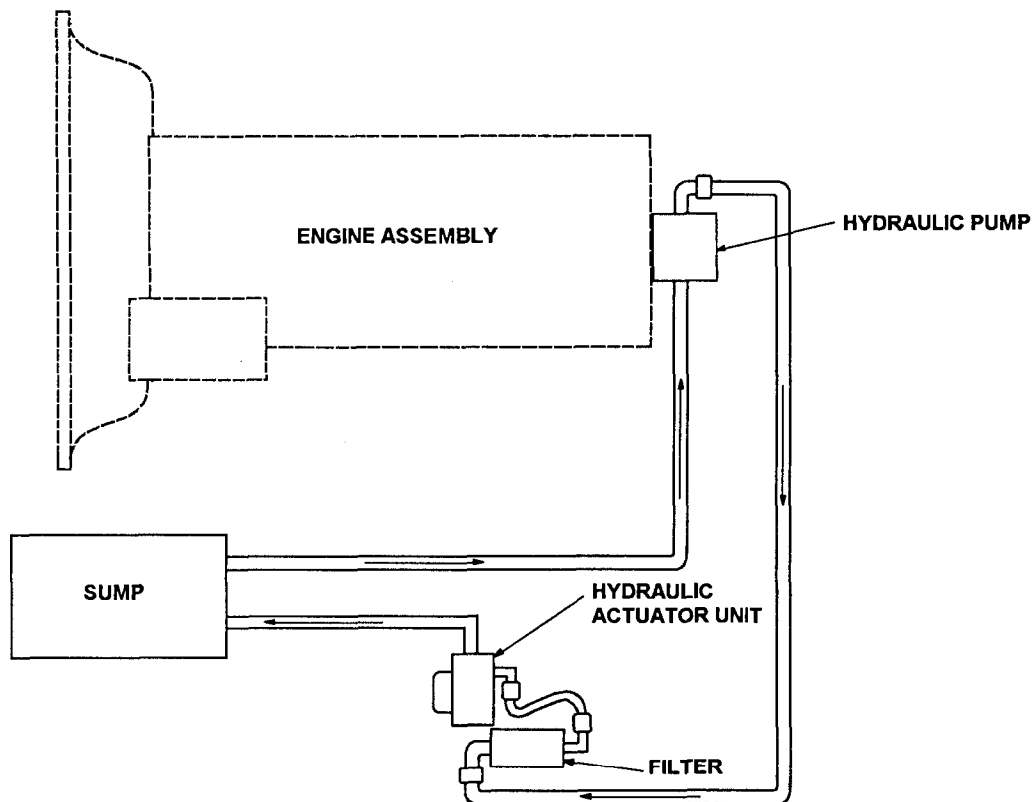


Figure 1-11. Output Supply System



**1-20 HYDRAULIC SYSTEM.** The hydraulic system (Figure 1-12) is used on the electro-hydraulic governor equipped precise generator sets. Its function is to provide precise frequency control. The system consists of a sump, a replaceable element type filter, a gear driven positive displacement type pump, a pressure relief valve, a hydraulic actuator and interconnecting lines. The hydraulic fluid is pumped from the sump through the hydraulic pump to the filter. The pressurized filtered fluid is routed through the hydraulic actuator and back to the sump. The actuator hydraulically operates the governor control linkage to change the governor setting. Changing the governor setting increases or decreases the engine speed causing a corresponding increase or decrease in generator output frequency.



**Figure 1-12. Hydraulic System Diagram  
(Electo-Hydraulic Governor Equipped Precise Sets Only)**

**1-21 ELECTRONIC GOVERNING SYSTEM.** The electronic governing system senses speed and load electrical-ly and provides the controls and load responses for effective single unit or parallel operation. The system consists of a rheostat for frequency adjustment, a load measuring unit for sensing load changes and a governor control unit which signals the actuator for rapid governor response.



## Chapter 2 OPERATING INSTRUCTIONS

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### Section 1. OPERATING PROCEDURES

**2-1 GENERAL.** This section describes and illustrates the various controls and instruments and provides the operator with sufficient information to insure proper operation of the generator set.

#### **2-2 CONTROLS AND INSTRUMENTS.**

- a. General. The generator set controls and instruments are illustrated in Figure 2-1.
- b. Panel Illumination Light (1, Figure 2-1). The panel illumination lights are 30 volt, 0.6 amp, candelabra bayonet base incandescent lamps with a clear finish. Each lamp is fitted with a hood which is slotted on the bottom to direct light onto the control panel. The panel illumination lights are controlled by the PANEL LIGHTS switch.
- c. Air Cleaner Condition Indicator (2, Figure 2-1). The air cleaner condition indicator is a press-to-test lamp with a red lens. It illuminates to indicate that the engine air cleaner is clogged.
- d. Frequency Meter (3, Figure 2-1). The frequency meter is a dial indicator type gauge. For the 50/60 Hz tactical precise and tactical utility, the meter is calibrated from 48 to 62 Hertz in 0.1 Hertz increments with the region between 53 and 57 Hertz unmarked. For the 400 Hz tactical precise model, the meter is calibrated in 0.5 Hertz increments from 388 to 412. The frequency meter indicates the frequency of the generator set output. Normal indication is 400 Hz for Mode II generator sets. For Mode I generator sets, normal indication is determined by the manual speed control adjustment (50 or 60 Hz).
- e. Kilowatt Meter (4, Figure 2-1). The kilowatt meter is a dial indicator type gauge calibrated in percent of rated output from 0 to 133. It indicates the generator set power output. Normal indication depends on applied load.
- f. Volts-Amps Transfer Switch (5, Figure 2-1). The VOLTS-AMPS transfer switch is a rotary type switch. It selects current in each phase, three line-to-line voltages, and three line-to-neutral voltages which are indicated on the ammeter and voltmeter.
- g. AC Ammeter (6, Figure 2-1). The ac ammeter is a dial indicator type gauge. For the 50/60 Hz tactical precise and tactical utility models, it is calibrated in percentage or rated current from 0 to 133 for 60 Hz operation and from 0 to 160 for 50 Hz operation. For the 400 Hz tactical precise model, it is calibrated in percentage of rated current from 0 to 133. Normal indication depends upon applied load.
- h. AC Voltmeter (7, Figure 2-1). The ac voltmeter is a dial indicator type gauge calibrated in 5 volt increments from 0 to 500. It indicates the voltage output of the generator set. Normal indication is 120, 208, 240 or 416, depending upon the position of the reconnection board and the volts-amps transfer switch.
- i. Low Oil Pressure Indicator (8, Figure 2-1). The low oil pressure indicator is an indicator lamp with a red lens. It illuminates when the oil pressure drops below  $20 \pm 2$  psi and the low oil pressure protective device actuates.
- j. Coolant High Temperature Indicator (9, Figure 2-1). The coolant high temperature indicator is an indicator lamp with a red lens. It illuminates when the coolant temperature rises above  $217 \pm 3^{\circ}\text{F}$  and the high coolant temperature protective device actuates.
- k. Overspeed Indicator (10, Figure 2-1). The overspeed indicator is an indicator lamp which has a red lens. It illuminates when the engine speed reaches 2400 to 2450 rpm and the overspeed protective device actuates.
- l. No Fuel Indicator (11, Figure 2-1). The no fuel indicator is an indicator lamp with a red lens. It illuminates when the day tank contains only enough fuel for one minute of operation and the low fuel protective device actuates.
- m. Short Circuit Indicator (12, Figure 2-1). The short circuit indicator is an indicator lamp with a red lens. It illuminates with the actuation of the short circuits protective device.



- n. Overload Indicator (13, Figure 2-1). The overload indicator is an indicator lamp with a red lens. It illuminates when the load on any phase reaches 130% of rated load and the overload protective device actuates.
- o. Under Voltage Indicator (14, Figure 2-1). The under voltage indicator is an indicator lamp with a red lens. It illuminates instantaneously when voltage drops below 48 volts or  $6 \pm 2$  seconds after voltage drops to  $99 \pm 4$  volts (tactical precise generator sets only).
- p. Under Frequency Indicator (15, Figure 2-1). The under frequency indicator is an indicator lamp with a red lens. For Model sets in 60 Hz operation, it illuminates when frequency drops to  $55 \pm 1$  Hz. For Mode I sets in 50 Hz operation, it illuminates when frequency drops to  $46 \pm 1$  Hz. For Mode II sets, it illuminates when frequency drops to  $370 \pm 5$  Hz. This indicator is operational on tactical precise sets only.
- q. Reverse Power Indicator (16, Figure 2-1). The reverse power indicator is an indicator lamp with a red lens. It illuminates when reverse power exceeds 20% and the reverse power protective device actuates.
- r. Over Voltage Indicator (17, Figure 2-1). The over voltage indicator is an indicator lamp with a red lens. It illuminates when voltage exceeds  $153 \pm 3$  volts and remains for 180 milliseconds and the over voltage protective device actuates.
- s. Fault Indicator Fuse (18, Figure 2-1). The fault indicator fuse is 1-1/4 x 1/4 inch, glass, 1 amp, 250 volt fuse. It protects the fault indicator circuits from overload.
- t. Test or Reset Switch (19, Figure 2-1). The test or reset switch is a single pole, momentary on, toggle switch. It permits testing of the fault indicator lamps and resetting of fault indicator lights.
- u. DC Circuit Breaker (20, Figure 2-1). The DC circuit breaker is a push type circuit breaker. It closes the 24 Vdc circuit from the battery to the controls. The DC circuit breaker is depressed (closed) during generator set operation.
- v. Manual Speed Control (21, Figure 2-1). The manual speed control is a push-pull control. It controls engine speed and thereby frequency output. A vernier type adjustment allows finer control. This control is inoperable on precise models of the generator set.
- w. Battle Short Switch (22, Figure 2-1). The battle short switch is a four pole on-off toggle switch. It is protected by a plastic guard. It permits emergency operation by bypassing the protective devices circuits (with the exception of the overspeed and short circuit). The battle short switch also locks out the starter circuit. During normal operation, the battle short switch is in the OFF position.
- x. Battle Short Indicator (23, Figure 2-1). The battle short indicator is a press-to-test indicator lamp with a red lens. It illuminates when the battle short switch is moved to the ON position and the generator set is operating.
- y. Voltage Adjust Rheostat (24, Figure 2-1). The voltage adjust rheostat allows adjustment of the generator set output voltage.
- z. Synchronizing Lights (25, Figure 2-1). The synchronizing lights are indicator lights with clear lens. They indicate the synchronization of frequency when the operation switch is placed in the PARALLEL position for paralleling of the generator sets.
- aa. Operations Switch (26, Figure 2-1). The operations switch is a four pole, two position, toggle switch. It is placed in the single unit position for single unit operation and in the PARALLEL position for parallel operation.
- ab. Voltage Sensing Switch (27, Figure 2-1). The voltage sensing switch is a double pole, two position toggle switch. It permits either local or remote monitoring of the voltage regulator circuit.
- ac. Panel Light Switch (28, Figure 2-1). The panel light switch is a single pole toggle switch. It controls the panel illumination lights.



- ad. Frequency Adjust Rheostat (29, Figure 2-1). The frequency adjust rheostat increases or decreases the frequency output of the tactical precise generator sets.

### NOTE

The frequency adjust rheostat is functional on the precise generator sets only.

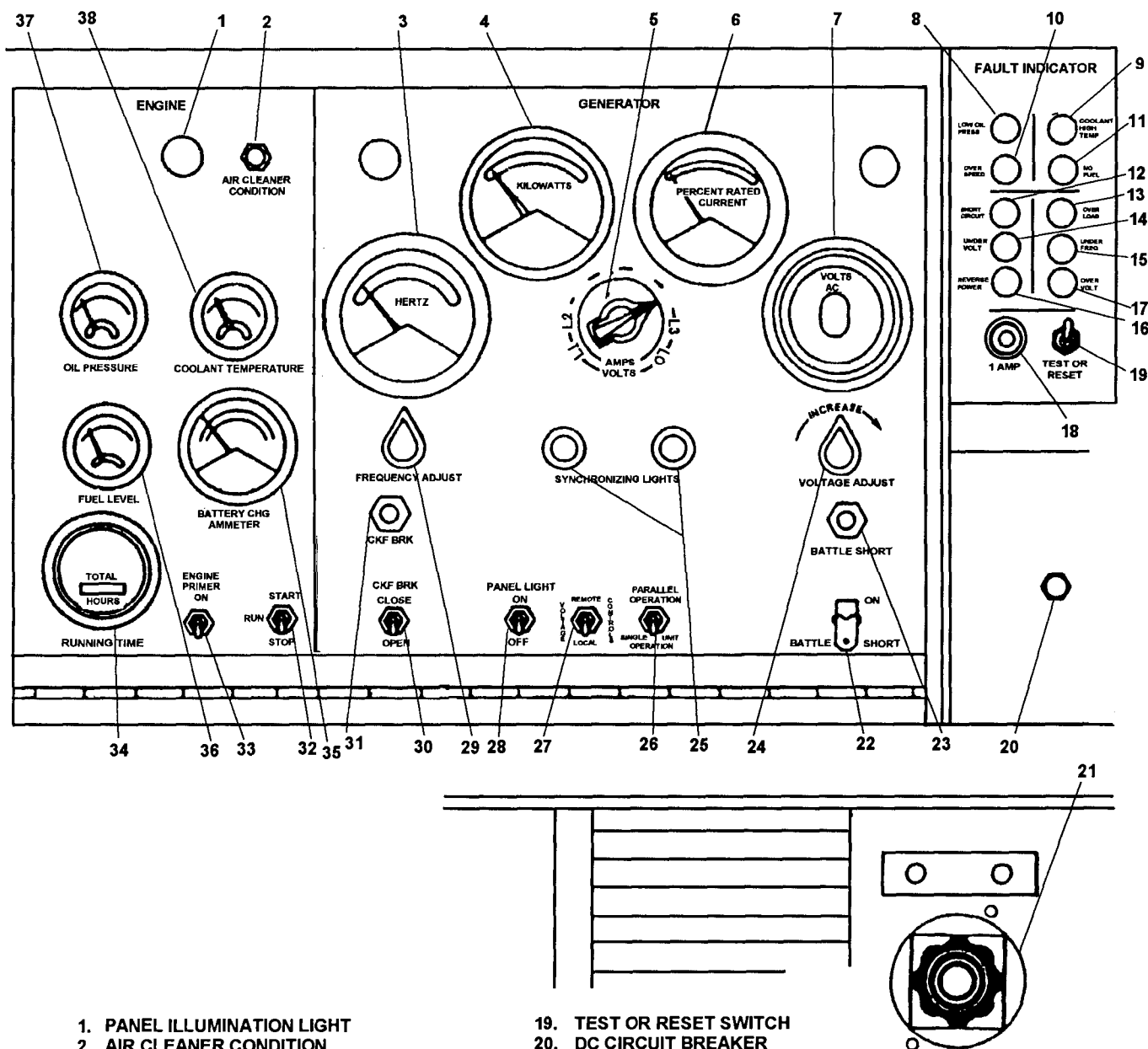
- ae. Circuit Breaker Switch (30, Figure 2-1). The circuit breaker switch is a three position, momentary-on-momentary-off toggle switch. It opens and closes the main load contactor. The circuit breaker switch is in the center position during normal operation.
- af. Circuit Breaker Indicator (31, Figure 2-1). The circuit breaker indicator is a press-to-test indicator light with a yellow lens. It illuminates when the main load contactor is closed.
- ag. Start-Run-Stop Switch (32, Figure 2-1). The start-run-stop switch is a three position toggle switch, used to start and stop the generator set.
- ah. Engine Primer Switch (33, Figure 2-1). The engine primer switch is a single pole, two position toggle switch. When the START-RUN-STOP switch is in the START position and the ENGINE PRIMER switch is moved to the ON position, and then released, it actuates the ether starting aid. During operation, the switch remains in the OFF position.
- ai. Running Time Meter (34, Figure 2-1). The running time meter is a time totalizing meter which indicates total engine operating time in hours and tenths of hours.
- aj. Battery Charging Ammeter (35, Figure 2-1). The battery charging ammeter is a dial indicator type gauge which measures dc current flow to and from the battery. It is calibrated in 1 ampere increments from -10 to +20. Normal indication of the meter is dependent upon the state of charge of the battery. A low charge such as exists immediately after engine starting, will result in a high reading. When enough charge has been restored to the battery the indicator should move near 0.
- ak. Fuel Level Gauge (36, Figure 2-1). The fuel level gauge is a liquid quantity indicator gauge which is calibrated 1/4 increments of tank quantity from E (empty) to F (full). It indicates the level of fuel in the main fuel tank.
- al. Engine Oil Pressure Gauge (37, Figure 2-1). The engine oil pressure gauge is a dial indicator type gauge which is calibrated in psig from 0 to 60. It measures engine lubrication oil pressure. Normal indication is from 20 to 55 psig.
- am. Coolant Temperature Gauge (38, Figure 2-1). The coolant temperature gauge is a dial indicator type gauge which is calibrated in degrees Fahrenheit from 120 to 240. Normal operation indication is 170°F (76.7°C) to 200°F (93.3°C).
- an. Fuel Selector Valve (Figure 1-5). The fuel selector valve is a three-way valve. It selects either the integral tank or the auxiliary source for fuel. It also serves as a shutoff valve.
- ao. Frequency Selector Switch (Figure 1-4). The frequency selector switch is a two position, positive locking toggle switch. It is located on the precise relay assembly. The switch changes the generator circuit from 60 Hz to 50 Hz operation. Most applications of the generator set will require that this switch be placed in the 60 Hz position.

### NOTE

The frequency selector switch is used on the 50/60 Hz Tactical Precise generator sets only.

- ap. Shutter Control Assembly. The shutter control assembly is a thermostatically controlled assembly. It is located at the bottom left of the radiator assembly. The assembly retains the shutter louvers (located behind the grille) in the dosed position until the engine coolant has reached normal operating temperature.





- |                                       |                               |
|---------------------------------------|-------------------------------|
| 1. PANEL ILLUMINATION LIGHT           | 19. TEST OR RESET SWITCH      |
| 2. AIR CLEANER CONDITION INDICATOR    | 20. DC CIRCUIT BREAKER        |
| 3. FREQUENCY METER                    | 21. MANUAL SPEED CONTROL      |
| 4. KILOWATT METER                     | 22. BATTLE SHORT SWITCH       |
| 5. VOLTS-AMPS TRANSFER SWITCH         | 23. BATTLE SHORT INDICATOR    |
| 6. AC AMMETER                         | 24. VOLTAGE ADJUST RHEOSTAT   |
| 7. AC VOLTMETER                       | 25. SYNCHRONIZING LIGHTS      |
| 8. LOW OIL PRESSURE INDICATOR         | 26. OPERATIONS SWITCH         |
| 9. COOLANT HIGH TEMPERATURE INDICATOR | 27. VOLTAGE SENSING SWITCH    |
| 10. OVERSPEED INDICATOR               | 28. PANEL LIGHT SWITCH        |
| 11. NO FUEL INDICATOR                 | 29. FREQUENCY ADJUST RHEOSTAT |
| 12. SHORT CIRCUIT INDICATOR           | 30. CIRCUIT BREAKER SWITCH    |
| 13. OVERLOAD INDICATOR                | 31. CIRCUIT BREAKER INDICATOR |
| 14. UNDER VOLTAGE INDICATOR           | 32. START-RUN-STOP SWITCH     |
| 15. UNDER FREQUENCY INDICATOR         | 33. ENGINE PRIMER SWITCH      |
| 16. REVERSE POWER INDICATOR           | 34. RUNNING TIME METER        |
| 17. OVER VOLTAGE INDICATOR            | 35. BATTERY CHARGING AMMETER  |
| 18. FAULT INDICATOR FUSE              | 36. FUEL LEVEL GAUGE          |
|                                       | 37. ENGINE OIL PRESSURE GAUGE |
|                                       | 38. COOLANT TEMPERATURE GAUGE |

Figure 2-1. Generator Set Controls and Instruments



**2-3 INSTALLATION OF SEPERATELY PACKED COMPONENTS.** There are no separately packed components.

**2-4 INSTALLATION INSTRUCTIONS.**

- a. General. The generator set installation site should be as level as possible and should provide adequate ventilation to prevent cooling air from recirculating. The site must be within 25 feet of any generator set to be connected in parallel and within 25 feet from any auxiliary fuel supply. The generator set control cubicle may be removed as a unit and installed up to 500 feet from the remainder of the set. A wiring harness with 40 AWG#16 and 7 AWG#12 conductors installed between connectors P1 and P2 (figures FO-1 and FO-2) allows the generator set to be started, operated, and monitored from the remotely installed control cubicle. Refer control cubicle removal and installation to higher level maintenance. Refer to Figure 2-2 for dimensions, clearances, air flow requirements and floor capacity requirements when selecting an installation site.
- b. Outdoor Installation. Select the site to make maximum use of natural protective barriers while allowing enough space on all sides for service and maintenance. The soil of the site should be firm and well drained. In areas where the soil will not support the generator set, use planks or other suitable material as dunnage.
- c. Indoor Installation.



**Do not operate the generator set in an enclosed area unless the exhaust fumes are piped outside the enclosure. Inhalation of exhaust gases will result in serious illness or death.**

Position the generator set so that a maximum supply of cooling air is available. Never situate the generator set with the radiator near a wall or other object which would impede the free circulation of cooling air. If a free supply of cooling air is not available, provide vents or ducting to the outside of the installation. Insure that the cooling air intake and outlet openings in the installation are at least as large as the cooling air intake and exhaust openings on the generator set. If louvers are used, increase the size of the openings by 35 percent. Install a gas tight metal pipe from the exhaust outlet on the generator set to the outside of the installation. Use as short a pipe as possible with no more than one 90 degree bend and as few lesser bends as possible. Insure that the inside diameter of the exhaust piping is as large or larger than the inside diameter of the exhaust connection on the generator set. The termination of the exhaust pipe shall be such that the hot gases or sparks will be discharged harmlessly and will not be directed against combustible material or into an area containing flammable gases or vapors. Provide an adequate fire-proof shield at the point where the exhaust piping passes through a flammable wall. Position the exhaust piping to eliminate the danger of personnel touching hot pipes. Refer to Figure 2-2 for dimensions, airflow requirements, and floor loading capacity.

- d. Grounding. The generator set maybe grounded to an underground metallic water system, a driven metal rod or a buried metal plate. A ground rod must have a minimum diameter of 5/8 inch if solid or 3/4 inch if pipe and must be driven to a minimum depth of 8 feet. A ground plate must have a minimum area of 9 square feet and be buried to a minimum depth of 4 feet. The ground lead must be at least No. 6 AWG copper wire. If ground rod is used, refer to Figure 2-3 and connect the generator set to the ground as follows:



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

- (1) Insert ground cable into slot in ground stud and tighten nut.
- (2) Connect coupling to ground rod and install driving stud. Make sure that driving stud seats on ground rod.
- (3) Drive the ground rod into ground until coupling is just above surface.



- (4) Remove driving stud and install another section of ground rod, making sure that it seats on first section.
  - (5) Install another coupling and driving stud. Drive the ground rod until the new coupling is just above ground surface.
  - (6) Use a minimum of three sections of 3 foot length ground rods. Add additional sections until ground rod has been driven sufficiently deep to provide effective ground.
  - (7) Remove driving stud and top coupling.
  - (8) Connect clamp and ground cable to ground rod and securely tighten screw.
- e. Load Connection.



**Lethal voltages are present at the load connection board of the generator set during operation. Do not attempt to connect or disconnect load leads while the generator set is operating. Do not attempt to connect or disconnect load leads with the generator set shutdown and the load connected to another power source or while the generator set is parallel to another which is operating.**

- (1) Open the left access door to the generator compartment and remove the safety cover from the load terminal board (Figure 1-5).
- (2) Insert load leads through plate and sleeve assembly (Figure 1-5) located to the left of the generator set air intake.
- (3) A 208 or 416 Vac three phase load may be connected between terminals marked L1, L2, L3, and L0 (Figure 2-4).

#### **NOTE**

**The load terminals will accommodate 2-wire single phase and 4-wire, 3 phase loads. One or more single phase loads can be served alone or in combinations with 3 phase loads; but the load on any one phase must not exceed 100 percent of the current rating of that phase.**

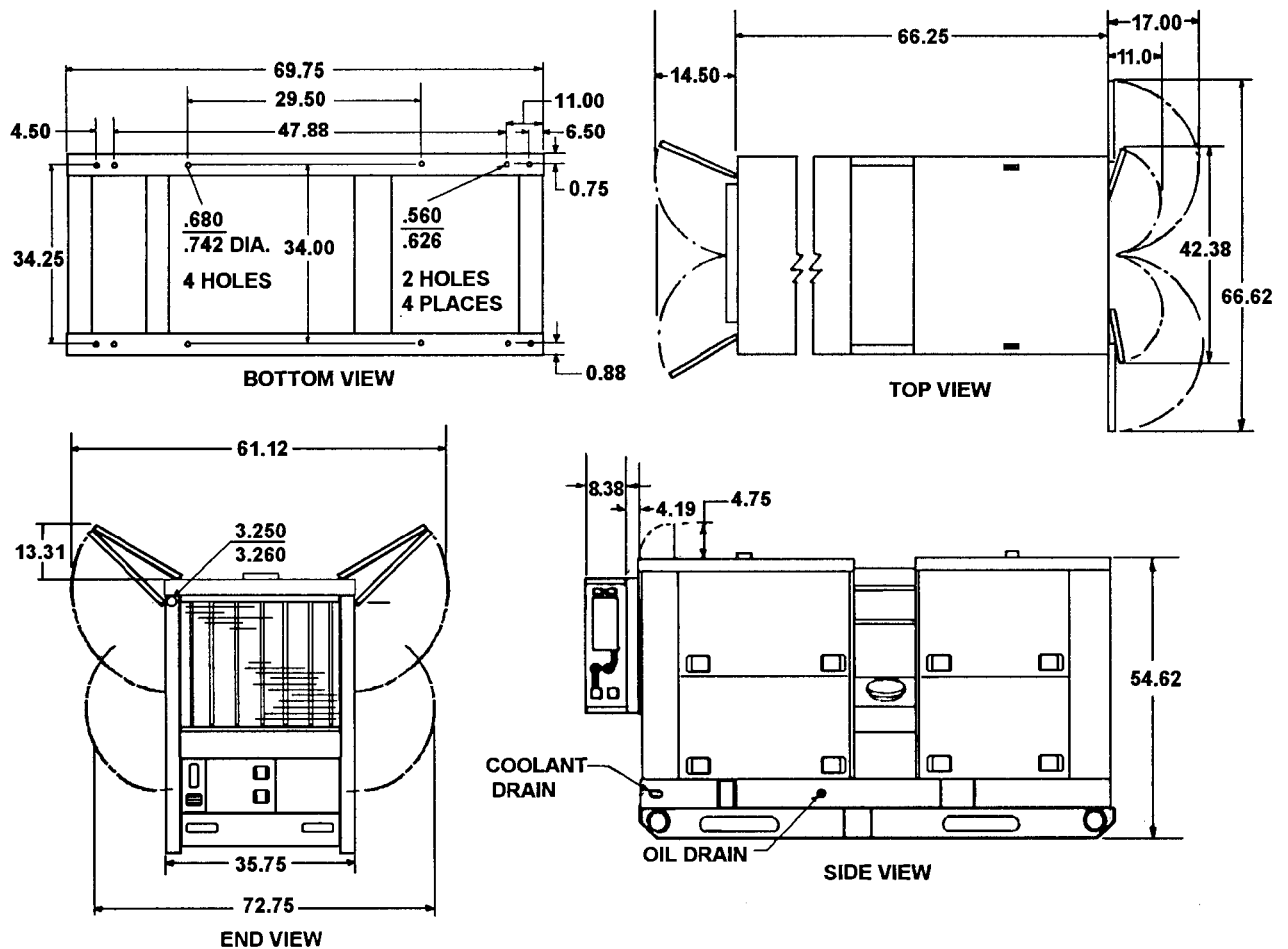
- (4) Phase rotation for three phase loads is L1, L2, L3.

#### **NOTE**

After load connection, tighten binding nuts with plastic/phenolic box end wrench and install safety cover. Refer to paragraph 2-5 and check that the reconnection board is set for proper voltage.

- f. Auxiliary Fuel Source Connection.
- (1) Connect the auxiliary fuel line to the generator set auxiliary fuel supply connection (Figure 1-5) located below the integral tank filler cap.
  - (2) Connect the auxiliary fuel line to the auxiliary fuel source.
  - (3) Position the fuel selector valve (Figure 1-5) in the AUXILIARY position.





NOTE 1. ALL DIMENSIONS ARE IN INCHES.

2. MINIMUM FLOOR CAPACITY 25 LBS/IN. SQ.

3. EXHAUST EXTENSION SHALL HAVE NO MORE THAN ONE 90° BEND.

AIR FLOW REQUIREMENTS	
ENGINE RPM	CFM
1500	7500
1800	10000
2000	12000

Figure 2-2. Installation Plan



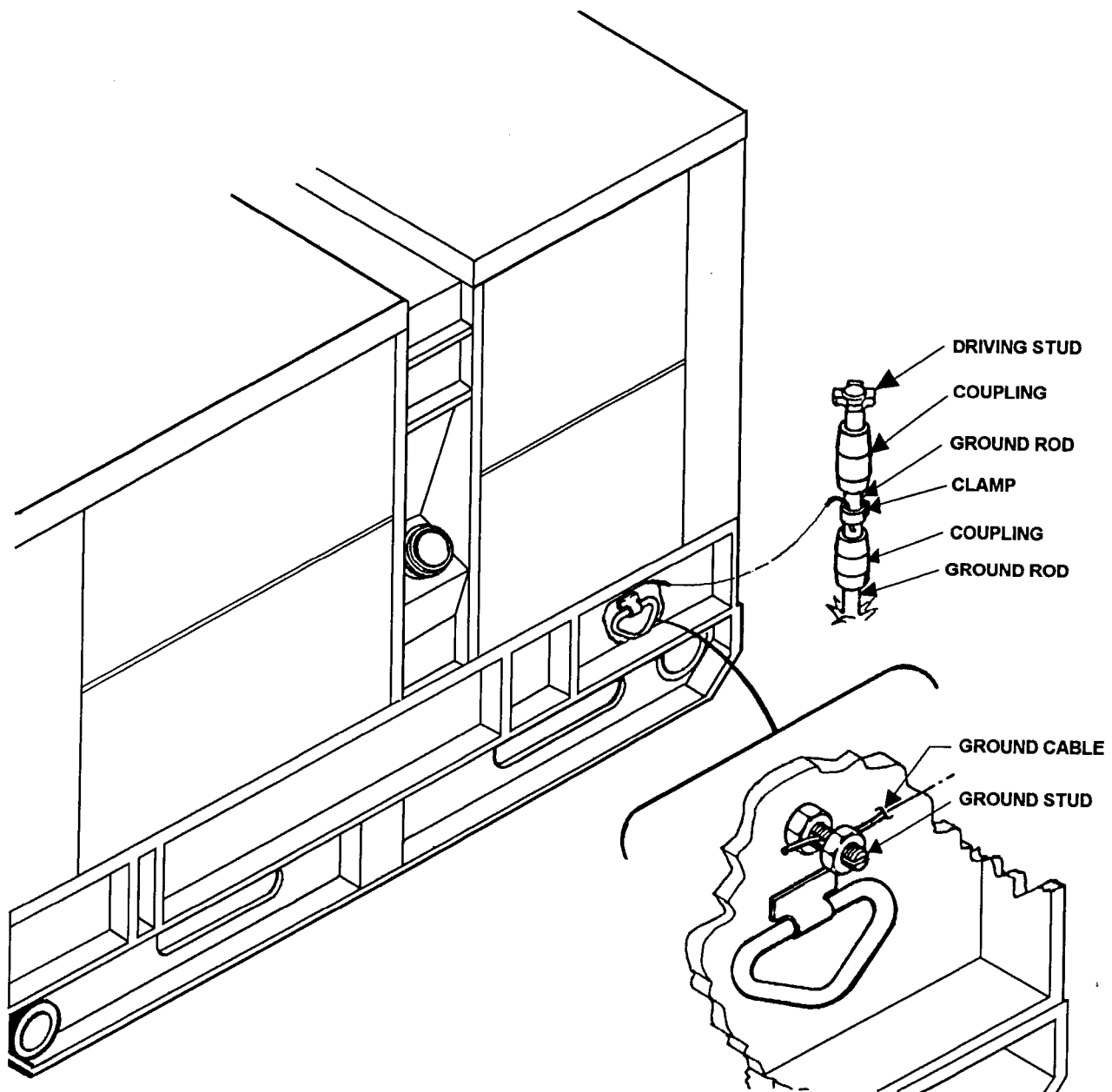
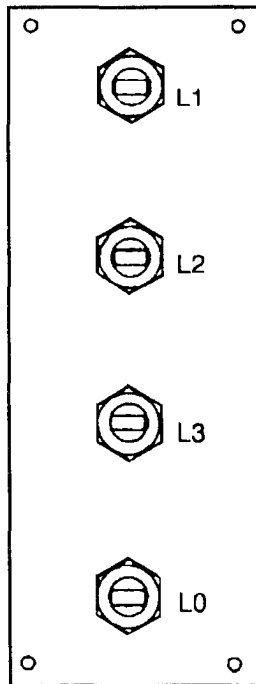


Figure 2-3. Ground Connections





**Figure 2-4. Load Terminal Board Assembly**

## **2-5 GENERATOR SET CONVERSION INSTRUCTIONS.**

- a. To convert the generator set for operation at 120/208 Vac or 240/416 Vac, proceed as follows.



**Do not attempt to alter position of the voltage reconnection board while the generator set is operating. Make sure that the generator set is not paralleled to another which is operating. Failure to observe this warning may result in death by electrocution.**

- (1) Remove 12 mounting nuts (Figure 2-7) and locate the movable board until the arrow at its edge mates with the arrow on the stationary board indicating the desired operator voltage.
  - (2) Install and tighten the mounting nuts.
- b. To convert 50/60 Hz precise set to 50 Hz operation, place frequency select switch (Figure 1-4) on precise relay assembly to 50 Hz position.



## **2-6 STARTING THE GENERATOR SET.**

### **CAUTION**

**If the generator set is to be operated for the first time, unit maintenance must be notified to perform service upon receipt. Equipment damage could result if caution is not observed.**

- a. Refer to paragraph 2-4 and check that the installation instructions have been properly accomplished.
- b. Refer to paragraph 2-5 and check that the reconnection board is in the position corresponding to the voltage requirements of the load and that the frequency selector switch is in the correct position.
  - (1) Refer to Table 2-2 and perform the BEFORE OPERATION checks and services.
  - (2) If an auxiliary fuel supply is used, position the fuel selector valve handle in the AUXILIARY position. If the generator set tank is to be used, position the handle in the SET TANK position.

### **NOTE**

If acoustic suppression kit is installed, open both inlet and discharge doors on roof prior to starting. Power cables must be routed through opening in rear panel assembly.

- (3) Close all access doors with the exception of those for the generator air vent and the control cubicle. Lock the generator set air inlet doors in the open position.
- (4) Check that the DC circuit breaker is in the closed position.
- (5) If the generator set fuel tank is being used, place the START-RUN-HOP switch in the RUN position and the BATTLE SHORT switch in the ON position. Check the fuel level gauge for sufficient fuel indication.

### **NOTE**

On precise generator sets the low oil pressure, under voltage, and under frequency indicator lights will illuminate. On utility generator sets, the low oil pressure indicator light will illuminate.

- (6) Leave the START-RUN-STOP switch in the RUN position and the BATTLE SHORT switch in the ON position a sufficient length of time to ensure that the day tank assembly contains enough fuel for starting.
  - (7) Place the BATTLE SHORT switch in the OFF position.
  - (8) Depress the fault location indicator, TEST OR RESET switch and check that all fault location indicator lights illuminate.
  - (9) On tactical utility generator sets, pull the manual speed control all the way out, then push approximately halfway in.
- c. Starting. Refer to Figure 2-8 for starting instructions. If acoustic suppression kit is installed, control access door must be opened for controls access. After starting, close control access door.
  - d. Single Unit Operation.
    - (1) Rotate the VOLTS-AMPS transfer switch to each phase position while observing the ac ammeter. If more than rated load is indicated in any phase, reduce the load.
    - (2) Check the kilowatt meter indication. If the indication is more than 100 percent rated load, reduce the load.

### **NOTE**

If load cannot be reduced, obtain another generator set and proceed to parallel operation.



## 2-7 STOPPING THE GENERATOR SET.

### a. Normal Stopping.

- (1) Refer to Figure 2-9 for stopping procedures.
- (2) Refer to Table 2-2 and perform the AFTER OPERATION checks and services,



**If acoustic suppression kit is installed, do not allow personnel to open or close exhaust discharge door when unit is hot. Serious burns or personal injury may result.**

### NOTE

if acoustic suppression kit is installed, after unit has cooled, close both inlet and discharge doors on roof after operation.

### b. Stopping by Safety Devices.

### NOTE

if any emergency situation requires continued operation of the generator set, the BATTLE SHORT switch may be used to over-ride any of the safety devices except the over-speed and short circuit devices.

The generator set is equipped with safety devices which will automatically stop the engine and simultaneously open the main load contactor upon the occurrence of engine overheating, loss of engine oil pressure, engine over-speeding, generator overvoltage, or no fuel. The occurrence of short circuits, overloads, generator under voltage, generator under frequency, or reverse power will result in the actuation of a protective device circuit which will automatically open the main load contactor, but will not stop the engine. The actuation of any protective device will result in the illumination of the corresponding indicator light on the fault indicator panel. Actuation ratings for each of the protective devices is given in the tabulated data portion of paragraph NO TAG.

**2-8 PARALLEL OPERATION OF TACTICAL PRECISE GENERATOR SETS.** This paragraph provides load connection and operating instructions for parallel operation of the 50/60 Hz and 400 Hz Tactical Precise Generator Sets. Parallel operating procedures are given for Load Sharing and Load Transfer separately.

### NOTE

Prior to attempting parallel operation, ensure all generator sets have the same frequency and voltage output.

## 2-9 LOAD CONNECTIONS FOR PARALLEL OPERATION.



**Lethal voltages are present at the load terminal board of the generator set during operation. Do not attempt to connect or disconnect load leads while the generator set is operating. Do not attempt to connect or disconnect load leads with the generator set shut down and the load connected to another power source, or while the generator set is paralleled to another set which is operating.**





**Do not attempt to connect the paralleling cable while either or both of the sets to be paralleled is operating. Make sure that there is no input to the load from another source. Failure to observe this warning may result in death by electrocution.**

#### **CAUTION**

**Precise generator sets equipped with the electric governor system cannot be paralleled with sets that have the electrohydraulic governor system. Equipment damage could result if caution is not observed.**

#### **NOTE**

Prior to attempting parallel operation, ensure all generator sets have the same frequency and voltage output.

- a. If the generator sets are to share a load greater than the KW rating of a single set, connect load terminal boards as shown in Figure 2-4. This arrangement allows for sharing or transferring of the load between generator sets.
- b. Open the left access door to the set compartment and remove the safety cover from the terminal board (Figure 1-5).
- c. Insert load leads through plate and sleeve assembly (Figure 1-5) located to the left of the generator set air intake.

#### **NOTE**

The load terminal boards will accommodate 2-wire single phase and 4-wire three phase loads. One or more single phase loads can be served alone or in combinations with three phase loads; but the load on any one phase must not exceed 100 percent of the current rating of that phase. Be sure that wire sizes are correct for load to be carried.

- d. Connect the load to terminals marked L1, L2, L3, and L0 (Figure 2-4).

#### **NOTE**

Make certain that the load terminal boards of the sets to be paralleled are connected properly. Reading left to right, phase rotation for the phase loads is L1, L2, L3. Be sure L1 is connected to L1, L2 is connected to L2, ect.

- e. Connect load leads and paralleling cables as shown in Figure 2-5 and Figure 2-6.

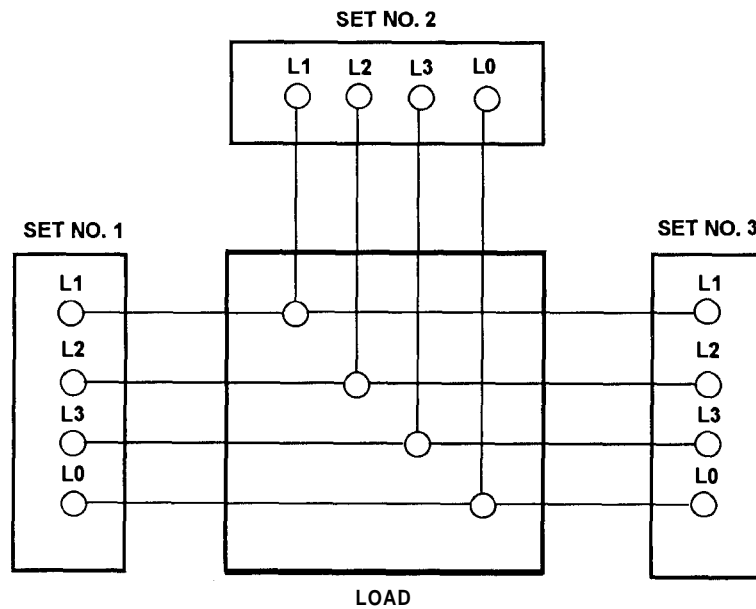
#### **NOTE**

After load connection, tighten binding nuts with plastic/phenolic box end wrench and install safety cover.

#### **NOTE**

Paralleling of tactical precise generator sets requires that paralleling cables be installed and the shorting plug located on one of the paralleling receptacles of each generator set be removed.





NOTE: Connect L1 to L1, L2 to L2, etc.

Figure 2-5. Parallel Connection

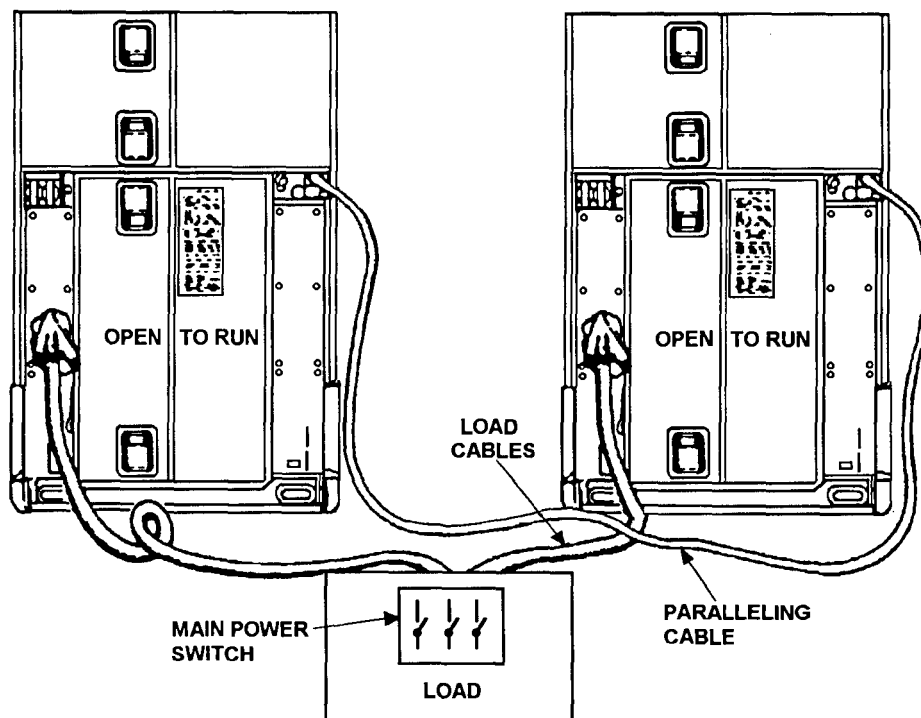


Figure 2-6. Paralleling for Load Transfer



## **2-10 PARALLEL OPERATION (LOAD SHARING).**

- a. The first set started shall be designated as "on-line" and the sets in parallel operation shall be designated "on coming". With all sets shut down install the paralleling cable and connect the load terminal boards as described in paragraph 2-4e. Check that the voltage reconnection boards (paragraph 2-5) of the sets are identically positioned.

### **CAUTION**

**Do not place the circuit breaker switch on any of the generator sets in the CLOSE position until specifically directed to do so. Closing the circuit breaker switch at any other time may severely damage one or more of the generator sets. Equipment damage could result if caution is not observed.**

### **CAUTION**

**Check that the main power switch (Figure 2-6) at the load is open before attempting to place a generator set on line. Equipment damage could result if caution is not observed.**

- b. Start the generator sets as described in paragraph 2-6. Do not perform steps 7 & 8 of Figure 2-8.
- c. Hold the CKT BRK switch (30, Figure 2-1) of the "on- line" set in the CLOSE position until the CKT BRK indicator light (31 ) illuminates. Place the operation switch (26) in the PARALLEL position.
- d. Adjust the voltage on both sets to the required value. Adjust the frequency of the "on-line" set to the required value. Place the operation switch (26) of the "on-coming" set in the PARALLEL position.

### **NOTE**

Observe the synchronizing lights of the "on-coming" set. The lights should go on and off simultaneously. If the lights go on and off alternately, sets are out of phase. Stop both sets and correct interconnect cables (Figure 2-5). If the problem persists, refer to next higher level of maintenance.

- e. Adjust the frequency of the "on-coming" set a little higher than the "on-line" set. Then reduce the frequency slowly with frequency adjust rheostat (29) until the synchronizing lights (25) remain on or off a 2 to 3 second intervals.
- f. Carefully observe the synchronizing lights of the "on-coming" set and, at the instant both lights go dark place the CKT BRK switch (30) of the "on-coming" set to the CLOSE position. When the CKT BRK indicator light (31 ) illuminates, the sets are operating in parallel.

### **CAUTION**

**The kilowatt meter and AC ammeter indicate percentages and do not indicate true KW and ampere readings. Equipment damage could result if caution is not observed.**

- g. With no external load on the paralleled sets, adjust the frequency adjust rheostat (29) of the "on-coming" set until both rated load meters (kilowatt) read zero. Adjust the voltage adjust rheostat of the "on-coming" set until the percent of rated current meters (ammeters) on both sets read zero. Turning counterclockwise will decrease readings.
- h. Apply load to the sets. The kilowatt load should divide so that the load on each set is equal. If the load and current are not shared equally adjust the voltage and frequency rheostats of the "on-coming" set until the load and current are divided equally between the generator sets.
- i. The current should divide so that the observed difference between the current on any phase between the "on-line" and "on-coming" sets is not more than 20 percent. If the readings are not within 20 percent, notify higher level maintenance.



### NOTE

If the reverse power indicator (16) of either set illuminates and the main load contactor opens, open the main power switch and reparallel the generator sets.

### CAUTION

**When generator sets are being operated in parallel, one or more operators must remain with the sets to monitor the rated load and current meters. Equipment damage could result if caution is not observed.**

### NOTE

Three generator sets can be operated in parallel. Paralleling procedures are the same as those described above. One generator set at a time is brought on line.

### CAUTION

**Prior to removal of generator sets from parallel operation, make sure the load does not exceed the full load rating of generation set(s) remaining on line. Equipment damage could result if caution is not observed.**

- j. To remove a generator set from parallel operation, place the circuit breaker switch of the set in the OPEN position. Stop the set described in paragraph 2-7.

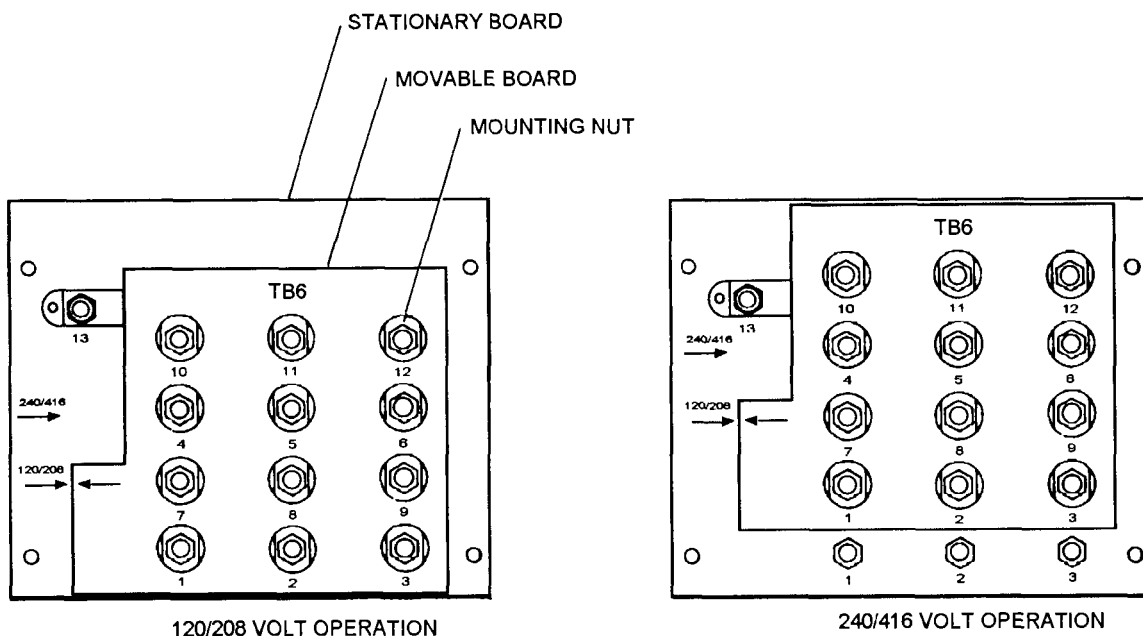
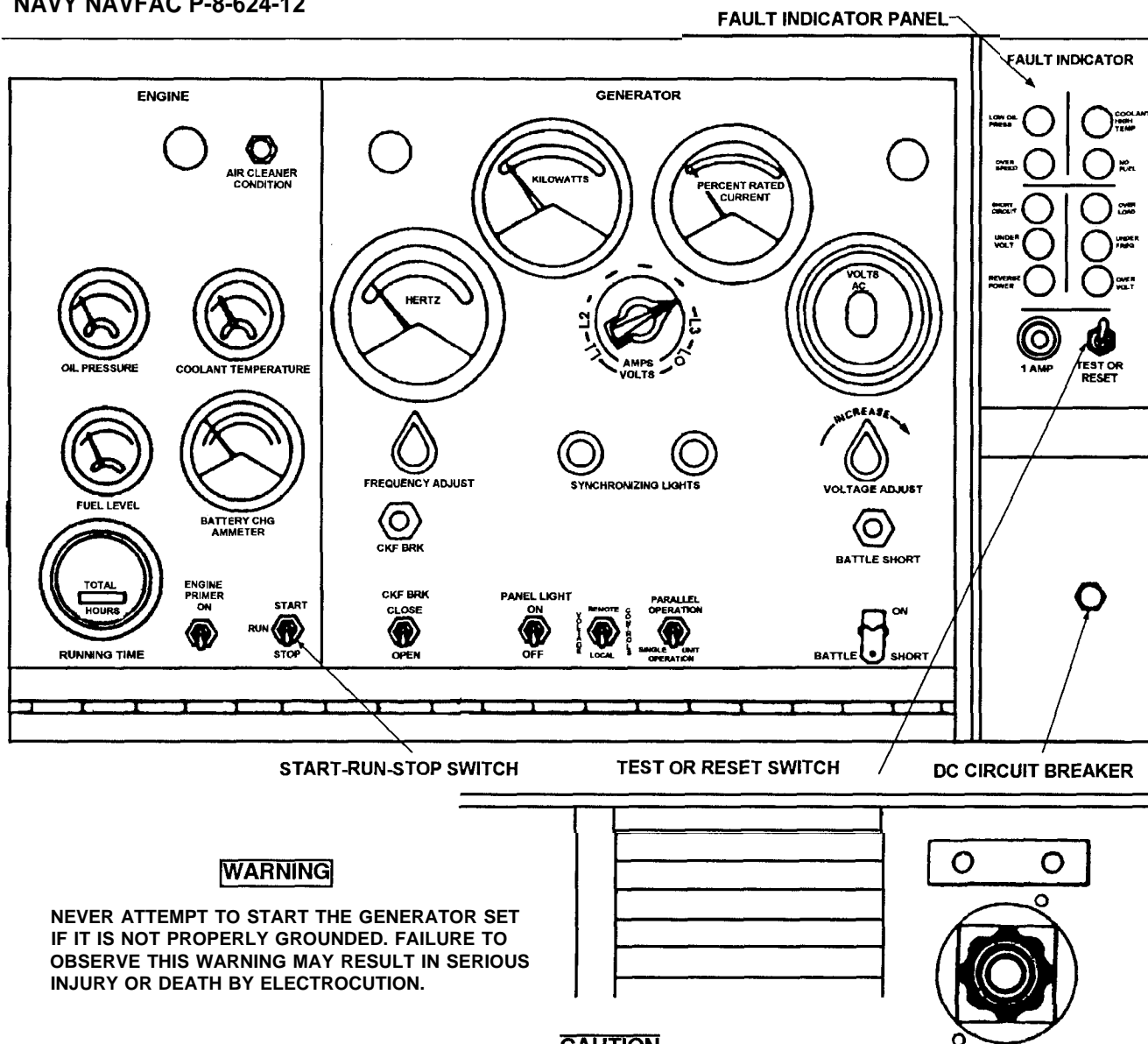


Figure 2-7. Voltage Reconnection Board



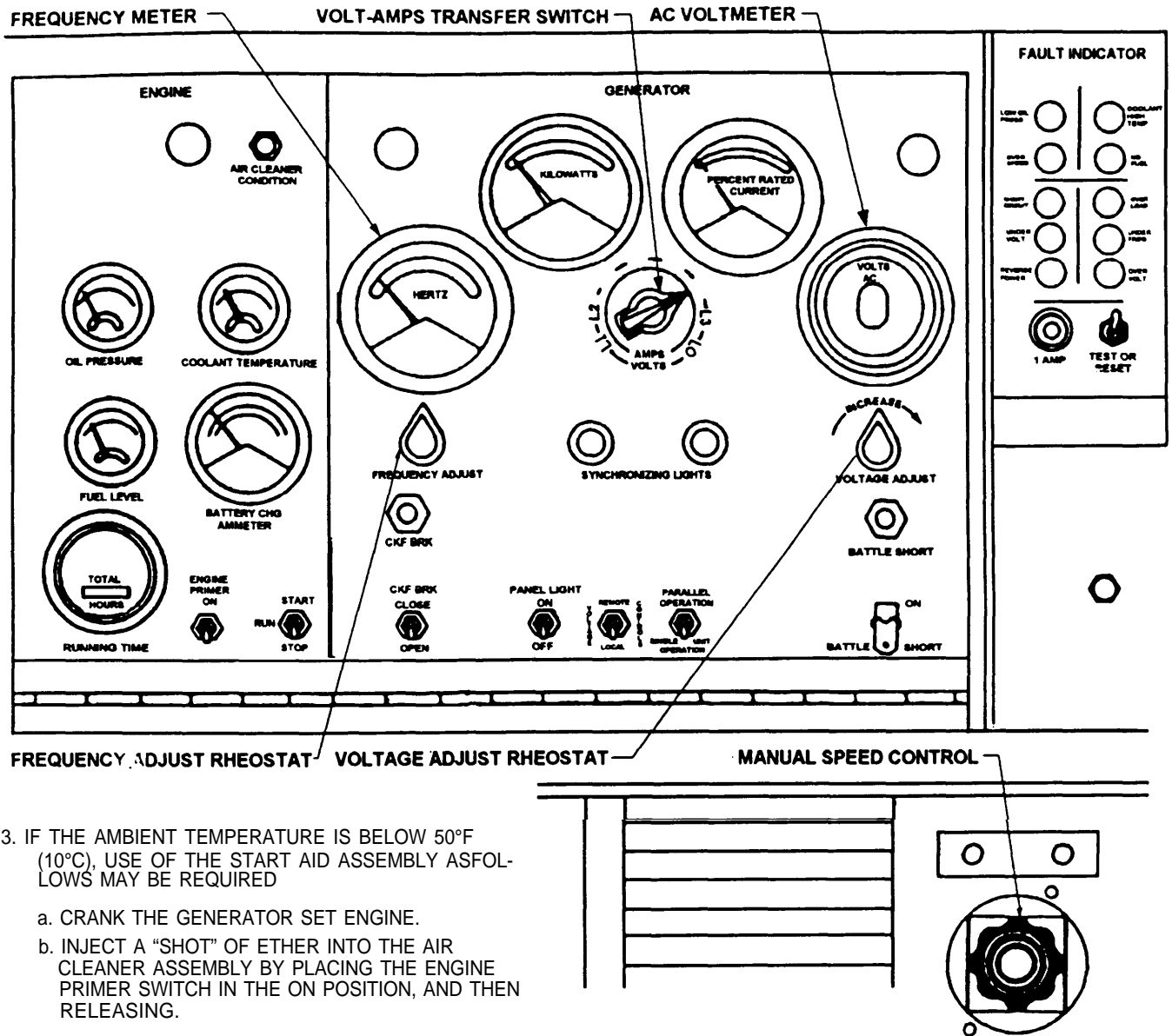


Step 1. HOLD THE START-RUN-STOP SWITCH IN THE START POSITION UNTIL THE ENGINE OIL PRESSURE GAUGE INDICATES OIL PRESSURE, AND VOLTMETER INDICATES VOLTAGE.

Step 2. RELEASE THE START-RUN-STOP SWITCH TO THE RUN POSITION

Figure 2-8. Starting the Generator Set (Sheet 1 of 3)





Step 3. IF THE AMBIENT TEMPERATURE IS BELOW 50°F (10°C), USE OF THE START AID ASSEMBLY ASFOL-  
LWS MAY BE REQUIRED

- CRANK THE GENERATOR SET ENGINE.
- INJECT A "SHOT" OF ETHER INTO THE AIR CLEANER ASSEMBLY BY PLACING THE ENGINE PRIMER SWITCH IN THE ON POSITION, AND THEN RELEASING.

### CAUTION

IF THE ENGINE FAILS TO START AFTER INJECTING THREE "SHOTS" OF ETHER, CEASE OPERATION AND NOTIFY MAINTENANCE PERSONNEL. EQUIPMENT DAMAGE COULD RESULT IF CAUTION IS NOT OBSERVED.

- IF THE ENGINE FAILS TO START WITHIN 15 SECONDS, RELEASE THE START-RUN-STOP SWITCH AND ALLOW THE CRANKING MOTOR TO COOL AT LEAST THREE MINUTES. REPEAT STEPS a AND b.

Step 4. PLACE THE VOLTS-AMPS TRANSFER SWITCH IN THE DESIRED OPERATING POSITION.

Step 5. ROTATE THE VOLTAGE ADJUST RHEOSTAT UNTIL THE DESIRED VOLTAGE IS INDICATED ON THE AC VOLTMETER.

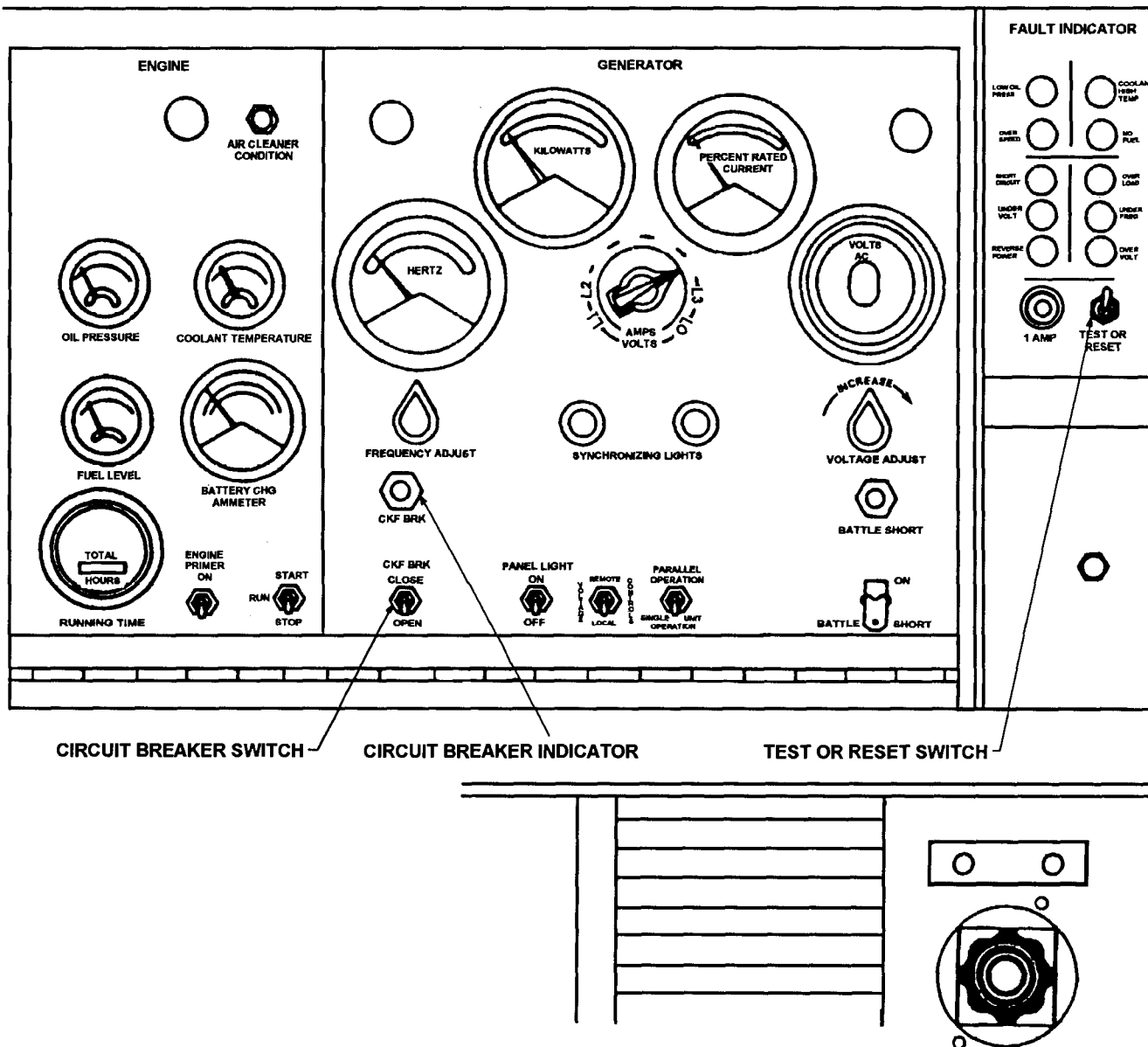
Step 6. ADJUST FREQUENCY TO THE DESIRED VALUE AS INDICATED ON THE FREQUENCY METER.

### NOTE

ON TACTICAL PRECISE GENERATOR SETS, FREQUENCY IS ADJUSTED WITH THE FREQUENCY ADJUST RHEOSTAT, ON TACTICAL UTILITY GENERATOR SETS, FREQUENCY IS ADJUSTED WITH THE MANUAL SPEED CONTROL

Figure 2-8. Starting the Generator Set (Sheet 2 of 3)





### CAUTION

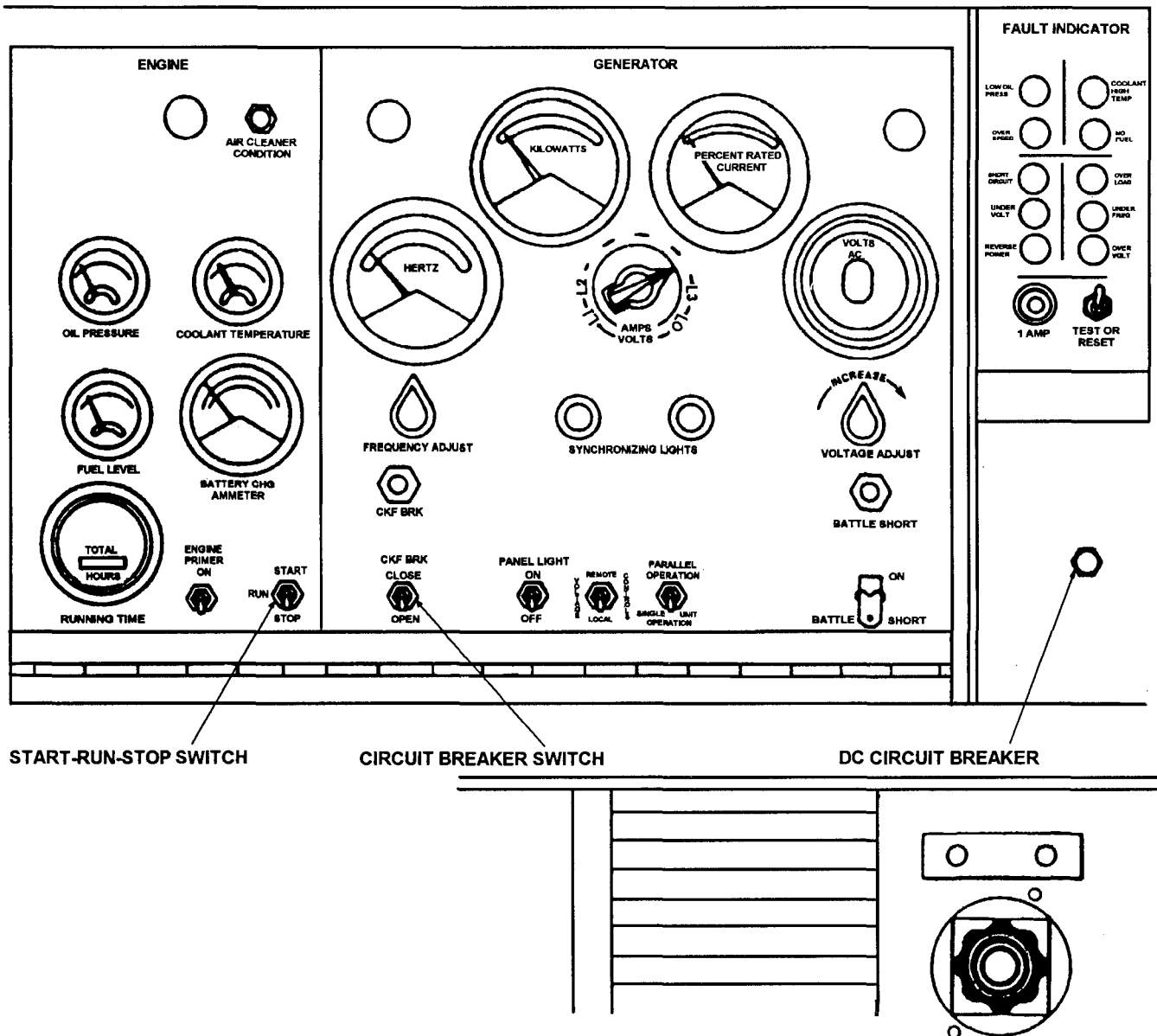
IF ANY OF THE INDICATOR LIGHTS ILLUMINATE, STOP THE GENERATOR SET (PARAGRAPH 2-7) AND CORRECT THE INDICATED FAULT BEFORE PROCEEDING WITH OPERATIONS. EQUIPMENT DAMAGE COULD RESULT IF CAUTION IS NOT OBSERVED,

Step 7. HOLD THE CIRCUIT BREAKER SWITCH IN THE CLOSE POSITION UNTIL THE CIRCUIT BREAKER INDICATOR ILLUMINATES.

Step 8. OBSERVE ALL ENGINE AND GENERATOR INSTRUMENTS FOR NORMAL READINGS.

Figure 2-8. Starting the Generator Set (Sheet 3 of 3)





- Step 1. PLACE THE CIRCUIT BREAKER SWITCH IN THE OPEN POSITION.
- Step 2. ALLOW THE GENERATOR SET TO OPERATE APPROXIMATELY THREE TO FIVE MINUTES WITH NO LOAD APPLIED WHILE OPERATING AT GOVERNED SPEED AND RATED HERTZ (DO NOT READJUST FREQUENCY ADJUST RHEOSTAT OR PUSH IN THE MANUAL SPEED CONTROL PRIOR TO SHUTDOWN).
- Step 3. PLACE THE START-RUN-STOP SWITCH IN THE STOP POSITION.
- Step 4. OPEN THE DC CONTROL CIRCUIT BREAKER.

**Figure 2-9. Stopping the Generator Set**



**2-11 PARALLEL OPERATION (LOAD TRANSFER).** The following method of parallel operation is to be used when it is necessary to transfer the load from one set to the other without interrupting power.

**NOTE**

Visually check that the power cable and parallel cable are in accordance with Figure 2-6. If the cables are not attached as indicated, shutdown the "on-line" set and follow instructions in paragraph 2-9.

**CAUTION**

**Do not attempt load connects in paragraph 2-9 unless all sets are off and no other external voltage is applied to the load. Equipment damage could result if caution is not observed.**

- a. The set in operation shall be designated as "on-line" and the sets placed in parallel operation shall be designated "on-coming".
- b. Place the operations switch (26, Figure 2-1 ) on both sets in the PARALLEL OPERATION position.

**CAUTION**

**Do not close the circuit breaker switch after starting the "on-coming" set as serious damage to one or both generator sets may result. Equipment damage could result if caution is not observed.**

- c. Refer to paragraph 2-6 and start the "on-coming" set. Do not perform steps 7 & 8 of Figure 2-8.
- d. Note the voltage indicated on the "on-line" set. Adjust the voltage of the "on-coming" set to the voltage noted on the "on-line" set.
- e. Adjust the frequency of the "on-coming" set to a higher value than that of the "on-line" set.
- f. Slowly reduce the frequency of the "on-coming" set until the SYNCHRONIZING LIGHTS (25, Figure 2-1) flash at 2 to 3 second intervals.

**CAUTION**

**Do not place the circuit breaker switch of the "on-coming" set in the CLOSE position while the SYNCHRONIZING LIGHTS are lit as damage to one or both generator sets may result. Equipment damage could result if caution is not observed.**

- g. Carefully watch the SYNCHRONIZING LIGHTS of the "on-coming" set. At the instant both lights go dark, move the circuit breaker switch of the "on-coming" set to the CLOSE position.
- h. Adjust the voltage and frequency rheostats of the "on-coming" set until load and current are divided equally between the two generator sets.
- i. Move the circuit breaker switch (30) of the "on-line" set to the OPEN position.
- j. Place the operations switch of the "on-coming" set to the SINGLE UNIT OPERATION position.
- k. Readjust voltage and frequency of the "on-coming" set as necessary.
- l. Refer to paragraph 2-7 and stop the "on-line" set.



## **2-12 OPERATION OF TACTICAL UTILITY GENERATOR SETS.**

### **a. Parallel Operation (Load Sharing).**

- (1) The first set started shall be designated as "on-line" and the sets in parallel operation shall be designated "on-coming". With all sets shut down connect the load terminal boards as described in paragraph 2-4e. Check that the voltage reconnection boards (paragraph 2-5) of the sets are identically positioned.

#### **CAUTION**

**Do not place the circuit breaker switch on any of the generator sets in the CLOSE position until specifically directed to do so. Closing the circuit breaker switch at any other time may severely damage one or more of the generator sets. Equipment damage could result if caution is not observed.**

#### **CAUTION**

**Check that the main power switch (Figure 2-6) at the load is open before attempting to place a generator set on line. Equipment damage could result if caution is not observed.**

- (2) Start the generator set as described in paragraph 2-6. Do not perform steps 7 & 8 of Figure 2-8.
- (3) Hold the CKT BRK switch (30, Figure 2-1) of the "on-line" set in the CLOSE position until the CKT BRK indicator light (31) illuminates. Place the operation switch (26) in the PARALLEL position.
- (4) Set "Volt-Amps Transfer Switch (5, Figure 2-1) in the L1 -L0 position. Adjust the voltage adjust rheostat (24) until the AC voltmeter indicates 122 volts for the 120/208 connection and 244 volts for the 240/416 connection. Adjust manual speed control (21) until the frequency meter indicates 61 Hertz. Place the operation switch (26) of the "on-coming" set in the PARALLEL position.

#### **NOTE**

Observe the synchronizing lights of the "on-coming" set. The lights should go on and off simultaneously. If the lights go on and off alternately, sets are out of phase. Stop both sets and correct interconnect cables (Figure 2-5). If the problem persists, refer to next higher level of maintenance.

- (5) Adjust the manual speed control of the "on-coming" set until the synchronizing lights (25), simultaneously, remain on or off at 2 to 3 second intervals.
- (6) Carefully observe the synchronizing lights of the "on-coming" set and, at the instant both lights go dark, place the CKT BRK switch (30) of the "on-coming" set to the CLOSE position. When the CKT BRK indicator light (31) illuminates, the sets are operating in parallel.
- (7) With no external load on the paralleled sets, adjust the manual speed control (21) of the "on-coming" set until both percent power meters (kilowatt) indicate zero. Adjust the voltage adjust rheostat (24) of the "on-coming" set until the percent of rated current meters (ammeters) on both sets indicate zero. Turning counter clockwise will decrease readings.
- (8) Apply load to the sets. The kilowatt load should divide so that the load on each set is equal. If the load and current are not shared equally, adjust the load by observing the set which has the higher reading on the kilowatt meter (4). Decrease the engine speed of this set by adjusting counter clockwise the manual speed control (21) in small increments. Increase the engine speed of the set with the lower kilowatt reading by adjusting clockwise the manual speed control in small increments. Adjustments should be made between both sets until the kilowatt meters are balanced.
- (9) The current should divide so that the observed difference between the current on any phase between the "on-line" and "on-coming" sets is not more than 20 percent. If the readings are not within 20 percent, notify higher level maintenance.



**CAUTION**

When generator sets are being operated in parallel, one or more operators must remain with the sets to monitor the rated load and current meters. Make further adjustments as required to maintain equal load on the paralleled sets. Equipment damage could result if caution is not observed.

**CAUTION**

Prior to removal of generator set from parallel operation, make sure the load does not exceed the full load rating of set(s) remaining on line. Equipment damage could result if caution is not observed.

- (10) To remove a generator set from parallel operation, place the circuit breaker switch of that set in the OPEN position. Stop the set as described in paragraph 2-7.
- b. Parallel Operation (Load Transfer). The following method of parallel operation is to be used when it is necessary to transfer the load from one set to the other without interrupting power.

**NOTE**

Visually check that the power cable and parallel cable are in accordance with Figure 2-6. If the cables are not attached as indicated, shutdown the "on-line" set and follow instructions in paragraph 2-9.

**CAUTION**

Do not attempt load connects in paragraph 2-9b unless all sets are off and no other external voltage is applied to the load. Equipment damage could result if caution is not observed.

- (1) The set in operation shall be designated as "on-line" and the sets placed in parallel operation shall be designated "on-coming".
- (2) Place the operations switch (26, Figure 2-1 ) on both sets in the PARALLEL OPERATION position.

**CAUTION**

Do not close the circuit breaker switch after starting the "on-coming" set as serious damage to one or both generator sets may result. Equipment damage could result if caution is not observed.

- (3) Refer to paragraph 2-6 and start the "on-coming" set. Do not perform steps 7 & 8 of Figure 2-8.
- (4) Note the voltage indicated on the "on-line" set. Adjust the voltage of the "on-coming" set to the voltage noted on the "on-line" set.
- (5) Adjust the frequency of the "on-coming" set to a higher value than that of the "on-line" set.
- (6) Slowly reduce the frequency of the "on-coming" set until the SYNCHRONIZING LIGHTS (25, Figure 2-1 ) flash at 2 to 3 second intervals.

**CAUTION**

Do not place the circuit breaker switch of the "on-coming" set in the CLOSE position while the SYNCHRONIZING LIGHTS are lit as damage to one or both generator sets may result. Equipment damage could result if caution is not observed.

- (7) Carefully watch the SYNCHRONIZING LIGHTS of the "on-coming" set. At the instant both lights go dark, move the circuit breaker switch of the "on-coming" set to the CLOSE position.
- (8) Adjust the voltage and frequency rheostats of both sets until load and current are divided equally between the two generator sets, as explained in paragraph 2-12a steps (7) and (8).
- (9) Move the circuit breaker switch (30) of the "on-line" set to the OPEN position.
- (10) Place the operations switch of the "on-coming" set to the SINGLE UNIT OPERATION position.
- (11) Readjust voltage and frequency of the "on-coming" set as necessary.
- (12) Refer to paragraph 2-7 and stop the "on-line" set.



### 2-13 EXERCISE OF ENGINE ON STANDBY SERVICE.

- a. General. The diesel engine of a generator set on standby service which is normally operated under optimum conditions should be exercised at least every 30 days. However, under any extreme environmental condition, the interval between exercise periods should be shortened appropriately. The exercise period should be long enough to enable the engine to attain normal operating temperature.
- b. Exercise Procedures.
  - (1) Perform the before operation checks and services of Table 2-2.
  - (2) Refer to paragraph 2-6 and start the engine.
  - (3) After allowing sufficient warm up time, run the engine at full speed for the period of time required to obtain two consecutive coolant temperature readings at a 15 minute interval of 160° F (71° C) minimum.
  - (4) Allow the engine to run an additional 30 minutes while performing the during operation checks and services listed in Table 2-2.
  - (5) Refer to paragraph 2-7 and stop the engine.
  - (6) Perform the after operation checks and services listed in Table 2-2.
  - (7) Correct any deficiencies noted during or after operation.
- c. Servicing an Engine on Standby.
  - (1) Change engine oil and oil filter element at a maximum of 6 months.
  - (2) Replace the fuel filter elements at a maximum of 12 months.

**Table 2-1. Freezing Points, Composition and Specific Gravities of Military Anti-freeze Materials**

Lowest expected ambient temp.°F	Pints of inhibited glycol per gal. of coolant <sup>1</sup>	Compound, antifreeze Arctic <sup>2</sup>	Ethylene glycol coolant solution specific gravity at 68 °F <sup>3</sup>
+20	1 1/2	Issued full strength and ready mixed for 0- to -65°F temperatures for both initial installation and replenishment of losses.	1.022
+10	2		1.036
	2 3/4		1.047
-10	3 1/4		1.055
-20	3 1/2		1.062
-30	4	DO NOT DILUTE WITH WATER OR ANY OTHER SUBSTANCE.	1.067
-40	4 1/4		1.073
-50	Arctic anti-freeze preferred		
-60			
-75			

<sup>1</sup>Maximum protection is obtained at 60 percent by volume (4.8 pints of ethylene glycol per gallon of solution).

<sup>2</sup>Military Specification MIL-C-11755 Arctic type, nonvolatile anti-freeze compound is intended for use in the cooling system of liquid-cooled internal combustion engines. It is used for protection against freezing primarily in Arctic regions where the ambient temperature remains for extended periods close to -40°F or drops below, to as low as -90°F.

<sup>3</sup>Use an accurate hydrometer. To test hydrometer, use 1 part ethylene glycol anti-freeze to 2 parts water. This should produce a hydrometer reading of 0°F.



## **Section II. OPERATION UNDER UNUSUAL CONDITIONS**

### **2-14 OPERATION IN EXTREME COLD (Below -25° F).**

- a. General. The generator set is designed to operate in ambient temperature as low as -25° F (-31 °C) without special winterization equipment. For operation at lower temperatures, the engine must be heated by either a fuel burning or electric winterization kit. Refer to paragraph 2-22 and 2-23 for operation instructions for these winterization kits.
  - (1) Cleaning. Keep the generator set and surrounding area as free of ice and snow as practical. Pay particular attention to the fuel tank cap and filler neck.
  - (2) Fuel System. Keep the fuel tank as full as possible to prevent condensation of moisture. Service the fuel tank with the proper grade of fuel for the existing ambient temperatures. Service the fuel strainer and filter assembly and secondary fuel filter at more frequent intervals. At the end of operation cycle, drain sediment from the fuel tank, fuel strainer and filter assembly, day tank, and secondary fuel filter.
  - (3) Engine Electrical System. Keep the batteries clean and inspect regularly for cracked and damaged cases. Keep the batteries fully charged at all times to avoid freezing. After adding distilled water to the batteries, operate the engine for at least an hour. Inspect the entire electrical system frequently for cracked, broken and frayed insulation. Tighten any loose connections and mounting dampers.
  - (4) Lubrication. Make sure that lubricants used are as specified for the prevailing ambient temperature by the current Lubrication Order.
  - (5) Cooling System. Use a hydrometer to check the specific gravity of the coolant. Maintain the coolant specific gravity as specified for the prevailing ambient temperature in Table 2-1.

### **2-15 OPERATION IN EXTREME HEAT (Up to 125°F).**

- a. Cooling System. Check coolant level daily. Maintain coolant level approximately two inches below the radiator overflow pipe. Check that radiator louver control is operating properly. Check louvers and radiator air passages for obstructions frequently. Check fan belt for proper tension. Check coolant temperature gauge frequently for any indication of overheating.
- b. Lubrication. Make sure that lubricants used are as specified for the prevailing ambient temperature in the current Lubrication Order.
- c. Fuel System. When filling the fuel tank, allow sufficient space for fuel expansion.
- d. Batteries. Check electrolyte level frequently. Add distilled water as required to compensate for evaporation.
- e. Generator. Keep the generator clean and free of dirt. Make sure that the generator ventilating screen is free of obstructions which would inhibit airflow.
- f. Engine. Keep the external surface of the engine as clean as possible.

### **2-16 OPERATION IN DUSTY OR SANDY AREAS.**

- a. General. If possible, provide a shelter for the generator set. Use available natural barriers to shield the generator set from blowing dust or sand. Keep all access doors closed as much as possible to prevent entry of dust and sand into the enclosure assembly. If water is available, wet down dusty surface areas around the set frequently.
- b. Cleaning. Wipe dust and sand from the generator set components frequently. When the generator set is not operating, the exterior surface should be thoroughly washed down with clean water.
- c. Engine. Shorten the service interval for the engine air cleaner and oil filter to compensate for intake of additional dust or dirt. Keep the external surface of the engine as clean as possible.
- d. Fuel System. Drain sediment from the fuel tank, fuel strainer, and fuel filters frequently. Be particularly careful to prevent dust or dirt from entering the fuel tank. Shorten the service intervals for the fuel filters appropriately.
- e. Lubrication. Lubrication intervals must be shortened appropriately. Use particular care to keep lubricants from becoming contaminated with dust or dirt.



## **2-17 OPERATION UNDER RAINY OR HUMID CONDITIONS.**

- a. General. If possible, provide a shelter for the generator set. Keep the generator set doors closed as much as possible. Cover the generator set with canvas or other waterproof material when it is not being operated. Provide adequate drainage to prevent water from accumulating on the operation site.
- b. Lubrication. Keep the generator set well lubricated to protect components from moisture. Use caution to keep lubricants from becoming contaminated with water.
- c. Fuel System. Keep the fuel tank as full as is practical to keep moisture condensation to a minimum. Drain water from fuel tank, day tank, and filters daily. Service the fuel filters more frequently than under normal operating conditions.
- d. Electrical System. Wipe the electrical system components dry before and after each period of operation.
- e. Rust Prevention. Remove moisture from the generator set components before and after each operating period. Clean and repaint any rusty surfaces. Remove peeling or blistered paint and repaint.

## **2-18 OPERATION IN SALT WATER AREAS.**

- a. Protection. If possible, provide a shelter for the generator set. Locate the generator set so that the radiator faces into the prevailing winds. Utilize natural barriers or, if possible, fabricate a barrier to protect the generator set from salt spray. Keep the generator set covered when not in use and keep all access doors closed as much as possible.
- b. Cleaning. When the generator set is not operating, wash the exterior surfaces off frequently with clean water.
- c. Rust Prevention. Clean and repaint any rusty or corroded surfaces. Remove any defective paint and repaint.

**2-19 OPERATION AT HIGH ALTITUDES.** The generator set will operate at elevations up to 5000 feet above sea level without special adjustment or reduction in load. At 8000 feet above sea level, the kilowatt rating is reduced approximately 10 percent. Refer to paragraph NO TAG for additional information.

### **Section III. OPERATION UNDER BATTLE CONDITIONS**

**2-20 BATTLE DAMAGE REPAIR.** For battlefield damage assessment and repairs of the 15 KW Generator Set, Diesel Driven, refer to TM 9-6115-624-BD.

### **Section IV. OPERATION OF ANCILLARY EQUIPMENT**

**2-21 GENERAL.** This section provides the information and instructions necessary for the effective operation of auxiliary equipment used in conjunction with the generator set. Included are the fuel burning winterization kit, electric winterization kit, wheel mounting kit, bad bank, and applications kit.

## **2-22 FUEL BURNING WINTERIZATION KIT.**

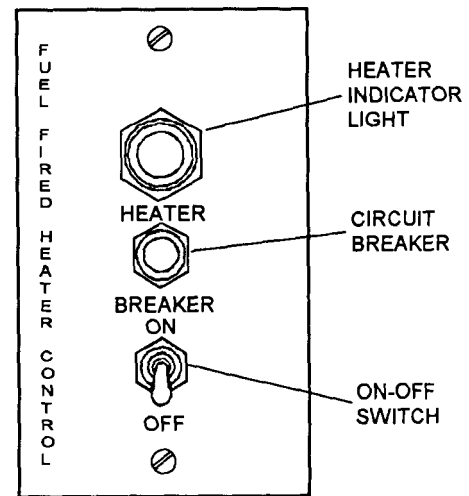
- a. General. The fuel burning winterization kit is utilized to preheat the engine coolant and lubricating oil in extremely cold weather. In ambient temperatures of -65°F (-53.9°C) the winterization kit should be placed in operation a minimum of 55 minutes prior to starting the generator set.
- b. Controls and Indicators.
  - (1) Heater Indicator Light (Figure 2-10). The heater indicator light is a press-to-test indicator light with a yellow lens. It illuminates when the winterization kit is in operation.
  - (2) Circuit Breaker (Figure 2-10). The circuit breaker is a trip-free, push-pull type circuit breaker. It opens and closes the 24 Vdc circuit to the heater controls.
  - (3) ON-OFF Switch (Figure 2-10). The ON-OFF switch is a double pole, two position toggle switch. When the switch is placed in the ON position, it closes the 24 Vdc circuit to the fuel pump and the igniter.
- c. Operation. Refer to Figure 2-10 for operating instructions.



**NOTE**

REFER TO THE FUEL BURNING WINTERIZATION SYSTEM DIAGRAM AND INSTRUCTION PLATE LOCATED ON THE INSIDE FACE OF THE LEFT SIDE ENGINE COMPARTMENT ACCESS DOOR FOR ADDITIONAL INSTRUCTIONS.

- Step 1. TURN THE MANUAL HEATER VALVE IN THE HEATER FUEL SUPPLY LINE AT THE DAY TANK ASSEMBLY TO THE OPEN POSITION.
- Step 2. OPEN THE SHUT OFF VALVES IN THE CYLINDER BLOCK COOLANT LINES.
- Step 3. IF GENERATOR SET IS EQUIPPED WITH BOTH FUEL BURNING AND ELECTRIC WINTERIZATION KITS, PLACE THREE-WAY VALVE POINTER IN OIL PAN COOLANT LINE IN THE 3 O'CLOCK POSITION.
- Step 4. DEPRESS CIRCUIT BREAKER ON HEATER CONTROL PANEL TO ACTIVATE HEATER CONTROL CIRCUITS.
- Step 5. PRESS IN ON HEATER INDICATOR LIGHT. IF IT DOES NOT ILLUMINATE, NOTIFY HIGHER LEVEL MAINTENANCE.



**CAUTION**

**IF HEATER FAILS TO IGNITE WITHIN THE SPECIFIED TIME, DO NOT ATTEMPT TO RESTART. THE IGNITION OF RESIDUAL FUEL VAPOR IN THE COMBUSTION CHAMBER MAY RESULT IN A MINOR EXPLOSION CAUSING DAMAGE TO THE HEATER, EQUIPMENT DAMAGE COULD RESULT IF CAUTION IS NOT OBSERVED.**

- Step 6. PLACE THE ON-OFF SWITCH IN THE ON POSITION, IF HEATER INDICATOR LIGHT DOES NOT ILLUMINATE WITHIN FOUR MINUTES, RETURN THE ON-OFF SWITCH TO THE OFF POSITION AND NOTIFY MAINTENANCE PERSONNEL.
- Step 7. ALLOW THE HEATER TO OPERATE UNTIL IT CYCLES "OFF" OR FOR 55 MINUTES, WHICHEVER OCCURS FIRST.
- Step 8. REFER TO PARAGRAPH 2-6 AND START THE ENGINE.
- Step 9. AFTER ENGINE STARTS. PLACE ON-OFF SWITCH IN THE OFF POSITION.

**NOTE**

THE HEATER BLOWER WILL CONTINUE TO OPERATE AFTER COMBUSTION SHUTDOWN TO CLEAR THE COMBUSTION CHAMBER OF RESIDUAL FUEL VAPOR.

- Step 10. TURN THE THREE-WAY VALVE HANDLE UNTIL THE POINTER IS IN THE 9 O'CLOCK POSITION.
- Step 11. CLOSE THE SHUTOFF VALVES IN THE CYLINDER BLOCK COOLANT LINES.
- Step 12. WHEN HEATER INDICATOR LIGHT GOES OUT, PULL OUT CIRCUIT BREAKER TO DE-ENERGIZE HEATER CONTROL CIRCUITS.

**Figure 2-10. Operating the Fuel Burning Winterization Kit**



## **2-23 ELECTRIC WINTERIZATION KIT.**

- a. General. The electric winterization kit uses an external power source to maintain the engine coolant and lubricating oil at normal operating temperature in standby situations which require immediate starting of the generator set. The kit will function effectively down to an ambient temperature of -65°F (-53.9°C). Coolant from the radiator is pumped into the heater assembly where it is heated by the heater elements. The heated coolant is circulated through the heat exchanger in the engine oil pan and through the cylinder block. After leaving the cylinder block, the coolant is returned to the radiator. Power for operation of the electric winterization kit may be obtained from any 208 to 240 volt, 50/60 Hz or 400 Hz, single phase source.
- b. Controls and Indicators.
  - (1) Circuit Breaker (Figure 2-11). The circuit breaker is a trip-free, push-pull type circuit breaker. It opens and closes the circuit to the winterization kit controls.
  - (2) POWER ON Indicator (Figure 2-11). The power on indicator is a press-to-test type indicator light. It illuminates when power is applied to the heater control circuits.
  - (3) ON-OFF Switch (Figure 2-11). The ON-OFF switch is a two-pole, two position switch. It opens and closes the two heater and the coolant pump motor circuits.
  - (4) HEATER ON Indicator (Figure 2-11). The HEATER ON indicator is a press-to-test type indicator light. It illuminates when the kit is in operation.
- c. Operation. Refer to Figure 2-11 for operating instructions.

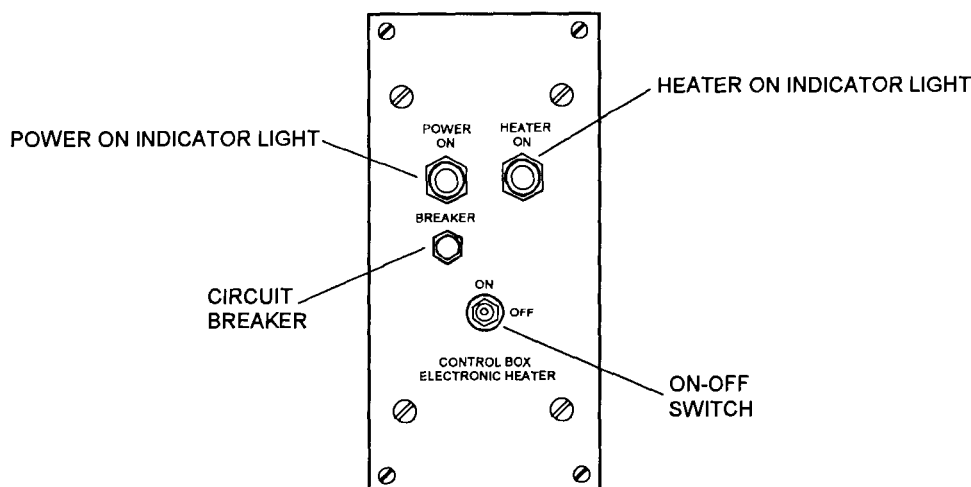
## **2-24 WHEEL MOUNTING KIT.**

- a. General. The wheel mounting kit extends the mobility of the generator set. It consists of a pair of two-wheeled axles which are bolted to the generator set skid frame. The front axle is equipped with a tow bar and safety chain. The front wheels are swivel mounted for steering. The rear axle is equipped with a parking brake.
- b. Using the Wheel Mounting Kit. Refer to Figure 2-12 for operating instructions.

## **2-25 LOAD BANK KIT.**

- a. General. The load bank kit is an air cooled, balanced, three phase resistive load which may be operated at either 120/208 or 240/416 volts. It provides up to 50 percent of the generator set rated load to minimize carbon buildup in the engine while the generator set is carrying a light load. The load bank incorporates protective devices which automatically removes its load should the generator become overloaded. The load bank kit will also automatically cease operation in the event that it overheats.
- b. Controls and Indicators.
  - (1) Voltage Selector Connectors (Figure 2-13). The voltage selector connectors are electrical connectors. They are used to reconnect the load bank circuits for 120/208 Vac or 240/416 Vac operation.
  - (2) Over Temperature Reset Switch (Figure 2-13). The OVER TEMPERATURE RESET switch is a triple circuit breaker. The switch trips automatically to open the load bank circuits to remove the unit from operation in the event of overheating. It is reset manually.
  - (3) Load Selector Switch (Figure 2-13). The LOAD SELECTOR switch is a five position rotary type switch. It is graduated in 12.5 percent increments which is 1/8 of the generator set rated load. It actuates the load bank power circuits.
  - (4) Load Bank Power On Indicator (Figure 2-13). The LOAD BANK POWER ON indicator is a press-to-test type indicator light with a red lens. It illuminates when power is applied to the load bank.
  - (5) Mode Selector Switch. The mode selector switch is a two position switch. When placed in the AUTO position, the load bank will automatically dump the load in the event that generator set load exceeds 81% of rated value. When the switch is placed in MANUAL position, the load must be manually removed.
- c. Operation. Refer to Figure 2-13 for operating instructions.





### **CAUTION**

**DO NOT ATTEMPT TO OPERATE THE ELECTRIC WINTERIZATION KIT IF THE GENERATOR SET IS EQUIPPED WITH A FUEL BURNING WINTERIZATION KIT WHICH IS OPERATING. EQUIPMENT DAMAGE COULD RESULT IF CAUTION IS NOT OBSERVED.**

### **NOTE**

REFER TO THE ELECTRIC WINTERIZATION SYSTEM DIAGRAM AND INSTRUCTIONS PLATE LOCATED ON THE INSIDE FACE OF THE LEFT SIDE ENGINE COMPARTMENT ACCESS DOOR FOR ADDITIONAL INFORMATION.

- Step 1. IF THE GENERATOR SET IS EQUIPPED WITH A FUEL BURNING WINTERIZATION KIT, TURN THE HANDLE OF THE THREE-WAY VALVE IN THE OIL PAN COOLANT LINE UNTIL THE POINTER IS IN THE 12 O'CLOCK POSITION.
- Step 2. OPEN BOTH SHUTOFF VALVES IN THE CYLINDER BLOCK COOLANT LINES.
- Step 3. DEPRESS THE CIRCUIT BREAKER TO ENERGIZE THE HEATER CONTROL CIRCUITS.
- Step 4. DEPRESS POWER ON AND HEATER ON INDICATOR LIGHTS. IF THEY DO NOT ILLUMINATE WHEN DEPRESSED, NOTIFY HIGHER LEVEL MAINTENANCE.
- Step 5. PLACE ON-OFF SWITCH IN THE ON POSITION. IF BOTH POWER ON AND HEATER ON INDICATOR LIGHTS DO NOT ILLUMINATE, CHECK FUSE. IF FUSE IS SERVICEABLE, CHECK INDICATOR LAMPS (paragraph 5-13d.). IF LAMPS ARE SERVICEABLE, CEASE OPERATION AND NOTIFY HIGHER LEVEL MAINTENANCE.
- Step 6. PRIOR TO STARTING THE GENERATOR SET, TURN THE THREE-WAY VALVE HANDLE UNTIL THE POINTER IS IN THE 9 O'CLOCK POSITION AND CLOSE BOTH SHUTOFF VALVES IN THE CYLINDER BLOCK COOLANT LINES.
- Step 7. PLACE THE ON-OFF SWITCH IN THE OFF POSITION.

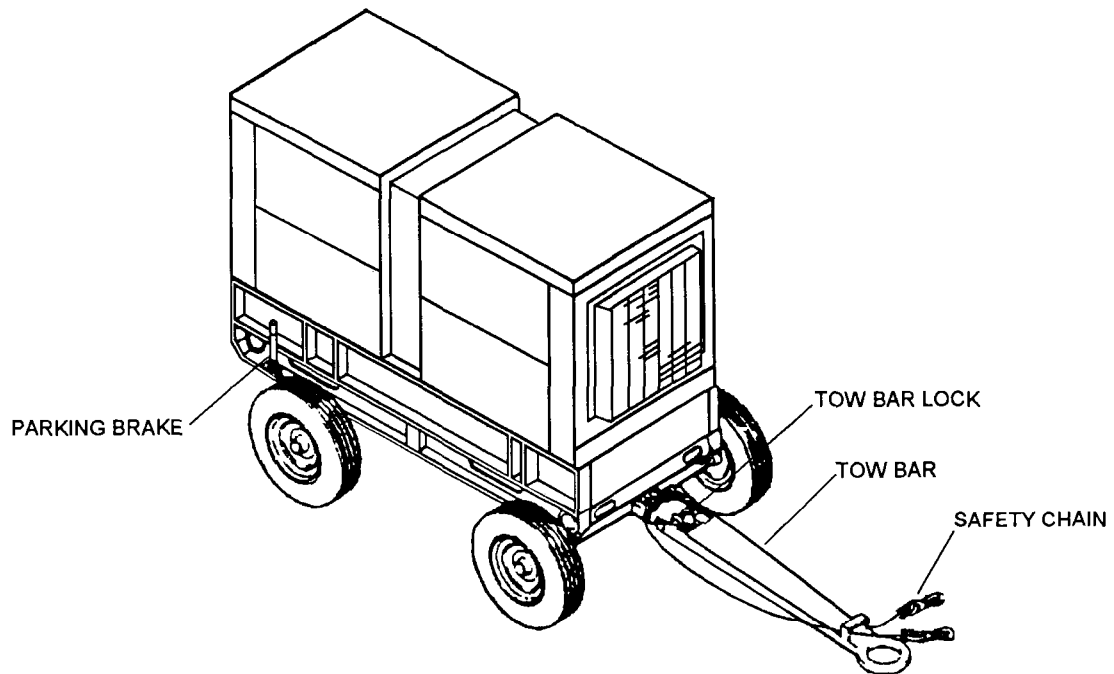
### **CAUTION**

**DO NOT START THE GENERATOR SET WHILE THE ON-OFF SWITCH IS IN THE ON POSITION. EQUIPMENT DAMAGE COULD RESULT IF CAUTION IS NOT OBSERVED.**

- Step 8. REFER TO PARAGRAPH 2-6 AND START THE GENERATOR SET.

**Figure 2-11. Operating the Electric Winterization Kit**





- Step 1. RELEASE THE TOW BAR LOCK AND LOWER THE TOW BAR.
- Step 2. ATTACH THE TOW BAR AND SAFETY CHAINS TO THE TOWING VEHICLE.
- Step 3. RELEASE THE PARKING BRAKE.

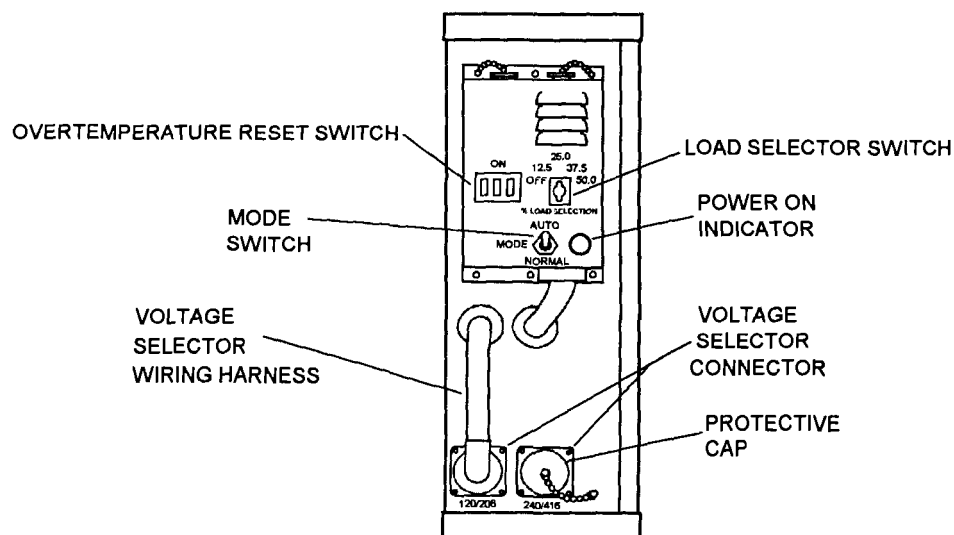
**CAUTION**

**DO NOT TOW THE GENERATOR IN EXCESS OF 5 MPH ON PAVED ROADS.  
EQUIPMENT DAMAGE COULD RESULT IF CAUTION IS NOT OBSERVED.**

- Step 4. TOW THE GENERATOR SET TO THE DESIRED POSITION.
- Step 5. ENGAGE THE PARKING BRAKE AND DISCONNECT THE SAFETY CHAINS AND TOW BAR FROM THE TOWING VEHICLE.
- Step 6. RAISE THE TOW BAR UNTIL THE TOW BAR LOCK ENGAGES.

**Figure 2-12. Using the Wheel Mounting Kit**





### **CAUTION**

**ALWAYS CHECK THE POSITION OF THE GENERATOR SET VOLTAGE RE-CONNECTION BOARD BEFORE PLACING THE LOAD BANK IN OPERATION. DAMAGE TO THE LOAD BANK WILL RESULT IF IT IS OPERATED AT A VOLTAGE DIFFERENT FROM THE GENERATOR SET OUTPUT VOLTAGE. EQUIPMENT DAMAGE COULD RESULT IF CAUTION IS NOT OBSERVED.**

- Step 1. CONNECT THE VOLTAGE SELECTOR WIRING HARNESS TO THE VOLTAGE SELECTOR CONNECTOR CORRESPONDING TO THE GENERATOR SET OPERATING VOLTAGE.
- Step 2. INSTALL THE PROTECTIVE CAP OVER THE REMAINING CONNECTOR.

### **CAUTION**

**DO NOT ALLOW THE GENERATOR SET TO OPERATE UNATTENDED WITH THE MODE SWITCH IN THE MANUAL POSITION. EQUIPMENT DAMAGE COULD RESULT IF CAUTION IS NOT OBSERVED.**

- Step 3. PLACE THE MODE SWITCH IN THE DESIRED OPERATING POSITION.
- Step 4. POSITION THE OVER TEMPERATURE RESET SWITCH TO THE ON POSITION.

### **CAUTION**

**DO NOT ALLOW LOAD BANK AND GENERATOR SET LOAD TO EXCEED THE RATED LOAD OF THE GENERATOR SET. EQUIPMENT DAMAGE COULD RESULT IF CAUTION IS NOT OBSERVED.**

- Step 5. POSITION THE LOAD SELECTOR SWITCH TO THE PERCENT LOAD WHICH, WHEN ADDED TO THE GENERATOR SET LOAD, WILL MOST NEARLY EQUAL, BUT NOT EXCEED, 100 PERCENT OF THE GENERATOR SET RATED LOAD.
- Step 6. CHECK THAT LOAD BANK POWER ON INDICATOR LIGHT IS LIT, IF IT IS NOT, PRESS IN ON THE LENS. IF THE LAMP ILLUMINATES BUT GOES OUT WHEN RELEASED, RETURN THE LOAD SELECTOR SWITCH TO THE OFF POSITION, NOTIFY MAINTENANCE PERSONNEL.
- Step 7. TO REMOVE THE LOAD BANK FROM OPERATION, POSITION THE LOAD SELECTOR SWITCH TO THE OFF POSITION AND PLACE THE OVER TEMPERATURE RESET SWITCH TO THE OFF POSITION.

**Figure 2-13. Operating the Load Bank**



**2-26 APPLICATIONS KIT.** The application kit provides remote control of the emergency stop capability and battle short capability and remote low fuel monitoring. The kit consists of a connector plate, wiring harness, and remote functions assembly. (Refer to Figure 2-14.)

**2-27 ACOUSTIC SUPPRESSION KIT.** The acoustic suppression kit provides the ability to lower the noise level of the generator set to 70dB(A) at 7 meters. The kit consists of panels, doors, and components that cover or replace original components of the generator set.

The generator set is operated and maintained in the same manner, however, access to components and operation will change slightly due to configuration changes. (Refer to para 1-11.)

Remember that overall weight and cube of the generator set will increase with the acoustic suppression kit installed. (Refer to Figure 2-15.)

#### NOTE

If generator set has a fuel burning winterization kit installed, the winterization kit cannot be operated unless the side panel skirt is raised to permit exhaust of the winterization kit.

Data plates and schematics used in troubleshooting are stored behind the document box mounted on rear panel when the acoustic suppression kit is installed on the generator set.

#### **2-28 PATRIOT LOAD BANK PROCEDURES.**

- a. General. This procedure is recommended for operating a load bank with the 15 KW Diesel Generator Sets mounted on the PATRIOT Launching Station. The load bank is a Test Set, Electrical (0-33 KW Load Bank), TS-4216/G. The Generator Set is a Diesel Engine Driven, MEP-113A, 3 phase 4 wire, 120/208 volts. The Launching Station (LS) is Launching Station, GM, Semi-Trailer Mounted, M901.
- b. Launching Station 15 KW generator sets should be run on a load bank when exhibiting symptoms resulting from a diesel engine condition identified as carbon buildup or wet stacking or slobbering. Cosmetically, the exhaust assembly and surroundings may be coated with fuel oil, a carbon mixture or sludge.
- c. Such symptoms relate to an accumulation of liquid petroleum products in a diesel exhaust system. The products often ooze from the exhaust manifold gasket or spit up an open exhaust stack. The symptoms, which may appear on an engine in reasonably good repair, are more likely to occur in cool weather. Typically the set will have been operated for hundreds of hours under high speed idle under no load or minimum load conditions.
- d. The visible symptoms may be accompanied by substandard engine performance. The engine may not accept full load, its speed may be erratic. The generator set output may show abnormal voltage and frequency fluctuations.
- e. The load bank may be transported to the LS by CUVC-CARGO, M1008 or other suitable vehicle. Off-loading at the LS site should be in accordance with TM 11-6625-3197-13&P. The load bank should not be placed directly on muddy ground or in standing water.



1. Cable Harness Assembly
2. Remote Functions Assembly
3. Tiedown Strap (8 ea.)
4. Capscrew (4 ea.)
6. Lockwasher (4 ea.)
6. Spacer (4 ea.)

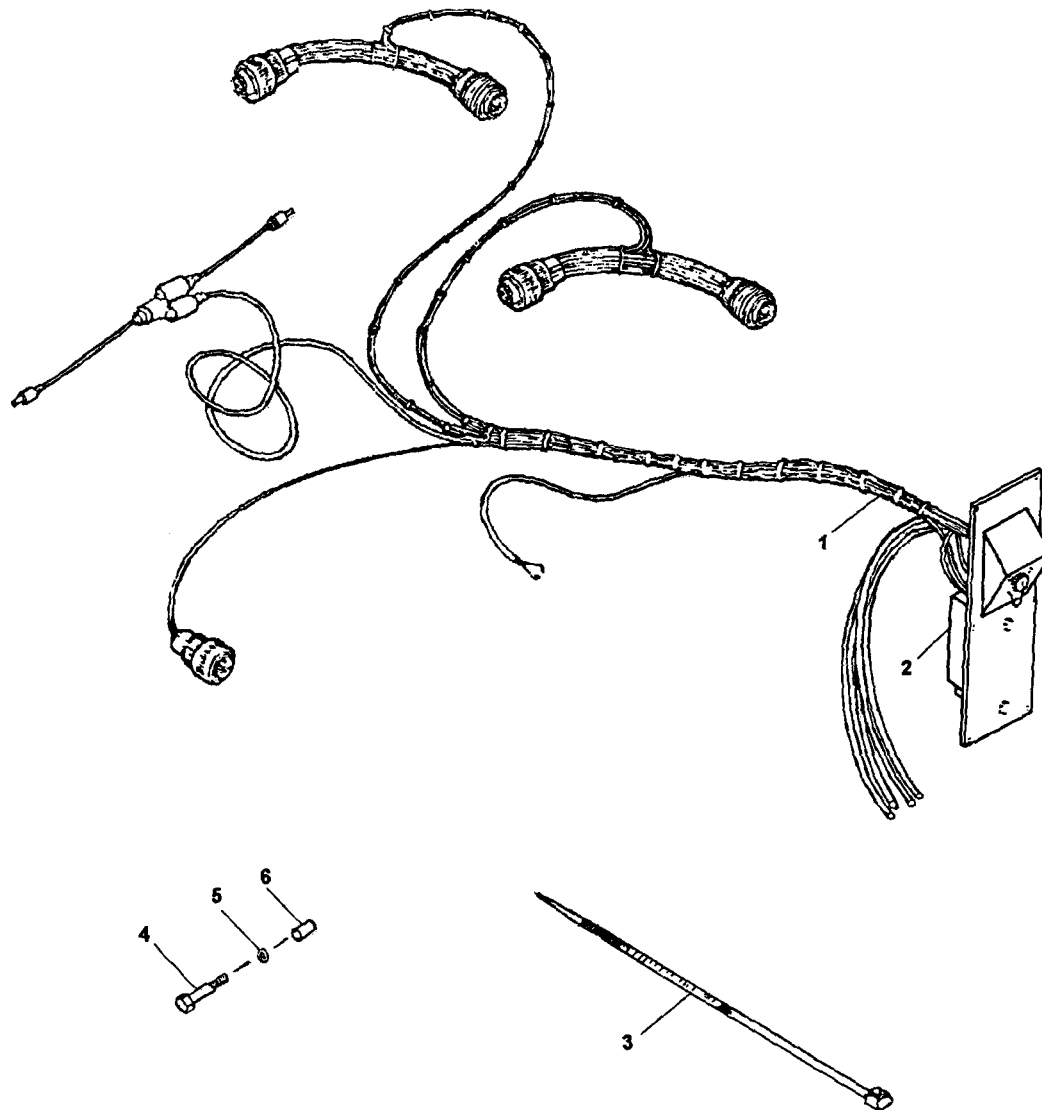


Figure 2-14. Applications Kit Components



1. Discharge Turn
2. Inlet Turn
3. Roof Panel Assembly
4. Rear Panel Assembly
5. Side Panel Skirt
6. Side Panel
7. Isolators
8. Bottom Panel Tray Assembly
9. Front Upper Panel Assembly
10. Front Lower Panel Assembly

11. Roof Stiffeners
12. Sealing Angle
13. Radiator Access Door
14. Lifting Eye Access Door
15. Controls Access Door
16. Lifting Strap
17. Controls Access Window
18. Upper Side Panel Skirt
19. Document Box

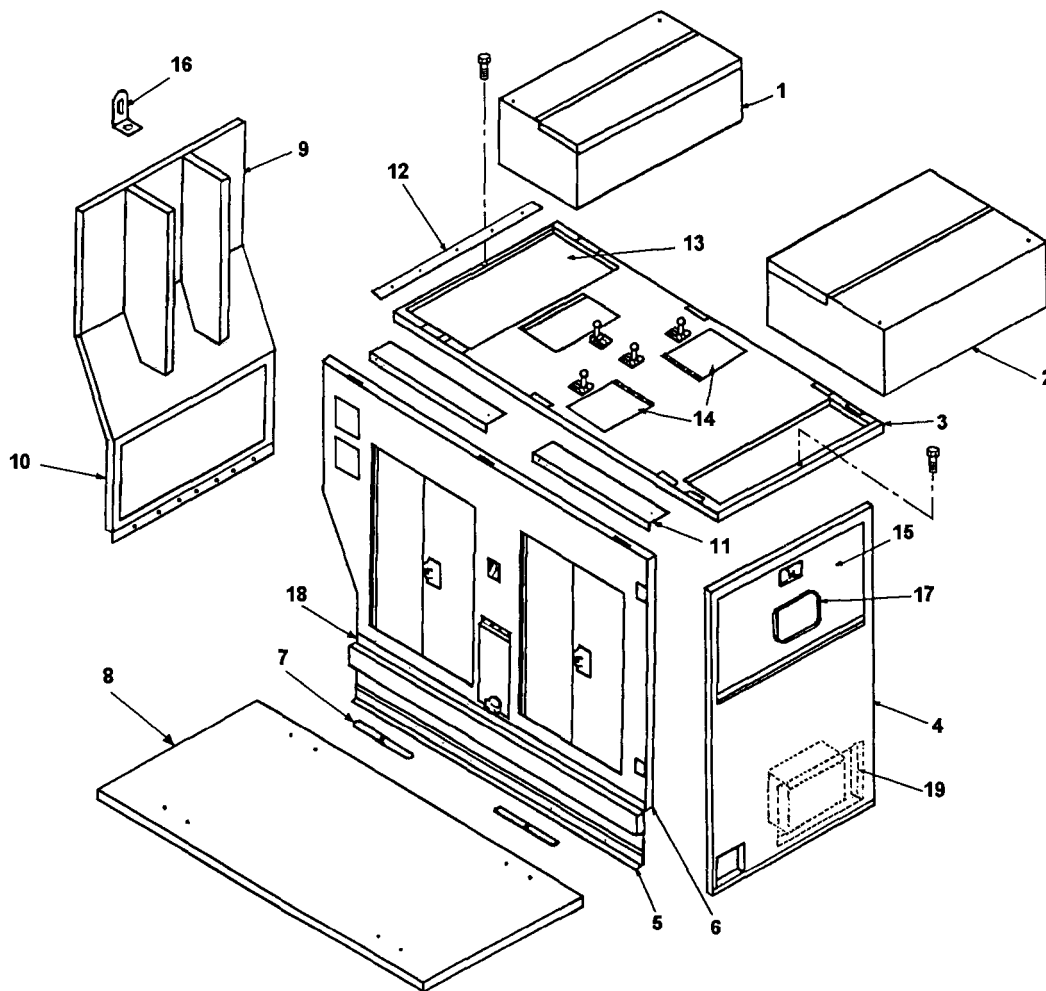


Figure 2-15. Acoustic Suppression Kit



f. Operating Procedures.

- (1) Prior to further operations, turn the LS MEP 113A generator set off. Place the LS Main Power AC circuit breaker on the Launcher Electronics module in the "OFF" position.



**TO AVOID ELECTRICAL SHOCK HAZARD THE LOAD BANK MUST ALWAYS BE CONNECTED TO EARTH GROUND.**

- (2) Ground the load bankframe by connecting the #8 AWG (or larger) green or bare conductor, provided with the load bank, from the ground stud to the LS ground stake.



**TO AVOID ELECTRICAL SHOCK HAZARD THE LS GENERATOR SET MUST BE OFF WHILE MAKING ELECTRICAL INTERCONNECTIONS.**

- (3) Position the load bank to assure the remaining 4 conductors, provided with the load bank, will reach from the load bank load terminal board to the road side of the LS generator set.



**TO AVOID ELECTRICAL SHOCK CHECK THAT THE GROUND CONDUCTOR FROM THE LOAD BANK TO THE EARTH GROUND IS CONNECTED AND THE CONDUCTOR IS CONTINUOUS.**

- (4) Internally connect the load bank for a 33 KW 208V L-L 3P/4W load in accordance with the reconnection procedure in TM 11-6625-3197-13&P.
- (5) Raise the generator set electrical terminal access door on the set road side and secure in this position.
- (6) Remove the plastic protective cover from the generator set electrical terminal assembly.
- (7) Connect the white or gray #6 AWG (or larger) conductor from the LO terminal on the load bank input terminal board to LO on the generator set output load terminal board.
- (8) Connect the remaining conductors from L1-L2-L3 on the load bank to L1-L2-L3 on the generator set.

**CAUTION**

**DO NOT ATTEMPT TO LATCH THE CLOSE GENERATOR SET DOOR. EQUIPMENT DAMAGE COULD RESULT IF CAUTION IS NOT OBSERVED.**

- (9) Release the generator set terminal door so electrical terminals are not exposed.
- (10) Close the latch on the load bank terminal access door.
- (11) Place the load bank control circuit breaker in the "OFF" position.
- (12) Start the LS generator set in accordance with TM 9-6115-464-12.
- (13) Place the generator set circuit breaker switch in the "ON" position.
- (14) operate the load bank in accordance with TM 11-6625-3197-13&P.
- (15) Load the generator set to 100 (redline) on the generator set control panel percent power meter. Load the set starting at 0 and increasing the load with the load bank variable control and switches until the 100 percent point is reached. The time interval for each load increment should be judged by engine stability. As the engine stabilizes at a given load, the next load increment may be applied.



- (16) Run the generator set for 5 hours at the full 100 percent load. The exhaust should then be clean with no evidence of oil dribbling or slobbering.
- (17) Reduce the load on the generator set from 100 percent to zero by placing each of the load bank toggle switches in the "OFF" position.
- (18) Place the load bank control circuit breaker in the "OFF" position.
- (19) Place generator set circuit breaker switch in the OFF position.
- (20) Place the 15 KW generator set in the "OFF" condition, shutting down the engine.
- (21) Disconnect the four L0, L1, L2, L3 interconnection power conductors.
- (22) Replace the plastic protective rover over the generator set electrical terminal assembly.
- (23) Disconnect the frame to ground conductor.
- (24) Stow the load bank and the interconnection conductors and return to the vehicle.



**HOT EXHAUST SURFACES MAY CAUSE PERSONAL INJURY.**

- (25) Clean outer engine surfaces of oil residue caused by previous slobbering/wet **stacking**.

**Section V. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)**

**NOTE**

The PMCS chart in this section contains all necessary operator preventive maintenance checks and services for this equipment.

**2-29 INTRODUCTION.**

Purpose. Your PMCS table lists the checks (inspections) and services (care) of your equipment to keep it in good operating condition. Inspection will allow defects to be discovered and corrected before they result in serious damage or failure. Table 2-2 lists the PMCS in sequence of performance. Operator personnel must observe all cautions and warnings.

**2-36 EXPLANATION OF COLUMNS.**

- a. Item Number column. This column provides identification numbers for the performance of PMCS functions in proper sequence. Use the numbers as a reference on reports of failures and deficiencies. (For Army users, report on DA Form 2404 Equipment Inspection and Maintenance Worksheet).
- b. Interval column. This column identifies when particular functions (checks/service) must be performed.
- c. Item to check/service column. This column identifies specific items for inspecting (servicing/checking).
- d. Procedures. The column lists the checks or services you have to perform and explains how to perform them.
- e. Not Fully Mission Capable If: column. This column tells you when and why your equipment cannot be used.



#### **NOTE**

The terms ready/available and mission capable refer to the same status: equipment is on hand and is able to perform its combat mission.

#### **NOTE**

Leakage definitions for operator PMCS shall be classified as follows:

Class I: See page of fluid (as indicated by wetness or discolorization) 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 the item being checked/inspected.

Class III: Leakage of fluid great enough to form drops that fall from the item being checked/inspected.

#### **CAUTION**

**Equipment operation is allowable with minor leakages (Class I or II). Of course, you must consider the fluid capacity in the item/system being checked/inspected. When in doubt, notify your supervisor.**

**When operating with Class I or Class II leaks, continue to check fluid levels as required by PMCS.**

Equipment damage could result if caution is not observed.

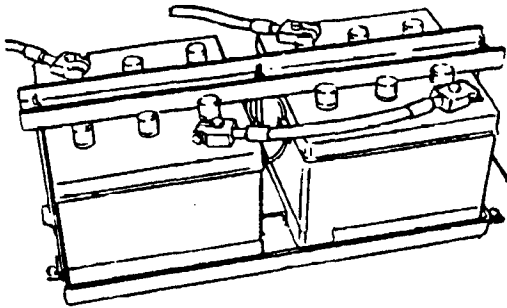
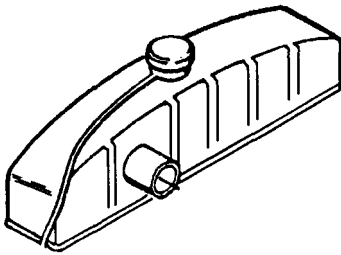
**2-31 REPORTING DEFICIENCIES.** If your equipment does not perform as required, and if you discover problems during PMCS that you are unable to correct, it must be reported. Refer to DA Pam 738-750 and report the deficiency using the proper forms.

#### **NOTE**

For generator sets in continuous operation, check and service only those items that can be checked and serviced without disturbing operation. Perform a complete PMCS when equipment can be shutdown. Deficiencies discovered during operation shall be noted for future correction. Stop the operation immediately if a deficiency is noted which could damage the equipment. Report all deficiencies and corrective actions on proper forms. Army, refer to DA Pamphlet 738-750. Air Force, refer to applicable inspection manuals and work card sets in the TO 35C2-3-1-426 series for periodic requirements and Table 2-2 for detailed procedures. Operator PMCS apply to Navy users in this manual.

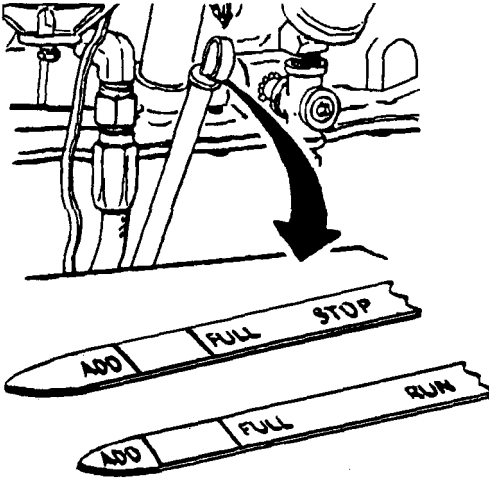
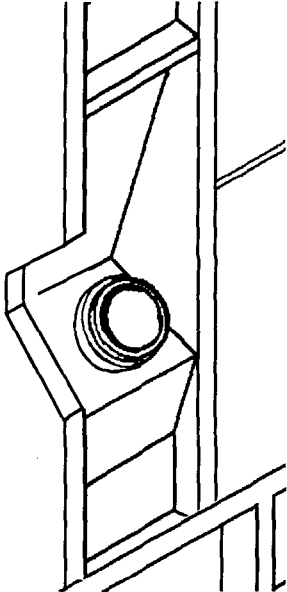


**Table 2-2. Operator Preventive Maintenance Checks and Services**

Item No.	Interval	Location	Procedure	Not Mission Capable If:
		Item to Check\ Service		
1	Before	Generator Set	Visually inspect the generator set for fuel, oil, hydraulic, and coolant leaks (para 3-28 through 3-30). Check for proper ground connections (para 2-4d).	Class III oil or any fuel leakage is detected during inspection or ground cable missing or not connected.
2	Before	Batteries	Visually inspect batteries for cracked or broken cases, corrosion on terminal posts, damaged or frayed cables and loose connections. Check electrolyte level (para 34).	
				
3	Before	Cooling System	Check coolant level. Proper level is two inches below the overflow pipe. Add coolant as required.	
				



**Table 2-2. Operator Preventive Maintenance Checks and Services - Continued**

Item No.	Interval	Location	Procedure	Not Mission Capable If:
		Item to Check\ Service		
4	Before	Engine Oil Level	<p>Check oil level. Add oil as necessary.</p> 	
5	Before	Fuel Tank	<p>Fill fuel tank at completion of operation (Figure 3-5, para 3-45)</p> 	



**Table 2-2. Operator Preventive Maintenance Checks and Services - Continued**

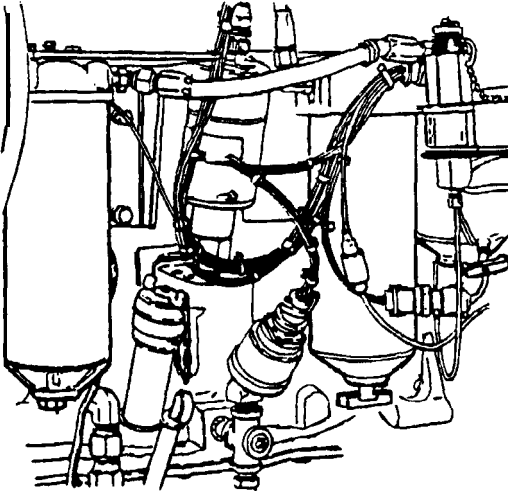
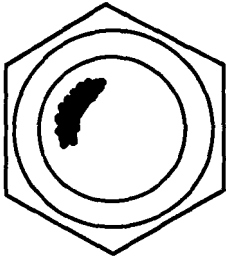
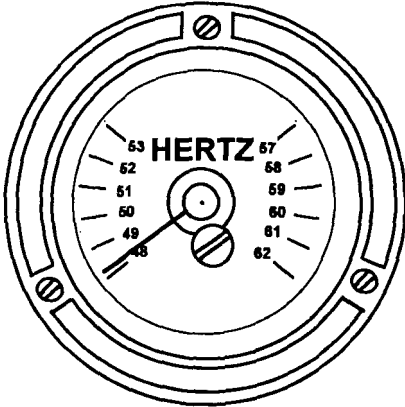
Item No.	Interval	Location	Procedure	Not Mission Capable If:
		Item to Check\ Service		
6	Before	Acoustic Suppression Kit	All doors and panels should seal and fit properly (Figure 2-9).	
7	Before	Fuel Filters and	<p>Drain water and sediment.</p>  <p><b>NOTE</b>            In freezing weather, drain shortly after operation. Allow to drain until fuel runs clear.</p>	

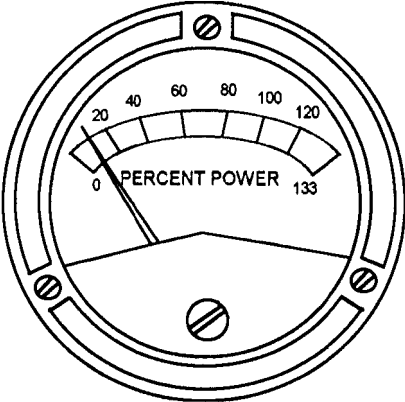
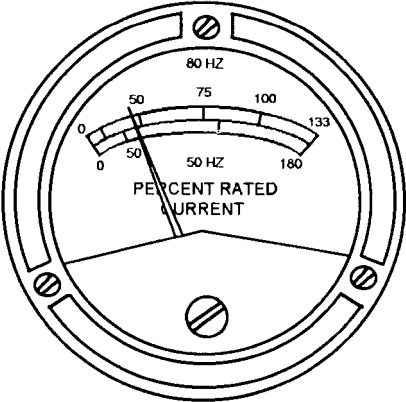


Table 2-2. Operator Preventive Maintenance Checks and Services - Continued

Item No.	Interval	Location	Procedure	Not Mission Capable If:
		Item to Check\ Service		
8	Before	Day Tank	Drain water and sediment.  <b>NOTE</b> In freezing weather, drain shortly after operation. Allow to drain until fuel runs clear.	
9	During	Engine Oil Level	Check oil level. Add oil as necessary.	
10	During	Control Panel a. Air Cleaner condition	Indications shall be within specified limits. Lights up to indicate a clogged air cleaner. Press-to-test (para 2-2c).	Air cleaner missing or unserviceable. Light remains on during operation.
	During	b. Frequency meter	50/60 Hz, 400 Hz (para 2-2d).   <b>AIR CLEANER CONDITION</b>	
				Frequency cannot be properly adjusted.

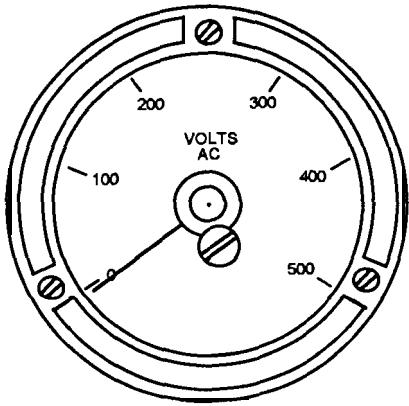
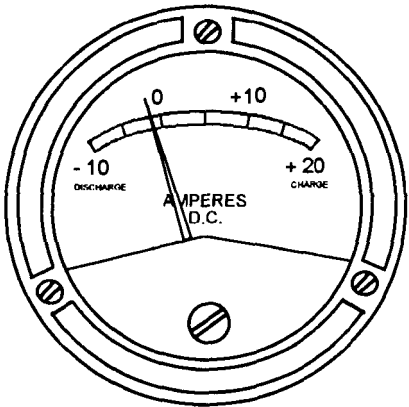


**Table 2-2. Operator Preventive Maintenance Checks and Services - Continued**

Item No.	Interval	Location	Procedure	Not Mission Capable If:
		Item to Check\ Service		
	During	c. Kilowatt meter	Indicates applied load not to exceed 100% para 2-2e).	
				
	During	d. AC Ammeter	Indicates percentage current. Not to exceed 100%	No indication when load is applied.
				

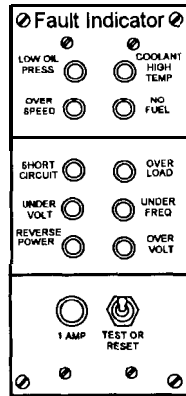


**Table 2-2. Operator Preventive Maintenance Checks and Services - Continued**

Item No.	Interval	Location	Procedure	Not Mission Capable If:
		Item to Check\ Service		
	During	3. AC Voltmeter	Indicates 120/208, or 240/416 volts.  	Voltage cannot be properly adjusted.
	During	f. Battery Charging Ammeter	Normal indication 0 to +20 amps, depending on battery charging rate. Should read in green portion of scale during normal operation.   <b>BATTERY CHG AMMETER</b>	Ammeter does not indicate charging current.

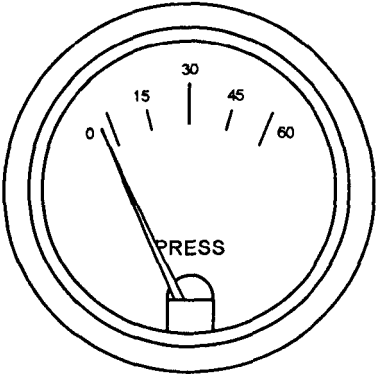
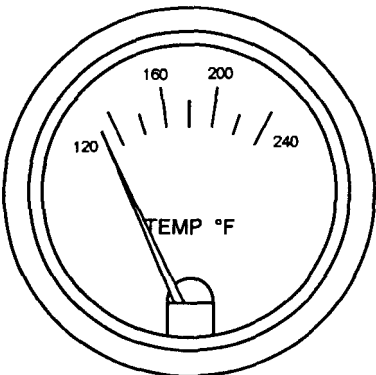


**Table 2-2. Operator Preventive Maintenance Checks and Services - Continued**

Item No.	Interval	Location	Procedure	Not Mission Capable If:
		Item to Check\ Service		
	During	g. Fault Indicator Panel	<p>All lights out during operation. Check bulb operation with test or retest switch on panel.</p>  <p><b>NOTE</b></p> <p>This equipment is not ready/available if column does not apply to the under voltage and under frequency lights on DOD Model 004A, Utility, 50/60 Hz, NSN 6115-00-118-1241 Generator Sets.</p>	Fault light will not extinguish when switch is placed to TEST or RETEST position, then released. All bulbs should be lit when switch is in test or reset position.



**Table 2-2. Operator Preventive Maintenance Checks and Services - Continued**

Item No.	Interval	Location	Procedure	Not Mission Capable If:
		Item to Check\ Service		
	During	h. Engine Oil Pressure Gage	<p>Normal indication 20 to 55 psi (para. 2-2a).</p>  <p>OIL PRESSURE</p>	Pressure below 20
	During	i. Coolant temperature Gauge	<p>Normal indication 170 - 200 °F (para. 2-2 am).</p>  <p>COOLANT TEMPERATURE</p>	Temperature exceeds 200 °F.



**Table 2-2. Operator Preventive Maintenance Checks and Services - Continued**

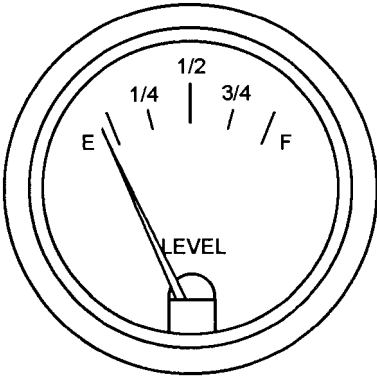
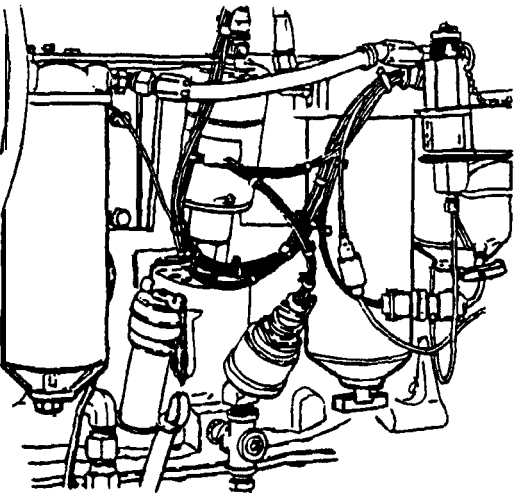
Item No.	Interval	Location	Procedure	Not Mission Capable If:
		Item to Check\ Service		
	During	Fuel Level Gauge	<p>Indicates qauantitv of fuel in tank para. 2-2 ak).</p>  <p><b>FUEL LEVEL</b></p>	
11	During	Acoustic Suppresion Kit	<p>All doors and panels should seal and fit properly (Figure 2-9).</p>	



Table 2-2. Operator Preventive Maintenance Checks and Services - Continued

Item No.	Interval	Location	Procedure	Not Mission Capable If:
		Item to Check\ Service		
12	After	Fuel Filters and Strainers	Drain water and sediment. 	
13	After	Day Tank	Drain water and sediment. <p><b>NOTE</b></p> <p>In freezing weather, drain shortly after operation. Allow to drain until fuel runs clear.</p> <p><b>NOTE</b></p> <p>In freezing weather, drain shortly after operation. Allow to drain until fuel runs clear.</p>	



## Section VI. MOVEMENT TO A NEW WORK SITE

### 2-32 DISMANTLING THE GENERATOR SET FOR MOVEMENT.

- a. Preparation for Movement.
  - (1) Disconnect the load leads.
  - (2) If exhaust extension was used, remove and install rain cap.
  - (3) Disconnect paralleling leads, if used.
  - (4) Disconnect auxiliary fuel line, if used, and store on unit.
  - (5) Disconnect ground lead, remove ground rods and store on unit.
  - (6) Secure all doors and panels.
- b. Movement.



**Do not use hoisting equipment or transporting vehicle with capacity less than 3200 pounds. Do not allow the generator set to swing when it is suspended. Securely attach the generator set to the transporting vehicle. Failure to observe this warning may result in serious injury or death of personnel or damage or destruction of the generator set.**

#### **CAUTION**

**To avoid undue side pressures which could result in damage to the lifting frame, use a minimum bridle of 5 feet on the hoisting sling. If acoustic suppression kit is installed, generator set must have 1-inch clearance under bottom tray assembly. Equipment damage could result if caution is not observed.**

- (1) Hoisting. Attach a sling to the generator set lifting clevises (Figure 1-4) for loading with a crane or movement by helicopter.
- (2) Fork Lift. Insert forks of fork lift into openings on skid base (Figure 1-4). Lift the generator set onto the carrier. If the distance is short and the terrain permits, the generator set may be transported with the fork lift. If acoustic suppression kit is installed, both side panel skirts must be raised and secured.
- (3) Skidding. Attach a sling through the pipes provided in the skid base and connect to a suitable vehicle for skidding to the desired location. Generator set cannot be skidded if acoustic suppression kit is installed.
- (4) Shipment. Movement over greater distances requires that the generator be prepared for shipment in accordance with paragraph 1-7. If acoustic suppression kit is installed, the inlet/discharge turns must be removed to reduce the cube of the generator set. For air shipment, inlet/discharge turns can be turned on their sides on trailer fenders. Place a band or strap around the entire unit to secure the inlet/discharge turns.

**2-33 REINSTALLATION AFTER MOVEMENT.** Refer to paragraph 2-4 and install the generator set in accordance with the instructions provided.







## Chapter 3 OPERATOR MAINTENANCE INSTRUCTIONS

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### Section I. LUBRICATION INSTRUCTIONS

**3-1 TOOLS AND EQUIPMENT (Not Applicable to Air Force.)** The tools required to perform operator and unit maintenance on the generator set are listed in Appendix B of this manual.

**3-2 GENERAL LUBRICATION INFORMATION.**

- a. This paragraph contains lubrication instructions which are supplemental to, and not specifically covered in the Lubrication Order.
- b. Refer to Lubrication Order LO 9-6115-464-12 for lubrication instructions.

**CAUTION**

The dipstick is marked to indicate that the crankcase oil level may be checked and oil added while the engine is running or stopped. Always make sure the correct side of the dipstick is checked. When checking oil with engine running, remove oil filler cap. Equipment damage could result if caution is not observed.

- c. When changing the engine crankcase oil, never fill the crankcase above the FULL mark on the dipstick. Do not allow the oil level to fall below the ADD mark on the dipstick. Service the oil filter element each time that the crankcase oil is changed.
- d. A seal in the dipstick cap prevents oil from leaking from the crankcase and foreign material from entering. Keep the dipstick firmly seated on the adapter tube at all times.
- e. Keep the crankcase breather tube open at all times to prevent pressure build-up in the engine crankcase which will cause oil leakage from the crankshaft seals.

### Section II. OPERATOR'S MAINTENANCE INSTRUCTIONS

**3-3 GENERAL.** The instructions in this section are published for the information and guidance of personnel operating the generator set. Deficiencies noted during inspection which are beyond the maintenance scope of the operator shall be reported to higher level maintenance.

**3-4 BATTERIES (Figure 1-4).**

- a. Inspection.
  - (1) Inspect batteries for cracked or broken cases, corrosion on terminal posts, damaged or frayed cables and loose connections.
  - (2) Slide battery tray out from compartment.
  - (3) Check electrolyte level at eight hour intervals. More often under high temperature conditions.
- b. Service.
  - (1) Remove corrosion from battery terminals and apply a light coat of grease.
  - (2) Maintain electrolyte level to slots in filler wells, by filling with distilled water.

**3-5 SLAVE RECEPTACLES (Figure 1-4).** Inspect the slave receptacles for loose mounting, loose connections, loose or damaged weather covers and other visible damage.

**3-6 BREATHING TUBE, EXHAUST PIPE AND MUFFLER (Figure 3-1 and Figure 3-2).**

- a. Inspect breathing tube for cracks, breaks, insecure mounting and dogging.
- b. Inspect exhaust pipe and muffler for insecure mounting, cracks, and obstructions.

**3-7 CONVENIENCE RECEPTACLES AND CIRCUIT BREAKER (Figure 1-5).** inspect convenience receptacles and circuit breaker for insecure mounting, cracks, loose connections, damaged leads and other visible damage.



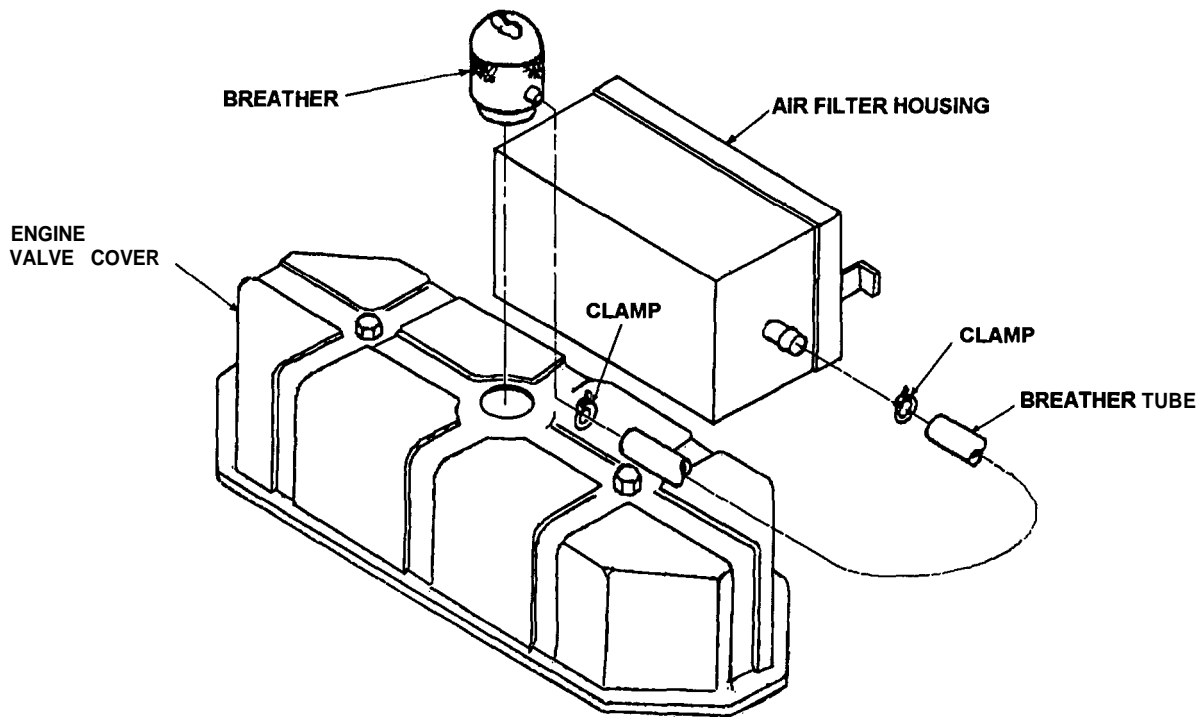


Figure 3-1. Inspecting the Breather and Breather Tube



1. Roll pin
2. Rain cap
3. Capscrew
4. Lockwasher
5. Flange
6. Capscrew
7. Lockwasher
8. Muffler
9. Gasket

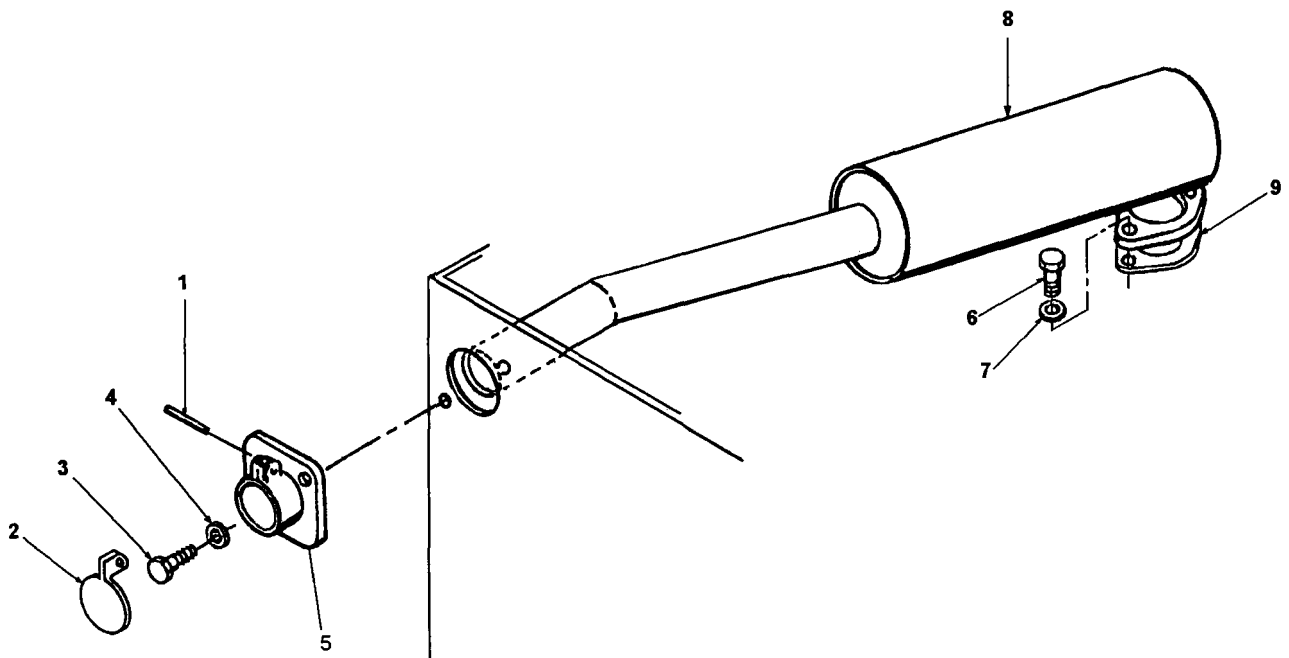


Figure 3-2. Inspecting the Muffler



**3-8 PLATE AND SLEEVE ASSEMBLY (Figure 1-5).**

- a. Inspect sleeve for tears, deterioration, and missing draw string.
- b. Check plate for dents, cracks, and illegible markings.

**3-9 PARALLELING RECEPTACLES (Figure 1-5).**

- a. Inspect paralleling receptacles for insecure mounting, corrosion, and damage.
- b. Check electrical leads for loose connection, frayed insulation, and evidence of shorting.

**3-10 AC VOLTMETER (7, Figure 2-1).**

- a. Inspection. Inspect ac voltmeter for cracked or broken glass, insecure mounting, bent indicator, corrosion or other damage.
- b. Adjustment. With the generator set shut off, rotate the voltmeter "zero" adjusting screw until the indicator points to zero.

**3-11 KILOWATT (PERCENT POWER) METER (4, Figure 2-1).**

- a. Inspection. Inspect the kilowatt meter for cracked, or broken glass, insecure mounting, bent indicator, corrosion and other damage.
- b. Adjustment. With the generator set shut off, rotate the kilowatt meter adjusting screw until the indicator is in the zero position.

**3-12 AC (PERCENT RATED CURRENT) AMMETER (6, Figure 2-1).**

- a. Inspection. Inspect ac ammeter for cracked or broken glass, insecure mounting, corrosion, loose connections, bent indicator and other damage.
- b. Adjustment. With the generator set shut off, rotate the ammeter adjusting screw until the indicator is in the "zero" position.

**3-13 FREQUENCY METER (3, Figure 2-1).** Inspect the frequency meter for cracked or broken glass, insecure mounting, corrosion, loose connections, bent indicator and other damage.

**3-14 CONTROL PANEL SWITCHES.** Inspect BATTLE SHORT switch (22, Figure 2-1), operations switch (26), VOLTAGE SENSING switch (27), PANEL LIGHTS switch (28), circuit breaker switch (30), START-RUN-STOP switch (32), and ENGINE PRIMER switch (33) for cracks, corroded terminals, loose connections and insecure mounting.

**3-15 CONTROL PANEL GAUGES.** Inspect FUEL LEVEL gauge (36, Figure 2-1), OIL PRESSURE gauge (37) and COOLANT TEMPERATURE gauge (38) for cracked or broken glass, corrosion, insecure mounting, loose connections, bent indicator and other damage.

**3-16 RUNNING TIME METER (34, Figure 2-1).** Inspect running time meter for broken glass, insecure mounting, loose connections, corrosion and other damage.

**3-17 BATTERY CHARGING AMMETER (35, Figure 2-1).** Inspect BATTERY CHARGING AMMETER for broken glass, insecure mounting, loose connections, corrosion and damage.

**3-18 GENERATOR SET HOUSING.**

- a. Inspect generator set doors, panels and covers for dents, corrosion, defective paint, and other damage.
- b. Check that all hinges and latches operate properly.
- c. Inspect for loose, damaged, or missing hardware.



**3-19 WIRING HARNESESSES.** Inspect engine, generator, and interconnecting wiring harnesses for loose connection, frayed insulation, or other damage.

**3-20 AIR CLEANER ASSEMBLY.**

- a. Inspection.
  - (1) Inspect air cleaner housing for dents, defective paint, corrosion, missing hardware and other damage (figure 3-3).
  - (2) Inspect air cleaner condition switch for insecure mount and evidence of shorting or other damage.

**3-21 DAY TANK ASSEMBLY.**

- a. Inspection. Inspect day tank assembly (Figure 1-5) for cracks, leaks, insecure mounting, loose or damaged fuel lines, and loose electrical connections.
- b. Service. Before and after each operation period, open the valve and allow any sediment and water to drain into a suitable container. When clean fuel begins to emerge, close the drain valve. For complete draining of the tank, leave valve open until no more fuel will drain out.

**3-22 FUEL FILTER AND STRAIN ASSEMBLY.**

- a. Inspection. Inspect fuel filter and strainer assembly for insecure mounting, cracks, dents, leaks, loose fuel lines, and other discrepancies (Figure 3-4).
- b. Service. Open the drain cocks on the fuel strainer housing and the fuel filter housing and allow the fuel to drain into a suitable container.

**3-23 START AID ASSEMBLY.**

- a. Inspection. Inspect start aid assembly for damage, insecure mounting, and loose fittings.

**NOTE**

Start aid assembly is located on day tank assembly (Figure 1-5).

- b. Service. Replace an unserviceable or empty ether tank as follows:
  - (1) Open ether tank bracket.
  - (2) Unscrew ether tank from the solenoid valve and discard.
  - (3) Inspect threads of replacement tank and solenoid valve for damage.
  - (4) Screw replacement tank onto solenoid valve hand tight.
  - (5) Close ether tank bracket.

**3-24 FUEL TRANSFER PUMPS.** Inspect fuel transfer pumps for damage, leaks, insecure mountings and loose electrical and fuel connections.

**3-25 RADIATOR GRILLE.** Inspect the radiator grille for dirt, cracks, dents, insecure mounting, corrosion and other damage.

**3-26 SHUTTER ASSEMBLY AND THERMOSTAT.**

- a. Check shutter assembly for bent or dented louvers and for insecure mounting.
- b. Check that control linkage is securely mounted and operates freely.
- c. Inspect thermostat housing for cracks, leaks, excessive corrosion or other damage.



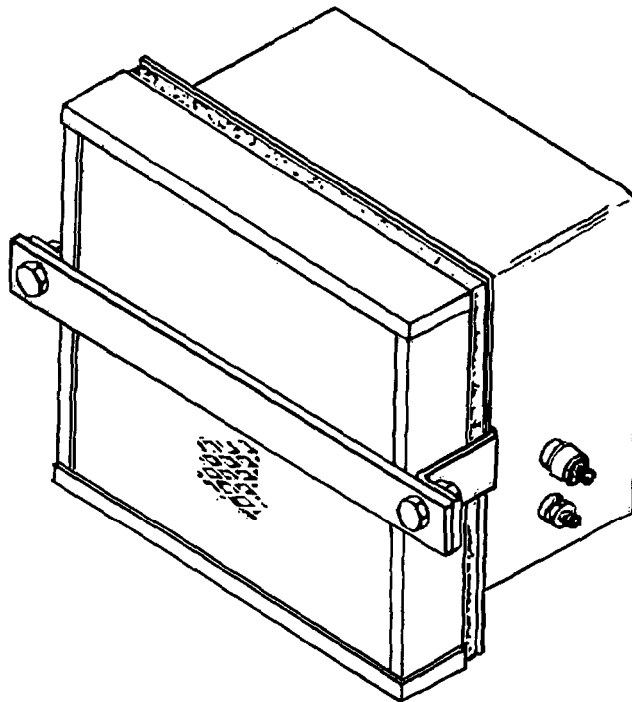


Figure 3-3. Inspecting the Engine Air Cleaner

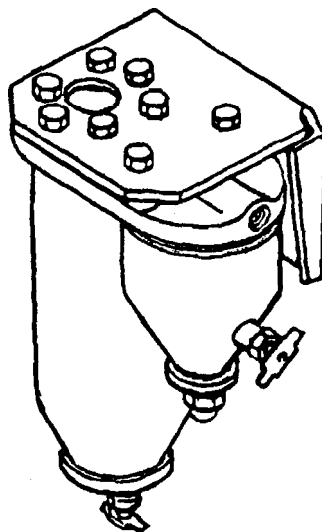


Figure 3-4. Inspecting and Servicing Fuel Strainer and Filter Housing



### 3-27 **RADIATOR (Figure 1-4).**

a. Inspection.

- (1) Check radiator core air passages for obstructions to airflow and bent cooling fins.
- (2) Check for leaks, loose connections, insecure mounting and excessive corrosion.



**Scalding can result from steam escaping from the coolant system when the radiator cap is removed. Always allow coolant to cool and remove the radiator cap slowly to permit any pressure to escape.**

- (3) Open the radiator cap access door, remove the radiator cap and check the coolant level. Check for accumulations of rust or scale in the radiator.
- (4) Check radiator hoses and coolant lines for deterioration and leaks.

b. Service.

- (1) To add coolant to the radiator, proceed as follows:

- (a) Open the radiator cap access door.
- (b) Remove the radiator cap.

#### **CAUTION**

**Do not add coolant to an overheated engine unless it is running.**

- (c) Add coolant, as specified on the coolant specification tag, to the radiator. Leave the coolant level approximately 2 inches below the overflow pipe to allow for expansion.
- (2) To flush the radiator, proceed as follows:
    - (a) Remove the radiator cap to facilitate drainage.
    - (b) Open the coolant drain cock at the bottom of the shutter control thermostat housing and allow the coolant to drain into a suitable container.
    - (c) Close the coolant drain valve.
    - (d) Fill the radiator with clean water and install the radiator cap; approved cleaning compounds may be used.
    - (e) Refer to paragraph 2-6 and start the engine.
    - (f) Allow the engine to operate until normal operating temperature is reached.
    - (g) Refer to paragraph 2-7 and stop the engine. Open the coolant drain valve to drain the water.
    - (h) Close the coolant drain valve.
    - (i) Fill the radiator with coolant as specified in Table 2-1 and attach a tag specifying the coolant used.
    - (j) Refer to paragraph 2-6 and start the engine and allow it to operate until normal operating temperature is reached.



**3-28 HYDRAULIC ACTUATOR (ELECTRO-HYDRAULIC GOVERNOR EQUIPPED PRECISE SETS ONLY).**

- a. Inspect hydraulic actuator unit for insecure mounting, dents, cracks, corrosion and other visible damage.
- b. Check electrical connectors for loose connection, bent or broken pins, and signs of shorting or other damage.
- c. Check hydraulic lines for loose connections, leaks, and other damage.
- d. Check governor control linkage for freedom of movement, worn ball joints, cracks, corrosion and other damage.

**3-29 HYDRAULIC SUMP AND FILTER (ELECTRO-HYDRAULIC GOVERNOR EQUIPPED PRECISE SETS ONLY).**

- a. Inspection.
  - (1) Inspect hydraulic sump for insecure mounting, cracks, corrosion, and other visible damage.
  - (2) Check filter assembly for insecure mounting, dents, cracks, corrosion, and other visible damage.
  - (3) Check hydraulic lines for loose connections, leaks, and damage.
- b. Service.
  - (1) Clean filler cap and surrounding area.
  - (2) Remove filler cap and check oil level as indicated on dipstick.
  - (3) Refer to LO 9-6115-464-12 and add oil to proper level on dipstick.
  - (4) Install filler cap.

**3-30 ENGINE ASSEMBLY**

- a. Inspection.
  - (1) Inspect the engine assembly for fuel, oil, and water leaks. Check for accumulation of dirt. Check for cracks, corrosion and other damage.
  - (2) Check for damage, insecure mounting, or missing parts or accessories.
- b. Service.
  - (1) Keep the external areas of the engine and accessories clean and free of oil and grease.
  - (2) Check cylinder block drain plugs and radiator drain cock for evidence of leaking.

**3-31 V-BELT.** Inspect the v-belt frequently for indications of wear, deterioration, and oil soaking.

**3-32 BATTERY CHARGING ALTERNATOR.** Inspect the battery charging alternator for cracks, insecure mounting, loose connections, signs of shorting and other damage.

**3-33 SPEED SWITCH AND ADAPTER.** Inspect speed switch for insecure mounting, loose connector, corrosion, signs of shorting and visible damage. Inspect boot on reset switch S1 for deterioration.

**3-34 HYDRAULIC OIL PUMP (ELECTRO-HYDRAULIC GOVERNOR EQUIPPED PRECISE SETS ONLY).** Inspect hydraulic oil pump for cracks, leaks, loose fittings, insecure mounting and other damage.



### **3-35 OIL LEVEL GAUGE AND FILLER TUBE.**

- a. Inspection.
  - (1) Inspect oil level gauge for legibility of markings, loose fittings, bends and other damage.
  - (2) Check for oil leaks at the base of the filler tube and the oil level gauge tube.
  - (3) Inspect filler tube for cracks, insecure mounting, dents and other damage.
  - (4) Inspect oil seal in filler cap for excessive wear, deterioration, and damage.
- b. Replacement.
  - (1) Replace oil level gauge by removing and installing a new one.
  - (2) To replace oil filler cap, remove the cap and disconnect the captive chain. Connect the captive chain to a new cap and install the cap onto the filler tube.

**3-36 STARTER ASSEMBLY.** Inspect starter assembly for insecure mounting, loose electrical connections, cracks, and damage to the starter solenoid.

**3-37 OIL PRESSURE TRANSMITTER.** Inspect the oil pressure transmitter for insecure mounting, leaks, loose electrical connections, cracks, and other damage.

**3-38 LUBE OIL FILTER.** Inspect the lube oil filter for cracks, dents, and leaks.

### **3-39 SECONDARY FUEL FILTER.**

- a. Inspection. Inspect the secondary fuel filter for leaks, cracks, breaks, and other damage.
- b. Service. Open the drain valve on bottom of day tank assembly (Figure 1-5) and allow the fuel to drain into a suitable container.

**3-40 FUEL INJECTION PUMP.** Inspect fuel injection pump for insecure mounting, cracks, leaks, loose connections and other damage.

**3-41 FAN ASSEMBLY.** Inspect fan assembly for bent blades, insecure mounting, cracked mounting bracket, and other damage.

**3-42 WATER PUMP ASSEMBLY.** Inspect water pump assembly for leaks, cracks, insecure mounting, loose coolant lines and hoses and other damage.

**3-43 COOLANT TEMPERATURE TRANSMITTER.** Inspect coolant temperature transmitter for insecure mounting, cracks, loose connections and leaks.

### **3-44 OIL PAN ASSEMBLY.**

- a. Inspect oil pan for dents, loose hardware, and oil leaks.
- b. Check oil heater coolant lines for leaks, loose fittings, pinching, cracks and other damage.
- c. Inspect drain hose for loose connections, deterioration, tears, and other damage.

### **3-45 MAIN FUEL TANK**

- a. Inspection.
  - (1) Inspect for insecure mounting, dents, leaks, cracks and other damage.
  - (2) Inspect filler cap for damage and corrosion.
  - (3) Check filler cap gasket for damage or deterioration.
  - (4) Inspect filler hose for leaks, deterioration, loose connections and other damage.
  - (5) Check drain valve and captive cap for leaks, damage, and corrosion.
  - (6) Check fuel lines for loose connections.
  - (7) Inspect fuel level sensor for loose electrical connections, insecure mounting, corrosion and other damage.



b. Servicing.

(1) Filler Cap,

- (a) Unscrew filler cap (Figure 3-5) and disconnect captive chain.
- (b) Inspect filler cap gasket for damage and deterioration. Replace gasket if deficiencies are present.
- (c) Clean cap in an approved solvent and dry thoroughly.
- (d) Inspect vent valve in filler cap for plugging.
- (e) Check cap for cracks, corrosion, and other damage. Replace cap if damage is present.
- (f) Check captive chain for corrosion and cracked or broken links. Replace chain if damage is noted.
- (g) Install gasket onto filler cap.
- (h) Connect captive chain to filler neck and install filler cap.

(2) Main Fuel Tank.

- (a) Remove captive cap from drain valve (Figure 3-5).
- (b) Install auxiliary fuel line onto drain line and position its free end to drain overboard into a suitable container.
- (c) Open drain valve and allow sediment to drain from fuel tank.
- (d) When all sediment has drained, close drain valve. Remove auxiliary fuel line and install captive cap.
- (e) Add fuel to tank as required.
- (f) For complete draining of the tank, complete steps (a) through (c) above and leave drain valve open until no more fuel will drain out.

**3-46 PARALLELING CABLE.** Inspect paralleling cable for damaged connectors and pins, frayed insulation, indications of shorting, and other damage.

**3-47 AUXILIARY FUEL LINE.** Inspect auxiliary fuel line for deterioration, damaged connectors, leaks and other damage.

### Section III. OPERATOR TROUBLESHOOTING

#### 3-48 GENERAL.

- a. This section contains troubleshooting information for locating and correcting operating troubles which may develop in the generator set. Each malfunction for an individual component unit, or system is followed by a list of tests or inspections which will help you to determine probable causes and corrective actions to take. You should perform the tests/inspections and corrective actions in order listed.
- b. This table cannot list all malfunctions that may occur, nor all tests or inspections and corrective actions. If a malfunction is not listed or cannot be corrected by listed corrective actions, notify your supervisor.

#### NOTE

Air Force and Navy users may perform maintenance within the scope of their abilities.



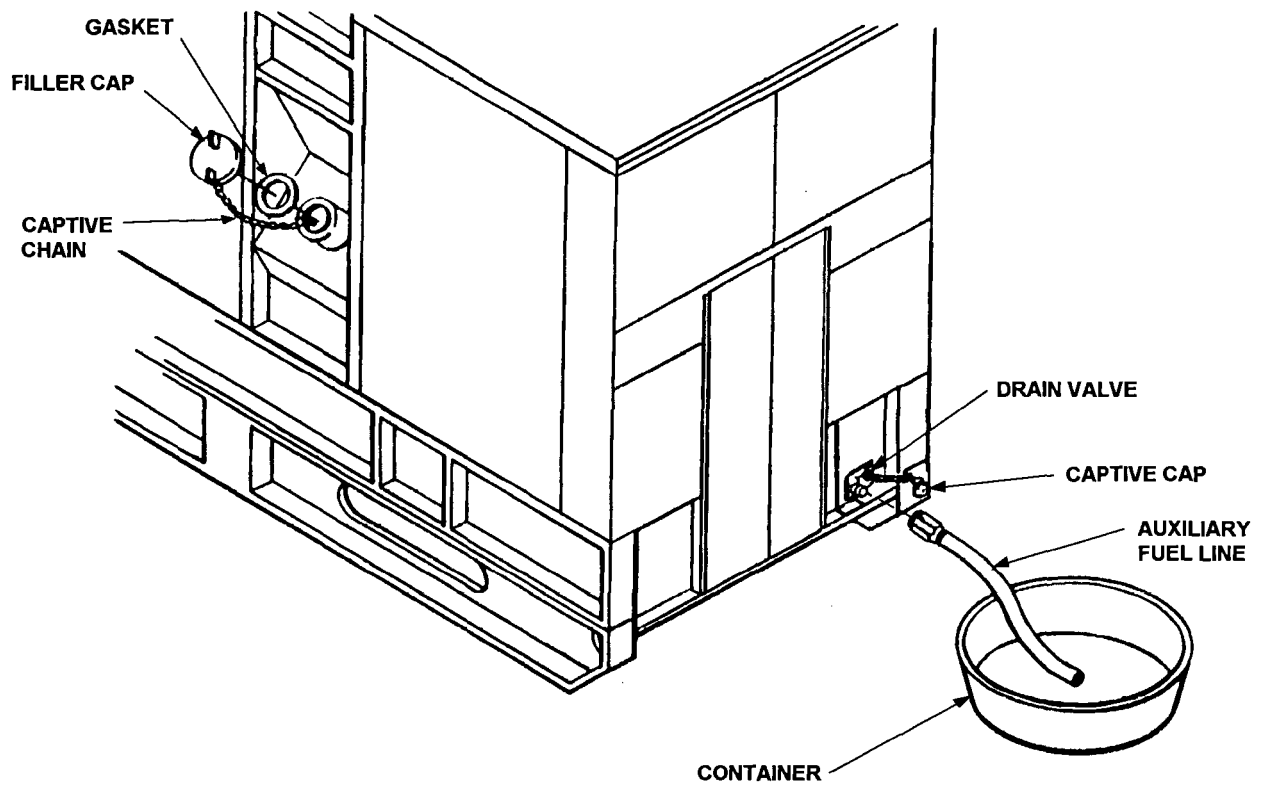


Figure 3-5. Main Fuel Tank Inspection and Service



Table 3-1. Operator Troubleshooting

NOTE

Before you use this table, make sure you have performed your PMCS.

---

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

---

1. ENGINE FAILS TO CRANK.

- Step 1. improper starting procedure.  
Perform starting procedure as outlined in para 2-6.
- Step 2. Corroded battery cable terminals and battery post.  
Clean battery post and battery cable terminals (para 3-4).

2. ENGINE CRANKS BUT FAILS TO START.

- Step 1. Improper starting procedure.  
Perform starting procedure as outlined in para 2-6.
- Step 2. Low or no fuel supply.  
Service fuel tank (para 3-45), or use auxiliary fuel supply (para 3-45).
- Step 3. Water in fuel, contaminated or incorrect grade of fuel.  
Drain entire fuel system. Service with clean fuel of proper grade (para 3-45).  
Service fuel filter (para 3-22).  
Drain day tank assembly (para 3-21).  
Drain fuel tank and service with dean fuel of proper grade (para 3-45).
- Step 4. Air in fuel lines.  
Bleed fuel system (para 3-21,3-22,3-45).
- Step 5. Clogged fuel strainers or filters.  
Service fuel strainers and filter assembly (para 3-22).  
Service secondary fuel filter (para 3-39).
- Step 6. Dirty air filter element.  
Notify higher level of maintenance.



**Table 3-1. Operator Troubleshooting - Continued**

<b>MALFUNCTION</b>	<b>TEST OR INSPECTION</b>	<b>CORRECTIVE ACTION</b>
<b>3. ENGINE STARTS CORRECTLY, BUT STOPS WHEN <u>START/RUN/STOP</u> SWITCH IS RELEASED.</b>		
	Step 1. Switch not held in START position long enough.	Hold switch in START position until engine oil pressure reaches 20 psi (para 2-6).
	Step 2. High coolant temperature.	Refer to malfunction 11 of this table.
<b>4. ENGINE STOPS SUDDENLY.</b>		
	Step 1. Protective device tripped.	Check fault indicator for malfunction indication. Refer to the appropriate maintenance section.
	Step 2. Fuel supply exhausted.	Service fuel tank (para 3-45).
	Step 3. Air lock in fuel supply line.	Bleed fuel system (para 3-21, 3-22, 3-45).
	Step 4. Water in fuel.	Drain main fuel tank (para 3-45), fuel filters (para 3-39, 3-41) and day tank (para 3-21). Service with clean fuel of proper grade (para 3-45).
<b>5. ENGINE RUNS ERRATICALLY OR MISFIRES.</b>		
	Step 1. Improper grade or contaminated fuel.	Drain the entire fuel system. Service with clean fuel of proper grade (para 3-45). Service fuel filters (para 3-22, 3-39).
	Step 2. Dirty air cleaner	Notify higher level of maintenance.
<b>6. ENGINE DOES NOT DEVELOP FULL POWER.</b>		
	Step 1. One or more cylinders misfiring.	Refer to malfunction 5 of this table.



**Table 3-1. Operator Troubleshooting - Continued**

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<b>7. ENGINE KNOCKS.</b>		
Step 1. Engine overheated.		Refer to malfunction 11 of this table.
Step 2. Low lube oil level.		Check oil level. Add oil if necessary (Lubrication order, para 3-2).
Step 3. Improper grade of fuel or water in fuel.		Drain main fuel tank (para 3-45), fuel filters (para 3-39, 3-41) and day tank (para 3-21).
		Service with clean fuel (para 3-45).
<b>8. BLACK SMOKE IN EXHAUST.</b>		
Step 1. Improper grade of fuel.		Drain main fuel tank (para 3-45), fuel filters (para 3-39, 3-41) and day tank (para 3-21).
		Service with clean fuel (para 3-45).
Step 2. Dirty air cleaner		Notify higher level of maintenance.
Step 3. Generator set overloaded.		Reduce load to rated level.
<b>9. BLUE OR WHITE SMOKE IN EXHAUST</b>		
Improper grade of fuel.		Drain main fuel tank (para 3-45), fuel filters (para 3-39, 3-41) and day tank (para 3-21).
<b>10. LOW OIL PRESSURE.</b>		
Step 1. Low oil level.		Add oil to proper level on dipstick (para 3-2).
Step 2. Improper viscosity of oil.		Drain crankcase and refill with oil of proper viscosity (Lubrication Order para 3-2).



**Table 3-1. Operator Troubleshooting - Continued**

<b>MALFUNCTION</b>	<b>TEST OR INSPECTION</b>	<b>CORRECTIVE ACTION</b>
<b>11. ENGINE OVERHEATING.</b>		
	Step 1. Low coolant level.	Check coolant level. Add coolant as necessary (para 3-27).
	Step 2. Radiator air passages dogged.	Clean radiator air passages (para 3-27).
	Step 3. Collapsed radiator hoses.	Notify higher level of maintenance.
<b>12. BATTERY CHARGING AMMETER SHOWS NO CHARGE WHEN BATTERIES ARE LOW OR DIS-CHARGED.</b>		
	Battery dry.	Refill battery cells with distilled water (para 3-4).
<b>13. AC VOLTMETER INDICATES VOLTAGE, BUT FREQUENCY METER IS OFF SCALE.</b>		
	Engine speed is too slow.	Adjust frequency rheostat (precise sets only) (para 2-6). Increase engine speed with manual speed control (utility sets only) (para 2-6).







## Chapter 4 UNIT MAINTENANCE INSTRUCTIONS

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### Section I. SERVICE UPON RECEIPT OF EQUIPMENT

#### 4-1 INSPECTING AND SERVICING THE GENERATOR SET.

- a. Inspection.
  - (1) Check the generator set rating plate for positive identification.
  - (2) Make a complete visual inspection of the exterior of the generator set for evidence of damage which may have occurred during shipment.
  - (3) Open the battery compartment access doors (Figure 1-4) and inspect the batteries for damage.
  - (4) Open the control panel access doors (Figure 1-5) and check the control panel for damage.
  - (5) Open the generator air intake doors (Figure 1-5) and inspect the generator vent grill for damage.
  - (6) Open the generator compartment access doors (Figure 1-4 and Figure 1-5) and check each component for obvious signs of damage and corrosion.
  - (7) Open the engine compartment access doors (Figure 1-4 and Figure 1-5) and check the engine and its components for visible damage.
  - (8) Check the engine air cleaner assembly and exhaust opening for obstruction.
  - (9) Check the v-belts for proper adjustment (paragraph 4-40).
  - (10) Make a thorough visual inspection of the generator set for loose or missing mounting hardware or damaged or missing parts.
  - (11) Check oil fuel and hydraulic hoses for loose connections. Tighten any loose connections.
  - (12) Check all wiring harnesses for loose connectors and terminals. Tighten any found loose.
- b. Servicing.
  - (1) Batteries.
    - (a) Open battery compartment access doors (Figure 1-4).
    - (b) Remove battery tray retaining screws and lockwashers and slide battery tray out of battery compartment.
    - (c) Remove battery vent caps.



**Battery electrolyte contains sulfuric acid which can cause severe burns. Never pour electrolyte into water as high temperatures will be generated and spattering of the electrolyte may result. If electrolyte comes in contact with skin or clothing, rinse immediately with clean water.**

- (d) Fill the battery cells to the slots in the filler wells with electrolyte and install the vent caps. Make sure that the vent holes in the caps are open.

#### **NOTE**

Batteries are shipped dry charged. Electrolyte must be requisitioned separately.



- (e) Refer to paragraph 4-14 and connect battery cables.
- (f) Apply an approved corrosion preventive compound to battery post and cable terminals.
- (g) Slide battery tray into battery compartment and secure with retaining screws and lockwashers.

#### **NOTE**

If generator set is not to be operated within 12 hours, batteries must be charged.

- (h) Close the battery compartment access doors.
  - (i) After 30 minutes, check electrolyte level. Add electrolyte as required.
- (2) Cooling System.
- (a) Open the radiator filler cap access door (Figure 1-4) and remove the radiator cap.
  - (b) Fill the cooling system with coolant as specified in Table 2-1 and replace cap.
- (3) Fuel System.
- (a) Check to see that the fuel tank drain valve (81, Figure 4-21) is closed and the cap is installed.
  - (b) Remove the fuel tank filler cap.



**When filling the fuel tank, maintain metal-to-metal contact between the fuel tank filler neck and the fuel nozzle to prevent sparks from static electricity. There shall be no smoking or open flames in the vicinity of the fueling operations**

**Hot refueling of generators while they are operating poses a safety hazard and should not be attempted. Hot engine surfaces and sparks produced from the engine and generator circuitry are possible sources of ignition. Severe injury, death to personnel and/or damage to the equipment may result.**

#### **CAUTION**

**JP-4 fuel is considered an emergency fuel only. Equipment damage could result if caution is not observed.**

- (c) Fill the fuel tank with fuel.
  - (d) Install the fuel tank filler cap.
- (4) Lubrication System.
- (a) Check to see that the drain plug is installed in the engine crankcase drain tube and close valve. (See Lubrication Order.)
  - (b) Fill the crankcase to the proper level with oil. (See paragraph 3-2 for lubrication information.)
- (5) Remove cap from hydraulic sump and fill sump to proper level on dipstick with oil conforming to Military Specification MIL-H-5606 (for electro-hydraulic governor equipped Precise Sets only).
- (6) Preventive Maintenance. Perform the before operation preventive maintenance checks and services. Refer to Table 2-2.



## Section II. REPAIR PARTS; SPECIAL TOOLS, TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE); AND SPECIAL SUPPORT EQUIPMENT

**4-2 TOOLS AND EQUIPMENT (Not applicable to Air Force).** The tools and equipment to perform unit maintenance on the generator set are listed in Appendix B of this manual. There are no special tools or equipment required to perform that maintenance.

**4-3 MAINTENANCE REPAIR PARTS.** The repair parts and special tools list for maintenance of the 15 kw generator set are listed and illustrated in TM 9-6115-464-24P.

## Section III. SPECIAL LUBRICATION INSTRUCTIONS

### 4-4 GENERAL.

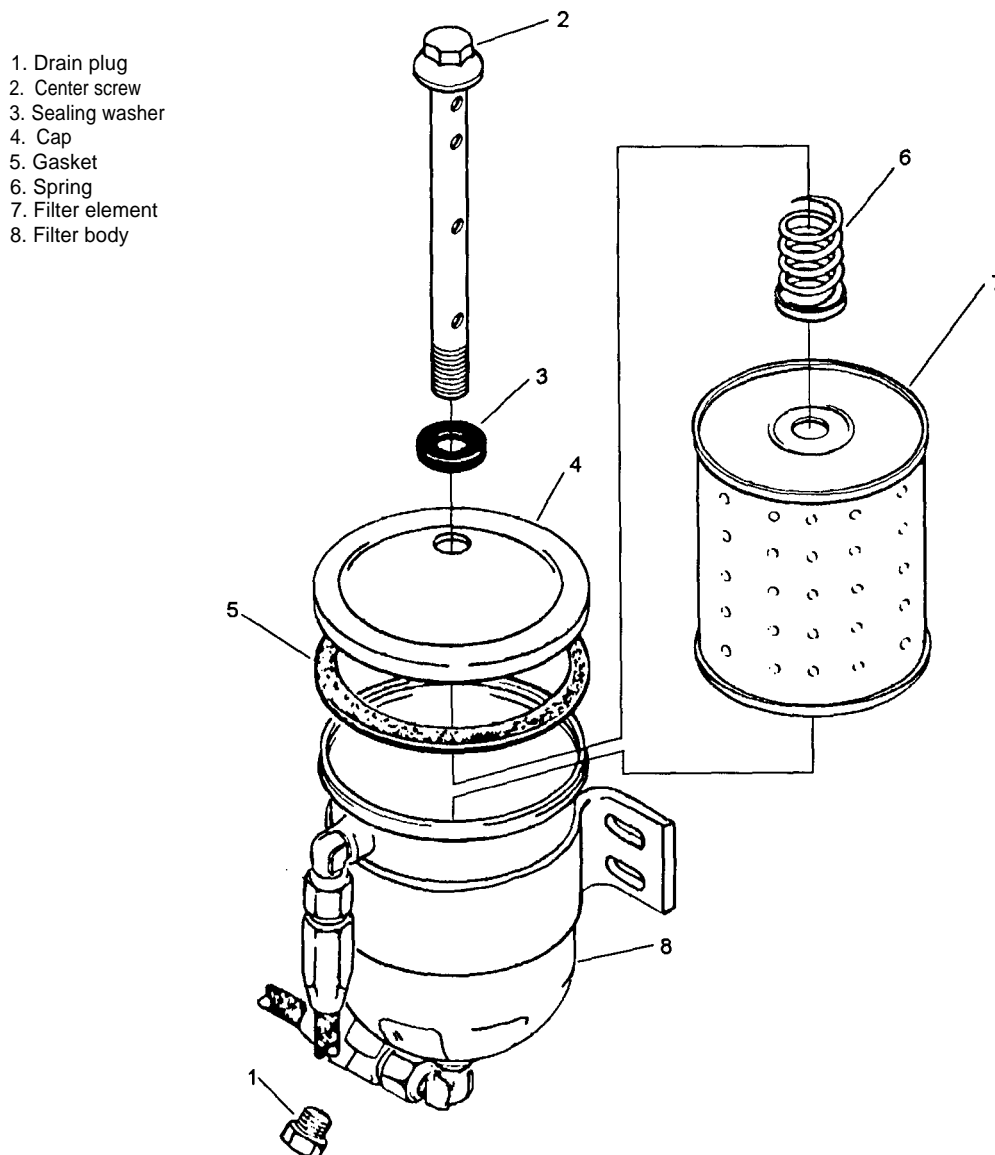
- a. The purpose of this section is to outline additional lubrication instructions not covered in LO 9-6115-464-12.
- b. For current and updated information on the latest editions of lubrication orders or instructions, see DA PAM 25-30 for Army, applicable work card set in TO 35C2-3-1-426 for Air Force.
- c. Keep all lubricants in closed containers and store in a clean, dry place away from external heat. Allow no dust, dirt or other foreign material to mix with the lubricants. Keep all lubrication equipment clean and ready for use.
- d. Cleaning. Keep all external parts not requiring lubrication free of lubricants. Before lubricating the generator set, wipe all lubrication points free of dirt and grease. Clean all lubrication points after lubricating to prevent accumulation of foreign matter.
- e. Engine Oil.
  - (1) The crankcase oil level must be checked at eight hour intervals or more often should oil consumption increase.
  - (2) A new or reconditioned engine shall have the oil changed after 50 hours of operation. Thereafter, the interval is lengthened to that described dependent on operating conditions.
  - (3) Before draining the engine crankcase, operate the engine until the engine coolant reaches a minimum of 140°F (60°C) to insure maximum suspension and drainage of particles.
  - (4) Stop the engine. Remove the oil pan drain plug and open the oil pan drain valve, to drain the crankcase.
  - (5) Close the oil pan drain valve and install the drain plug.
  - (6) Refer to paragraph f. below and service the oil filter.
  - (7) Fill the crankcase to the FULL mark on the dipstick with oil as specified in the Lubrication Order (paragraph 3-2).
  - (8) Operate the engine until the coolant reaches normal operating temperature.

### CAUTION

**Make sure that the proper side of the dipstick is checked. Equipment damage could result if caution is not observed.**

- (9) Check the oil level and add oil as necessary to bring it to the FULL level on the dipstick.
- (10) Inspect the engine for oil leaks. Repair as necessary.





**Figure 4-1. Servicing the Engine Oil Filter**

- f. Oil Filter Service.
- (1) Thoroughly clean the oil filter casings and the surrounding area.
  - (2) Remove drain plug (1, Figure 4-1) and allow the oil to drain into a suitable container.
  - (3) Remove center screw (2) and sealing washer (3).
  - (4) Remove cap (4), gasket (5), spring (6), and filter element (7) from filter body (8). Discard gasket and filter element.
  - (5) Install replacement filter element (7) into filter body (8).
  - (6) Install spring (6), replacement gasket (5) and cap (4) and secure with washer (3) and center screw (2). Tighten center screw securely to prevent leaks.
  - (7) Install drain plug (1) and tighten securely
- g. Generators. The generator is a sealed unit and does not require lubrication.



## Section IV. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

### NOTE

The PMCS chart in this section contains all necessary unit preventive maintenance checks and services for this equipment.

### 4-5 INTRODUCTION.

Purpose. Your PMCS table lists the checks (inspections) and services (care) of your equipment to keep it in good operating condition. Inspection will allow defects to be discovered and corrected before they result in serious damage or failure. Table 4-1 lists the PMCS in sequence of performance. Unit personnel must observe all cautions and warnings.

### 4-6 EXPLANATION OF COLUMNS.

- a. Item Number column. This column provides identification numbers for the performance of PMCS functions in proper sequence. Use the numbers as a reference on reports of failures and deficiencies. (For Army users, report on DA Form 2404 Equipment Inspection and Maintenance Worksheet).
- b. Interval column. This column identifies when particular functions (checks/service) must be performed.
- c. Item to check/service column. This column identifies specific items for inspecting (servicing/checking).
- d. Procedures. This column lists the checks or services you have to perform and explains how to perform them.
- e. Not Mission Capable If: column. This column tells you when and why your equipment cannot be used.

### CAUTION

**Equipment operation is allowable with minor leakages (Class I or II). Of course, you must consider the fluid capacity in the item/system being checked/inspected. When in doubt, notify your supervisor.**

**When operating with Class I or Class II leaks, continue to check fluid levels as required by PMCS.**

**Equipment damage could result if caution is not observed.**

### NOTE

The terms ready/available and mission capable refer to the same status: equipment is on hand and is able to perform its combat mission.

### NOTE

Leakage definitions for unit PMCS shall be classified as follows:

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 the item being checked/inspected.

Class III: Leakage of fluid great enough to form drops that fall from the item being checked/inspected.

**4-7 REPORTING DEFICIENCIES.** If your equipment does not perform as required, and if you discover problems during PMCS that you are unable to correct, it must be reported. Refer to DA Pam 736-750 and report the deficiency using the proper forms.



**NOTE**

For generator sets in continuous operation, check and service only those items that can be checked and serviced without disturbing operation. Perform a complete PMCS when equipment can be shutdown. Deficiencies discovered during operation shall be noted for future correction. Stop the operation immediately if a deficiency is noted which could damage the equipment. Report all deficiencies and corrective actions on paper forms. Army, refer to DA Pamphlet 738-750. Air Force, refer to applicable inspection manuals and work card sets in the TO 35C2-3-1-426 series for periodic requirements and Table 4-1 for detailed procedures. Operator PMCS apply to Navy users in this manual.

**Table 4-1. Unit Preventive Maintenance Checks and Services**

Item No.	Interval	Location	Procedure	Not Mission Capable If:
		Item to Check\ Service		
1	Hours	Fuel Pump Filters	Change every 100 hours (para 4-29, Figure 4-15).	Air cleaner missing.
2	Hours	Fuel Filters	Replace filter elements every 100 hours (para 4-29, 4-31, and Figure 4-15 and Figure 4-16).	
			<b>NOTE</b>  Items 9, 10 and 11 apply to electro-hydraulic governor equipped precise sets only.	
3	Hours	Hydraulic Sump	Drain and refill (para 4-47). (Refer to LO).	
4	Hours	Hydraulic Filter	Replace filter (para 4-47). (Refer to LO).	
5	Hours	Hydraulic Actuator Screen	Clean filter (para 4-48). (Refer to LO).	
6	Hours	Breather and Breather Tube	Inspect for damage. Clean breather and breather tube at oil change interval as directed by Army Oil Analysis Program (para 4-54).	
7	Hours	Engine Oil	As directed by Army Oil Analysis Program.	
8	Hours	Oil Filters	As directed by Army Oil Analysis Program.	
9	Hours	Air Cleaner	This unit is equipped with an air filter condition indicator light that will indicate when filter element needs cleaning. Clean element when necessary as indicated by light (para 3-20).	
10	Weekly	Fluid Levels Hydraulic sump (electro-hydraulic governor equipped precise sets only)	Check fluid levels Check fluid level. Add fluid as required.	



**Table 4-1. Unit Preventive Maintenance Checks and Services - Continued**

Item No.	Interval	Location	Procedure	Not Mission Capable If:
		Item to Check\ Service		
11	Weekly	Main Fuel Tank	Drain water and sediment.  <b>NOTE</b>  In freezing weather, drain shortly after operation. Allow to drain until fuel runs clear.	
12	Weekly	Fuel Pump Strainers	Service (para 4-29, Figure 4-16).  <b>NOTE</b>  In freezing weather, drain shortly after operation. Allow to drain until fuel runs clear.	
13	Monthly	Generator Set	Check entire unit for missing, loose, or damaged parts and hardware, and for unusual wear or deterioration.	
14	Monthly	Batteries	Check electrolyte level. Check condition with a hydrometer. Add water as required (para 3-4).	
15	Monthly	V-Belt	Inspect for worn, frayed, cracked, or oil-soaked belt. Check adjustment. If adjustment is required, adjust for a 1/2 inch deflection when belt is depressed at a point midway between alternator and water pump pulley (para 4-40).	



Section V. UNIT TROUBLESHOOTING

4-8 INTRODUCTION.

This section contains troubleshooting information for locating and correcting operating troubles which may develop in the generator set. Each malfunction for an individual component unit, or system is followed by a list of tests or inspections which will help you to determine probable causes and corrective actions to take. You should perform the tests/inspections and corrective actions in the order listed.

This table cannot list all malfunctions that may occur, nor all tests or inspections and corrective actions. If a malfunction is not listed or cannot be corrected by listed corrective actions, notify your supervisor.

NOTE

Air Force and Navy users may perform maintenance within the scope of their abilities.

Table 4-2. Unit Troubleshooting

NOTE

Before you use this table, make sure you have performed your PMCS.

---

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

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1. ENGINE FAILS TO CRANK.

Step 1. Discharges batteries.

Charge or replace batteries (para 4-14).

NOTE

Use slave receptacle (SR1) when extra cranking power is required.

Step 2. Improperly installed batteries.

Install batteries correctly (para 3-4).

Step 3. Defective dc circuit breaker.

Replace dc circuit breaker (para 4-66).

Step 4. Defective START-RUN-STOP switch.

Replace START-RUN-STOP switch (para 4-63).

Step 5. Loose electrical connection or break in starting circuit.

Check starting circuit wiring. Replace any damaged wires. Tighten loose connections.

Step 6. Worn starter brushes.

Replace starter brushes (para 4-16).

Step 7. Defective starter solenoid.

Replace starter solenoid (para 4-16).

Step 8. Defective starter motor.

Replace starter motor (para 4-16).



**Table 4-2. Unit Troubleshooting - Continued**

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
-------------	--------------------	-------------------

**2. ENGINE CRANKS BUT FAILS TO START.**

- |   |  |  |
|---|--|--|
| Step 1. improper starting procedure.                              |  | Perform starting procedure as outlined in para 2-6.  |
| Step 2. Low or no fuel supply.                                    |  | Service fuel tank (para 4-1), or use auxillary fuel supply (para 4-3).   |
| Step 3. Water in fuel, contaminated or incorrect grade of fuel.   |  | Drain entire fuel system. Service with clean fuel of proper grade (para 3-45).<br>Service fuel filter (para 3-22).<br>Drain day tank assembly (para 3-21).<br>Drain fuel tank and service with clean fuel of proper grade (para 3-45). |
| Step 4. Air in fuel lines.  |  | Bleed fuel system (para 3-21, 3-22, 3-45).<br>Tighten any loose fuel supply line connections (para 4-33).  |
| Step 5. Obstruction in fuel supply line.                          |  | Clean or replace fuel supply line (para 4-33).   |
| Step 6. Defective day tank fuel level and low fuel cutoff switch. |  | Replace switch (para 4-24).  |
| Step 7. Defective fuel solenoid valve.                            |  | Replace fuel solenoid valve (para 4-25).   |
| Step 8. Clogged fuel strainers or filters.                        |  | Service fuel strainers and filter assembly (para 3-22, 4-29).<br>Service secondary fuel filter (para 3-39).  |
| Step 9. Dirty air filter element.                                 |  | Service air cleaner assembly (para 4-52).  |
| Step 10. Speed switch not reset after overspeed shutdown.         |  | Depress reset button on back of overspeed switch (para 4-19).  |
| Step 11. Defective nozzle holder assembly.                        |  | Replace nozzle holder assembly (para 4-32).  |



**Table 4-2. Unit Troubleshooting - Continued**

---

**MALFUNCTION**

**TEST OR INSPECTION**

**CORRECTIVE ACTION**

---

**3. ENGINE STARTS CORRECTLY, BUT STOPS WHEN START/RUN/STOP SWITCH IS RELEASED.**

Step 1. Defective speed switch.

Replace speed switch (para 4-19).

Step 2. Defective START-RUN-STOP switch.

Replace switch (para 4-63).

Step 3. Clogged oil filter assembly.

Service oil filter assembly (para 4-4)

Step 4. Defective oil pressure switch.

Replace low oil pressure switch (para 4-23).

Step 5. High coolant temperature.

Refer to malfunction 11 of this table.

Step 6. Low fuel in day tank.

Check main tank fuel level. Check transfer pumps for proper operation. Replace if necessary (para 4-28). Check fuel solenoid valve for proper operation. Replace if defective (para 4-25). Check day tank fuel level and low fuel cut-off switch for proper operation. Replace if necessary (para 4-24).

**4. ENGINE STOPS SUDDENLY**

Step 1. Fuel supply exhausted.

Service fuel tank (para 3-45).

Step 2. Air lock in fuel supply line.

Bleed fuel system (para 3-21, 3-22, 3-45). Tighten any loose fuel line connections (para 4-33).

Step 3. Obstruction in fuel supply line.

Clean or replace fuel supply line (para 4-33).

Step 4. Water in fuel.

Drain main fuel tank (para 3-45), fuel filters (para 3-39, 3-22) and day tank (para 3-21).

Service fuel system with clean fuel of proper grade (para 3-45).



**Table 4-2. Unit Troubleshooting - Continued**

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**MALFUNCTION**

**TEST OR INSPECTION**

**CORRECTIVE ACTION**

---

**5. ENGINE RUNS ERRATICALLY OR MISFIRES.**

- Step 1. Dirty air cleaner.  
Service air cleaner (para 4-51).
- Step 2. Obstruction in fuel supply line.  
Clean or replace fuel supply line (para 4-33).
- Step 3. Valves out of adjustment.  
Adjust valve tappet clearance (para 4-60).
- Step 4. Dirty nozzles.  
Clean and replace defective nozzles.

**6. ENGINE DOES NOT DEVELOP FULL POWER.**

- Step 1. One or more cylinders misfiring.  
Refer to malfunction 5 of this table.
- Step 2. Exhaust pipe or muffler restricted.  
Clean or replace exhaust pipe or muffler (para 4-53).

**7. ENGINE KNOCKS.**

- Step 1. Engine overheated.  
Refer to malfunction 11 of this table.
- Step 2. Low lube oil level.  
Check oil level. Add oil if necessary (Lubrication order, para 4-4).
- Step 3. Valve tappet clearance too great.  
Adjust valve tappet clearance (para 4-60).
- Step 4. Injector nozzle broken.  
Replace injector nozzle (para 4-32).
- Step 5. improper grade of fuel or water in fuel.  
Drain main fuel tank (para 3-45), fuel filters (para 3-22, 3-39) and day tank (para 3-21). Service system with clean fuel (para 3-45).



**Table 4-2. Unit Troubleshooting - Continued**

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<b>MALFUNCTION</b>
<b>TEST OR INSPECTION</b>
<b>CORRECTIVE ACTION</b>

---

**8. BLACK SMOKE IN EXHAUST.**

Step 1. Improper grade of fuel.

Drain main fuel tank (para 3-45), fuel filters (para 3-22, 3-39) and day tank (para 3-21). Service system with clean fuel (para 3-45).

Step 2. Dirty injector nozzles.

Clean or replace injector nozzles (para 4-32).

Step 3. Dirty air cleaner.

Service air cleaner (para 4-52).

Step 4. Generator set overloaded.

Reduce load to rated level.

**9. BLUE OR WHITE SMOKE IN EXHAUST.**

Step 1. Improper grade of fuel.

Drain main fuel tank (para 3-45), fuel filters (para 3-22, 3-39) and day tank (para 3-21). Service system with clean fuel (para 3-45).

Step 2. Engine operating temperature too low due to defective thermostat.

Replace thermostat (para 4-43).

Step 3. Crankcase oil level too high.

Drain crankcase and refill to proper level (para 4-4).

Step 4. Defective nozzle holder assembly.

Replace nozzle holder assembly (para 4-32).

Step 5. Improper valve tappet clearance.

Adjust valve tappet clearance (para 4-60).



Table 4-2. Unit Troubleshooting - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<b>10. LOW OIL PRESSURE.</b>		
Step 1.	Defective oil pressure gauge.	Replace oil pressure gauge (para 4-63).
Step 2.	Defective oil pressure transmitter.	Replace oil pressure transmitter (para 4-22).
Step 3.	Clogged oil filters.	Service oil filters (para 4-4).
Step 4.	Improper viscosity of oil.	Drain crankcase and refill with oil of proper viscosity (Lubrication Order para 4-4).
<b>11. ENGINE OVERHEATING.</b>		
Step 1.	V-belt broken or out of adjustment.	Adjust or replace V-belt (para 4-40).
Step 2.	Defective thermostat.	Replace thermostat (para 4-43).
Step 3.	Defective or improperly adjusted shutter and controls.	Adjust or replace shutter and control assembly (para 4-39).
Step 4.	Rust or scale clogging radiator.	Replace radiator (para 4-38).
Step 5.	Radiator air passages dogged.	Clean radiator air passages (para 4-19).
Step 6.	Collapsed radiator hoses.	Replace radiator hoses.
Step 7.	Defective water pump.	Replace water pump assembly (para 4-42).
Step 8.	Exhaust pipe or muffler restricted.	Clean or replace exhaust pipe or muffler (para 4-53).



**Table 4-2. Unit Troubleshooting - Continued**

<b>MALFUNCTION</b>	<b>TEST OR INSPECTION</b>	<b>CORRECTIVE ACTION</b>
--------------------	---------------------------	--------------------------

**12. ENGINE COOLANT TEMPERATURE TOO LOW.**

- |  |  |   |
|--|--|---|
| Step 1. Thermostat stuck open.   |  | Replace thermostat (para 4-43).   |
| Step 2. Improperly adjusted shutter or control linkage and thermostat. |  | Adjust or replace shutter and control assembly (para 4-39).<br>Replace defective control linkage or thermostat (para 4-37). |
| Step 3. Defective temperature transmitter.                             |  | Replace temperature transmitter (para 4-20).  |
| Step 4. Defective coolant temperature gauge.                           |  | Replace coolant temperature gauge (para 4-63).  |

**13. BATTERY CHARGING AMMETER SHOWS NO CHARGE WHEN BATTERIES ARE LOW OR DISCHARGED.**

- |  |  |  |
|--|--|--|
| Step 1. Defective alternator fuse.                         |  | Replace fuse in back of alternator (para 4-19, Figure 4-18)                                    |
| Step 2. Improperly adjusted alternator.                    |  | Adjust alternator (para 4-19).   |
| Step 3. V-belt is out of adjustment or broken.             |  | Adjust or replace V-belt (para 4-40)   |
| Step 4. Defective alternator.                              |  | Replace alternator (para 4-19).  |
| Step 5. Open wire or loose connection in charging circuit. |  | Check charging circuit wiring. Replace broken wires and tighten loose connections (para 4-14). |
| Step 6. Batteries dry.                                     |  | Refill battery cells with distilled water (para 4-14).   |



**Table 4-2. Unit Troubleshooting - Continued**

**MALFUNCTION**

**TEST OR INSPECTION**

**CORRECTIVE ACTION**

**14. BATTERY CHARGING AMMETER SHOWS EXCESSIVE CHARGING AFTER PROLONGED OPERATION.**

- Step 1. Improperly adjusted alternator.  
Adjust alternator (para 4-19).
- Step 2. Defective batteries.  
Replace batteries (para 4-14).
- Step 3. Defective alternator.  
Replace alternator (para 4-19).
- Step 4. Short in charging circuit.  
Check charging circuit. Repair or replace shorted wiring.
- Step 5. Defective battery charging ammeter.  
Replace battery charging ammeter (para 4-63).

**15. AC VOLTMETER DOES NOT INDICATE VOLTAGE.**

- Step 1. Defective Volt-Amp transfer.  
Replace switch (para 4-63).
- Step 2. Defective voltage adjust rheostat.  
Replace defective voltage adjust rheostat (para 4-63).
- Step 3. Defective ac voltmeter.  
Replace ac voltmeter (para 4-63).

**16. AC VOLTMETER INDICATES VOLTAGE, BUT FREQUENCY METER IS OFF SCALE.**

- Step 1. Engine speed too slow.  
Adjust frequency rheostat (Precise sets only) (para 2-6). Increase engine speed with manual speed control (utility sets only) (para 2-6).
- Step 2. Defective frequency meter.  
Replace frequency meter (para 4-63).
- Step 3. Defective frequency transducer.  
Replace frequency transducer (para 4-63).



**Table 4-2. Unit Troubleshooting - Continued**

<b>MALFUNCTION</b>	<b>TEST OR INSPECTION</b>	<b>CORRECTIVE ACTION</b>
--------------------	---------------------------	--------------------------

**17. AC VOLTAGE FLUCTUATES.**

- |  |   |  |
|--|---|--|
| Step 1. Loose electrical connection.         | Inspect electrical system and make any repairs necessary (FO-1 and FO-2). |  |
| Step 2. Defective Volt-Amps selector switch. | Replace Volt-Amps switch (para 4-63).                                     |  |
| Step 3. Defective voltage adjust rheostat.   | Replace defective voltage adjust rheostat (para 4-63).                    |  |
| Step 4. Defective ac voltmeter.              | Replace ac voltmeter (para 4-63).   |  |

**18. FREQUENCY FLUCTUATES.**

- |  |  |  |
|--|--|--|
| Step 1. Erratic engine operation.                                | Refer to malfunction 5 of this table.          |  |
| Step 2. Defective frequency adjust rheostat (class I sets only). | Replace frequency adjust rheostat (para 4-63). |  |
| Step 3. Defective frequency meter.                               | Replace frequency meter (para 4-63).           |  |
| Step 4. Defective frequency transducer.                          | Replace frequency transducer (para 4-63).      |  |

**19. MAIN AC CONTACTOR (CB2) WILL NOT CLOSE.**

- |   |  |  |
|---|--|--|
| Step 1. Defective circuit breaker switch S3.  | Inspect test S3. Replace if defective (para 4-63).   |  |
| Step 2. Defective main load contactor (4-40). | Disconnect electrical connector (per J41, FO-1, sheet 4) from main load contactor (CB2). Start generator set, while holding circuit breaker switch (S3) in closed position. Using a voltmeter, test for 28 vdc at J41, receptacle A(+) and Receptacle B(-). If 28 vdc is present, inspect and test CB2 (para 4-62). Replace if defective. If 28 vdc is not present, notify higher level maintenance. |  |



**4-9 BATTLE DAMAGE.** Unit maintenance troubles may occur while the generator set is operating in the field where supplies and repair parts are not available and normal corrective action cannot be performed. When this condition exists, refer to the Battle Damage Assessment and Repair manual TM 9-6115-624-BD.

## **Section VI. RADIO INTERFERENCE SUPPRESSION**

**4-10 GENERAL METHODS USED TO OBTAIN PROPER SUPPRESSION.** Essentially, suppression is obtained by providing a path to ground for stray currents. The methods used include shielding high frequency wires, grounding the frame with bonding straps, and using capacitors, inductors and resistors.

### **4-11 INTERFERENCE SUPPRESSION COMPONENTS.**

- a. Primary Interference Suppression Components. The primary interference components are those whose primary function is the suppression of electromagnetic interference. Those components are located at three different assemblies. The assemblies are the exciter regulator, the load terminal board, and are an integral part of the fuel transfer pumps. The suppression components located on the load terminal board and the exciter regulator are effective for generator sets designed serial number KZ00001 and RZ60001 and up.
- b. Secondary Interference Suppression Components. These components have radio interference suppression functions which are incidental or secondary to their primary function. The generator set contains no secondary suppression components.

**4-12 TESTING OF INTERFERENCE SUPPRESSION COMPONENTS.** Test radio suppression components as follows:

- a. Place START-RUN-STOP switch (paragraph 2-6) in RUN position and allow fuel transfer pumps to run until day tank float switch cuts them off.
- b. Start the generator set (paragraph 2-6) and check for electromagnetic interference.
- c. If interference is present, and the fuel transfer pumps are not operating, the transfer pumps are not the source.
- d. If interference is not present, allow the generator set to operate until the day tank float switch turns the fuel transfer pumps on.
- e. If interference is present with fuel transfer pumps operating, shutdown the generator set (paragraph 2-7) and replace the pumps.
- f. If the foregoing test indicates interference is caused by defective components other than those within the fuel pumps, replace one at a time, each of the four capacitors on the load terminal board assembly while observing the effect on interference.
- g. If the above tests do not eliminate the interference, the fault may be in the exciter regulator. Refer to higher level maintenance.

## **Section VII. UNIT MAINTENANCE OF THE ENGINE ELECTRICAL SYSTEM**

### **4-13 GENERAL**

This section contains unit maintenance instructions for the engine electrical system. Electrical power for starting the generator set engine is supplied by two 12 volt, 100 amp-hour, lead-acid type batteries connected in series. A slave receptacle facilitates external connection to the batteries. The starting motor is a 24 volt, heavy duty unit equipped with a positive indexing drive and an overrun type clutch. An integral solenoid switch is connected to the clutch shift lever by linkage and engages the clutch pinion gear with the flywheel and holds it in mesh during engine cranking. A 28-volt, continuous duty, alternator with integral voltage regulator and diode rectifier supplies electrical power for recharging the batteries after cranking. A manually reset speed switch driven by the camshaft provides sequence control of circuits during starting and also provides automatic shutdown in the event of engine overspeeding.



Coolant temperature is read through a temperature transmitter. An overtemperature switch provides automatic shutdown in the event that coolant temperature exceeds  $220 \pm 3^{\circ}\text{F}$ . The engine lube oil pressure is read through a pressure transmitter. A low oil pressure switch provides automatic shutdown in the event that oil pressure falls below  $20 \pm 2$  psig. The day tank is equipped with a double float switch which controls the fuel solenoid valve and provides automatic shutdown when only enough fuel remains for one minute of operation. The components of the engine electrical system are connected electrically through the engine wiring harness.

#### 4-14 **BATTERIES.**

a. Installation.

- (1) Refer to paragraph 3-4 and service the batteries.



**Battery electrolyte contains sulfuric acid which can cause severe burns. Handle batteries with care. If electrolyte should contact the skin or clothing, rinse immediately with clean water.**

- (2) install batteries and connect as shown in Figure 4-2.

#### **NOTE**

When installing battery cables, always connect ground (negative) cable last.

- (3) install retainer and secure with washers and nuts.  
(4) Apply an approved corrosion preventive compound to battery posts and cable terminals.

b. Replacement.

(1) Removal.

- (a) Remove battery tray retaining screws and washers (Figure 4-2) and slide battery tray out from compartment.  
(b) Remove nuts, washers, and retainer (Figure 4-2).  
(c) Remove battery cables.

#### **NOTE**

When removing battery cables, always disconnect ground (negative) cable first.

- (d) Remove batteries from battery tray.

- (2) Installation. Refer to subparagraph a. above for installation instructions.

c. Testing.

- (1) Tests specific gravity of electrolyte in each battery cell with a hydrometer. Refer to Table 4-3 for specific gravity temperature corrections. Refer to Table 4-4 for state of charge with specific gravity corrected to  $80^{\circ}\text{F}$ .



**Batteries generate hydrogen, a highly volatile gas, during charging. There shall be no smoking or open flame in the vicinity. Failure to observe this warning could result in an explosion, severe personal injury or death.**

- (2) Recharge or replace batteries as necessary.



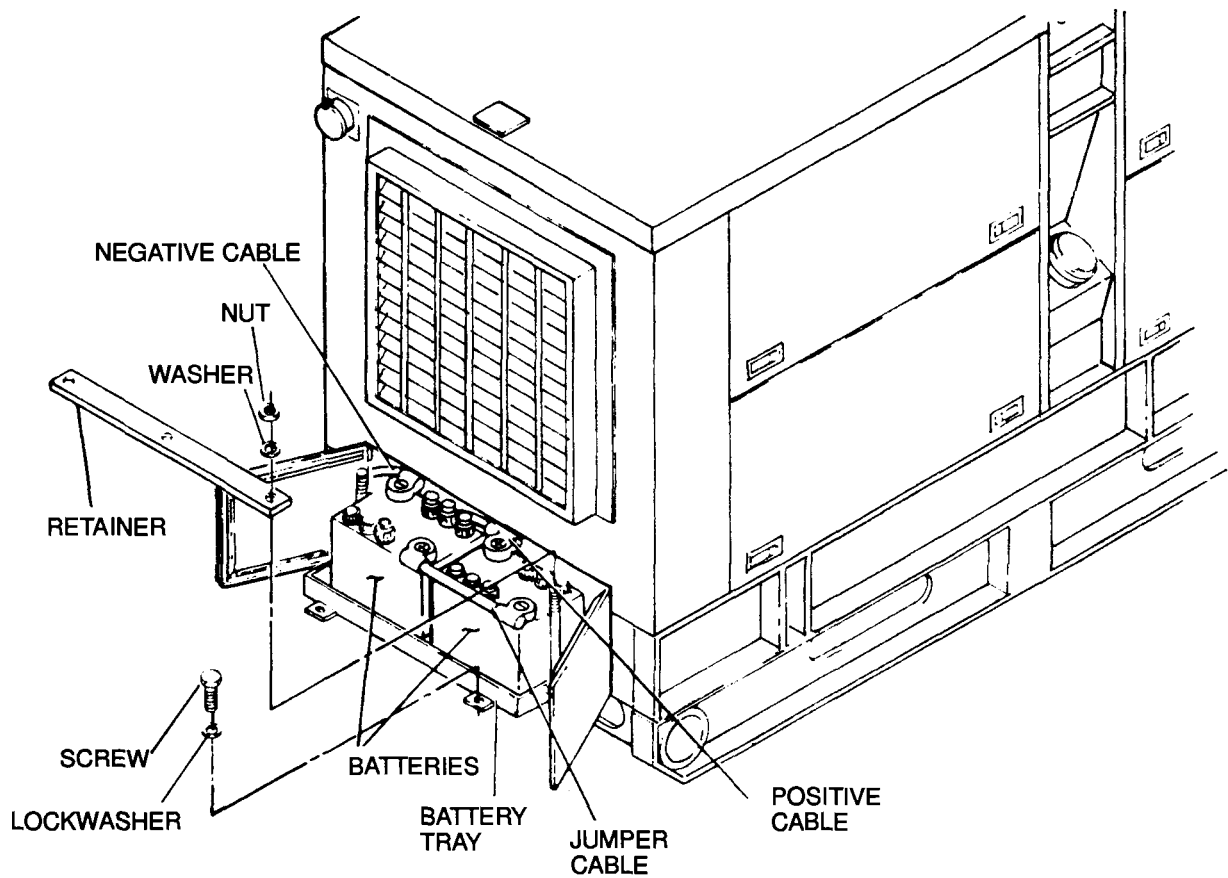


Figure 4-2. Battery Installation



**Table 4-3. Specific Gravity Temperature Corrections**

Temperature °F	Correction Factor
+120	+0.016
+115	+0.014
+110	+0.012
+105	+0.010
+100	+0.008
+95	+0.006
+90	+0.004
+85	+0.002
+80	0.0
+75	-0.002
+70	-0.004
+65	-0.006
+60	-0.008
+55	-0.010
+50	-0.012
+45	-0.014
+40	-0.016
+35	-0.018
+30	-0.020
+25	-0.022
+20	-0.024
+15	-0.026
+10	-0.028
+5	-0.030
0	-0.032
-5	-0.034
-10	-0.036
-15	-0.038
-20	-0.040

**Table 4-4. State of Charge With Specific Gravity Corrected to 80°F**

Specific Gravity	Percent Charge
1.280	100
1.250	75
1.220	50
1.190	25
1.160	Little useful capacity
1.130	Discharged



#### **4-15 SLAVE RECEPTACLE.**

- a. Removal.
  - (1) Tag and disconnect electrical leads to the slave receptacle.
  - (2) Remove nuts (1, Figure 4-3), screws(2) and washes (3) to remove slave receptacle (4).
- b. Cleaning and Inspection.
  - (1) Clean receptacle with filtered compressed air and a soft bristle brush.
  - (2) Clean receptacle box with a clean, lint-free cloth moistened with an approved solvent.
  - (3) Inspect receptacle for bent or broken pins, stripped terminal threads, corrosion or other damage.
  - (4) Inspect wiring of receptacle for frayed or deteriorated insulation, evidence of shorting and other damage.
  - (5) Inspect receptacle box for dents, corrosion and other damage.
  - (6) Replace any parts damaged beyond simple repair.
- c. Installation.
  - (1) Install slave receptacle (4), washers (3), screws (2), and nuts (1, Figure 4-3).
  - (2) Untag and reconnect electrical leads to the slave receptacle.

#### **4-16 STARTER ASSEMBLY.**

- a. Removal.
  - (1) Tag and disconnect electrical leads to starter assembly (Figure 4-4).
  - (2) Remove three bolts and lockwashers to remove starter from bell housing.
- b. Cleaning and Inspection.
  - (1) Clean starter assembly with a clean, lint-free cloth moistened with an approved solvent.
  - (2) Inspect starter assembly for cracks, corrosion, evidence of shorting and other damage.
  - (3) Inspect solenoid assembly for cracks, corrosion, evidence of shorting and other damage.
  - (4) Inspect all threaded parts for stripped or damaged threads.
- c. Repair.
  - (1) Brush replacement.

#### **NOTE**

It is not necessary to remove the starter assembly from the engine to replace the brushes.

- (a) Remove screws (1, Figure 4-5), and lockwashers (2)
- (b) Carefully remove commutator end frame assembly (3) and O-ring (4). Remove pipe plug (5) and oil wick (6) from end frame (7).
- (c) Remove screws (8 and 12) and lockwashers (9 and 13) to remove electrical leads (10 and 14) and brushes (11 and 15).
- (d) Remove brushholder pin (17) to remove brushholder spring (18) and brushholders (19 and 20) from brush support.
- (e) Clean commutator end frame, brush support, brushholders, and brushholder springs in an approved solvent and dry thoroughly.
- (f) Soak oil wick in a small container of approved cleaning solvent to remove oil. Remove from container, squeeze out excess solvent and allow to air dry.



- 1. Nut
- 2. Screw
- 3. Washer
- 4. Receptacle, slave

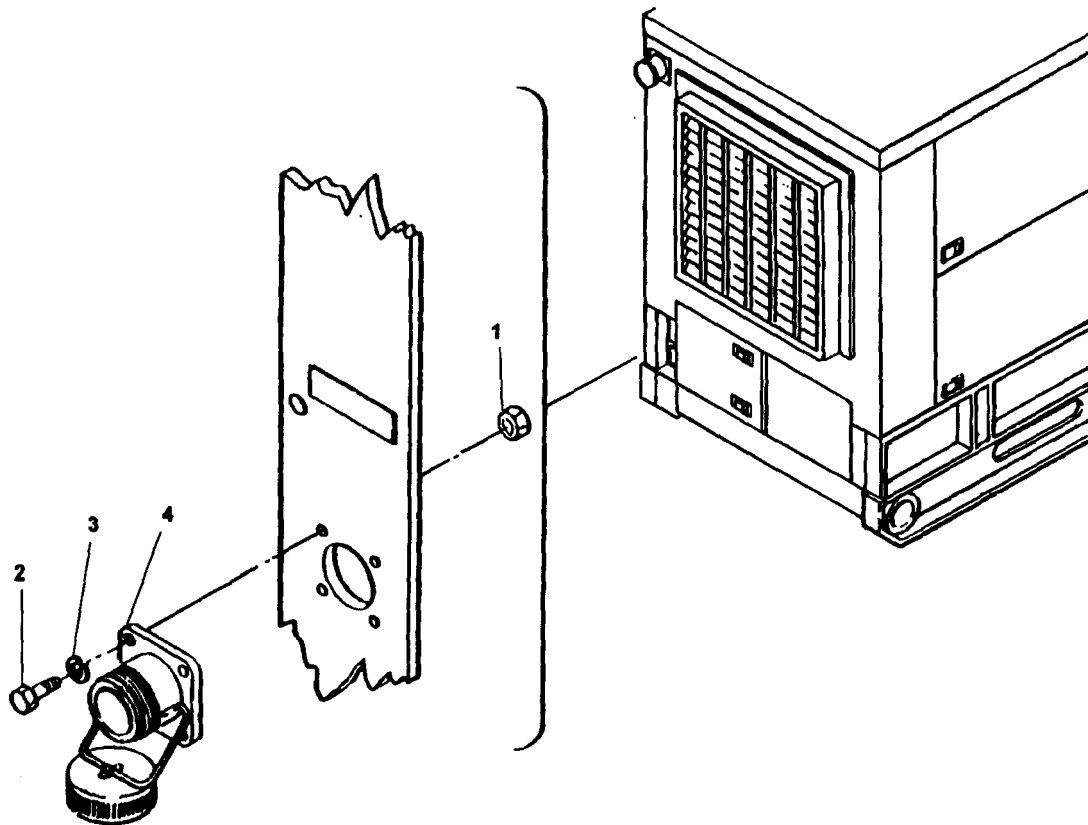


Figure 4-3. Slave Receptacle, Removal and Installation

- (g) Measure brush length. Replace brushes if length is  $\frac{3}{8}$  inch or less.

**CAUTION**

Use extreme care to avoid enlarging commutator slots. Equipment damage could result if care is not observed.

- (h) Inspect starter armature commutator slots for thrown solder. Remove any found with a narrow blunt instrument.
- (i) Check bronze bushing in commutator end frame and armature shaft for deep wear patterns, scoring, or other damage. Replace starter assembly if damage exists.
- (j) Check brushholders and brush support for corrosion, cracks, breaks, and other damage. Replace any defective parts.



- (k) Inspect electrical leads and visible starter assembly wiring for burned insulation, bare wires and rub marks. Replace starter assembly if damage is present.
- (l) Check all attaching hardware for stripped, crossed or otherwise damaged threads. Replace any damaged or defective parts.
- (m) Install brushholders (19 and 20) and spring (18) and secure with pin (17).
- (n) Install brushes (11 and 15) and electrical leads (10 and 14) and secure with lockwashers (9 and 13) and screws (8 and 12).

### **CAUTION**

**Use care when installing end frame to avoid damaging the bronze armature shaft bushing. Equipment damage could result if caution is not observed.**

- (o) Install commutator end frame (7) and O-ring (4) and secure with lockwashers (2) and screws (1).
  - (p) Install oil wick (6), saturate with oil and secure with pipe plug (5).
- (2) Solenoid replacement.

### **NOTE**

It is not necessary to remove the starter assembly from the generator set to replace the solenoid assembly.

- (a) Remove nut (1, Figure 4-6) and lockwasher (2) to disconnect electrical lead (3).
- (b) Remove nut (4), lockwasher (5), nut (6), lockwasher (7) and terminal lead (8).
- (c) Loosen damp (9) and remove screws (10) to remove solenoid frame assembly (11). Remove sleeve (12).
- (d) Remove drive housing plug (13).
- (e) Remove retaining ring (14) and lever pin (15) to remove plunger assembly (16) from starter assembly (17).
- (f) Remove retaining ring (18) to separate spring retainer (19), spring (20), seal (21), seal retainer (22), and spring retainer (23) from plunger (24).
- (g) Clean solenoid frame assembly with filtered compressed air and a soft bristle brush.
- (h) Using an ohmmeter, check for continuity between solenoid frame assembly terminals. Replace entire solenoid assembly if discontinuity is noted.
- (i) Clean all other parts in an approved solvent and dry thoroughly.
- (j) Inspect plunger for cracks, corrosion, and other damage.
- (k) Inspect seal for damage and deterioration.
- (l) Inspect spring for cracks, breaks, and distortion.
- (m) Replace any defective parts.
- (n) Install spring retainer, seal retainer, seal (21), spring (20), and spring retainer (19) onto plunger (24) and secure with retaining ring (18).
- (o) Install plunger assembly (16) into drive end housing.
- (p) Install lever pin (15) and secure with retaining ring (14).
- (q) Install plug (13).
- (r) Install sleeve (12) and clamp (9) onto drive end housing.



- (s) Install solenoid frame assembly (11) and screws (10). Tighten damp (9).
- (t) Install terminal lead (8) and secure with lockwasher (7), nut (6), lockwasher (5) and nut (4).
- (u) Install electrical lead (3) and secure with lockwasher (2) and nut (1).

d. Testing.

- (1) Check specific gravity of batteries to determine state of charge (paragraph 4-14). Charge or replace batteries if necessary.
- (2) Open the right side engine compartment access door. Listen for audible evidence of solenoid actuation while someone attempts to start the generator set (Figure 1-4).
- (3) If no sounds of solenoid actuation are heard, proceed as follows:
  - (a) Set selector switch of a multimeter to the 50 Vdc position.

**CAUTION**

**Maintain proper polarity when connecting multimeter. Electrical lead (3, Figure 4-6) is positive lead. Equipment damage could result if caution is not observed.**

- (b) Connect multimeter between positive solenoid terminal and starter ground terminal.
- (c) If multimeter does not indicate approximately 24 Vdc, trouble is in wiring and not the solenoid.

**CAUTION**

**Always disconnect negative (ground) cable first. Equipment damage could result if caution is not observed.**

- (d) If multimeter indicates approximately 24 Vdc, disconnect leads from starter.
- (e) Using multimeter as an ohmmeter, check for indication of open circuit across solenoid terminals.
- (f) If multimeter indicates open circuit, replace solenoid (subparagraph c. (2) above).
- (g) If multimeter indicates continuity, reconnect electrical leads.
- (4) If solenoid actuates, but starter will not rotate engine, proceed as follows:
  - (a) Set selector switch of multimeter to the 50 Vdc position.

**CAUTION**

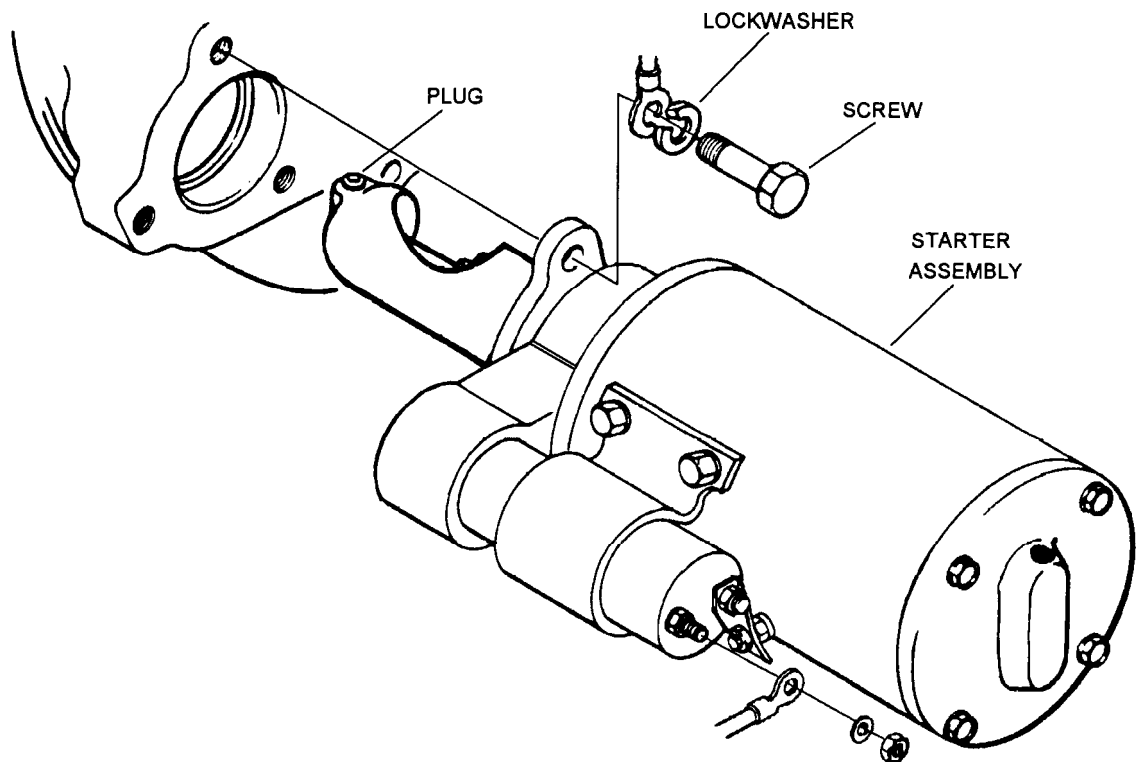
**Maintain proper polarity when connecting multimeter. Equipment damage could result if caution is not observed.**

- (b) Connect multimeter between starter-to-solenoid terminal and ground terminal.
- (c) Observe multimeter while assistant attempts to start the generator set.
- (d) If multimeter does not indicate approximately 24 Vdc, replace solenoid assembly (paragraph c. (2) above).
- (e) If multimeter indicates correct voltage, check brush length (paragraph c. (1) above). Replace brushes if necessary.
- (5) If trouble persists, replace starter assembly.

e. Installation.

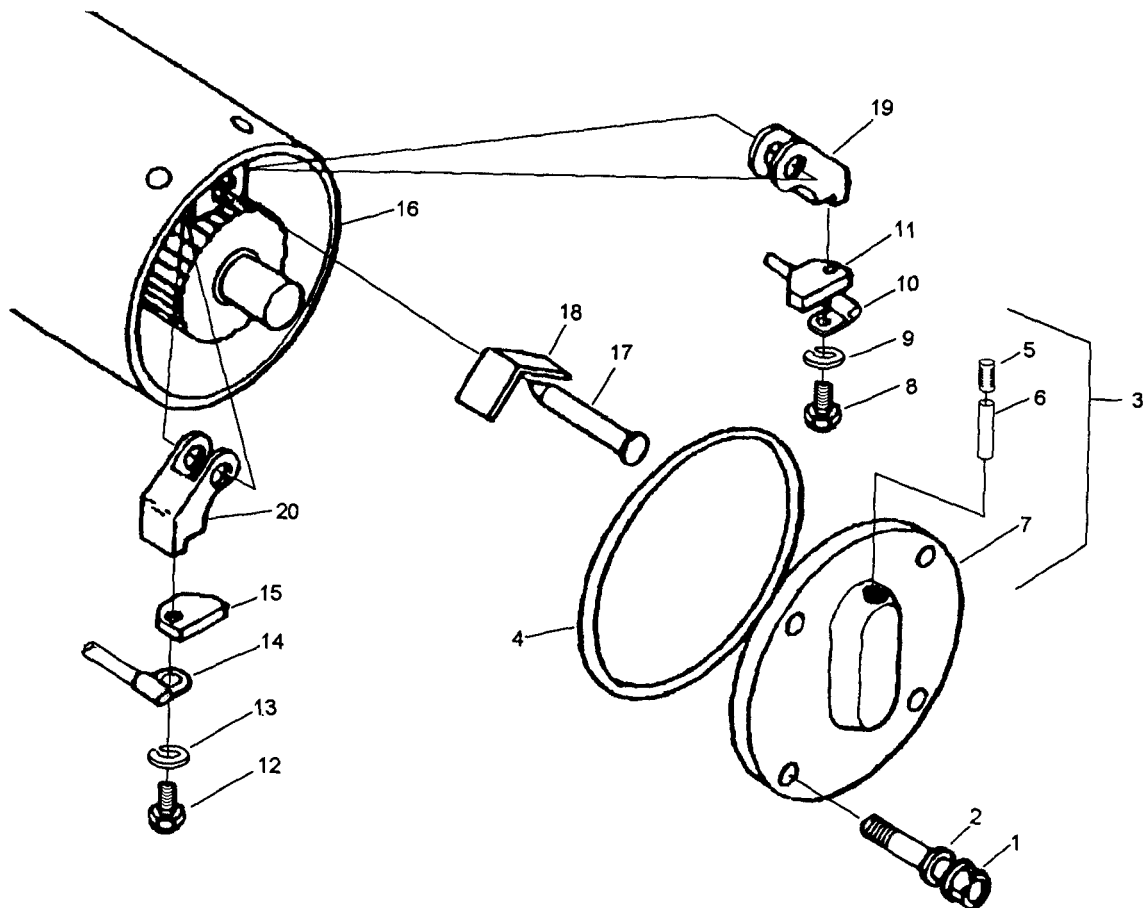
- (1) Install starter assembly with lockwashers and three bolts to the bell housing.
- (2) Untag and reconnect electrical leads to starter assembly (Figure-4-4).





**Figure 4-4. Starter Assembly, Removal**

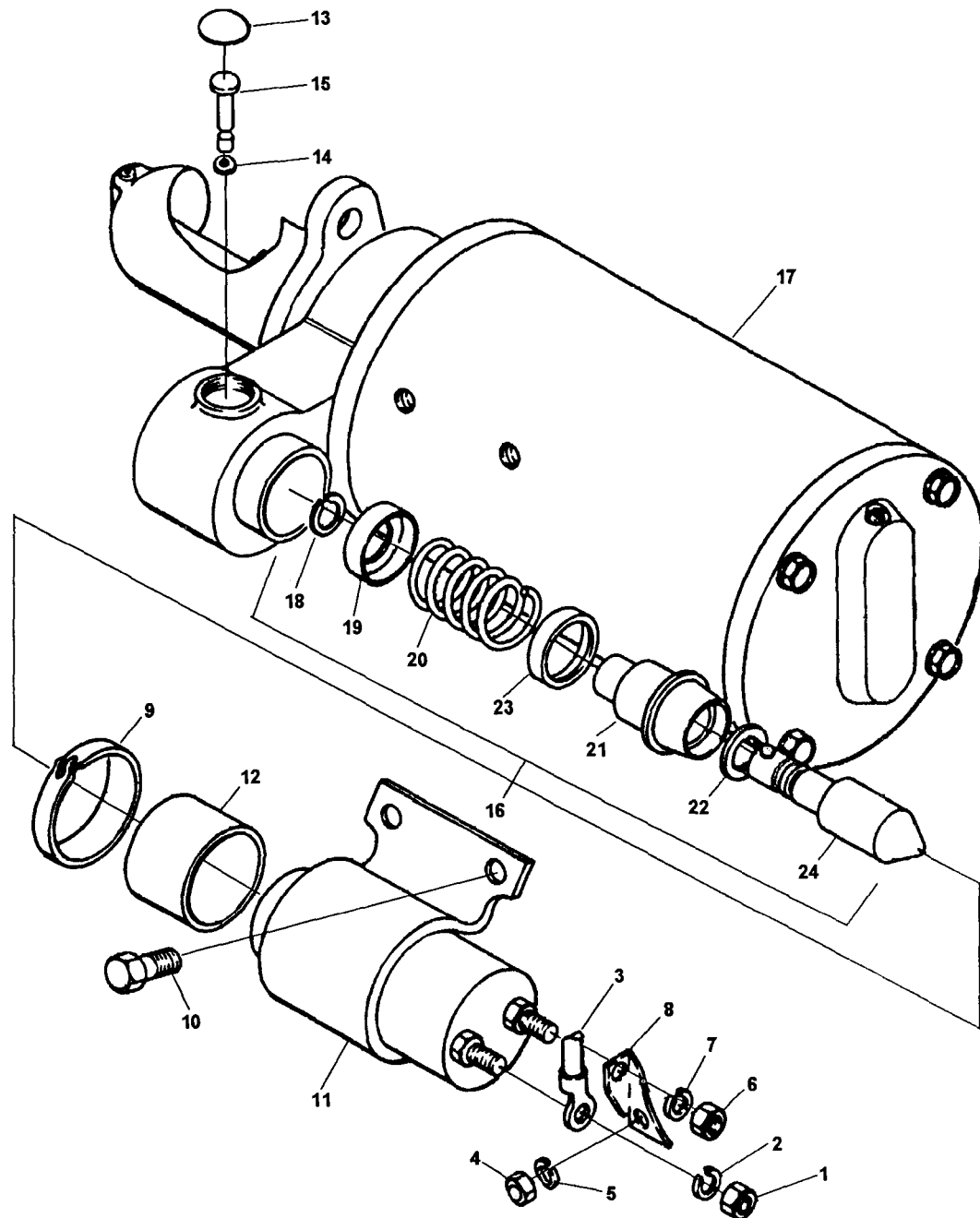




- |                              |                        |
|------------------------------|------------------------|
| 1. Screw                     | 11. Brush              |
| 2. Lockwasher                | 12. Screw              |
| 3. Commutator end frame assy | 13. Lockwasher         |
| 4. O-ring                    | 14. Electrical lead    |
| 5. Pipe plug                 | 15. Brush              |
| 6. Oil wick                  | 16. Starter assy       |
| 7. End frame                 | 17. Brushholder pin    |
| 8. Screw                     | 18. Brushholder spring |
| 9. Lockwasher                | 19. Brushholder        |
| 10. Electrical lead          | 20. Brushholder        |

Figure 4-5. Starter Brushes Replacement





- |                             |                          |
|-----------------------------|--------------------------|
| 1. Nut                      | 13. Drive end frame plug |
| 2. Lockwasher               | 14. Retaining ring       |
| 3. Electrical lead          | 15. Lever pin            |
| 4. Nut                      | 16. Plunger assembly     |
| 5. Lockwasher               | 17. Starter assembly     |
| 6. Nut                      | 18. Retaining ring       |
| 7. Lockwasher               | 19. Spring retainer      |
| 8. Terminal lead            | 20. Spring               |
| 9. Clamp                    | 21. Seal                 |
| 10. Screw                   | 22. Seal retainer        |
| 11. Solenoid frame assembly | 23. Spring retainer      |
| 12. Sleeve                  | 24. Plunger              |

Figure 4-6. Starter Solenoid Replacement



#### 4-17 STARTER ASSEMBLY

##### **NOTE**

Effective with serial numbers KZ00001 through KZ01226 and RZ60001 and up.

- a. Removal.
  - (1) Tag and disconnect electrical leads to starter assembly (Figure 4-7).
  - (2) Remove three bolts and lockwashers to remove starter from bell housing.
- b. Cleaning and Inspection.
  - (1) Clean starter assembly with a clean, lint-free cloth moistened with an approved solvent.
  - (2) Inspect starter assembly for cracks, corrosion, evidence of shorting and other damage.
  - (3) Inspect solenoid assembly for cracks, corrosion, evidence of shorting and other damage.
  - (4) Inspect all threaded parts for stripped or damaged threads.

##### **NOTE**

Using prick punch, pin prick mark points of contact between the drive housing and shifter (lever) housing, and main housing and commutator end frame so that parts may be realigned accurately when reassembling. Refer to Figure 4-7.

- c. Repair
  - (1) Brush replacement.

##### **NOTE**

It is not necessary to remove the starter assembly from the engine to replace the brushes.

- (a) Remove screws (1, Figure 4-8) and lockwashers (2).
- (b) Carefully remove commutator end frame (3) and O-ring (4).
- (c) Remove screws (5 and 8) to remove electrical leads (6 and 9) and brushes (7 and 10).
- (d) Remove brushholder pin (12) to remove brushholder spring (13) and brushholders (14 and 15) from brush support.
- (e) Clean commutator end frame, brush support, brushholders, and brushholder springs in an approved solvent and dry thoroughly.
- (f) Measure brush length. Replace brushes if length is 3/8 inch or less.

##### **CAUTION**

**Use extreme care to avoid enlarging commutator slots. Equipment damage could result if caution is not observed.**

- (g) Inspect starter armature commutator slots for thrown solder. Remove any found with a narrow blunt instrument.
- (h) Check bronze bushing in commutator end frame and armature shaft for deep wear patterns, scoring, or other damage. Replace starter assembly if damage exists.
- (i) Check brushholders and brush support for corrosion, cracks, breaks, and other damage. Replace any defective parts.
- (j) Inspect electrical leads and visible starter assembly wiring for burned insulation, bare wires and rub marks. Replace starter assembly if damage is present.



- (k) Check all attaching hardware for stripped, crossed or otherwise damaged threads. Replace any damaged or defective parts.
- (l) Install brushholders (14 and 15) and spring (13) and secure with pin (12).
- (m) Install brushes (7 and 10) and electrical leads (6 and 9) and secure with screws (5 and 8).

**CAUTION**

**Use care when installing end frame to avoid damaging the bronze armature shaft bushing. Equipment damage could result if caution is not observed.**

- (n) Install commutator end frame (3) and O-ring (4) and secure with lockwashers (2) and screws (1).
- (2) Solenoid replacement.

**NOTE**

It is not necessary to remove the starter assembly from the generator set to replace the solenoid assembly.

- (a) Remove nut (1, Figure 4-9) and lockwasher (2) to disconnect electrical lead (3).
- (b) Remove nut (4), lockwasher (5), nut (6), lockwasher (7) and connector (8).
- (c) Loosen damp (9) and remove screws (10) to remove solenoid assembly (11 ). Remove boot (12).
- (d) Remove inspection plug (13) and gasket (14).
- (e) Remove adjusting nut (15) and remove plunger assembly (16) from starter assembly (17).
- (f) Remove snap ring (18), O-ring (19), spring retainer (20), spring (21), O-ring (22), spring retainer (23), and washer (24) from plunger (25).
- (g) Clean solenoid frame assembly with filtered compressed air and a soft bristle brush.
- (h) Using an ohmmeter, check for continuity between solenoid frame assembly terminals. Replace entire solenoid assembly if discontinuity is noted.
- (i) Clean all other parts in an approved solvent and dry thoroughly.
- (j) Inspect plunger for cracks, corrosion, and other damage.
- (k) Inspect seal for damage and deterioration.
- (l) Inspect spring for cracks, breaks, and distortion.
- (m) Replace any defective parts.
- (n) Install washer (24), spring retainer (23), O-ring (22), spring (21), spring retainer, O-ring (19) onto plunger (25) and secure with snap ring (18).
- (o) Install plunger assembly (16) into lever housing.
- (p) install adjusting nut (15) and install gasket (14) and inspection plug (13).
- (q) Install boot (12) and clamp (9) onto lever, housing.
- (r) Install solenoid frame assembly (11 ) and screws (10). Tighten clamp (9).
- (s) Install connector (8) and secure with lockwasher (5), nut (4), lockwasher (7) and nut (6).
- (t) Install electrical lead (3) and secure with lockwasher (2) and nut (1).



d. Testing.

- (1) Check specific gravity of batteries to determine state of charge (paragraph 4-14). Charge or replace batteries if necessary.
- (2) Open the right side engine compartment access door. Listen for audible evidence of solenoid actuation while someone attempts to start the generator set (Figure 1-4).
- (3) If no sounds of solenoid actuation are heard, proceed as follows:
  - (a) Set selector switch of a multimeter to the 50 Vdc position.

**CAUTION**

**Maintain proper polarity when connecting multimeter. Electrical lead (3, Figure 4-9) is positive lead. Equipment damage could result if caution is not observed.**

- (b) Connect multimeter between positive solenoid terminal and starter ground terminal.
- (c) If multimeter does not indicate approximately 24 Vdc, trouble is in wiring and not the solenoid.

**CAUTION**

**Always disconnect negative (ground) cable first. Equipment damage could result if caution is not observed.**

- (d) If multimeter indicates approximately 24 Vdc, disconnect leads from starter.
  - (e) Using multimeter as an ohmmeter, check for indication of open circuit across solenoid terminals.
  - (f) If multimeter indicates open circuit, replace solenoid (subparagraph c. (2) above).
  - (g) If multimeter indicates continuity, reconnect electrical leads.
- (4) If solenoid actuates, but starter will not rotate engine, proceed as follows:
    - (a) Set selector switch of multimeter to the 50 Vdc position.

**CAUTION**

**Maintain proper polarity when connecting multimeter. Equipment damage could result if caution is not observed.**

- (b) Connect multimeter between starter-to-solenoid terminal and ground terminal.
  - (c) Observe multimeter while attempting to start the generator set.
  - (d) If multimeter does not indicate approximately 24 Vdc, replace solenoid assembly (paragraph c. (2) above).
  - (e) If multimeter indicates correct voltage, check brush length (paragraph c. (1) above). Replace brushes if necessary.
- (5) If trouble persists, replace starter assembly.

e. Installation.

- (1) Install starter assembly with lockwashers and three bolts to the bell housing.
- (2) Untag and reconnect electrical leads to starter assembly (Figure 4-8).



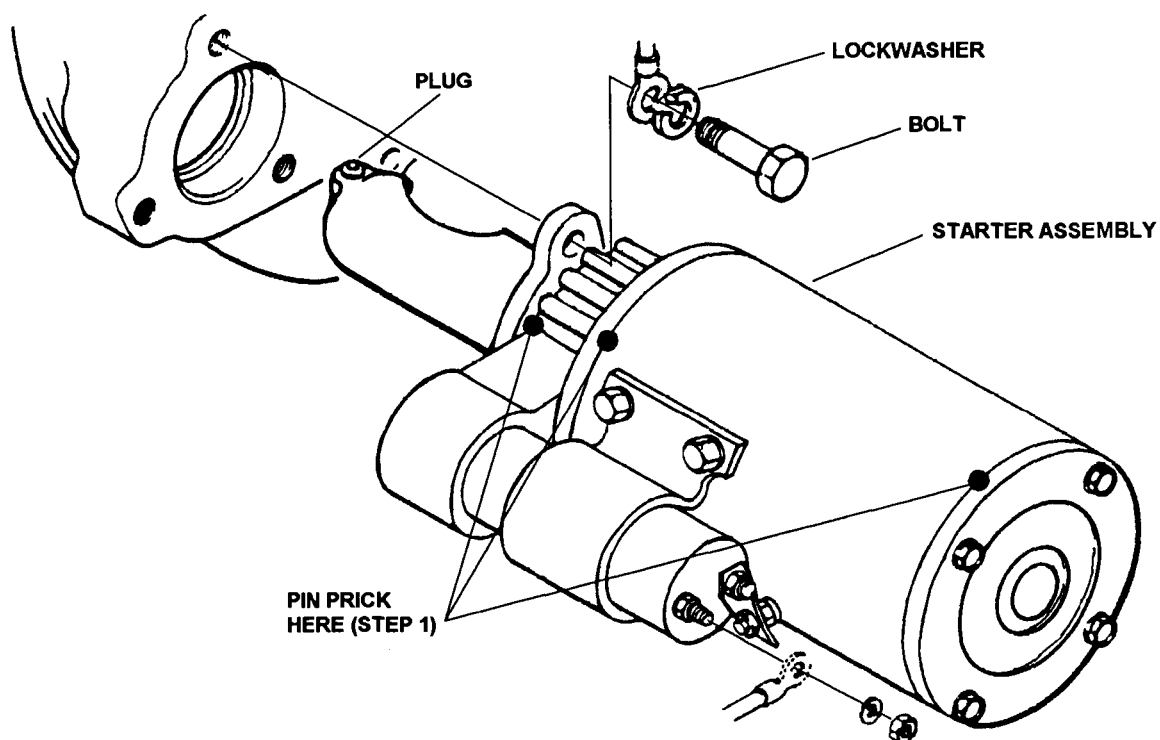
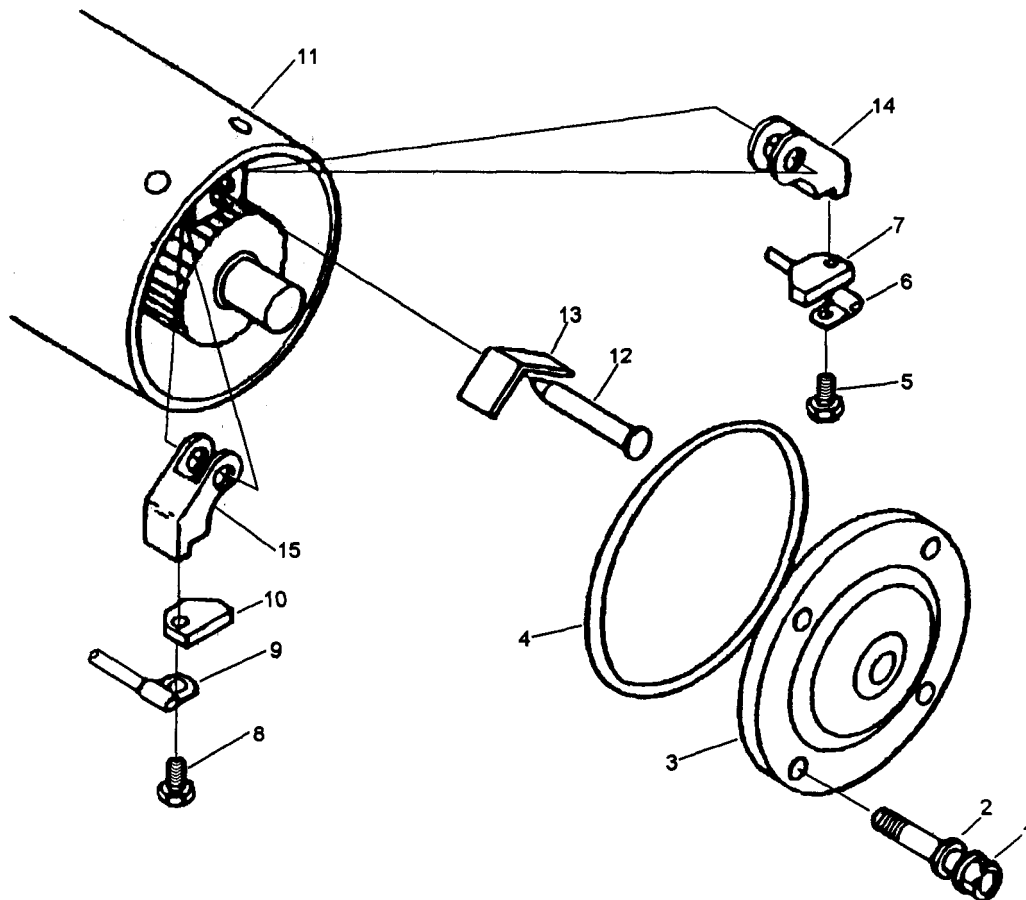


Figure 4-7. Starter Assembly Removal

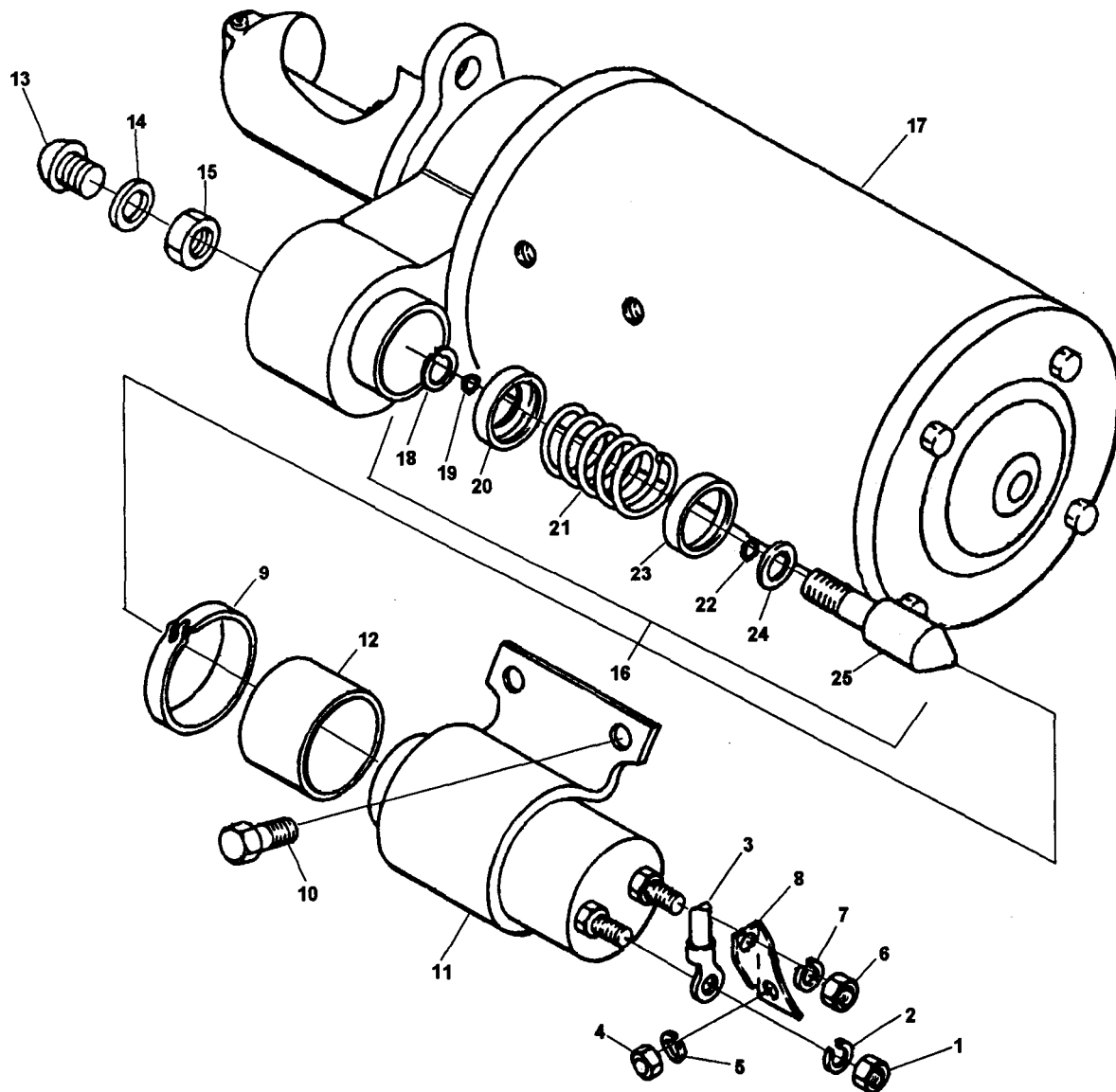




1. Screw
2. Lockwasher
3. Commutator end frame
4. O-ring
5. Screw
6. Electrical lead
7. Brush
8. Screw
9. Electrical lead
10. Brush
11. Starter assy
12. Brushholder pin
13. Brushholder spring
14. Brushholder
15. Brushholder

**Figure 4-8. Starter Brushes Replacement (effective with serial no. KZ00001 through KZ01226 and RZ00001 and up)**





1. Nut
2. Lockwasher
3. Electrical lead
4. Nut
5. Lockwasher
6. Nut
7. Lockwasher
8. Connector
9. Clamp
10. Screw
11. Solenoid frame assembly
12. Boot
13. inspection plug

14. Gasket
16. Adjusting nut
16. Plunger assembly
17. Starter assembly
18. Snap ring
19. O-ring
20. Spring retainer
21. Spring
22. O-Ring
23. Spring retainer
24. Washer
25. Plunger

Figure 4-9. Starter Solenoid Replacement (effective with serial no. KZ00001 through KZ01226 and RZ60001 and up)



#### **4-18 BATTERY CHARGING ALTERNATOR.**

- a. Removal.

##### **NOTE**

Test the alternator in accordance with subparagraph c. below before removal.

- (1) Disconnect electrical connector (1, Figure 4-10).
- (2) Loosen alternator mounting hardware and remove v-belt (2).
- (3) Remove screw (3), lockwasher (4), and flat washer (5).
- (4) Remove nut (6), lockwasher (7), flat washer (8) and screw (9) to remove alternator assembly (10).
- (5) Do not remove screws (11 and 14), lockwashers (12 and 15), adjusting bracket (13) and mounting bracket (16) unless inspection reveals damage.

- b. Cleaning and Inspection.

- (1) Clean alternator with dry, filtered, compressed air and a soft bristle brush or wipe with a clean, lint-free cloth lightly moistened with an approved solvent.
- (2) Inspect alternator for cracks, corrosion, evidence of shorting and overheating, bent or broken connector pins and other damage.
- (3) If the electrical connector receptacle is loose, remove end cap. Remove old rivets and refasten the receptacle with new rivets or screws and nuts.

- c. Testing and Adjustment.

- (1) Remove four screws attaching the rear cover plate to the alternator.
- (2) Carefully pull the cover plate away from the alternator assembly.
- (3) Fabricate two test leads as follows:
  - (a) Cut two pieces of No. 8 or No. 10 insulated wire; one 5 inches long and the other 10 inches long.
  - (b) Strip both ends of each wire and tin with solder (Federal Specification TB-SIG-222).
  - (c) Attach a No. 10 ring terminal to one end of the 10 inch test lead.
  - (d) Attach a No. 10 ring terminal to one end of the 5 inch wire.
- (4) Attach the test leads as shown in Figure 4-11 and pass the free end of each lead through a hole in the ventilated shield of the alternator housing.
- (5) Carefully install the rear cover plate and secure with screws.
- (6) If alternator is still installed in the generator set, connect wiring harness connector to the alternator.
- (7) If alternator has been removed, install it in test setup as shown in Figure 4-12 and provide a means of rotation at approximately 2500 rpm.
- (8) Place multimeter selector in the 50 Vdc position.
- (9) Operate alternator at the required rpm and note the reading on the multimeter.
- (10) If multimeter reading is not in accordance with Table 4-5, rotate adjusting screw to obtain proper reading.



**Table 4-5. Alternator Voltages at Ambient Temperature**

Ambient Temperature	DC Voltage Minimum - Maximum
0° (-18°)	29.20-30.12
20° (-6.6°)	28.86-29.73
40° (4.5°)	28.64-29.36
60° (15.5°)	28.32-28.98
80° (26.6°)	28.00-28.60
100° (38°)	27.68-28.32
120° (49°)	27.32-28.04

**NOTE**

Rotating adjusting screw clockwise increases voltage output. Rotating adjusting screw counterclockwise decreases output.

(11 ) If proper voltage cannot be obtained with adjusting screw, replace alternator.

d. Installation.

- (1) If removed, install mounting bracket (16), adjusting bracket (13), lockwashers (15 and 12), and screws (14 and 11), (Figure 4-10).
- (2) Install alternator assembly (10), screw (9), flatwasher (8), lockwasher (7), and nut (6).
- (3) Install flat washer (5), lockwasher (4), and screw (3).
- (4) Tighten alternator mounting hardware and install v-belt (2).
- (5) Reconnect electrical connector (1).

**4-19 SPEED SWITCH.**

**NOTE**

Test speed switch in accordance with paragraph c. below before removal.

a. Removal.

- (1) Remove wiring harness connector from speed switch connector (Figure 1-5).
- (2) Use 1-1/8 inch wrench to loosen and remove the speed switch.

b. Cleaning and Inspection.

- (1) Clean speed switch with filtered compressed air and a soft bristle brush or wipe with a clean, lint-free cloth lightly moistened with an approved solvent.
- (2) Inspect speed switch for cracked casing, corrosion, bent or broken connector pins and stripped or damaged threads.

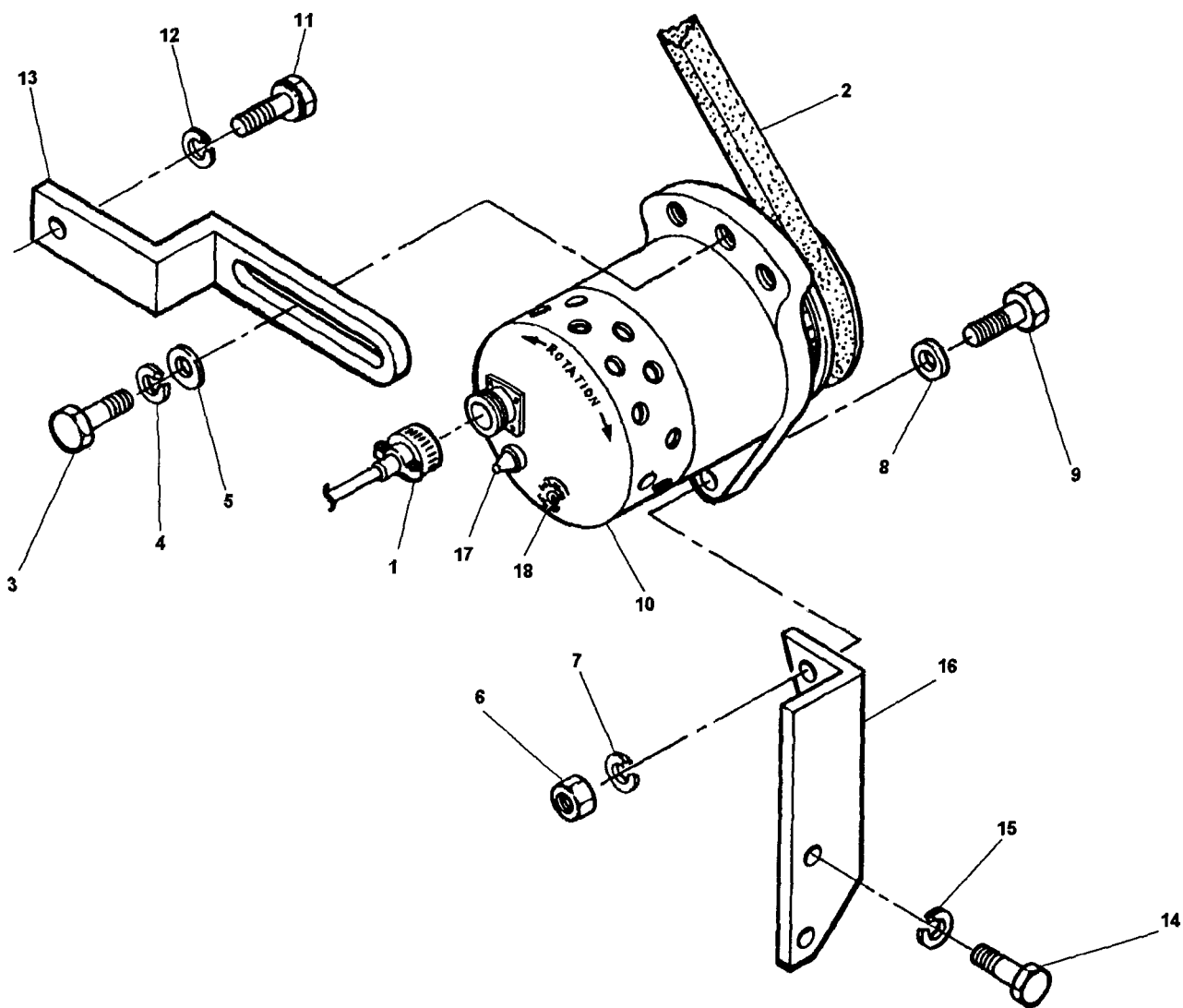
c. Testing. Replace the speed switch, if any of the following continuity or discontinuity checks are not verified.

- (1) Continuity between connector pins A and B and between pins G and H.
- (2) Discontinuity between pins A and C, between D and E and between F and J.

d. Installation.

- (1) Use 1-1/8 inch wrench to install and tighten the speed switch.
- (2) Install wiring harness connector onto speed switch connector (Figure 1-5).





- 1. Electrical connector
- 2. V-belt
- 3. Screw
- 4. Lockwasher
- 5. Flat Washer
- 6. Nut
- 7. Lockwasher
- 8. Flat Washer
- 9. Screw

- 10. Alternator assy
- 11. Screw
- 12. Lockwasher
- 13. Adjusting bracket
- 14. Screw
- 15. Lockwasher
- 16. Mounting bracket
- 17. Fuse
- 18. Adjusting screw

Figure 4-10. Battery Charging Alternator Removal and Installation



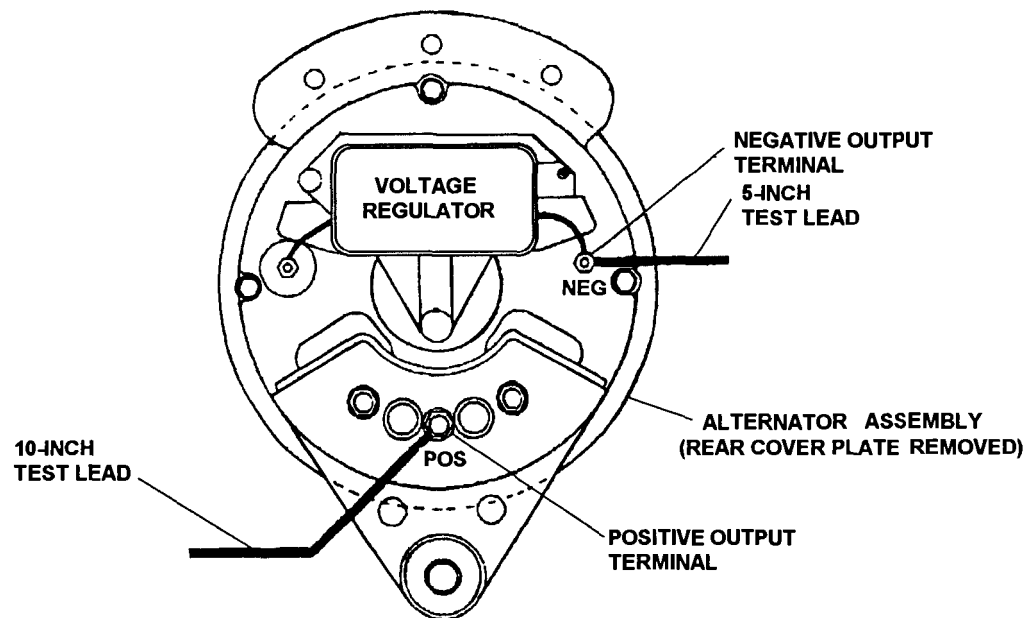


Figure 4-11. Alternator Test Leads Attachment

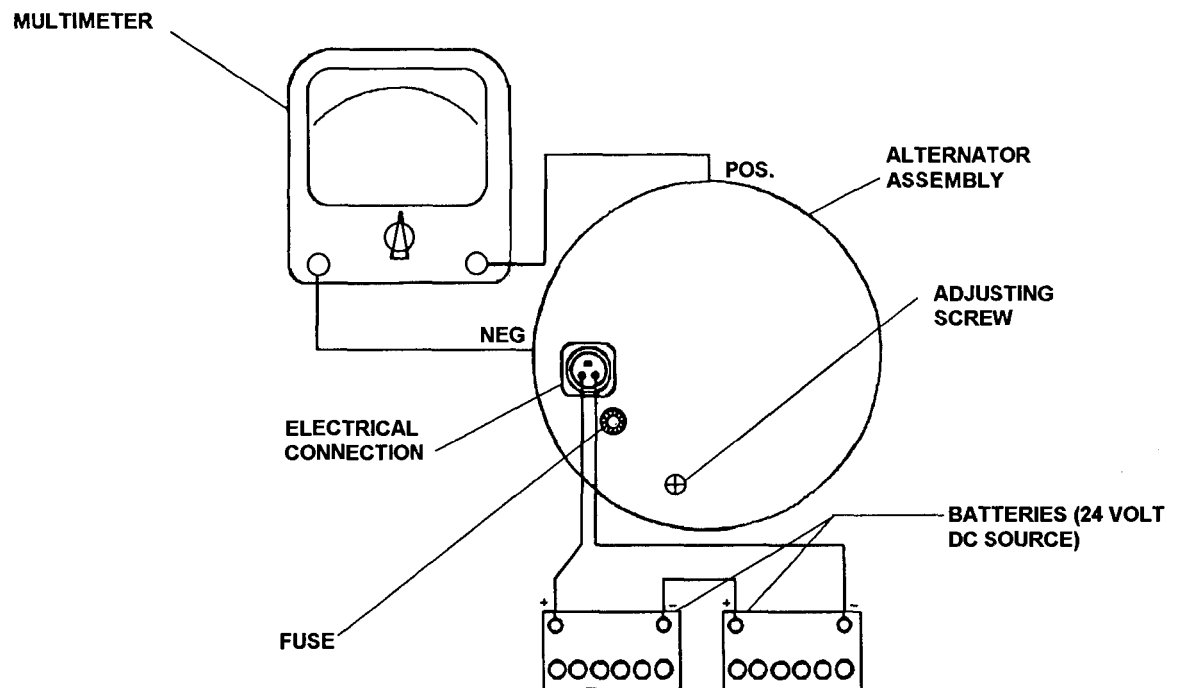


Figure 4-12. Alternator Test Circuit



#### **4-20 COOLANT TEMPERATURE TRANSMITTER.**

- a. Removal.

##### **NOTE**

Test coolant temperature transmitter in accordance with paragraph c. below prior to removal. Coolant temperature transmitter is located on the engine thermostat housing.

- (1) Refer to paragraph 3-27 and drain coolant from the radiator.
  - (2) Unscrew the wiring connector from the temperature transmitter.
  - (3) Unscrew the temperature transmitter from the thermostat housing.
- b. Cleaning and Inspection.
- (1) Clean temperature transmitter with filtered compressed air and a soft bristle brush or with a clean lint-free cloth lightly moistened with an approved solvent.
  - (2) Inspect temperature transmitter for cracked casing, corrosion and damaged threads and connector.
- c. Testing.
- (1) Disconnect wiring harness connector from coolant temperature transmitter.
  - (2) Connect an ohmmeter or similar device between the connector and casing.
  - (3) Refer to paragraph 2-6 and start the engine.
  - (4) Allow the engine to operate while observing the ohmmeter.
  - (5) Resistance should increase to a reading of 680 to 745 ohms when the engine reaches normal operating temperature.
  - (6) Refer to paragraph 2-7 and stop the engine.
  - (7) Replace coolant temperature transmitter if resistance is not within specified limits.
- d. Installation.
- (1) Install temperature transmitter into thermostat housing spacer and tighten to 12-15 lbs-ft torque.
  - (2) Refer to paragraph 3-27 and service the radiator.

#### **4-21 OVER-TEMPERATURE SWITCH.**

- a. Removal.

- (1) Refer to paragraph 3-27 and drain the coolant from the radiator.
- (2) Unscrew wiring connector from the overtemperature switch connector.

##### **NOTE**

The over-temperature switch is located on the left rear side of the engine cylinder head assembly.

- (3) Unscrew over-temperature switch from cylinder head assembly.
- b. Cleaning and Inspection.
- (1) Clean over-temperature switch with filtered compressed air and a soft bristle brush or with a clean, lint-free cloth lightly moistened with an approved solvent.
  - (2) Inspect over-temperature switch for cracked casing, corrosion, stripped or damaged threads, and bent or broken connector pins.



c. Testing.

- (1) Suspend over-temperature switch in a container of clean oil so that sensing element is completely immersed but not touching the sides or bottom of the container.
- (2) Suspend a reliable thermometer in the container. Do not allow the end of the thermometer to reset on the bottom of the container.
- (3) Using an ohmmeter, check continuity between pins A and D (figures FO-1 and FO-2) and between pins B and C of the switch connector. A and D should indicate continuity and B and C should indicate discontinuity.
- (4) Attach the ohmmeter leads to pins A and D.



Do not exceed 250°F (121.1°C) as oil may ignite.

- (5) Gradually heat the oil, stirring so that heat will be evenly distributed, and observe the thermometer and ohmmeter.
- (6) At 220°F ± 3°F (104.8 ± 1.5°C) the ohmmeter should indicate discontinuity.
- (7) Check continuity between pins B and C. Ohmmeter should indicate continuity.
- (8) Replace the over-temperature switch if it fails to operate within the above limits.

d. Installation.

- (1) Install over-temperature switch into cylinder block and tighten to 12 to 15 lbs-ft torque.
- (2) Refer to paragraph 3-27 and service radiator.

**4-22 OIL PRESSURE TRANSMITTER (Figure 1-5).**

a. Removal.

**NOTE**

Test oil pressure transmitter in accordance with paragraph c. below prior to removal.

- (1) Remove nut, washer, and electrical lead from oil pressure transmitter.
- (2) Unscrew oil pressure transmitter from coupling in engine block.

b. Cleaning and Inspection.

- (1) Clean oil pressure transmitter with dry, filtered compressed air and a soft bristle brush or wipe with a dean, lint-free cloth lightly moistened with an approved solvent.
- (2) Inspect oil pressure transmitter for cracked casing, stripped or damaged threads, corrosion, or other visible damage.

c. Testing.

- (1) Disconnect electrical lead to oil pressure transmitter.
- (2) Connect an ohmmeter between transmitter terminal and casing. Readings should indicate 15 ohms at 30 psi and 300 ohms at 60 psi.
- (3) Refer to paragraph 2-6 and start the engine.
- (4) Allow the engine to operate until normal operating temperature is indicated on the temperature gauge.
- (5) Observe ohmmeter. Resistance shall be as specified in paragraph 1-11.



- (6) Refer to paragraph 2-7 and stop the engine.
- (7) Replace oil pressure transmitter if the above resistance requirements are not met.

d. Installation.

- (1) Screw oil pressure into coupling in engine block and tighten to 20 lbs-ft torque.
- (2) Install electrical lead and secure with washer and nut.

**4-23 LOW OIL PRESSURE SWITCH.**

a. Removal.

**NOTE**

Test low oil pressure switch in accordance with subparagraph c. below before removal.

- (1) Tag and disconnect electrical connectors from low oil pressure switch (Figure 1-5).
- (2) Unscrew switch from block adapter.

b. Cleaning and Inspection.

- (1) Clean low oil pressure switch with dry, filtered compressed air and an electrician's brush or wipe with a clean, lint-free cloth lightly moistened with an approved solvent.
- (2) Inspect low oil pressure switch for cracked casing, stripped or damaged threads, corrosion, or other damage.

c. Testing.

- (1) Remove wiring harness connector from low pressure switch.
- (2) Install a jumper across wiring harness connector pins A and B (figures FO-1 and FO-2).
- (3) Connect an ohmmeter across switch connector pins A and D. Ohmmeter shall indicate open circuit.
- (4) Connect ohmmeter across switch connector pins B and C. Ohmmeter shall indicate continuity.
- (5) Start the generator set (para 2-6). Place BATTLE SHORT switch in the ON position before releasing START-RUN-STOP switch.
- (6) Check that ohmmeter indicates open circuit.
- (7) Connect ohmmeter across pins A and D. Ohmmeter shall indicate continuity.
- (8) Stop the generator set (para 2-7) and return the BATTLE SHORT switch to the OFF position.
- (9) If switch meets continuity requirements, install wiring harness connector.
- (10) If switch fails to meet continuity requirements, replace.

d. installation.

- (1) Install low oil pressure switch into block adapter and tighten to 20 lbs-ft torque.
- (2) Install electrical connectors.

**4-24 DAY TANK FUEL LEVEL AND LOW FUEL CUTOFF SWITCH.**

**NOTE**

Test day tank fuel level and low fuel cutoff switch in accordance with paragraph c. below prior to removal.

a. Removal.

- (1) Disconnect electrical connector (Figure 4-13).
- (2) Unscrew fuel level and low fuel cutoff switch from day tank.



b. Cleaning and Inspection.

- (1) Clean day tank fuel level and low fuel cutoff switch with filtered compressed air and a soft bristle brush or wipe with a clean lint-free cloth lightly moistened with an approved solvent.
- (2) Inspect switch for cracked casing, corrosion, damaged floats, stripped or damaged threads and bent or broken connector pins.

c. Testing.

- (1) Open the drain on the bottom of the day tank and allow the fuel to drain into a suitable container.
- (2) Disconnect electrical connector from day tank fuel level and low fuel cutoff switch.
- (3) Using an ohmmeter, check for continuity between switch connector pins A and B and between pins C and D. Continuity should exist indicating switches are closed.
- (4) Connect fuel solenoid connector and float switch connector.
- (5) Place START-RUN-STOP switch (32, Figure 2-1) in RUN position and BATTLE SHORT switch in ON position.
- (6) When fuel transfer pumps have refilled day tank, return both switches to the original position.
- (7) Disconnect fuel solenoid connector and float switch connector.
- (8) Check for open circuit between pins A and B and between pins C and D.
- (9) Replace switch if the above continuity requirements are not met.

d. Installation.

- (1) Screw day tank fuel level and low fuel cutoff switch onto day tank (Figure 4-13).
- (2) Reconnect electrical connector.

**4-25 FUEL SOLENOID VALVE AND RECTIFIER ASSEMBLY.**

a. Removal.

**NOTE**

Test fuel solenoid valve in accordance with paragraph c. below before removal.

- (1) Disconnect fuel supply hose, electrical connector and injector return line (Figure 4-13).
- (2) Unscrew tee from day tank assembly.
- (3) Remove elbows and tee from fuel solenoid valve.
- (4) Disconnect electrical connector from rectifier assembly.
- (5) Remove screw and captive washer and remove rectifier assembly.

b. Cleaning and Inspection.

- (1) Clean solenoid valve with dry, filtered compressed air and a soft bristle brush or wipe with a clean, lint-free cloth lightly moistened with an approved solvent.
- (2) Clean rectifier assembly with a clean, lint-free cloth.
- (3) Inspect solenoid valve for cracks, corrosion, stripped or damaged threads, bent or broken connector pins and evidence of shorting or other damage.
- (4) Inspect rectifier assembly for cracks, corrosion, stripped or damaged threads, and evidence of shorting or other defects.



- c. Testing.
  - (1) Open drain on bottom of day tank and allow fuel to drain into a suitable container.
  - (2) Place START-RUN-STOP switch in RUN position and BATTLE SHORT switch in ON position (32, Figure 2-1).
  - (3) If day tank does not refill, check that fuel transfer pumps and day tank fuel level and low fuel cutoff switch and interconnecting wire harnesses are operational.
  - (4) If fuel transfer pumps and day tank fuel level and low fuel cutoff switch are operational, fuel solenoid valve is defective and must be replaced.
  - (5) Check the diodes in the rectifier assembly by placing the positive lead of an ohmmeter on the red coded terminal and the negative lead on one of the yellow coded terminals (Figure 4-13). The ohmmeter should indicate a low resistance.
  - (6) Reverse the ohmmeter leads. The ohmmeter should read a high resistance (not infinity).
  - (7) Perform the checks in paragraphs (5) and (6) above using the opposite yellow coded terminal.
- d. Installation.
  - (1) Install screw and captive washer and install rectifier assembly (Figure 4-13).
  - (2) Reconnect electrical connector to rectifier assembly.
  - (3) Install elbows and tee to fuel solenoid valve.
  - (4) Screw tee onto daytank assembly.
  - (5) Reconnect fuel supply hose, electrical connector, and injector return line.

#### **4-26 ENGINE WIRING HARNESS ASSEMBLY.**

- a. Removal. Prior to removal, tag or otherwise identify electrical terminals, connectors, and wiring and location of support clamps to facilitate installation. Remove wiring harness terminals, wires, and connectors as required for access to other components and to replace damaged parts.
- b. Cleaning and Inspection.
  - (1) Clean engine wiring harness with filtered compressed air and a soft bristle brush or wipe with a clean, lint-free cloth moistened with an approved solvent.
  - (2) Visually inspect wiring harness for burned, bent, corroded or otherwise damaged connectors and terminals.
  - (3) Inspect insulation for burns, chafing, and deterioration.
- c. Testing. Check continuity of individual wires using a multimeter or continuity light. Refer to figures FO-1 and FO-2 for wire routing.

#### **NOTE**

If more than 30 percent of the wires are damaged, or have been repaired, replace the wiring harness and forward it to higher level maintenance for rebuilding.

#### **CAUTION**

**Do not use acid core solder on electrical components. Equipment damage could result if caution is not observed.**

- d. Repair. Replace damaged wire, terminals, and connectors by unsoldering connections, installing replacement parts and soldering connections.
- e. Installation. Install wiring harness terminals, electrical leads, and connectors.



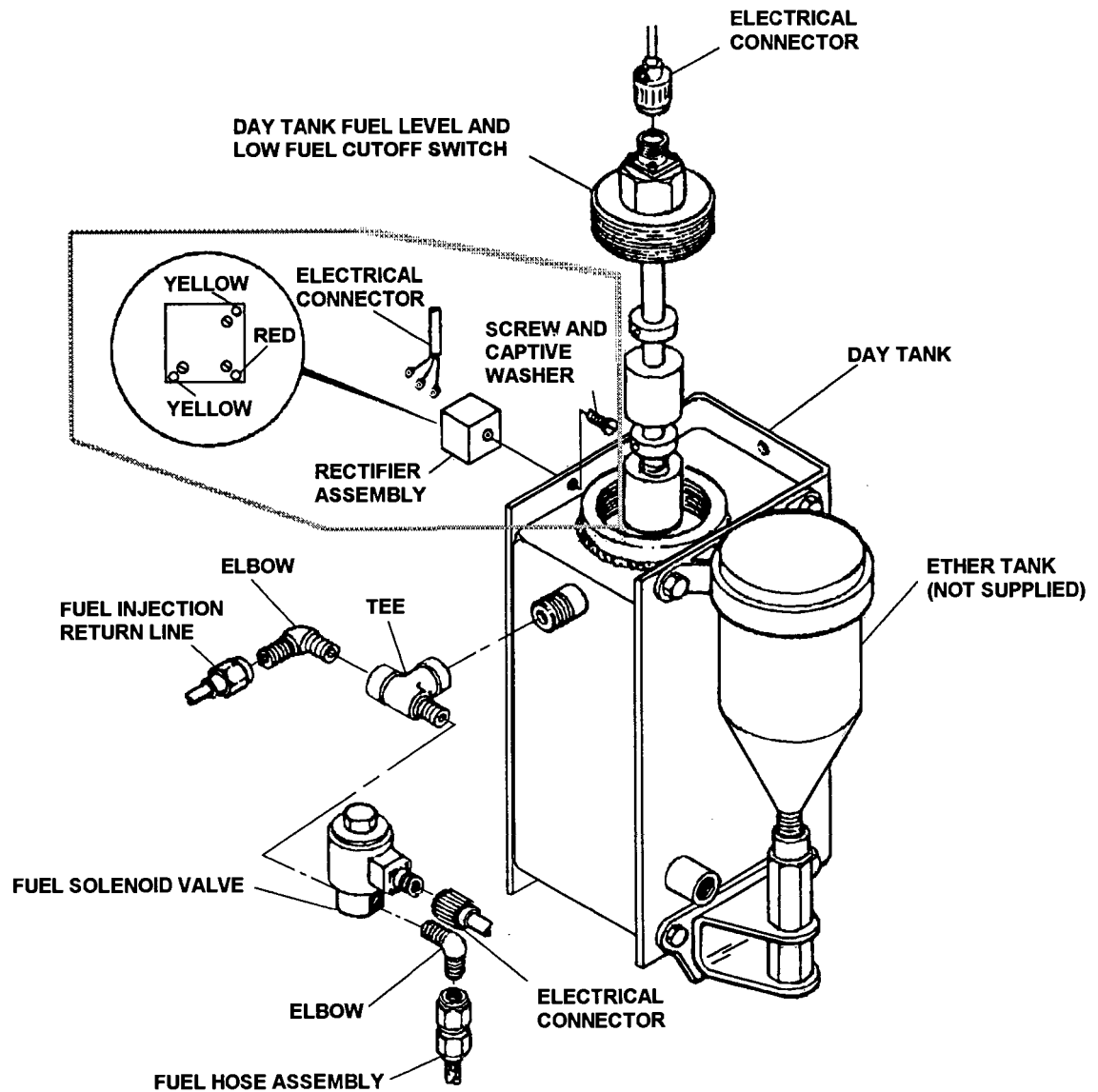


Figure 4-13. Day Tank Fuel Level, Low Fuel Cutoff Switch, Fuel Solenoid Valve and Rectifier Assembly, Removal and Installation



## Section VIII. UNIT MAINTENANCE OF THE ENGINE FUEL SYSTEM

**4-27 GENERAL.** This section contains unit maintenance instructions for the engine fuel system. Fuel is stored in the main fuel tank located in the generator set skid base. Two electrically driven pumps which are controlled by the day tank fuel level and low fuel cutoff switch transfer the fuel from the fuel tank to the day tank. Before entering the day tank the fuel passes through the fuel strainer and primary fuel filter. From the day tank the fuel passes through the secondary fuel filter to the fuel injection pump. The fuel injection pump forces the fuel to the injectors in the cylinder bed. Excess fuel is returned to the day tank through the fuel return line. The entire fuel system is vented through the main fuel tank filler cap.

### **4-28 FUEL TRANSFER PUMPS.**

- a. Removal.

#### **NOTE**

Test fuel transfer pumps in accordance with subparagraph d. below prior to removal.

- (1) Disconnect electrical leads at pump.
- (2) Disconnect fuel supply hose (1, Figure 4-14) and remove elbow (2).
- (3) Disconnect fuel discharge hose (3) and remove elbow (4).
- (4) Remove tube assembly (5) and elbows (6 and 7).
- (5) Remove nuts (8), lockwashers (9), flatwashers (10) and screws (11) to remove fuel transfer pumps (12).

- b. Cleaning and Inspection.



**Dry cleaning solvent P-D-680, Type II, inflammable and toxic. Use only in an approved cleaning cabinet or in a well-ventilated area away from open flames or intense heat. Avoid prolonged inhalation of solvent fumes and extended exposure of skin to solvents. Death to personnel and damage to equipment may result. Wear/use protective clothing and equipment. Wash thoroughly with soap and water after contact with solvents.**

- (1) Clean fuel transfer pumps with a clean, lint-free cloth moistened with an approved cleaning solvent (P-D-680).
- (2) Inspect fuel transfer pumps for cracked casing, corrosion, stripped threads or other damage.

- c. Service.

- (1) Remove cover (13, Figure 4-14) and gasket (14).
- (2) Carefully remove filter (15) from pump body (16).
- (3) Wash filter in dry cleaning solvent (Federal Specification P-D-680).
- (4) Inspect filter for tears or other damage. Replace if defective.
- (5) Position filter in pump body; install gasket, and secure with cover.

- d. Testing.

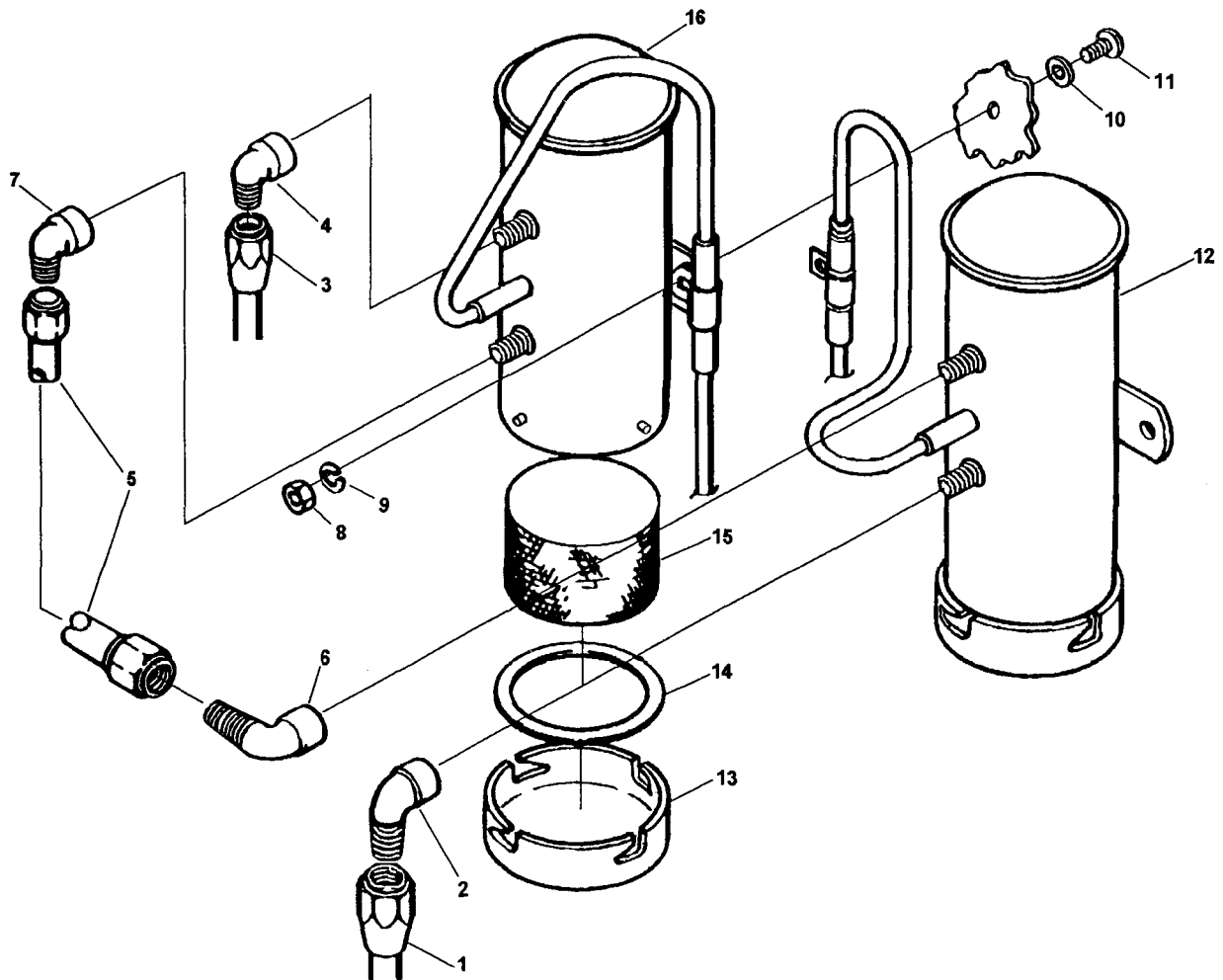
- (1) Disconnect fuel line from fuel solenoid valve (paragraph 4-24) and position to drain into a suitable graduated container.
- (2) Disconnect electrical connector from day tank fuel level and low fuel cutoff switch (paragraph 4-23).
- (3) Place START-RUN-STOP switch in RUN position and BATTLE SHORT switch in ON position (32, Figure 2-1).



- (4) Fuel transfer pump should deliver 3 gallons of fuel in 10 minutes when operating properly.
- (5) Replace fuel transfer pump if it fails to operate properly.

e. Installation.

- (1) Install fuel transfer pump (12, Figure 4-14 ), screws (11), flat washers (10), lockwashers (9), and nuts (8),
- (2) Install elbows (7 and 6), and tube assembly (5).
- (3) Install elbow (4), and connect fuel discharge hose (3).
- (4) Install elbow (2), and connect fuel supply hose (1).
- (5) Connect electrical leads to pump.



- |                        |                   |
|------------------------|-------------------|
| 1. Fuel supply hose    | 9. Lockwasher     |
| 2. Elbow               | 10. Flat washer   |
| 3. Fuel discharge hose | 11. Screw         |
| 4. Elbow               | 12. Fuel transfer |
| 5. Tube assembly       | 13. Cover         |
| 6. Elbow               | 14. Gasket        |
| 7. Elbow               | 15. Filter        |
| 8. Nut                 | 16. Pump body     |

Figure 4-14. Fuel Transfer Pumps, Service and Replacement



#### **4-29 FUEL STRAINER AND FILTER ASSEMBLY.**

- a. Removal.
  - (1) Open the drain cocks on the fuel strainer housing and the fuel filter housing and allow the fuel to drain into a suitable container.
  - (2) Disconnect fuel hoses (1, Figure 4-15) and remove elbows (2).
  - (3) Remove cap screws (3) and lockwashers (4) and remove fuel strainer and filter assembly (5) from mounting bracket (8).
  - (4) Do not remove capscrews (6), lockwashers (7), mounting bracket (8) or gasket (9) unless inspection reveals damage.
- b. Disassembly.
  - (1) Remove center screw (1, Figure 4-16) and washer(2) to remove fuel filter housing (3) and gasket (4). Discard gasket.
  - (2) Withdraw filter element (5) from housing and discard.
  - (3) Do not remove drain cock (6) unless replacement is necessary.
  - (4) Remove cup nut (7) and sealing washer (8) to remove strainer housing (9) and gasket (10). Discard gasket. Do not remove drain cock (13) unless replacement is necessary.
  - (5) Remove retainer (11) to remove strainer (12).
- c. Cleaning and Inspection.
  - (1) Clean strainer, housings, and attaching hardware with dry cleaning solvent (Federal Specification P-D-680) and dry with filtered compressed air.
  - (2) Inspect fuel strainer and filter assembly and mounting bracket for cracks, corrosion, and other damage.
  - (3) Inspect all threaded parts for stripped or otherwise damaged threads.
  - (4) Replace any damaged or defective parts.
- d. Reassembly.
  - (1) If removed, install drain cock (13), (Figure 4-16).
  - (2) Install strainer (12) and secure with retainer (11) finger tight.
  - (3) Install replacement gasket (10) and housing (9) and secure with sealing washer (8) and cup nut (7). Tighten nut securely to prevent leaks.
  - (4) If removed, install drain cock (6).
  - (5) Install replacement filter element (5) into housing (3).
  - (6) Install replacement gasket (4), housing (3), washer (2), and center screw (1). Torque screw to  $17\pm 2$  lb-ft.
  - (7) Close drain cocks on strainer and filter housings.
- e. installation.
  - (1) If removed, install gasket (9), mounting bracket (8), lockwasher (7), capscrews (6) (Figure 4-15).
  - (2) Install fuel strainer and filter assembly (5) onto mounting bracket (8), lockwashers (4), and capscrews (3).
  - (3) Install elbow (2) and reconnect fuel hoses (1).
  - (4) Close drain cocks on the fuel strainer housing and the fuel filter housing.



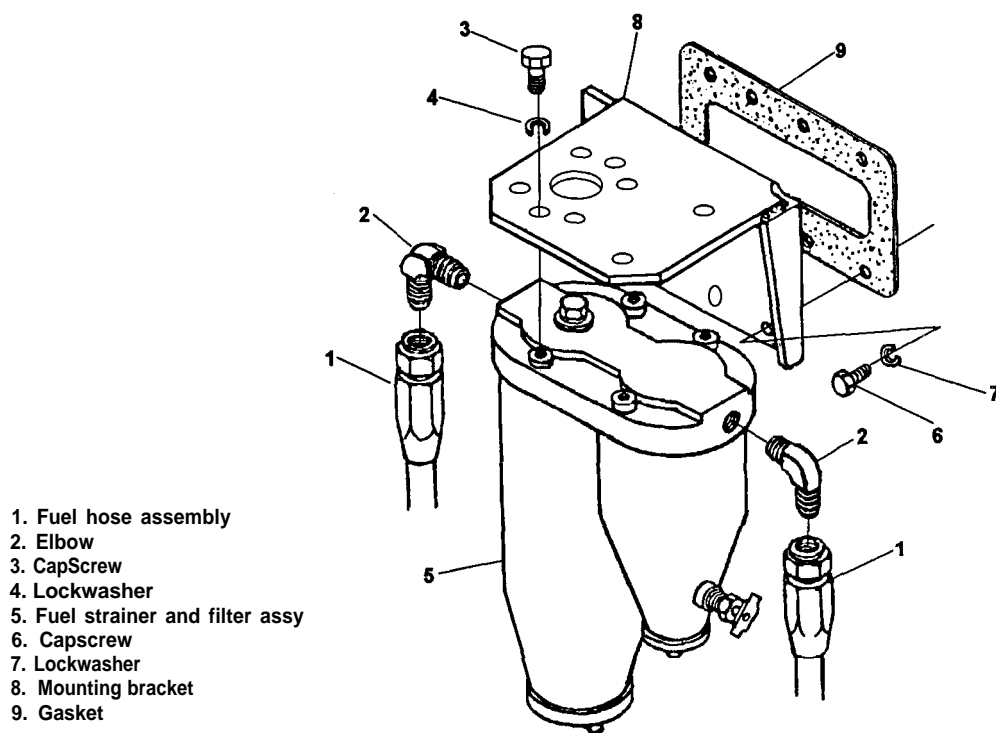


Figure 4-15. Fuel Strainer and Filter Assembly, Removal and Installation

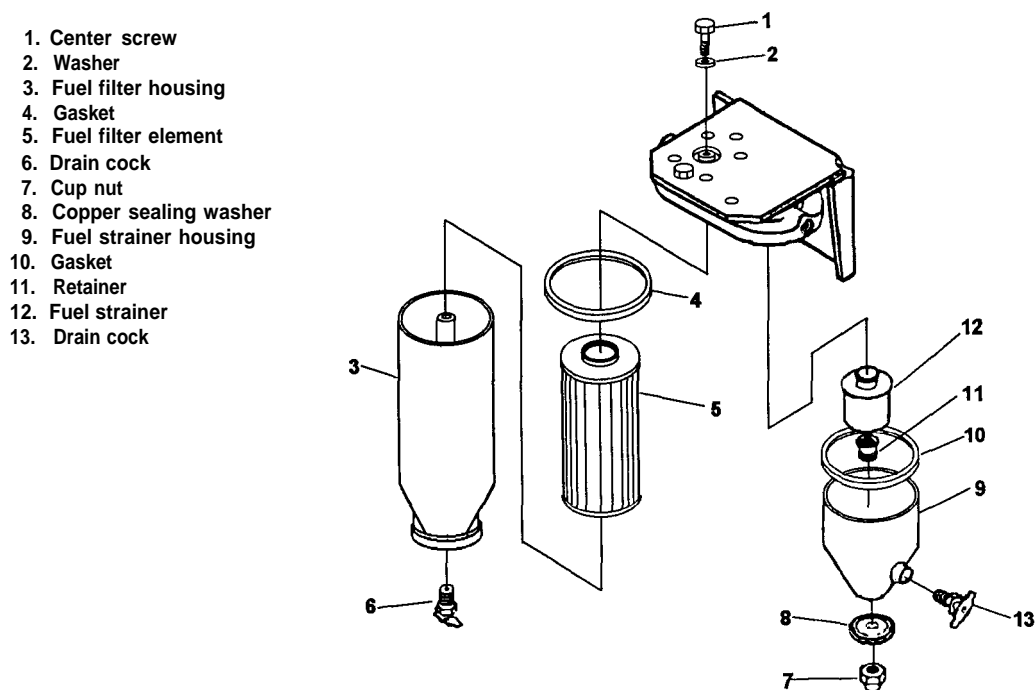


Figure 4-16. Fuel Strainer and Filter Housing, Disassembly and Reassembly



#### **4-30 DAY TANK ASSEMBLY.**

- a. Removal.
  - (1) Refer to paragraph 3-21 and drain the day tank.
  - (2) Refer to paragraph 4-25 and remove fuel solenoid valve and rectifier assembly.
  - (3) Refer to paragraph 4-24 and remove day tank fuel level and low fuel cutoff switch.
  - (4) Refer to paragraph 4-34 and remove starting aid ether tank and solenoid valve.
  - (5) Loosen spring clamp (1, Figure 4-17) and remove vent tube (2).
  - (6) Disconnect fuel hose assembly (3).
  - (7) Remove nuts (4), lockwashers (5) and screws (6) to remove day tank with assembly parts.
- b. Disassembly.
  - (1) Remove fuel hose assembly adapter (7).
  - (2) Remove drain cock (8) from day tank (9).
- c. Cleaning and Inspection.
  - (1) Clean day tank with a clean, lint-free cloth moistened with an approved cleaning solvent.
  - (2) Inspect day tank for cracks, corrosion, stripped or damaged threads or other damage.
- d. Assembly
  - (1) Install drain cock (8).
  - (2) Install fuel hose assembly adapter (7).
- e. installation.
  - (1) Install screws (6, Figure 4-17), lockwashers (5), nuts (4).
  - (2) Reconnect fuel hose assembly (3).
  - (3) Install vent tube (2) and tighten spring clamp (1).
  - (4) Refer to paragraph 4-34 and install starting aid ether tank and solenoid valve.
  - (5) Refer to paragraph 4-24 and install day tank fuel level and low fuel cutoff switch.
  - (6) Refer to paragraph 4-25 and install fuel solenoid valve and rectifier assembly.
  - (7) Fill the day tank.



1. Spring clamp
2. Vent tube
3. Fuel hose assembly
4. Nut
5. Lockwasher
6. Screw
7. Fuel hose assembly adapter
8. Drain cock
9. Day tank

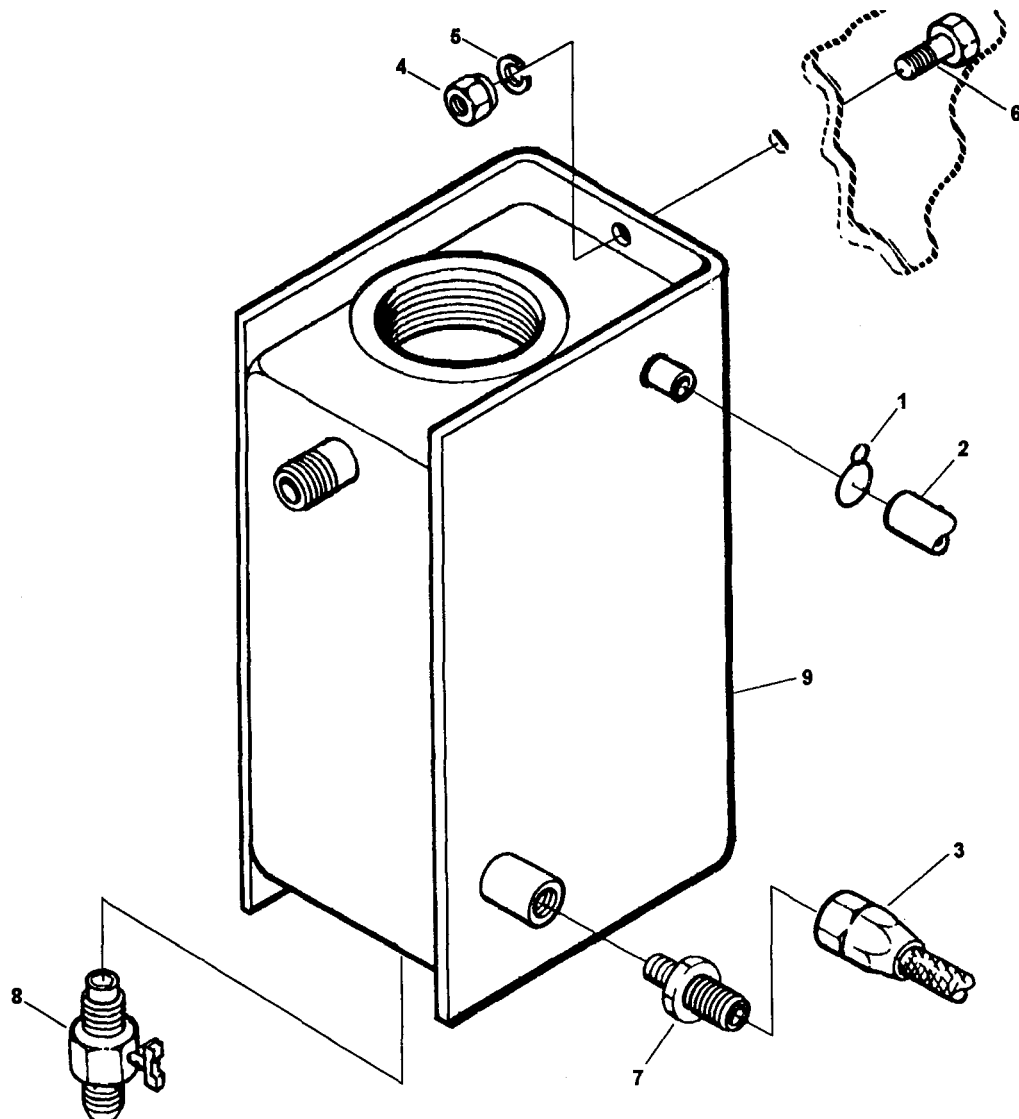


Figure 4-17. Day Tank Assembly, Removal and Installation



#### 4-31 **SECONDARY FUEL FILTER.**

- a. Removal.
  - (1) Drain day tank assembly (para 3-21).
  - (2) Open drain cock (1, Figure 4-18) and allow fuel to drain into a suitable container.
  - (3) Disconnect fuel hose assemblies (2 and 3).
  - (4) Remove capcrews (4) and lockwashers (5) to remove secondary fuel filter (6).
  - (5) Remove elbows (7).
  - (6) Do not remove capscrews (8), lockwashers (9), mounting bracket (10) and gasket (11) unless replacement is necessary.
  - (7) Refer to paragraph 4-31b and disassemble fuel filter assembly.
- b. Disassembly
  - (1) Open drain cock (1, Figure 4-19) and allow fuel to drain into a suitable container.
  - (2) Remove center screw assembly (2) and washer (3) to remove housing (6) and gasket (7). Discard gasket.
  - (3) Remove bleeder plug (4) from center screw (5).
  - (4) Withdraw filter element (8) from housing and discard.
- c. Cleaning and Inspection.
  - (1) Clean fuel filter assembly parts and mounting bracket in an approved solvent and dry thoroughly.
  - (2) Inspect filter head and casing for cracks, corrosion and other damage.
  - (3) Inspect mounting bracket for cracks, corrosion, and cracked or broken welds.
  - (4) Replace any defective parts.

#### **CAUTION**

**Remove old filter gasket before installing new gasket. Failure to do so could result in cracking head assembly. Equipment damage could result if caution is not observed.**

- d. Reassembly.
  - (1) Insert replacement filter element (8) into housing (Figure 4-19).
  - (2) Install replacement gasket (7) and secure housing (6) with washer (3) and center screw (2). Torque screw 17±2 lbs-ft.
  - (3) Close drain cock (1) and fill day tank.
  - (4) Install bleeder plug (4).
- e. Installation.
  - (1) Refer to para 4-31d and reassemble fuel filter assembly.
  - (2) If removed (Figure 4-18), install gasket (11), mounting bracket (10), lockwashers (9), and capscrews (8).
  - (3) Install elbows (7).
  - (4) Install secondary fuel filter (6), lockwashers (5), and capscrews (4).
  - (5) Reconnect fuel hose assemblies (3 and 2).
  - (6) Close drain cock (1).
  - (7) Fill day tank.



1. Drain cock
2. Fuel hose assy
3. Fuel hose assy
4. Capscrew
5. Lockwasher
6. Secondary fuel filter assy
7. Elbow
8. Capcrew
9. Lockwasher
10. Mounting bracket
11. Gasket

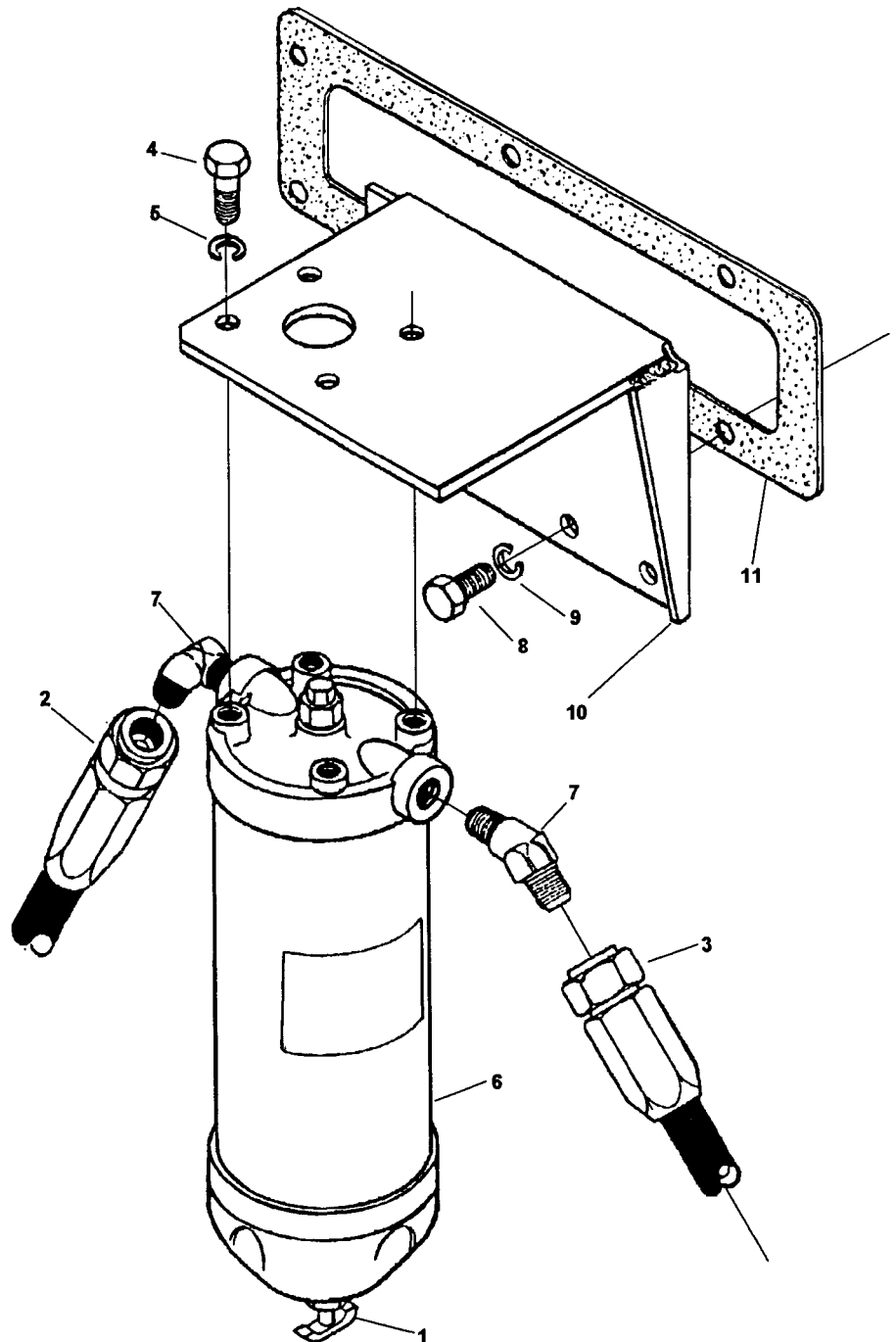


Figure 4-18. Secondary Fuel Filter Assembly, Removal and Installation



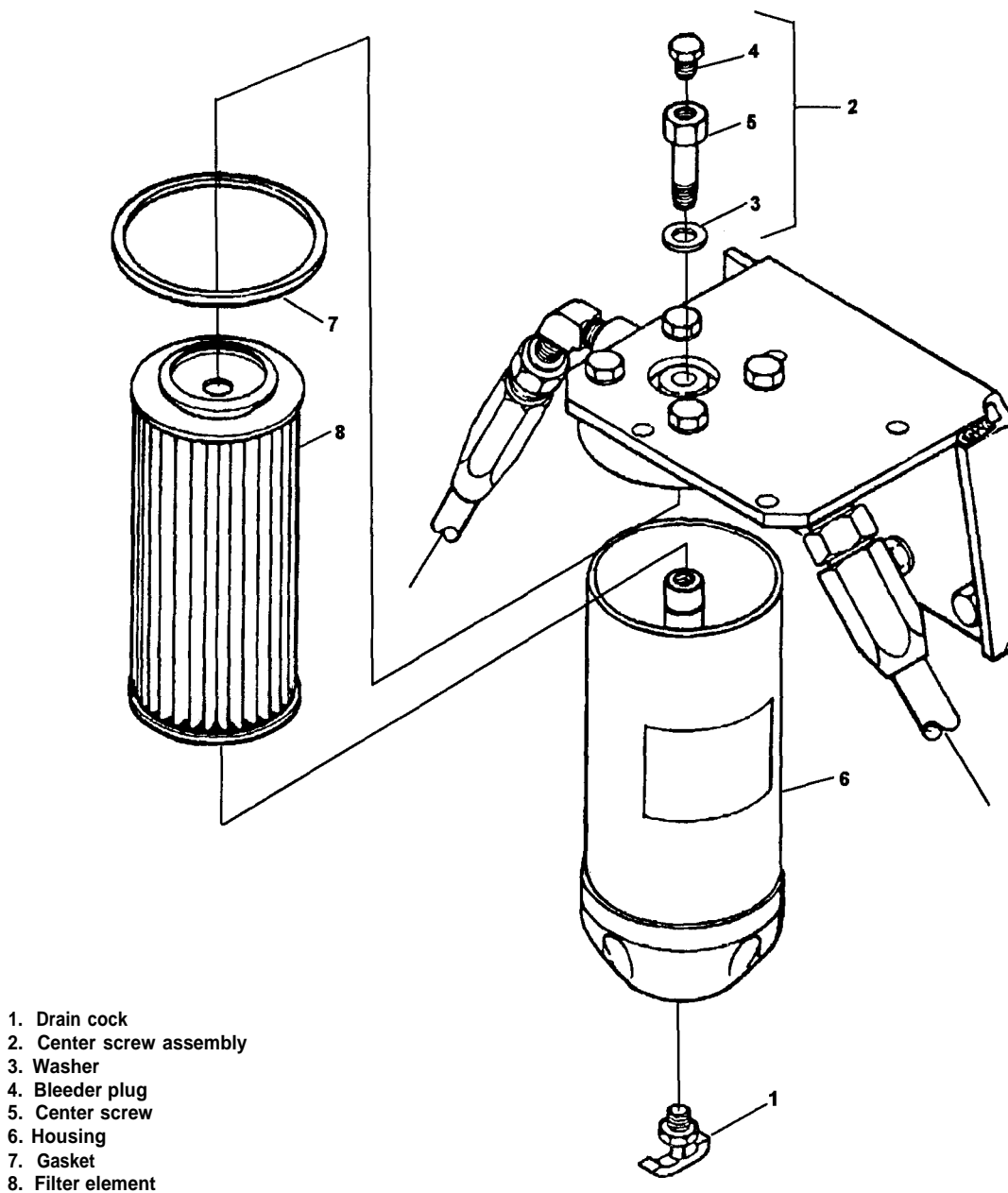


Figure 4-19. Secondary Fuel Filter, Disassembly and Reassembly



#### **4-32 FUEL INJECTION NOZZLE HOLDERS AND LINES.**

- a. Removal.

##### **NOTE**

Locate faulty injectors as directed in subparagraph c. below.

- (1) Remove injector and return lines and fittings (1 through 7, Figure 4-20).

##### **NOTE**

Tag or otherwise identify lines and fittings and the location of support dampers to facilitate installation.

- (2) Remove screws (10) to remove injector nozzle holders (11), seals (12), sleeves (13) and seals (14).

- b. Cleaning and Inspection.

- (1) Clean nozzle holders and lines with an approved solvent and dry thoroughly.  
(2) Inspect nozzle holder assemblies for cracks, corrosion, signs of leaking, or other defects.  
(3) Inspect lines for pinching, cracks, corrosion, and other damage.  
(4) Check all threaded parts for stripping or otherwise damaged threads.

- c. Testing.

- (1) Refer to paragraph 2-6 and start the generator set.  
(2) Loosen the fuel line at the injector on cylinder No. 1 until fuel flows freely from the break.  
(3) If engine performance is affected, the injector is functioning properly.  
(4) If engine performance is not affected, the injector is faulty and must be replaced.  
(5) Tighten the injector fuel line.  
(6) Repeat steps (2) through (5) for each injector.  
(7) Refer to paragraph 2-7 and stop the generator set.  
(8) Remove faulty injectors in accordance with subparagraph a. above.

- d. Installation. Sealing washers (5, Figure 4-20) must be replaced at each removal.

- (1) Install seals (14, Figure 4-20), sleeves, seals (12), injector nozzle holders (11) and screws (10).  
(2) Install injector and return lines and fittings (1 through 7).

#### **4-33 FUEL LINES AND FITTINGS.**

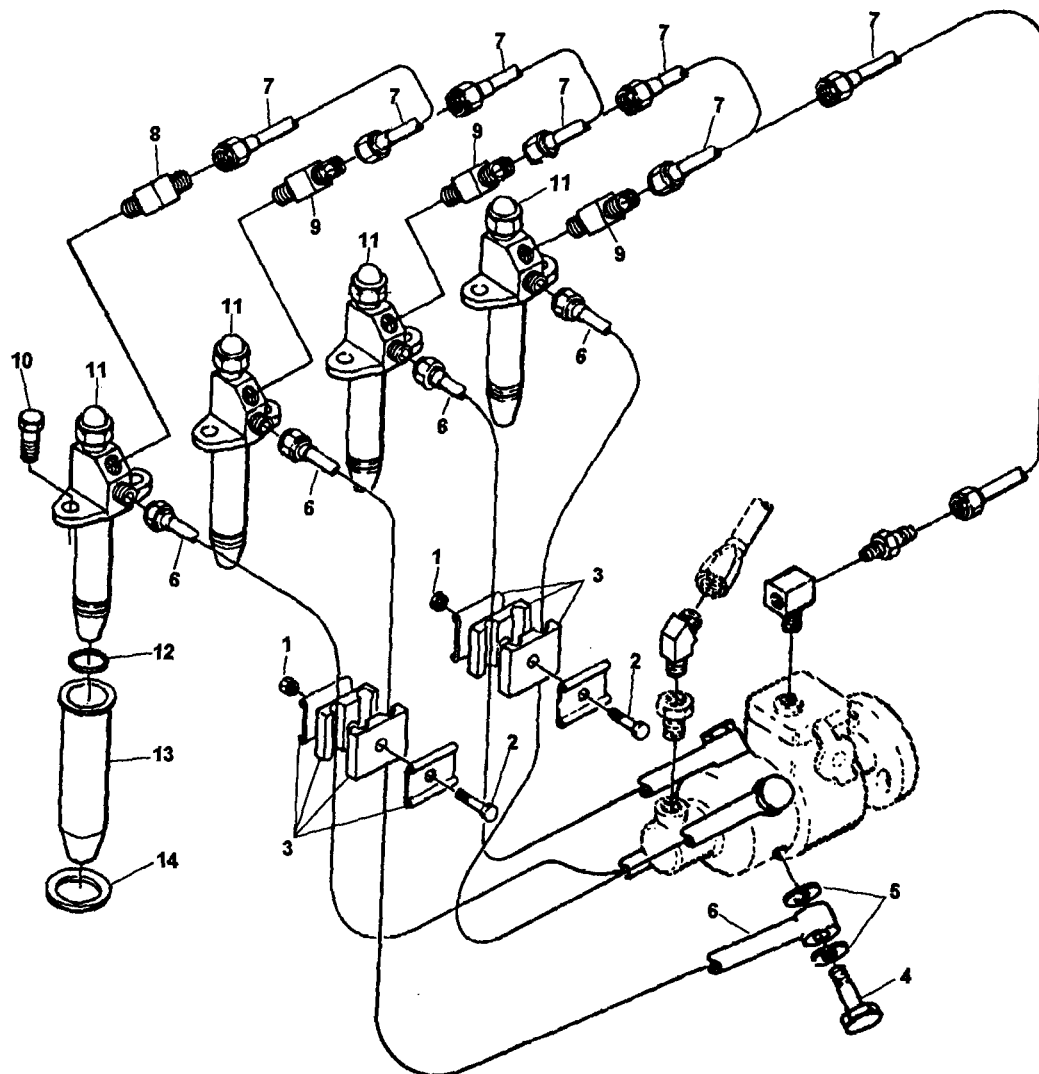
- a. Removal. Remove damaged fuel lines and fittings by following the ascending numerical sequence of index numbers, 1 through 81, assigned to Figure 4-21.

##### **NOTE**

It is not necessary to remove all fuel lines and fittings to replace a single part. Only those parts requiring replacement need be removed.

- b. Installation. Install fuel lines and fittings by following descending numerical sequence numbers 81 through 1 assigned to Figure 4-21.





- |                       |                        |
|-----------------------|------------------------|
| 1. Nut                | 8. Elbow               |
| 2. Screw              | 9. Tee                 |
| 3. Clamp assembly     | 10. Screw              |
| 4. Bolt               | 11. Nozzle holder assy |
| 6. Sealing washer     | 12. Seal               |
| 6. injector fuel line | 13. Sleeve             |
| 7. Return line        | 14. Seal               |

Figure 4-20. Fuel Injection Nozzle Holders and Lines, Exploded View



- |                             |                         |                    |
|-----------------------------|-------------------------|--------------------|
| 1. Fuel supply hose assy    | 17. Elbow               | 32. Connector      |
| 2. Elbow                    | 18. Fuel hose assy      | 33. Elbow          |
| 3. Elbow                    | 19. Elbow               | 34. Tee            |
| 4. Auxiliary fuel hose assy | 20. Elbow               | 35. Screw          |
| 5. Adapter                  | 21. Fuel hose assy      | 36. Tube cap assy  |
| 6. Fuel hose assy           | 22. Elbow               | 37. Nut            |
| 7. Elbow                    | 23. Elbow               | 38. Bulkhead union |
| 8. Screw                    | 24. Fuel solenoid valve | 39. Washer         |
| 9. Valve handle             | 25. Fuel hose assy      | 40. Fuel hose assy |
| 10. Nut                     | 26. Connector           | 41. Elbow          |
| 11. Lockwasher              | 27. Elbow               | 42. Screw          |
| 12. Screw                   | 28. Fuel hose assy      | 43. Tube cap assy  |
| 13. Three-way valve         | 29. Elbow               | 44. Nut            |
| 14. Elbow                   | 30. Elbow               | 45. Bulkhead union |
| 15. Tube assy               | 31. Fuel hose assy      | 46. Nut            |

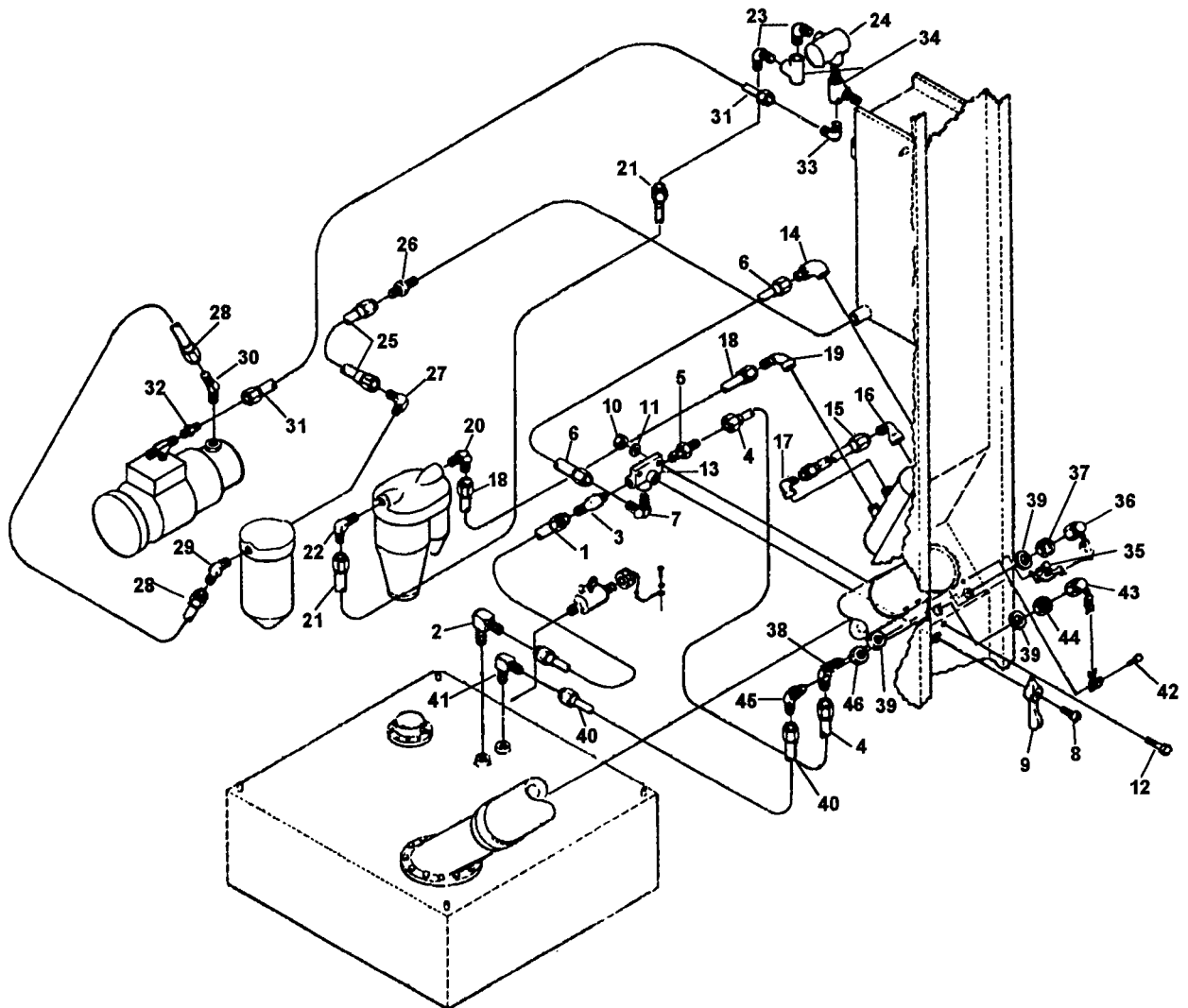


Figure 4-21. Fuel Lines and Fittings, Exploded View (Sheet 1 of 2)



- 47. Clamp
- 48. Hose
- 49. Screw
- 50. Clip
- 51. Clamp
- 52. Hose
- 53. Vent tube
- 54. Clamp
- 55. Hose
- 56. Clamp
- 57. Hose
- 58. Tee
- 59. Clamp
- 60. Hose
- 61. Clamp
- 62. Hose
- 63. Vent tube
- 64. Clamp
- 65. Hose
- 66. Screw
- 67. Clip
- 68. Clamp
- 69. Hose
- 70. Vent tube
- 71. Tee
- 72. Tee
- 73. Clamp
- 74. Hose
- 75. Clamp
- 76. Hose
- 77. Vent tube
- 78. Screw
- 79. Lockwasher
- 80. Captive cap
- 81. Drain valve

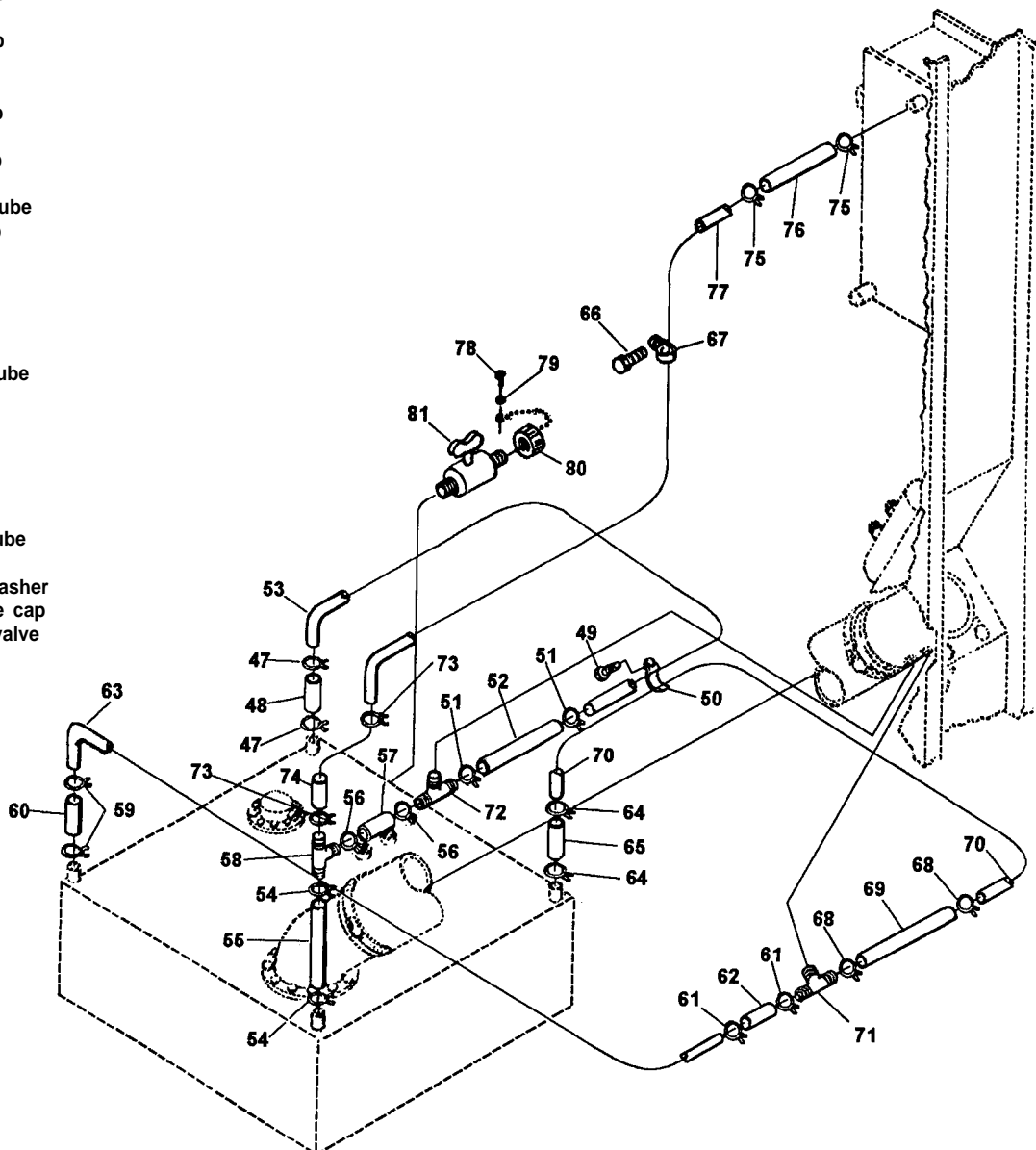


Figure 4-21. Fuel Lines and Fittings, Exploded View (Sheet 2 of 2)



#### **4-34 START AID ASSEMBLY.**

a. Removal.

- (1) Remove tube assembly (1, Figure 4-22) and unscrew spray nozzle (2) from air cleaner housing.
- (2) Remove ether tank and install protective cap (4) on solenoid valve assembly (8).
- (3) Disconnect electrical connector (3) from solenoid valve assembly.
- (4) Remove nuts (5), screws (6), and lockwashers (7) to remove solenoid valve assembly (8).
- (5) Remove nuts (9), screws (10), and lockwashers (11 ) to remove clamp bracket (12) from day tank assembly (13).

b. Cleaning and Inspection.

- (1) Clean solenoid with filtered compressed air and a soft bristle brush or wipe with a clean lint-free cloth lightly moistened with an approved solvent.
- (2) Clean all other parts with an approved solvent and dry thoroughly.
- (3) Visually inspect start aid solenoid valve for cracks, corrosion, stripped or damaged threads and evidence of shorting or other damage.
- (4) Inspect ether tank bracket for cracks, breaks, corrosion, and other damage.
- (5) Inspect tube assembly for cracks, breaks, pinching, stripped or damaged threads, and other damage.
- (6) Inspect spray nozzle for cracks, corrosion, wear, clogging, or other damage.
- (7) Check all threads for stripping or other damage.
- (8) Replace any parts found defective.

c. Installation.

- (1) Install clamp bracket (12, Figure 4-22), lockwashers (11), screws (10), and nut (9) onto the day tank assembly (13).
- (2) Install solenoid valve assembly (8), lockwashers (7), screws (6) and nuts (5).
- (3) Reconnect electrical connector (3) to solenoid valve assembly.
- (4) Install ether tank and remove protective cap (4) from solenoid valve assembly (8).
- (5) Screw spray nozzle (2) into air cleaner housing and install tube assembly (1).



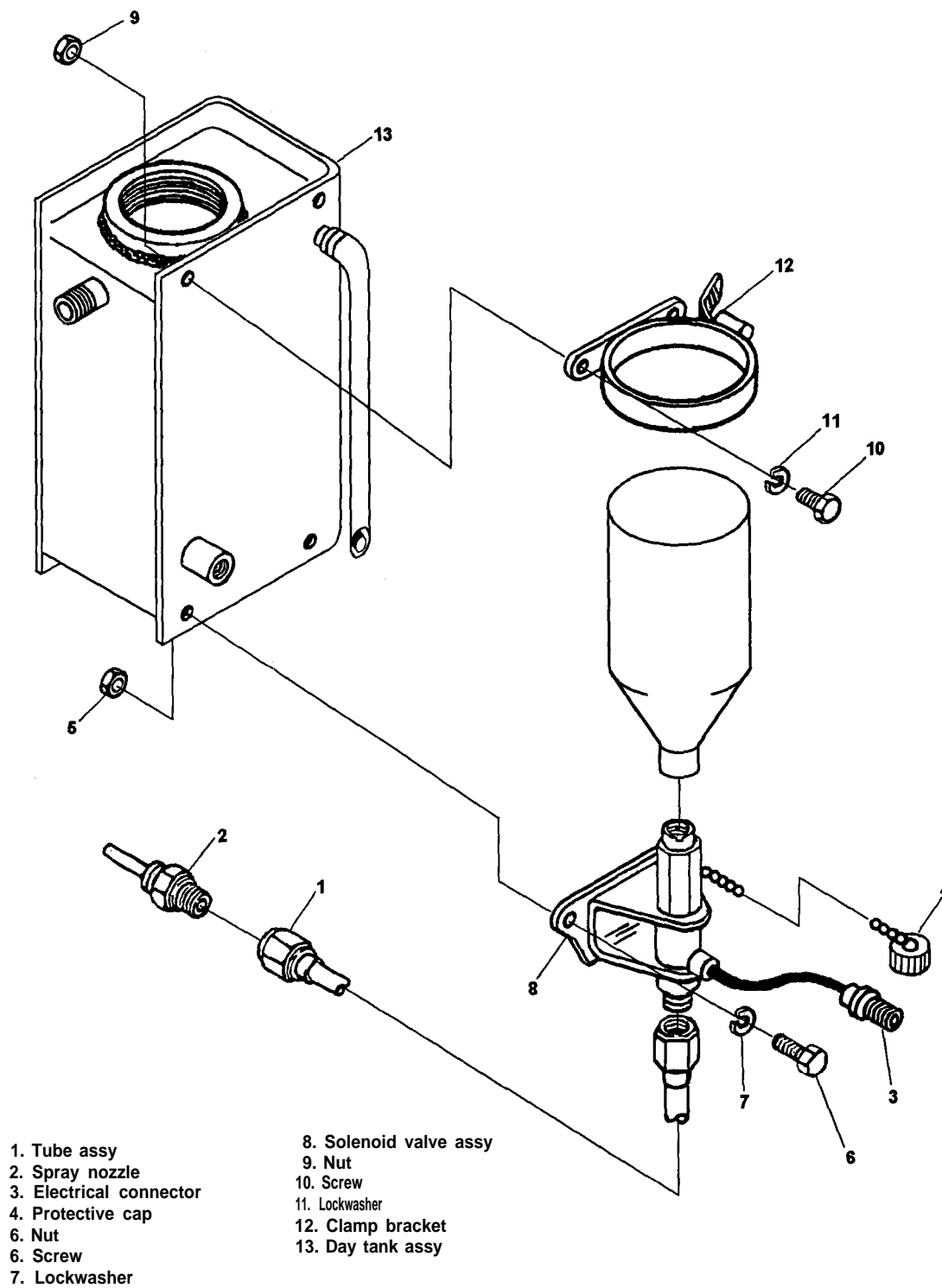


Figure 4-22. Start Aid Assembly, Removal and Installation



## Section IX. UNIT MAINTENANCE OF THE ENGINE COOLING SYSTEM

**4-35 GENERAL.** This section contains unit maintenance instructions for the engine cooling system. The cooling system consists of a radiator, a belt driven cooling fan and water pump, a coolant control thermostat and a thermostatically controlled shutter assembly. The water pump forces coolant through passages in the engine block and cylinder head where it absorbs heat generated by engine operation. When the engine reaches normal operating temperature, the coolant control thermostat opens and the heated coolant flows through the upper radiator hose assembly into the radiator where the heat is dissipated. The cooling fan circulates air through the air passages of the radiator where it absorbs heat from the coolant tubes. The shutter assembly blocks the flow of cooling air through the radiator until the engine has reached normal operating temperature. It is equipped with a manual control which may be used in the event that the shutter control thermostat or linkage fails to function properly.

### **4-36 GRILLE.**

- a. Removal. Remove nuts (1, Figure 4-23), lockwashers (2), screws (3), flatwashers (4) and remove grille (5).
- b. Cleaning and Inspection.
  - (1) Clean grille with a mild soap and water solution, rinse with clean water and dry thoroughly.
  - (2) Inspect grille for cracks, corrosion, broken welds, dents, and other damage.
- c. Repair.
  - (1) Repair grille by straightening cross members and removing minor dents.
  - (2) Replace grille if damaged beyond simple repair.
- d. Installation. Install grille (5, Figure 4-23), flatwashers (4), screws (3), lockwashers (2), and nuts (1).

### **4-37 SHUTTER CONTROL THERMOSTAT.**

- a. Removal.
  - (1) Drain radiator and disconnect radiator hoses (paragraph 3-27).
  - (2) Loosen clamp (6, Figure 4-23) and remove drain tube (7).
  - (3) Remove cotter pin (8) to disconnect shutter control linkage.
  - (4) Remove screws (9) and Lockwashers (10) to remove control assembly and gasket (11 ). Discard gasket.
  - (5) Remove screws (12) to separate thermostat housing (13) from linkage (14).
  - (6) Remove gasket (15) and thermostat (16). Discard gasket.
  - (7) Do not remove drain cock (17) and adapter bushing (18) unless damage is present and replacement is necessary.
- b. Cleaning and Inspection.
  - (1) Clean shutter control thermostat with an approved solvent and dry thoroughly.
  - (2) Inspect thermostat for cracks, corrosion, and other damage.
  - (3) Inspect shutter control assembly for cracks, corrosion, bent manual control lever and other damage.



- |                        |                     |
|------------------------|---------------------|
| 1. Nut                 | 17. Drain cock      |
| 2. Lockwasher          | 18. Adapter bushing |
| 3. Screw               | 19. Setscrew        |
| 4. Flat washer         | 20. Screw           |
| 5. Grille              | 21. Flat washer     |
| 6. Clamp               | 22. Radiator shroud |
| 7. Drain tube          | 23. Clamp           |
| 8. Cotter pin          | 24. Overflow tube   |
| 9. Screw               | 25. Nut             |
| 10. Lockwasher         | 26. Lock washer     |
| 11. Gasket             | 27. Screw           |
| 12. Screw              | 28. Flat washer     |
| 13. Thermostat housing | 29. Radiator        |
| 14. Linkage            | 30. Screw           |
| 15. Gasket             | 31. Lockwasher      |
| 16. Thermostat         | 32. Shutter assy    |

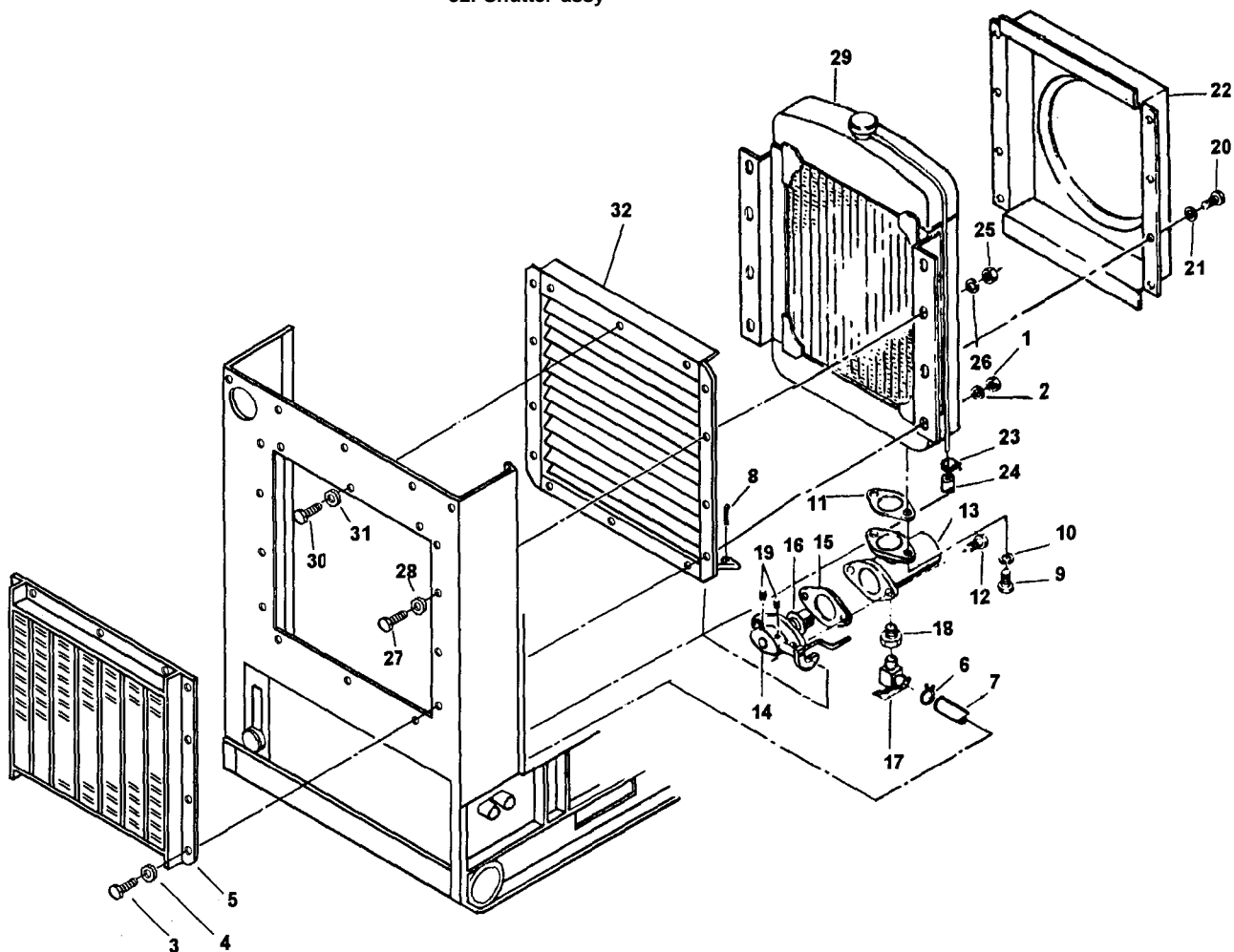


Figure 4-23. Grille, Radiator, and Shutter Assembly, Exploded View



c. Testing.

- (1) Suspend the thermostat in a container of water so that it is completely immersed but does not touch the bottom or sides of the container.
- (2) Suspend a reliable thermometer in the container so that the temperature sensing end is in the water but not touching the sides or bottom of the container.

**CAUTION**

**Do not overheat as damage to the thermostat may result. Equipment damage could result if caution is not observed.**

- (3) Gradually heat the water while stirring to distribute the heat evenly.
- (4) Observe both the thermometer and the thermostat. If the thermostat is operating properly, it should begin opening when the water temperature reaches 162°F (72.2°C) and be fully open when the water temperature reaches 178°F (81.1 °C).
- (5) Replace the thermostat if it fails to operate properly.

d. Installation.

- (1) Loosen setscrews (19, Figure 4-23). Push upon shutter control linkage manual control until shutter vanes are sealed, then tighten setscrews.
- (2) If removed, install adapter bushing (18) and draincock (17).
- (3) Install thermostat (16) and new gasket (15).
- (4) Attach linkage (14) to thermostat housing (13) and secure with screws (12).
- (5) Install control assembly and new gasket (11), lockwashers (10), and screws (9).
- (6) Connect shutter control linkage and install cotter pin (8).
- (7) Install drain tube (7) and tighten damp (6).
- (8) Connect radiator hoses and install attaching hose dampers and refill radiator.

**4-38 RADIATOR.**

a. Removal of Hoses.

- (1) Remove screws and fan guard (Figure 4-24).
- (2) Refer to step (2) (b) in paragraph 3-27 and drain the radiator.
- (3) Loosen dampers and remove defective radiator hose (Figure 4-24).
- (4) Clean radiator and engine hose connection points.
- (5) Remove clamps from defective hose and place on replacement.

**CAUTION**

Do not push hose too far in on water pump outlet pipe and orient clamp so that it does not scrape against fan belt. Equipment damage could result if caution is not observed.

- (6) Push replacement hose onto engine and radiator connectors and tighten clamps.
- (7) Install fan guard and screws.
- (8) Refer to step (2)(i) in paragraph 3-27 and service the radiator.



b. Removal of Radiator.

- (1) Remove front top housing panel and doors (paragraph 4-85).
- (2) Remove shutter control thermostat and housing (paragraph 4-37).
- (3) Remove fan guards (paragraph 3-31).
- (4) Loosen clamps (23, Figure 4-23) and disconnect overflow tube (24).
- (5) Remove grille (paragraph 4-36),
- (6) Remove nuts (25, Figure 4-23), lockwashers (26), screws (27) and flat washers (28) to remove radiator (29).

c. Cleaning and Inspection.

- (1) Clean radiator air passages with filtered compressed air.
- (2) Clean exterior surfaces with a cloth moistened with an approved solvent.
- (3) Inspect radiator for corrosion, dents, bent cooling fins.
- (4) Check for accumulations of rust or scale in radiator openings.
- (5) Refer to paragraph 3-27 and flush radiator if necessary.

d. Installation.

- (1) Position radiator (29, Figure 4-23), to install flat washers (28), screws (27), lockwashers (26), and nuts (25).
- (2) Install grille (paragraph 4-36).
- (3) Connect overflow tube (24, Figure 4-23) and tighten clamps (23)
- (4) Install fan guards (paragraph 3-31).
- (5) Install shutter control thermostat and housing (paragraph 4-37),
- (6) Install front top housing panel and doors (paragraph 4-85).
- (7) Fill radiator with coolant as specified in Table 2-1.

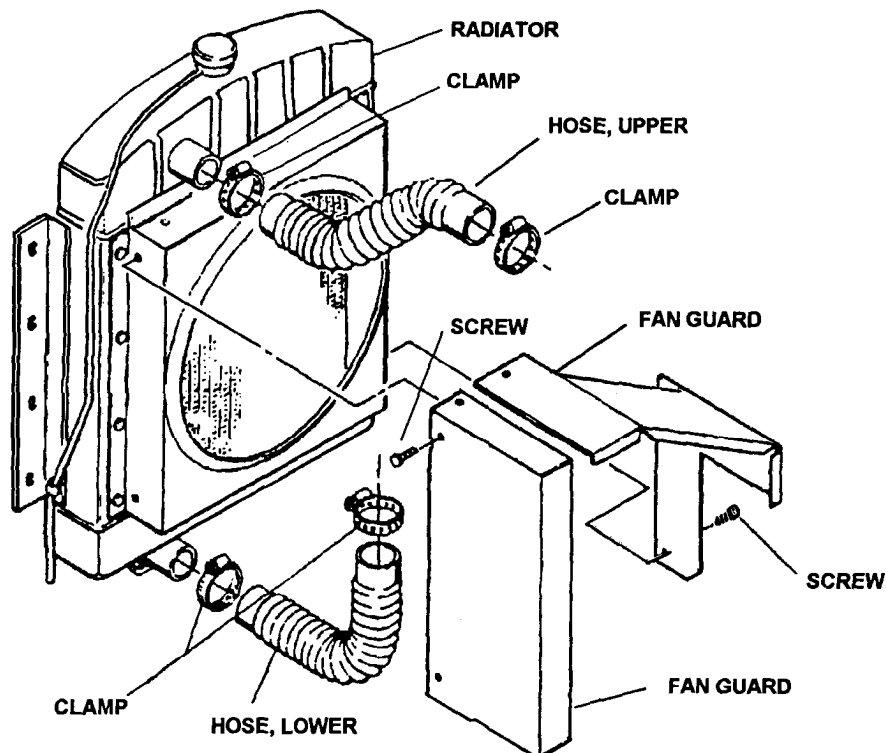


Figure 4-24. Radiator Hose Replacement



#### **4-39 SHUTTER ASSEMBLY.**

- a. Removal.
  - (1) Remove grille (paragraph 4-36).
  - (2) Remove radiator assembly (paragraph 4-38).
  - (3) Remove screws (30, Figure 4-23) and lockwasher (31) to remove shutter assembly (32).
- b. Cleaning and Inspection.
  - (1) Clean shutter assembly with a mild soap and water solution, rinse with dean water and dry thoroughly.
  - (2) Inspect shutter assembly for cracks, corrosion, bent vanes and other damage.
  - (3) Inspect neoprene seal on leading edge of shutter vanes for damage or deterioration.
  - (4) Check vane support brackets for loose or missing rivets.
  - (5) Check control rod and linkage for damage or binding.
  - (6) Replace shutter assembly if damaged beyond simple repair.
- c. Installation.
  - (1) Position shutter assembly (32, Figure 4-23), install lockwashers (31), and screws (30).
  - (2) Install radiator assembly (paragraph 4-38).
  - (3) Install grille (paragraph 4-36).
- d. Adjustment. Adjust shutter control linkage as outlined in paragraph 4-37 above.

#### **4-40 V-BELT.**

- a. Removal.
  - (1) Remove screws (20, Figure 4-23), flat washers (21), and shroud (22).
  - (2) Loosen battery charging alternator mounting hardware (paragraph 4-18).
  - (3) Rotate alternator toward cooling fan until v-belt is slack enough to slip over alternator pulley.
  - (4) Remove v-belt (1, Figure 4-25) from fan pulley and crankshaft pulley.
  - (5) Slip v-belt between cooling fan and radiator.
- b. Installation.
  - (1) Slip v-belt between cooling fan and radiator.
  - (2) Install v-belt (1, Figure 4-25) onto fan pulley and crankshaft pulley.
  - (3) Adjust fan belt tension as outlined in subparagraph c. below.
  - (4) Tighten battery charging alternator mounting hardware (paragraph 4-18).
  - (5) Install shroud (22, Figure 4-23), flat washers (21), and screws (20).
- c. Adjustment.
  - (1) Loosen alternator mounting hardware.
  - (2) Rotate alternator on pivot bolt until firm pressure on v-belt midway between alternator pulley and water pump pulley will depress it approximately 1/2 inch.
  - (3) Tighten alternator mounting hardware.



#### **4-41 COOLING FAN.**

- a. Removal.
  - (1) Remove right side fan guard (paragraph 4-38a (1)).
  - (2) Remove v-belt as outlined in paragraph 4-40.
  - (3) Remove capscrews (2, Figure 4-25), lockwashers (3) and fan (4).
- b. Cleaning and Inspection.
  - (1) Clean cooling fan with a clean lint-free cloth moistened with an approved solvent.
  - (2) Inspect fan for bent blades, dents, cracks, corrosion and other damage.
  - (3) Check all threaded parts for stripped or otherwise damaged threads.
  - (4) Replace fan if damaged beyond simple repair.
- c. Installation.
  - (1) Install fan (4, Figure 4-25), lockwashers (3), and capscrews (2).
  - (2) Install and adjust v-belt as outlined in paragraph 4-40 above.
  - (3) install right side fan guard (paragraph 4-38a (1)).

#### **CAUTION**

**When installing cooling fan, use the following procedures to insure that the fan is not inatalled backward. Equipment damage could result if caution is not observed.**

- (4) When standing in front of the engine, rotation of the fan will be clockwise. install the fan so that the leading edges of the fan bldes will be toward the radiator, The trailing edge (concave side) must be toward the engine.

#### **NOTE**

After installation of the fan, and prior to tightening the belt and starting the engine, rotate the fan to insure that the fan blades have sufficient clearance.

#### **4-42 WATER PUMP.**

- a. Removal.
  - (1) Drain radiator (paragraph 3-27).
  - (2) Remove radiator hoses from water pump (paragraph 4-38a).
  - (3) Remove cooling fan as described in paragraph 4-41 above.
  - (4) Remove capscrews (5, Figure 4-25), lockwashers (6) and nut (10) to remove water pump (7) and gasket (8).
  - (5) Do not remove fan pulley (9) unless inspection reveals damage.
- b. Cleaning and Inspection.
  - (1) Clean water pump with a stiff-bristle brush and an approved solvent.
  - (2) inspect water pump for cracks, corrosion, evidence of leaks, and other damage.
  - (3) Check all threaded parts for stripped or otherwise damaged threads.



c. Installation.

- (1) If removed, install fan pulley (9, Figure 4-25).
- (2) Install gasket (8), water pump (7), nut (10), lockwasher (6), and capscrews (5).
- (3) Install cooling fan as described in paragraph 4-41 above.
- (4) Install radiator hoses onto water pump (paragraph 4-38a).
- (5) Fill radiator.

1. V-belt
2. Capscrew
3. Lockwasher
4. Fan
5. CapScrew
6. Lockwasher
7. Water pump
8. Gasket
9. Fan pulley
10. Nut

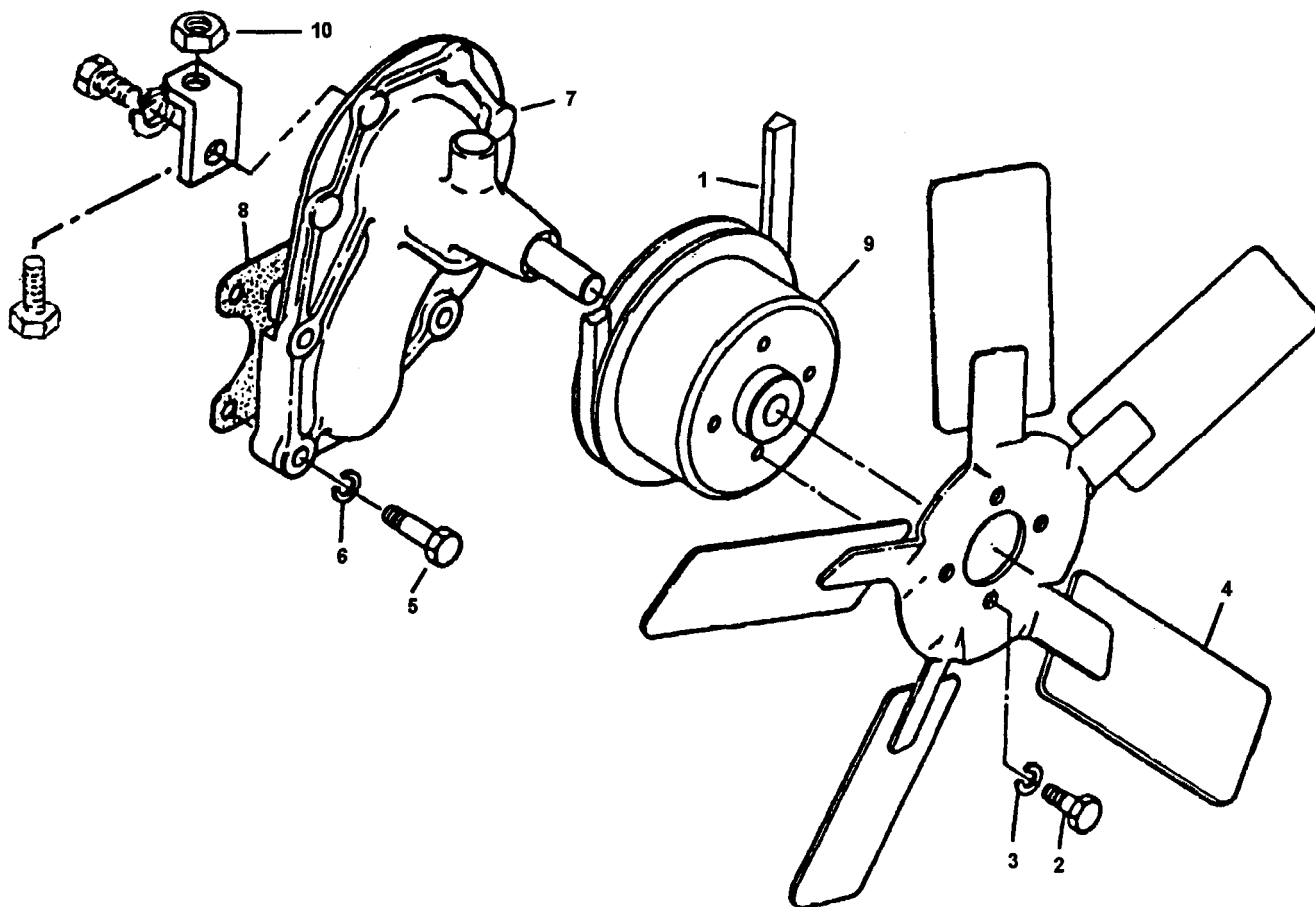


Figure 4-25. Water Pump, Cooling Fan and V-Belt, Removal and Installation



#### 4-43 COOLANT THERMOSTAT AND HOUSING.

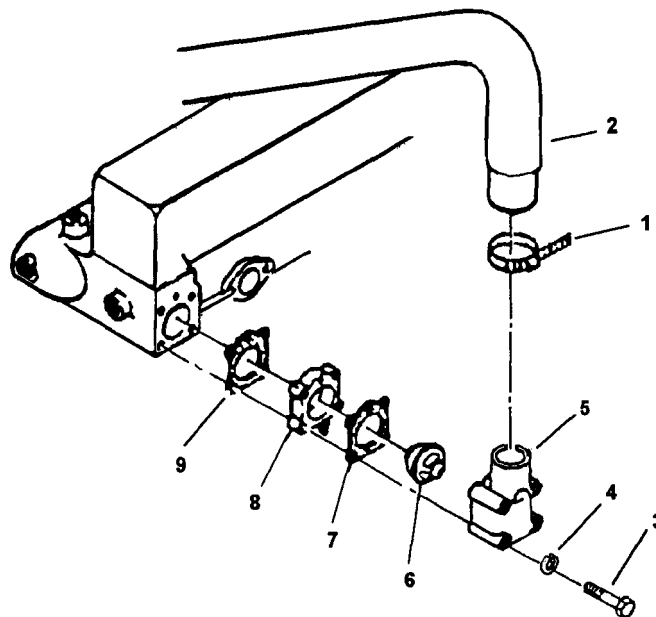
- a. Removal.
  - (1) Remove left side fan guard (paragraph 4-38a (1)).
  - (2) Refer to paragraph 3-27 and drain the radiator.
  - (3) Refer to paragraph 4-20 and remove the coolant temperature transmitter.
  - (4) Loosen clamp (1, Figure 4-26) and remove radiator hose (2).
  - (5) Remove screws (3) and lockwashers (4) to remove thermostat housing (5), thermostat (6), gasket (7), spacer (8), and gasket (9).
- b. Cleaning and Inspection.
  - (1) Clean thermostat and housing with an approved solvent.
  - (2) Inspect thermostat for cracks, corrosion, accumulations of scale or rust, and other damage.
  - (3) Inspect housing for cracks, corrosion, and other damage.
- c. Testing.
  - (1) Suspend thermostat in a container of water so that it is completely immersed but not touching the bottom or sides of the container.
  - (2) Suspend a reliable thermometer so that its temperature sensing end is immersed but not touching the bottom or sides of the container.

#### **CAUTION**

Do not overheat as damage to thermostat may result. Equipment damage could result if caution is not observed.

- (3) Gradually heat the water while stirring to evenly distribute the heat.
  - (4) Observe the thermometer and the thermostat. If the thermostat is operating properly, it should begin opening when the water temperature reaches 177°F (80.6°C) and be fully open at 205°F (96.1°C).
  - (5) Replace the thermostat if it fails to function properly.
- d. Installation.
  - (1) Install gasket (9), spacer (8), gasket (7), thermostat (6), thermostat housing (5), lockwashers (4), and screws (3).
  - (2) Install radiator hose clamp (1) on radiator hose (2), and install radiator hose (2) on thermostat housing (5) and tighten radiator base clamps (1).
  - (3) Refer to paragraph 4-20 and install coolant temperature transmitter.
  - (4) Refer to paragraph 3-27 and fill the radiator.
  - (5) Install left side fan guard (paragraph 4-38a).





**4-67**



## Section X. UNIT MAINTENANCE OF THE ENGINE LUBRICATION SYSTEM

**4-44 GENERAL.** The oil pan serves as a cover for the bottom of the crankcase and, also, as a reservoir for engine lubricating oil. It is equipped with a bayonet type oil gauge which is used to measure the oil level in the pan. Oil is drawn into a gear type, positive displacement pump through a large screen which prevents the entry of coarse abrasive. The oil pump forces the oil through a full flow type oil filter which removes minute abrasive particles. A pressure transmitter, located between the oil pump and oil filter, measures the pump output pressure and transmits it electrically to the engine oil pressure gauge. From the oil filter, the oil enters the header, a drilled passage in the engine block. A pressure switch measures the oil pressure in the header and automatically shuts down the engine if the pressure falls to a dangerously low level. From the header, the oil is distributed to the internal moving parts of the engine. No unit maintenance is allocated for the oil pan and oil pump. Refer to paragraph 4-22 for unit maintenance of the oil pressure transmitter and to paragraph 4-23 for unit maintenance of the low oil pressure switch.

### **4-45 LUBRICATION OF OIL FILTER ASSEMBLY.**

- a. Removal.
  - (1) Remove drain plug (1, Figure 4-27) and allow the oil to drain into a suitable container.
  - (2) Disconnect hose assemblies (2 and 3) from the filter assembly.
  - (3) Remove nuts (4), lockwashers (5), flat washers (6) and screws (7).
  - (4) Do not remove screws (8), lockwashers (9) and mounting bracket (10) unless inspection reveals damage.
- b. Disassembly.
  - (1) Remove elbows (11 and 12).
  - (2) Remove square nut (13), flat washer (14) and screw (15) to remove clamp (16) from filter assembly (17).
  - (3) Refer to paragraph 4-4 and disassemble the oil filter assembly.
- c. Cleaning and Inspection.
  - (1) Clean oil filter assembly parts with dry cleaning solvent (Federal Specification P-D-680).
  - (2) Inspect mounting bracket (10) for cracks, corrosion, and other damage.
  - (3) Inspect oil line assemblies for dogging, deterioration, or other damage.
  - (4) Check all threads for stripping or other damage.
- d. Repair. Repair of oil filter assembly is limited to replacement of defective parts.
- e. Assembly.
  - (1) Refer to paragraph 4-4 and assemble oil filter assembly.
  - (2) Install elbows (11 and 12) into filter assembly (17).
  - (3) Insert oil filter assembly (17) into clamp (16).
  - (4) Install screw (15), flat washer (14) and square nut (13). Tighten screw securely.
- f. Installation. After installation, refer to Figure 2-8 and run engine while checking oil level. Check for leaks.
  - (1) Install mounting bracket (10), lockwashers (9), and screws (8).
  - (2) Install screws (7), flat washers (6), lockwashers (5), and nuts (4).
  - (3) Reconnect hose assemblies (3 and 2) onto the filter assembly.
  - (4) Install drain plug (1) into oil filter assembly (17) and refill.



1. Drain plug
2. Hose assy
3. Hose assy
4. Nut
5. Lockwasher
6. Flat washer
7. Screw
8. Screw
9. Lockwasher
10. Mounting bracket
11. Elbow
12. Elbow
13. Square nut
14. Flat washer
15. Screw
16. Clamp
17. Oil filter assy

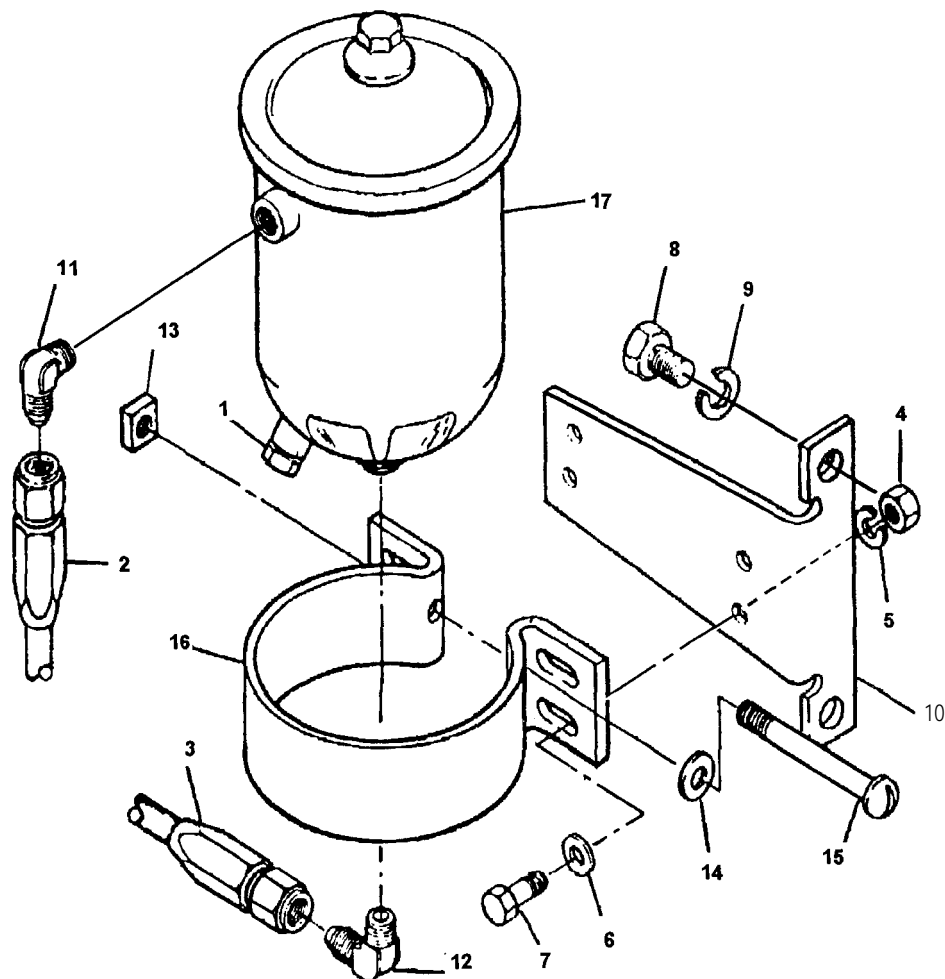


Figure 4-27. Lubrication Oil Filter Assembly, Removal and Installation



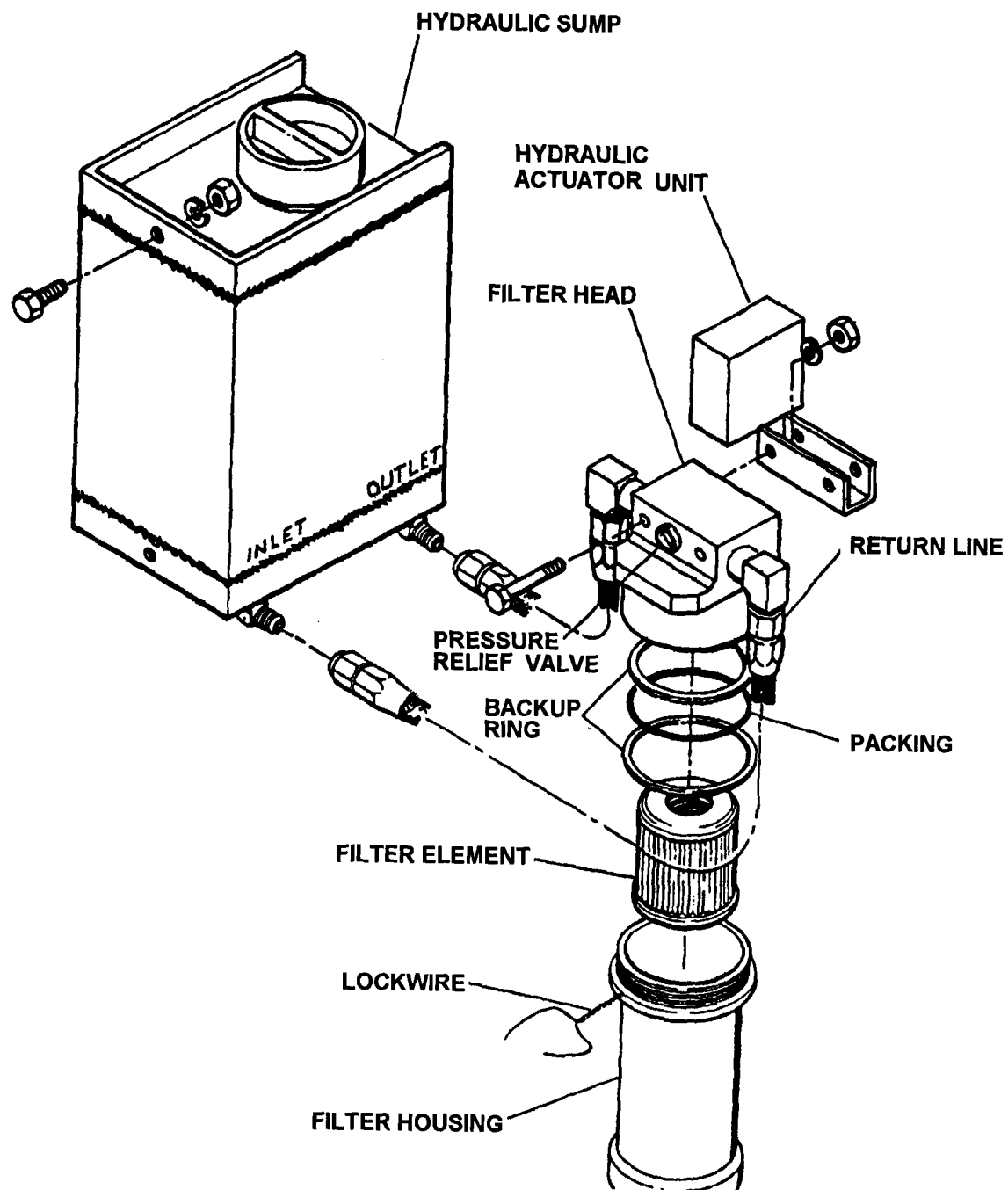


Figure 4-28. Hydraulic Sump and Filter Service



## Section XI. UNIT MAINTENANCE OF THE HYDRAULIC SYSTEM

**4-46 GENERAL.** The hydraulic system is used only on MEP-103A and some MEP-113A Precise Generator Sets equipped with electro-hydraulic governors. Its function is to provide a means of precise frequency control. The system consists of a sump, a replaceable element type filter, a gear driven positive displacement type pump, a pressure relief valve, a hydraulic actuator and interconnecting lines. The actuator hydraulically operates the governor control linkage to change the governor setting. Changing the governor setting increases or decreases the engine speed causing a corresponding increase or decrease in generator output frequency.

### **4-47 HYDRAULIC SUMP AND FILTER.**

- a. Disconnect return line from hydraulic actuator unit and allow the oil to drain into a suitable container (Figure 4-28).

#### **NOTE**

Drain oil while it is at operating temperature to insure maximum suspension and drainage of particles.

- b. Remove lockwire and unscrew filter housing from filter head.
- c. Withdraw filter element and discard.
- d. Remove and discard packing and backup rings.
- e. Clean filter housing with dry cleaning solvent (Federal Specification P-D-680) and dry with filtered compressed air.
- f. Soak replacement filter element in oil conforming to Military Specification MIL-H-5606.
- g. Install replacement packing and back-up rings.
- h. Insert oil soaked filter element into filter housing and fill housing with clean hydraulic oil.
- i. Apply a thin coating of hydraulic oil to packing, back-up ring, and threads of filter head and housing.
- j. Thread filter housing onto head hand tight and secure with lockwire.
- k. Connect return line to hydraulic actuator unit and fill hydraulic sump as directed in paragraph 3-29.

#### **NOTE**

No maintenance is required on the pressure relief valve. If the valve is damaged or fails to relieve pressure, replace the valve.

### **4-48 HYDRAULIC ACTUATOR UNIT FILTER.**

- a. Disconnect hydraulic hose assembly (Figure 4-29).
- b. Remove elbow, adapter, and filter.
- c. Clean filter with dry cleaning solvent (Federal Specification P-D-680) and dry thoroughly.
- d. Inspect filter for holes, tears, and other damage. Replace filter if defects are noted.
- e. Install filter and elbow.
- f. Install hydraulic hose.

### **4-49 HYDRAULIC LINES.**

#### **NOTE**

It is not necessary to remove all hydraulic lines to replace a single part. Only those hydraulic lines requiring replacement need be removed.

- a. Removal. Drain hydraulic system (see paragraph 4-47). Remove damaged hydraulic lines by following the ascending numerical sequence of index numbers (1 through 16) assigned to Figure 4-30.
- b. Installation. Install hydraulic lines that are damaged by following the ascending numerical sequence of index numbers (1 through 16) assigned to Figure 4-30.



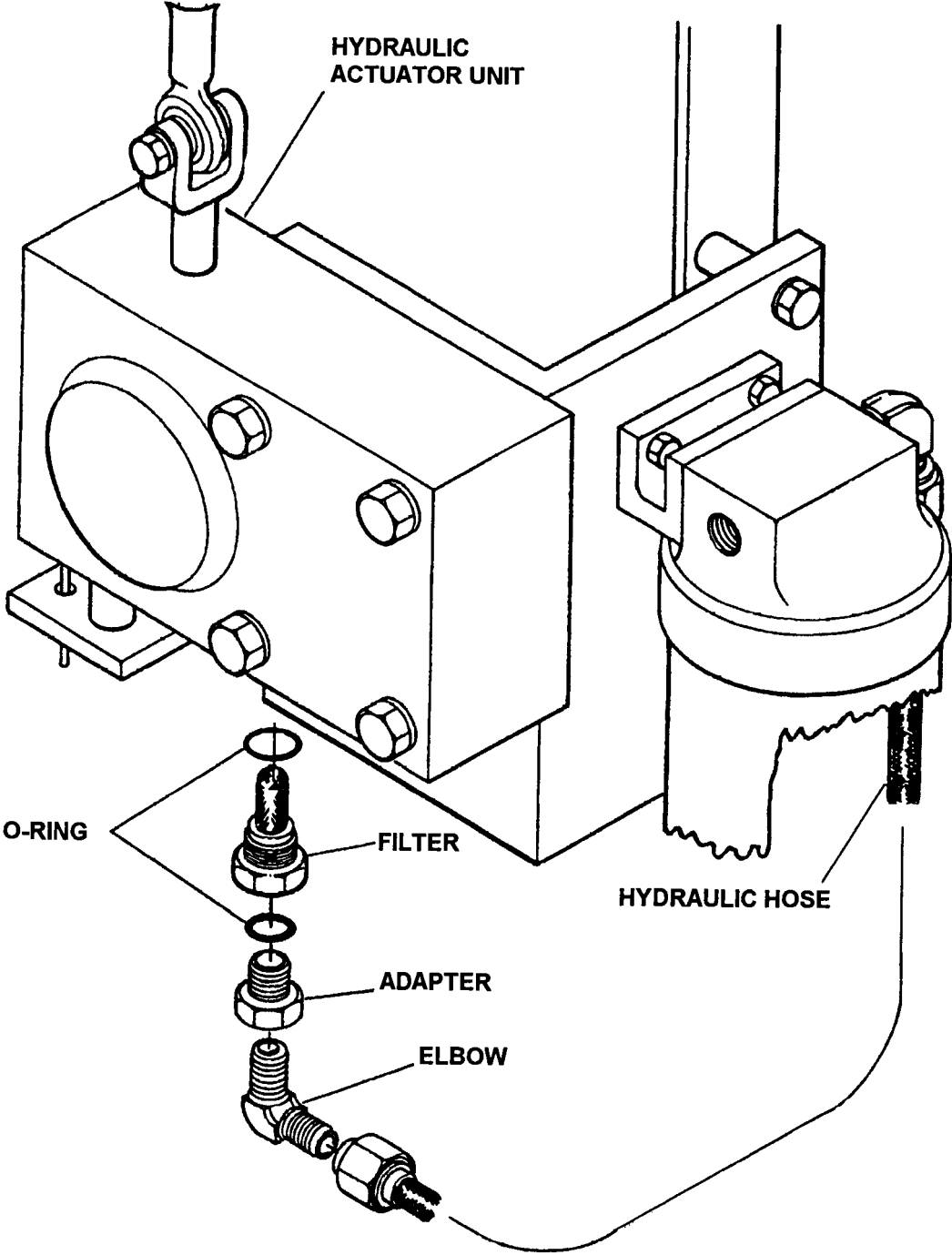


Figure 4-29. Servicing the Hydraulic Actuator Unit Filter



1. Return hose assy
2. Elbow
3. Elbow
4. Hose assy
5. Elbow
6. Elbow
7. Hose assy
8. Elbow
9. Elbow
10. Adapter
11. O-ring
12. Hose assy
13. Elbow
14. Elbow
15. Adapter
16. O-ring

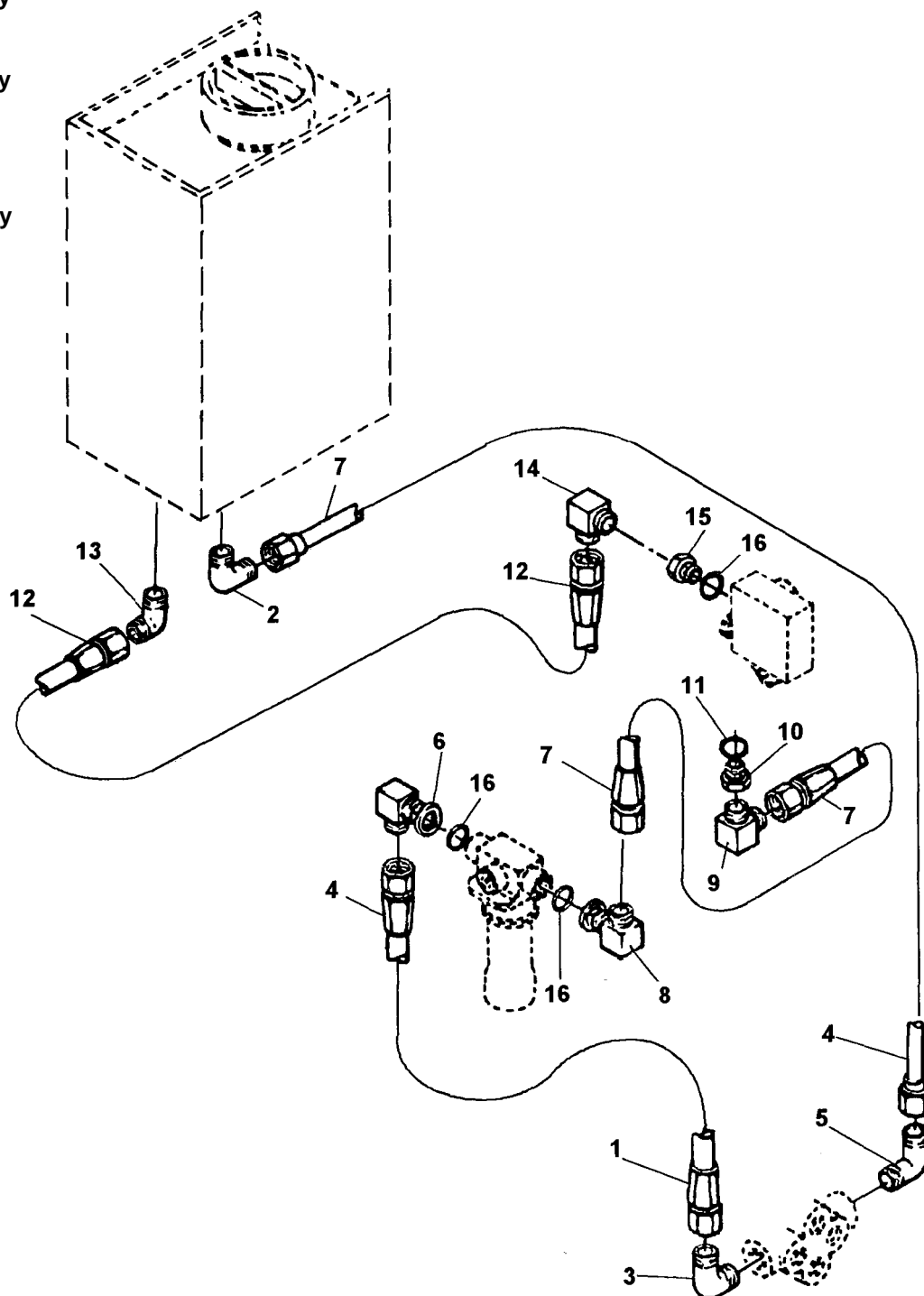


Figure 4-30. Hydraulic Lines and Fittings, Exploded View



## Section XII. UNIT MAINTENANCE OF THE INTAKE AND EXHAUST SYSTEMS AND BREATHER TUBE

### 4-50 GENERAL.

- a. The intake system consists of a dry type air cleaner assembly with a replaceable filter element which removes dust and dirt from the engine combustion air. The air cleaner assembly is equipped with a condition transducer. The air cleaner condition transducer measures the vacuum created by the filter element, but it transmits an electrical impulse which illuminates the AIR CLEANER CONDITION indicator lamp on the engine control panel when the filter element becomes unserviceable.
- b. The exhaust system provides a means of expelling exhaust fumes from the engine and muffles much of the noise generated by engine operation.
- c. The breather tube provides an escape route for gases which accumulate in the crankcase during engine operation. The gases pass through the breather, located in the engine valve cover, and are expelled into the air cleaner housing through the breather tube.

### 4-51 AIR CLEANER ASSEMBLY.

- a. Removal.
  - (1) Disconnect electrical leads from air cleaner condition transducer.
  - (2) Disconnect start aid tube assembly and remove spray nozzle (paragraph 4-34).
  - (3) Disconnect breather tube assembly (paragraph 4-54).
  - (4) Remove nuts (1, Figure 4-32), lockwashers (2) and screws (3) to remove retainer (4) and filter element (5).
  - (5) Remove screws (6) and lockwashers (7) to remove housing (8) and gasket (9).
  - (6) Remove condition transducer (10).
- b. Cleaning and Inspection.
  - (1) Clean filter element as directed in paragraph 4-52.
  - (2) Clean all other parts with a clean, lint free cloth moistened with an approved solvent.
  - (3) Inspect air cleaner housing for dents, cracks, corrosion and other damage.
  - (4) Inspect air cleaner condition transducer for cracked casing, corrosion, evidence of shorting and other damage.
  - (5) Check all threaded parts for stripped or otherwise damaged threads.
  - (6) Replace any parts damaged beyond simple repair.
- c. Installation.
  - (1) Install air cleaner condition transducer (10, Figure 4-32).
  - (2) Install gasket (9), housing (8), lockwashers (7), and screws (6).
  - (3) Install filter element (5), retainer (4), screws (3), lockwashers (2), and nuts (1).
  - (4) Connect breather tube assembly, (paragraph 4-54).
  - (5) Install spray nozzle and connect start aid tube assembly (paragraph 4-34).
  - (6) Connect electrical leads to air cleaner condition transducer.



#### 4-52 AIR CLEANER ASSEMBLY. ELEMENT.

a. Service.

- (1) Remove nuts, lockwashers, screws and retainer (Figure 4-31).
- (2) Carefully remove dirty filter element from housing.

**CAUTION**

**Do not clean air cleaner filter element in gasoline or other petroleum solvents. Equipment damage could result if caution is not observed.**

- (3) Soak and agitate filter element for 15 minutes in a solution of warm water and mild detergent.

**CAUTION**

**Do not use compressed air to dry a wet filter element. Equipment damage could result if caution is not observed.**

- (4) Rinse filter element until clean and air dry for approximately 24 hours.
- (5) The filter element may also be cleaned with low pressure (40 psig MAX), filtered compressed air.
- (6) Place a light behind the cleaned filter element and check for holes, tears or other defects. Replace if defective.
- (7) Clean interior of housing.

b. Installation.

- (1) Install filter element into housing.
- (2) Install retainer, screws, lockwashers, and nuts.

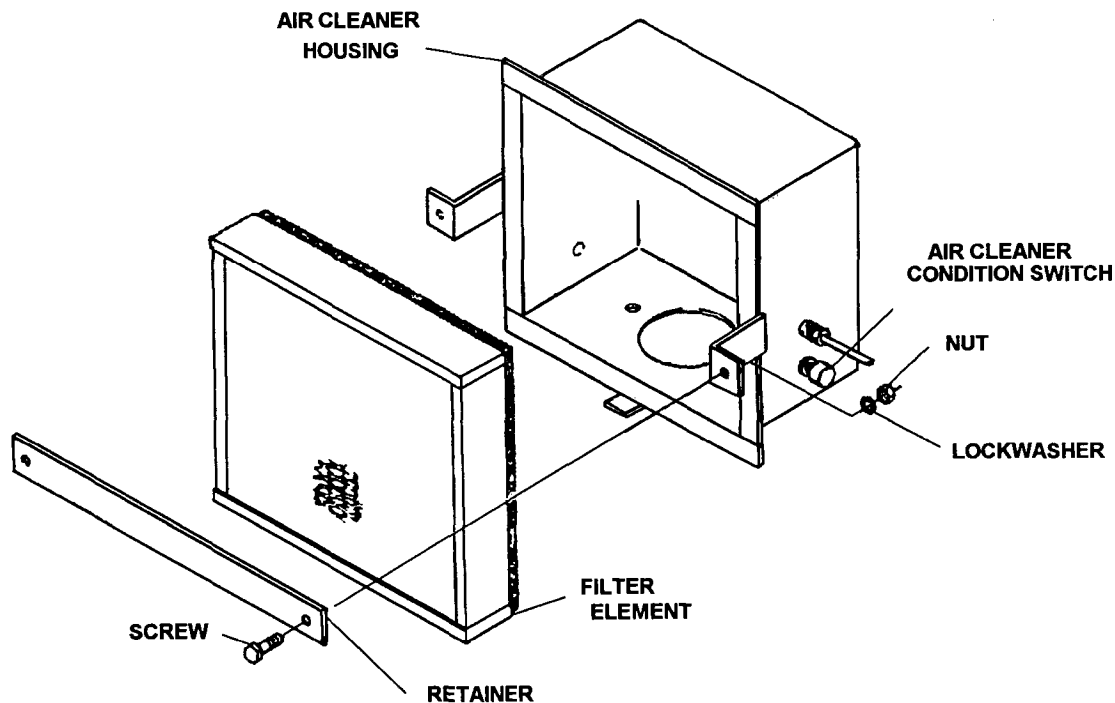


Figure 4-31. Servicing the Engine Air Cleaner



#### **4-53 MUFFLER.**

- a. Removal.
  - (1) Remove roll pin (1, Figure 4-33) to remove rain cap (2).
  - (2) Remove capscrews (3), lockwashers (4) to remove flange (5).
  - (3) Remove capscrews (6) and lockwashers (7) to remove muffler (8) and gasket (9). Discard gasket.
- b. Cleaning and Inspection.
  - (1) Clean exhaust pipe and muffler with a stiff bristle brush and an approved solvent.
  - (2) Inspect exhaust pipe and muffler for dents, cracks, excessive corrosion, dogging, and other damage.
  - (3) Check all threaded parts for stripped or otherwise damaged threads.
  - (4) Replace any parts damaged beyond simple repair.
- c. Installation.
  - (1) Install new gasket (9, Figure 4-33), muffler (8), lockwasher (7), and capscrews (6).
  - (2) Install flange (5), lockwashers (4), and capscrews (3).
  - (3) install rain cap (2) and roll pin (1).
- d. When a spark arrester is required, the installation instruction will be on the instruction sheet furnished with the spark arrester kit, TM 9-6115-464-24P.

#### **4-54 BREATHER AND BREATHER TUBE.**

- a. Removal.
  - (1) Remove clamps (Figure 4-34) and breather tube.
  - (2) Loosen wing nut on breather, unscrew slotted stud and remove breather.
- b. Cleaning and Inspection.
  - (1) Clean breather tube with a clean, lint-free cloth moistened with an approved solvent.
  - (2) Clean breather with an approved solvent and dry with filtered compressed air.
  - (3) Inspect breather tube for cracks, corrosion, dogging and other damage.
  - (4) Check all threaded parts for stripped or otherwise damaged threads.
  - (5) Replace any parts damaged beyond simple repair.
- c. Installation.
  - (1) Install breather and screw on slotted stud (Figure 4-34).
  - (2) Install breather tube and clamps.



1. Nut
2. Lockwasher
3. Screw
4. Retainer
5. Filter element
6. Screw
7. Lockwasher
8. Air cleaner housing
9. Gasket
10. Air cleaner condition transducer

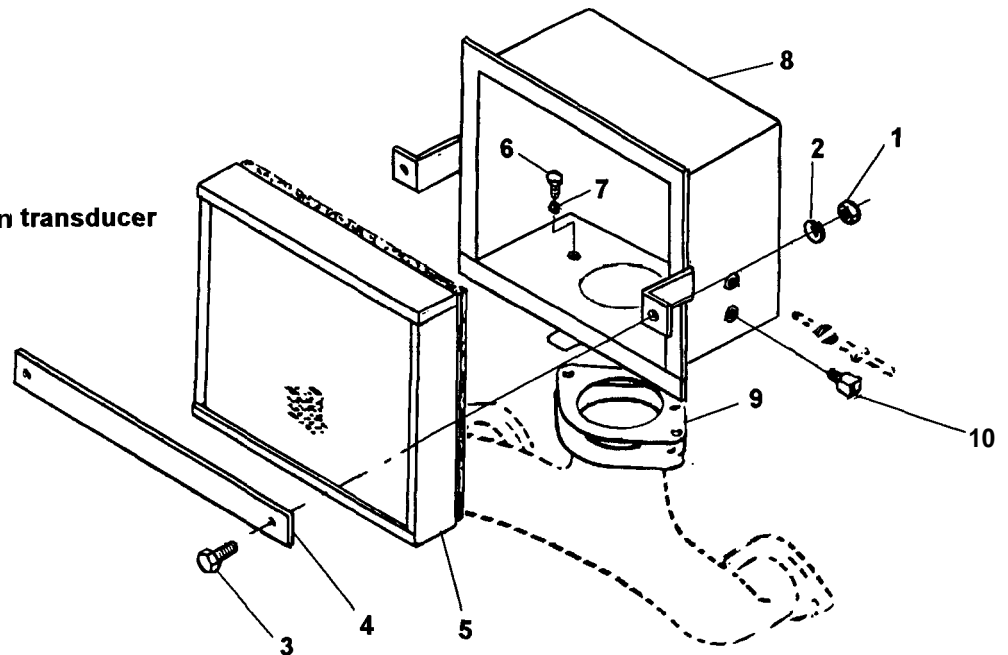


Figure 4-32. Air Cleaner Assembly, Exploded View

1. Roll pin
2. Rain cap
3. Capscrew
4. Lockwasher
5. Flange
6. Capscrew
7. Lockwasher
8. Muffler
9. Gasket

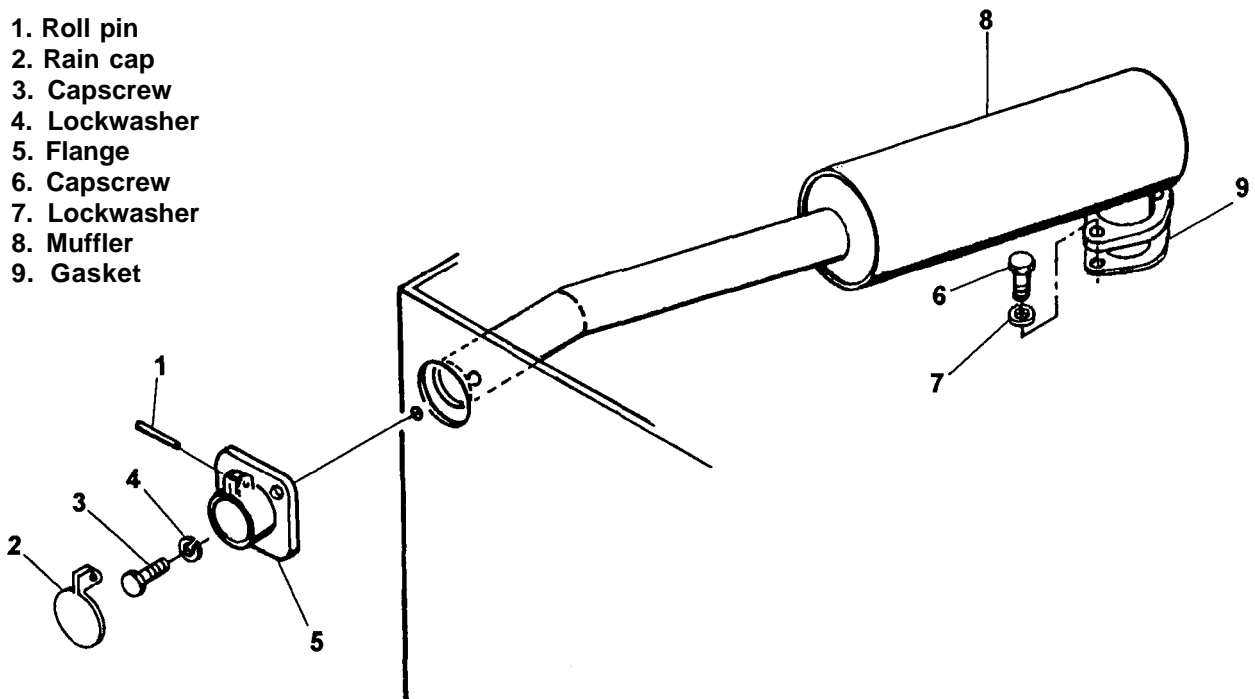


Figure 4-33. Muffler, Exploded View



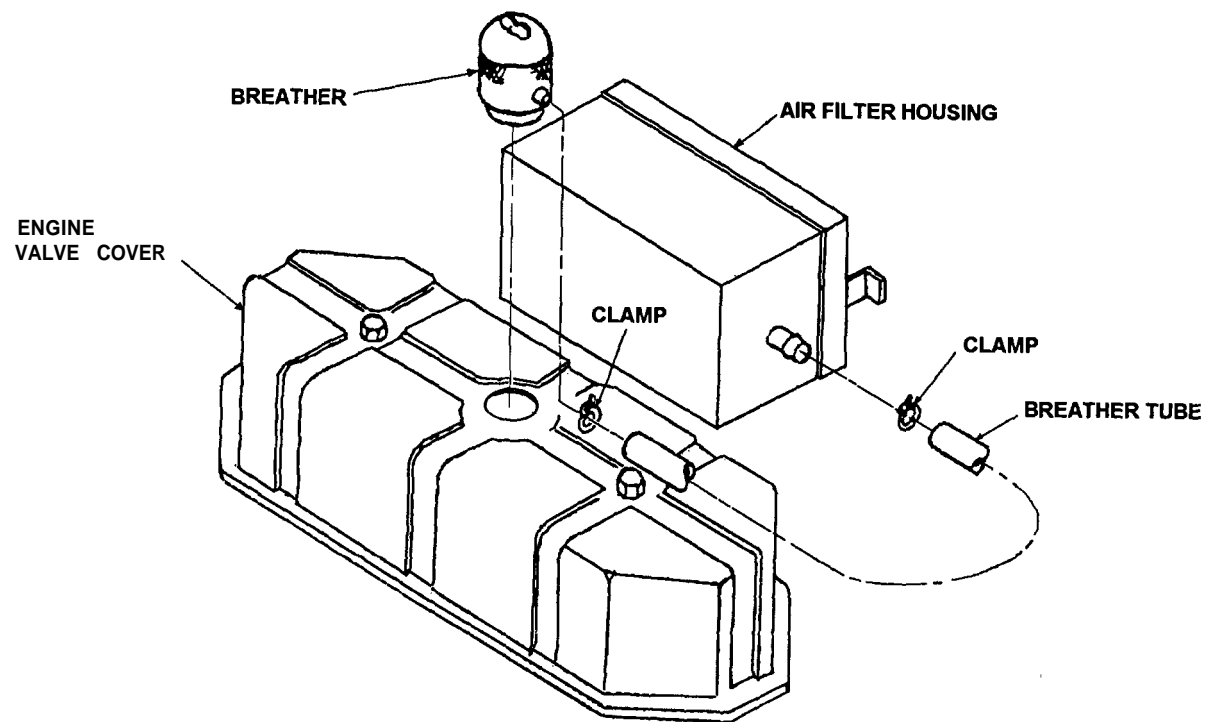


Figure 4-34. Breather and Breather Tube, Exploded View



### Section XIII. UNIT MAINTENANCE OF THE ENGINE ASSEMBLY

**4-55 GENERAL.** Rotational power for driving the generator is developed by a water cooled, four cylinder, four cycle, compression ignition diesel engine. Unit maintenance of the engine assembly is limited to inspecting the crankshaft pulley, inspecting and replacing the intake and exhaust manifolds, inspecting the rocker arm assembly, adjusting the valve tappet clearance, and testing the engine assembly.

#### **4-56 CRANKSHAFT PULLEY.**

- a. General. The crankshaft pulley is mounted on the front end of the engine crankshaft and pulls the drive belt for the water pump, radiator cooling fan, and alternator.
- b. Inspection.
  - (1) Inspect v-belt groove for "step" wear along side and bottom of groove which would indicate excessive wear.
  - (2) Check for cracks in v-belt groove and around crankshaft hub.

#### **4-57 INTAKE MANIFOLD.**

- a. Removal.
  - (1) Refer to paragraph 4-51 and remove air cleaner assembly.
  - (2) Remove nuts and Lockwashers (Figure 4-35) to remove intake manifold and gaskets. Discard gaskets.
- b. Cleaning and Inspection.
  - (1) Clean intake manifold with a stiff bristle brush and an approved solvent.
  - (2) Scrape all gasket remains from the mating surfaces of intake manifold and cylinder head.
  - (3) Inspect intake manifold for cracks, excessive corrosion and other damage.
  - (4) Check all threaded parts for stripped or otherwise damaged threads.
- c. Installation.
  - (1) Position new gaskets and install intake manifold (Figure 4-35), install lockwashers and nuts. Torque nuts 35 lbs-ft.
  - (2) Refer to paragraph 4-52 and install air cleaner assembly.

#### **4-58 EXHAUST MANIFOLD.**

- a. Removal.
  - (1) Refer to paragraph 4-53 and remove the muffler.
  - (2) Remove nuts and washers (Figure 4-36) to remove exhaust manifold and gaskets. Discard gaskets.
- b. Cleaning and Inspection.
  - (1) Clean exhaust manifold with a stiff bristle brush and an approved solvent.
  - (2) Scrape all gasket remains from mating surfaces of exhaust manifold and cylinder.
  - (3) Inspect exhaust manifold for cracks, excessive corrosion and other damage.
  - (4) Check all threaded parts for stripped or otherwise damaged threads.
- c. Installation. Torque nuts to 35 lbs.-ft.
  - (1) Position new gaskets and install exhaust manifold (Figure 4-35), with washers and nuts.
  - (2) Refer to paragraph 4-53 and install the muffler.



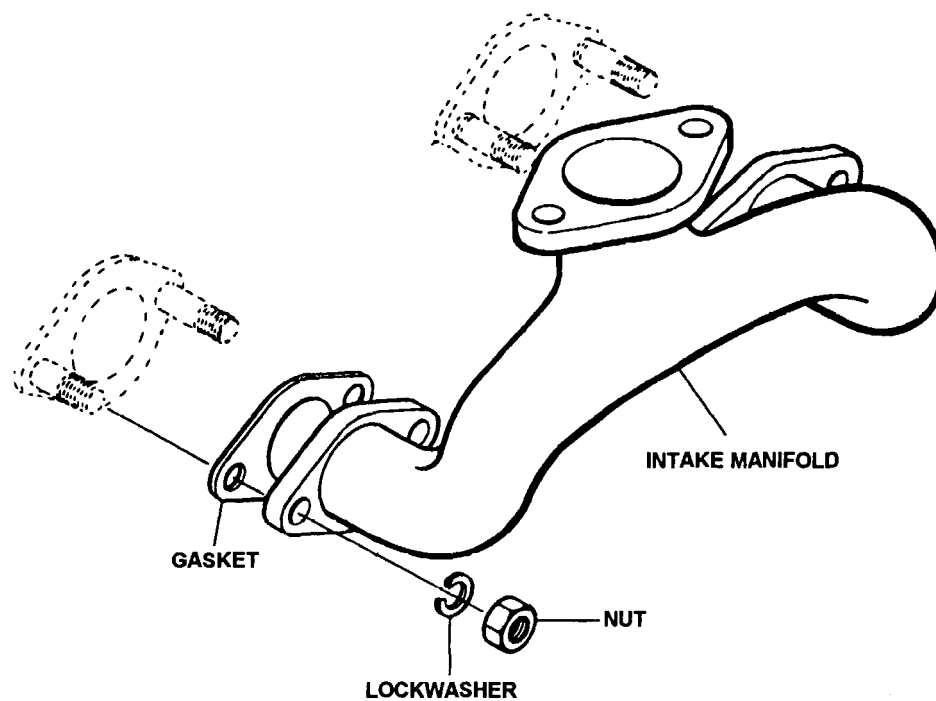


Figure 4-35. Intake Manifold, Removal and Installation

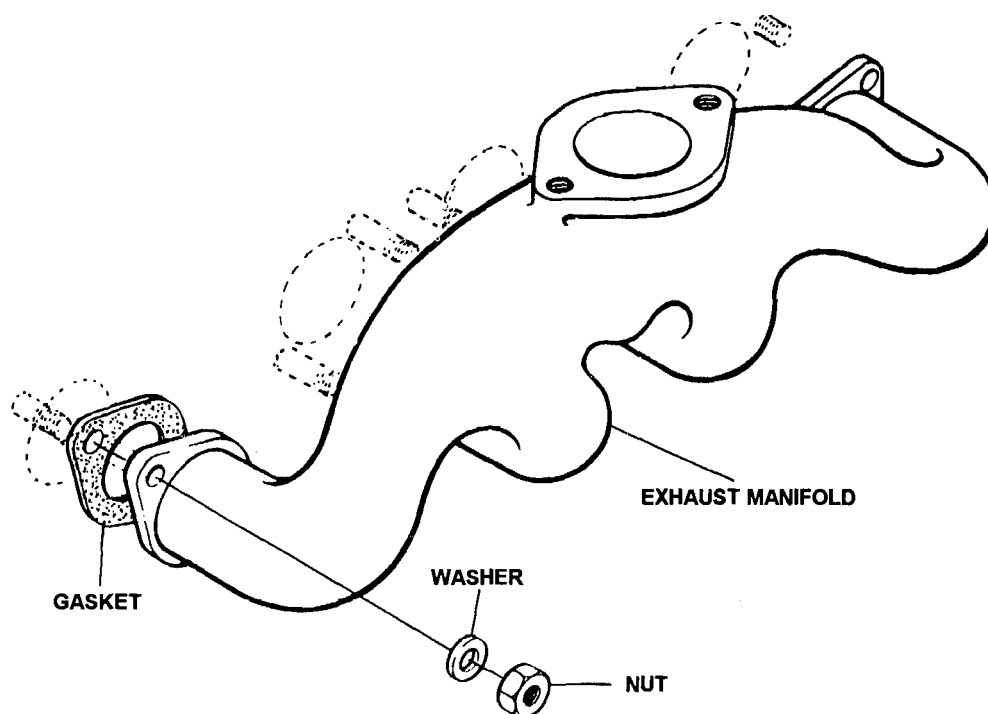


Figure 4-36. Exhaust Manifold, Removal and Installation

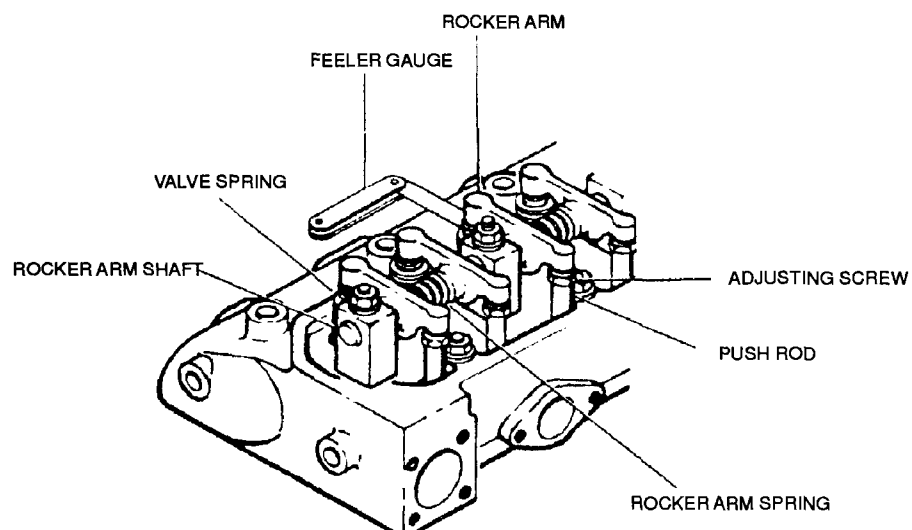


#### **4-59 ROCKER ARM ASSEMBLY.**

- a. Remove air cleaner assembly (paragraph 4-51).
- b. Thoroughly clean the valve cover and surrounding area.
- c. Remove capscrews and washers to remove valve cover and gasket. Discard gasket.
- d. Inspect valve rocker arm assembly as follows (Figure 4-37).
  - (1) Check adjusting screw, rocker arms, and shaft for cracks and indications of excessive wear.
  - (2) Inspect springs for distortion, cracks, and breaks.
  - (3) Check the oil hole in each rocker arm for plugging. Use a small wire and compressed air to clean plugged oil holes.
- e. If damage or excessive wear of the rocker arm assembly is present, notify higher level maintenance.
- f. Install gasket and valve cover and secure with washers and capscrews.
- g. Install breather and breather tube.

#### **4-60 VALVE TAPPET CLEARANCE ADJUSTMENT.**

- a. Refer to paragraph 2-6 and operate the engine until the coolant temperature gauge indicates normal operating temperature.
- b. Refer to paragraph 4-59 and remove the valve cover.
- c. Bar the engine over by hand until both the intake and exhaust valves on No. 1 cylinder are completely dosed.
- d. Using a feeler gauge, check clearance between the valve stem and the rocker arm on both intake and exhaust valves (Figure 4-37). Clearance should be 0.015 hot.
- e. If the clearance is not as specified, use a suitable wrench to rotate adjusting screw until proper clearance is obtained.
- f. Check and, if necessary, adjust the clearance of the valves on the remaining cylinders as outlined in paragraphs c., d., and e. above, following the firing order of 1, 2, 4, 3.
- g. When all valves are properly adjusted, refer to paragraph 4-54 and install the valve cover.



**Figure 4-37. Rocker arm assembly inspection and valve tappet clearance adjustment**



#### **4-61 ENGINE TESTING.**

- a. Check that the generator set is properly grounded (para 2-4d.).
- b. Connect a 15 KW load to the load terminal board (para 2-4e.).
- c. Start the engine (para 2-6) and allow it to operate approximately 15 minutes at no load governed speed.
- d. Refer to paragraph 2-2 and check that all engine instruments indicate normal operation.
- e. Listen for abnormal sounds, such as “knocking”, while the engine is operating.
- f. Observe the exhaust for excessive smoke.
- g. Visually check for excessive vibration while the engine operates.
- h. Refer to paragraph 2-6 and apply the load to the generator.
- i. Repeat steps d. through g. above.
- j. Stop the generator set (para 2-7).
- k. If any abnormalities were noted during test operation, refer to Table 4-1 for reference to the applicable maintenance paragraph.
1. Test cylinder compression pressure as follows:
  - (1) Disconnect fuel pump solenoid (pump will be in off position and will not pump fuel).
  - (2) Refer to paragraph 4-37 and remove fuel injection nozzle holders.
  - (3) Use fully charged batteries and take readings at cranking speed (150 to 200 RPM).
  - (4) Do not operate starter more than 15 seconds at a time to prevent overheating of starter. Allow one (1) minute between cranking cycles to allow starter to cool.
  - (5) Readings on the gage can be used as reference between cylinders. Maximum pressure difference between cylinders is 20 percent. An extremely low reading in any one cylinder would indicate valve, head gasket or piston ring blow-by.
  - (6) Refer to paragraph 4-37 and install fuel injection nozzle holders.
  - (7) Connect fuel pump solenoid.



## Section XIV. UNIT MAINTENANCE OF THE GENERATOR SET CONTROLS

**4-62 GENERAL.** This paragraph contains unit maintenance instructions for the generator set controls. The control cubicle assembly and the fault locator panel contain the controls, instruments, and indicators for controlling and monitoring the operation of the generator set. The 400 Hz and 50/60 Hz tactical precise models incorporate a governor control unit which operates the hydraulic actuator to change the governor setting. This function is fulfilled by the manual speed control on the tactical utility model. The interconnecting wiring harness provides electrical connection between the major assemblies and the control cubicle and fault indicator panel.

### **4-63 CONTROL CUBICLE ASSEMBLY.**



**The generator shall be shut off and the battle disconnected prior to performing maintenance on the control cubicle assembly. Failure to observe this warning may result in electrical shock or death by electrocution.**

#### **NOTE**

Access to the interior of the control cubicle assembly is obtained by loosening three fasteners at the top of the panel and swinging the panel forward on the hinge at its lower side until its weight is supported by the door holders.

- a. Oil Pressure Gauge.
  - (1) Removal.
    - (a) Tag and disconnect electrical leads to oil pressure gauge.
    - (b) Remove nuts (1, Figure 4-38), lockwashers (2) and clamp (3).
    - (c) Remove oil pressure gauge (4) from panel.
  - (2) Inspection and cleaning.
    - (a) Clean oil pressure gauge with filtered compressed air and a soft bristle brush or wipe with a clean, lint-free cloth lightly moistened with an approved solvent.
    - (b) Visually inspect oil pressure gauge for corrosion, cracked casing, cracked or broken glass, stripped or otherwise damaged threads, and evidence of other damage.
  - (3) Testing.
    - (a) Connect a multimeter across the terminals of a rheostat.
    - (b) Adjust rheostat until multimeter indicates 30 ohms resistance.
    - (c) Disconnect multimeter, but do not disturb rheostat adjustment.
    - (d) Connect rheostat to terminal of oil pressure gauge marked SEND.
    - (e) Connect rheostat and oil pressure gauge in series with a 24 Vdc source with negative lead to oil pressure gauge terminal marked IGN.
    - (f) Oil pressure gauge should indicate 60 PSI.
    - (g) Replace oil pressure gauge if it does not function properly.
  - (4) Installation.
    - (a) Install oil pressure gauge (4, Figure 4-38) onto panel.
    - (b) Install clamp (3), lockwashers (2), and nuts (1).
    - (c) Connect electrical leads to oil pressure gauge.



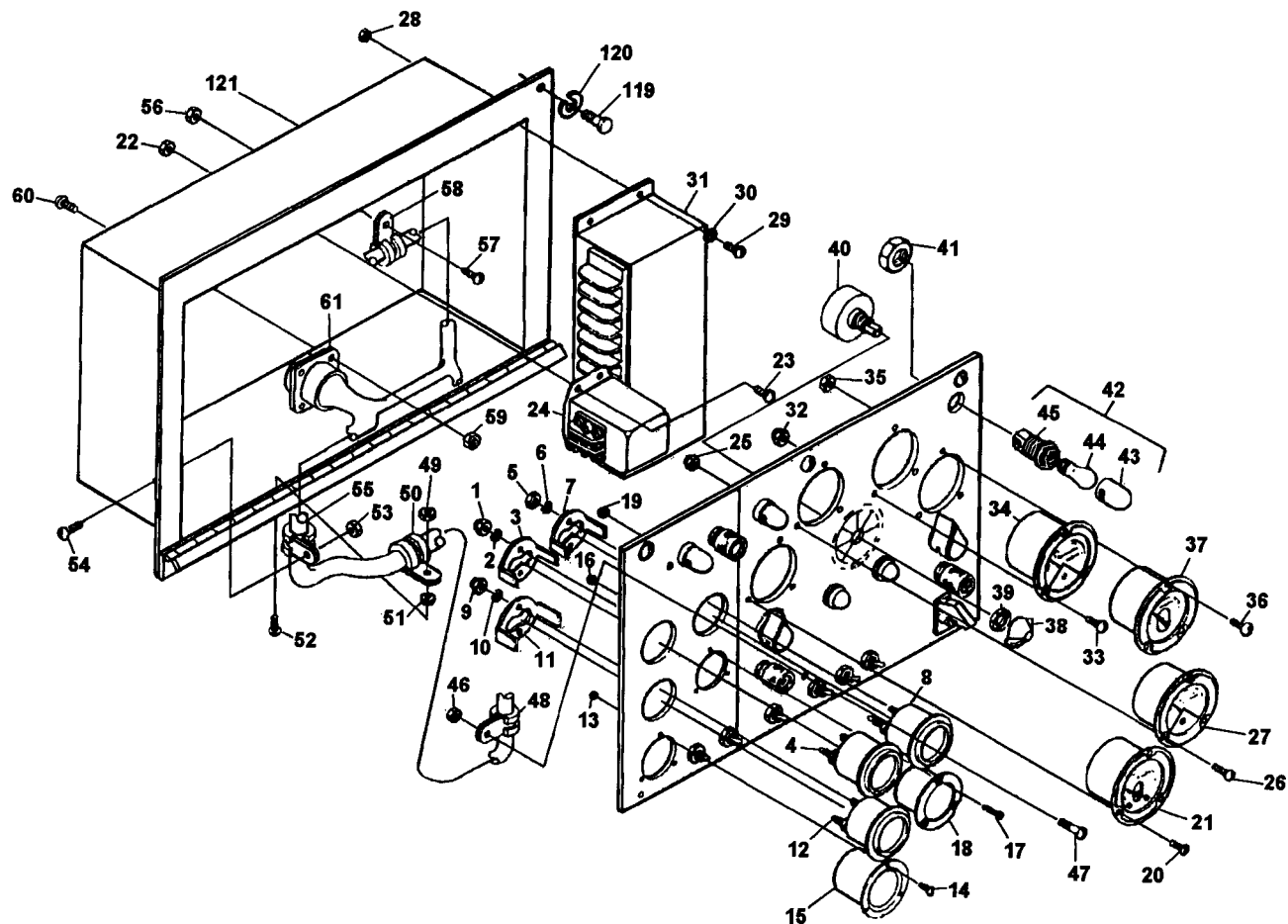


Figure 4-38. Control Cubicle Assembly, Exploded View (Sheet 1 of 3)



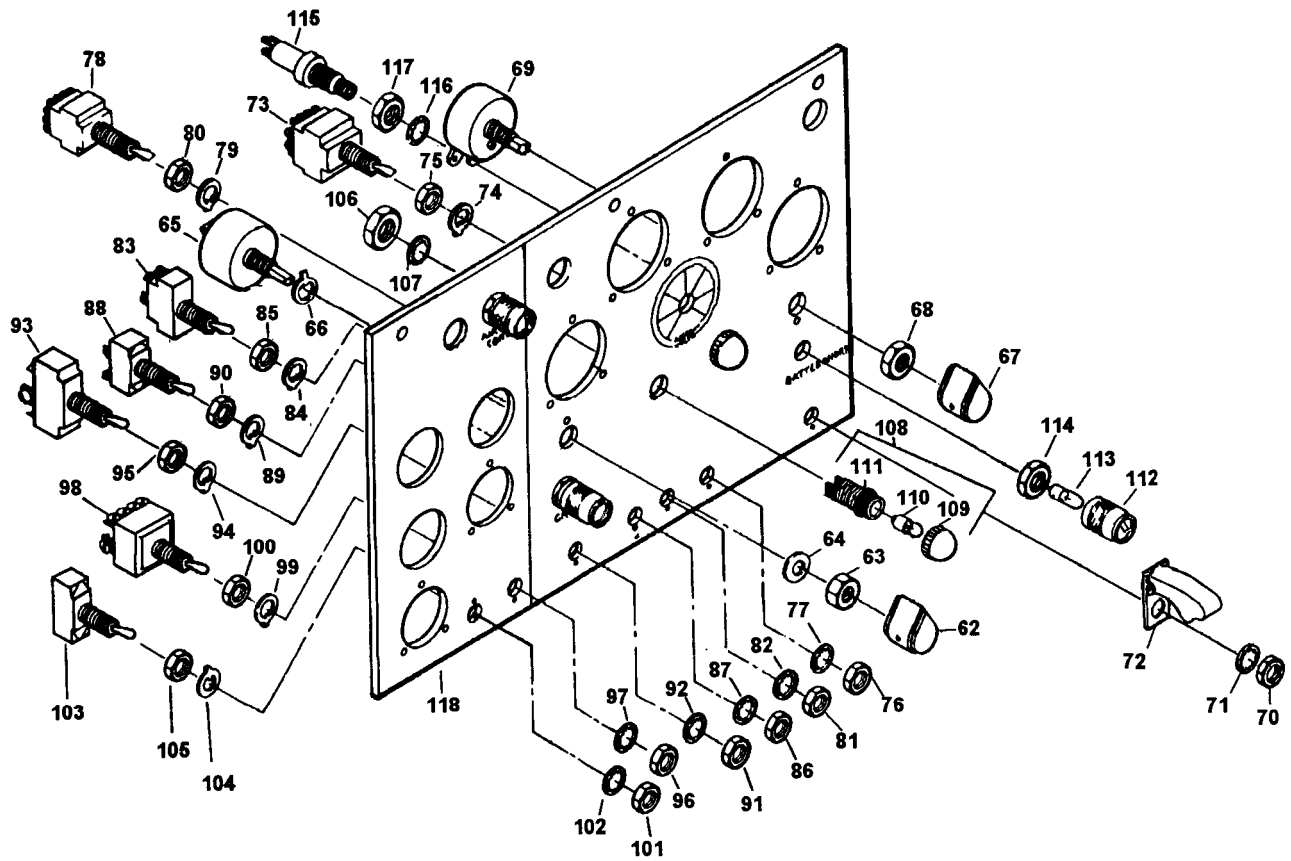


Figure 4-38. Control Cubicle Assembly, Exploded View (Sheet 2 of 3)



- |                              |                                     |
|------------------------------|-------------------------------------|
| 1. Nut                       | 62. Control knob                    |
| 2. Lockwasher                | 63. Nut                             |
| 3. Clamp                     | 64. Washer                          |
| 4. Oil pressure gauge        | 65. Frequency adjust rheostat       |
| 5. Nut                       | 66. Key washer                      |
| 6. Lockwasher                | 67. Control knob                    |
| 7. Clamp                     | 66. Nut                             |
| 8. Coolant temperature gauge | 69. Voltage adjust rheostat         |
| 9. Nut                       | 70. Nut                             |
| 10. Lockwasher               | 71. Tooth lockwasher                |
| 11. Clamp                    | 72. Switch guard                    |
| 12. Fuel level gauge         | 73. Battle short switch             |
| 13. Self-locking nut         | 74. Key washer                      |
| 14. Screw                    | 75. Nut                             |
| 15. Hourmeter                | 76. Nut                             |
| 16. Self-locking nut         | 77. Troth lockwasher                |
| 17. Screw                    | 78. Operations switch               |
| 18. Battery charging ammeter | 79. Key washer                      |
| 19. Self-locking nut         | 60. Nut                             |
| 20. Screw                    | 81. Nut                             |
| 21. Frequency meter          | 62. Tooth lockwasher                |
| 22. Self-locking nut         | 63. Voltage sensing switch          |
| 23. Screw                    | 84. Key washer                      |
| 24. Frequency transducer     | 65. Nut                             |
| 25. Self-locking nut         | 66. Nut                             |
| 26. Screw                    | 87. Tooth lockwasher                |
| 27. Kilowatt meter           | 66. Panel light switch              |
| 28. Self-locking nut         | 89. Key washer                      |
| 29. Screw                    | 80. Nut                             |
| 30. Washer                   | 91. Nut                             |
| 31. Thermal waft converter   | 82. Tooth lockwasher                |
| 32. Self-locking nut         | 83. Circuit breaker switch          |
| 33. Screw                    | 94. Key washer                      |
| 34. AC current meter         | 95. Nut                             |
| 35. Self-locking nut         | 86. Nut                             |
| 36. Screw                    | 97. Tooth lockwasher                |
| 37. AC voltmeter             | 86. START-RUN-STOP switch           |
| 38. Control knob             | 88. Key washer                      |
| 39. Nut                      | 100. Nut                            |
| 40. Switch                   | 101. Nut                            |
| 41. Nut                      | 102. Tooth lockwasher               |
| 42. Panel light assembly     | 103. Engine primer switch           |
| 43. Cover                    | 104. Key washer                     |
| 44. Lamp                     | 105. Nut                            |
| 45. Base                     | 106. Nut                            |
| 46. Self-locking nut         | 107. Tooth lockwasher               |
| 47. Screw                    | 108. Synchronizing light assembly   |
| 48. Clamp                    | 109. Lens                           |
| 49. Self-locking nut         | 110. Lamp                           |
| 50. Clamp                    | 111. Base                           |
| 51. Self-locking nut         | 112. Lens                           |
| 52. Screw                    | 113. Lamp                           |
| 53. Self-locking nut         | 114. Nut                            |
| 54. Screw                    | 115. Base                           |
| 55. Clamp                    | 116. Tooth lockwasher               |
| 56. Self-locking nut         | 117. Nut                            |
| 57. Screw                    | 118. Control cubicle assembly panel |
| 58. Clamp                    | 119. Screw                          |
| 59. Self-locking nut         | 120. Lockwasher                     |
| 60. Screw                    | 121. Housing                        |
| 61. Wiring harness assembly  |                                     |

Figure 4-38. Control Cubicle Assembly, Exploded View (Sheet 3 of 3)



b. Coolant Temperature Gauge.

(1) Removal.

- (a) Tag and disconnect electrical leads to coolant temperature gauge.
- (b) Remove nuts (5, Figure 4-38, sheet 1 of 3), lockwashers (6) and damp (7).
- (c) Remove coolant temperature gauge (8) from panel.

(2) Cleaning and Inspection.

- (a) Clean coolant temperature gauge with filtered compressed air or wipe with a clean, lint-free cloth lightly moistened with an approved solvent.
- (b) Visually inspect coolant temperature gauge for corrosion, cracked casing, cracked or broken glass, stripped or otherwise damaged threads, and evidence of other damage.

(3) Testing.

- (a) Connect an ohmmeter across the wiper arm terminal and any other terminal of 10-500 ohm potentiometer.
- (b) Adjust potentiometer until ohmmeter indicates 460 ohms resistance.
- (c) Disconnect ohmmeter but do not disturb potentiometer adjustment.
- (d) Connect potentiometer to coolant temperature gauge terminal marked SEND.
- (e) Connect potentiometer and coolant temperature gauge in series with a 24 Vdc source with positive lead to temperature gauge terminal marked IGN.
- (f) Coolant temperature gauge should indicate 240°F. If it does not, replace it.

(4) Installation.

- (a) Install coolant temperature gauge (8, Figure 4-38, sheet 1 of 3) to panel.
- (b) Install clamp (7), lockwashers (6), and nuts (5).
- (c) Reconnect electrical leads to coolant temperature gauge.

c. Fuel Level Gauge.

(1) Removal.

- (a) Tag and disconnect electrical leads to fuel level gauge.
- (b) Remove nuts (9, Figure 4-38, sheet 1 of 3), lockwashers (10) and clamp (11).
- (c) Remove fuel level gauge (12) from panel.

(2) Cleaning and Inspection.

- (a) Clean fuel level gauge with filtered compressed air or wipe with a clean, lint-free cloth lightly moistened with an approved solvent.
- (b) Visually inspect fuel level gauge for corrosion, cracked casing, cracked or broken glass, stripped or otherwise damaged threads, and evidence of other damage.



(3) Testing.

- (a) Connect an ohmmeter across the wiper arm terminal and any other terminal of a potentiometer.
- (b) Adjust potentiometer until ohmmeter indicates 30 ohms resistance.
- (c) Remove ohmmeter, but do not disturb potentiometer adjustment.
- (d) Connect the fuel level gauge in series with a 24 Vdc source with the negative lead to fuel level gauge terminal marked IGN.
- (e) Fuel level gauge should indicate EMPTY
- (f) Disconnect 24 Vdc positive lead from fuel level gauge SEND terminal and connect potentiometer adjusted to 30 ohms resistance.
- (g) Fuel level gauge should indicate FULL.
- (h) Replace fuel level gauge if it fails to function properly.

(4) Installation.

- (a) Install fuel level gauge (12, Figure 4-38, sheet 1 of 3) onto panel.
- (b) Install clamp (11), lockwashers (10), and nut (9).
- (c) Reconnect electrical leads to fuel level gauge.

d. Hourmeter.

(1) Removal.

- (a) Tag and disconnect electrical leads to hourmeter.
- (b) Remove self-locking nuts (13, Figure 4-38, sheet 1 of 3), and screws (14).
- (c) Remove hourmeter (15) from panel.

(2) Cleaning and Inspection.

- (a) Clean hourmeter with filtered compressed air or wipe with a dean, lint-free cloth lightly moistened with an approved solvent.
- (b) Visually inspect hourmeter for corrosion, cracked casing, cracked or broken glass, stripped or otherwise damaged threads, and evidence of shorting or other damage.

(3) Testing. Connect hourmeter to a 24 Vdc source and observe for proper operation. Replace hourmeter if it fails to operate correctly.

(4) Installation.

- (a) Install hourmeter (15, Figure 4-38, sheet 1 of 3) onto panel.
- (b) Install screws (14) and self-locking nuts (13).
- (c) Reconnect electrical leads to hourmeter.

e. Battery Charging Ammeter.

(1) Removal.

- (a) Tag and disconnect electrical leads to battery charging ammeter.
- (b) Remove self-locking nuts (16, Figure 4-38, sheet 1 of 3) and screws (17).
- (c) Remove battery charging ammeter (18) from panel.



(2) Cleaning and Inspection.

- (a) Clean battery charging ammeter with filtered compressed air or wipe with a clean, lint-free cloth lightly moistened with an approved solvent.
- (b) Visually inspect battery charging ammeter for corrosion, cracked casing, cracked or broken glass, evidence of shorting, stripped or otherwise damaged threads and other damage.
- (c) Testing. If the battery charging ammeter is suspected of being faulty, temporarily substitute a known functional meter in its place. If the same readings are obtained with the substitute meter, the original is operational and need not be replaced.

(3) Installation.

- (a) Install battery charging ammeter (18, Figure 4-38, sheet 1 of 3) onto panel.
- (b) Install screws (17), and self-locking nuts (16).
- (c) Reconnect electrical leads to battery charging ammeter.

**NOTE**

The frequency meter and frequency transducer should be tested with a frequency test meter, frequency counter or an STE/ICE prior to replacement.

f. Frequency Meter.

(1) Removal.

- (a) Tag and disconnect electrical leads to frequency meter.
- (b) Remove self-locking nuts (19, Figure 4-38, sheet 1 of 3) and screws (20).
- (c) Remove frequency meter (21) from panel.

(2) Cleaning and Inspection.

- (a) Clean frequency meter with filtered compressed air or wipe with a dean, lint-free cloth lightly moistened with an approved solvent.
- (b) Visually inspect frequency meter for corrosion, cracked casing, cracked or broken glass, stripped or otherwise damaged threads, evidence of shorting, and other damage.

(3) Installation.

- (a) Install frequency meter (21, Figure 4-38, sheet 1 of 3) onto panel.
- (b) Install screws (20), and self-locking nuts (19).
- (c) Reconnect electrical leads to frequency meter.

**NOTE**

The frequency meter and frequency transducer are matched components and shall be replaced as such.

g. Frequency Transducer.

(1) Removal.

- (a) Tag and disconnect electrical leads to frequency transducer.
- (b) Remove self-locking nuts (22, Figure 4-38, sheet 1 of 3) and screws (23).
- (c) Remove frequency transducer (24) from control cubicle.



- (2) Cleaning and Inspection.
  - (a) Clean frequency transducer with filtered compressed air or wipe with a clean, lint-free cloth lightly moistened with an approved solvent.
  - (b) Visually inspect frequency transducer for dents, cracks, corrosion, and other damage.
- (3) Installation.
  - (a) Install frequency transducer (24, Figure 4-38, sheet 1 of 3) onto panel.
  - (b) Install screws (23) and self-locking nuts (22).
  - (c) Reconnect electrical leads to frequency transducer.
- h. Kilowatt Meter.
  - (1) Removal.
    - (a) Tag and disconnect electrical leads to kilowatt meter.
    - (b) Remove self-locking nuts (25, Figure 4-38, sheet 1 of 3) and screws (26).
    - (c) Remove kilowatt meter (27) from panel.
  - (2) Cleaning and Inspection.
    - (a) Clean kilowatt meter with filtered compressed air or wipe with a dean, lint-free cloth lightly moistened with an approved solvent.
    - (b) Visually inspect kilowatt meter for corrosion, cracked casing, cracked or broken glass, stripped or damaged threads, and evidence of shorting or other damage.
  - (3) Installation.
    - (a) Install kilowatt meter (27, Figure 4-38, sheet 1 of 3) onto panel.
    - (b) Install screws (26), and self-locking nuts (25).
    - (c) Reconnect electrical leads to kilowatt meter.
- i. Thermal Watt Converter.
  - (1) Removal.
    - (a) Tag and disconnect electrical leads to thermal watt converter.
    - (b) Remove self-locking nuts (28, Figure 4-38, sheet 1 of 3), screws (29) and washers (30) to remove thermal watt converter (31 ) from control cubicle assembly.
  - (2) Cleaning and Inspection.
    - (a) Clean thermal watt converter with filtered compressed air or wipe with a clean, lint-free cloth lightly moistened with an approved solvent.
    - (b) Visually inspect thermal watt converter for dents, cracks, corrosion, stripped or otherwise damaged threads, and evidence of shorting or other damage.
  - (3) Installation.
    - (a) Install thermal watt converter (31, Figure 4-38, sheet 1 of 3), washers (30), screws (29), and self-locking nuts (28) onto control cubicle assembly.
    - (b) Reconnect electrical leads to thermal watt converter.



j. AC Current Meter.

(1) Removal.

- (a) Tag and disconnect electrical leads to AC current meter.
- (b) Remove self-locking nuts (32, Figure 4-38, sheet 1 of 3) and screws (33) to remove AC current meter (34) from panel.

(2) Cleaning and Inspection.

- (a) Clean AC current meter with filtered compressed air or wipe with a clean, lint-free cloth lightly moistened with an approved solvent.
- (b) Visually inspect AC current meter for corrosion, cracked casing, cracked or broken glass, stripped or otherwise damaged threads and evidence of shorting or other damage.

(3) Installation.

- (a) Install AC current meter (34, Figure 4-38, sheet 1 of 3), screws (33), and self-locking nuts (32) onto panel.
- (b) Reconnect electrical leads to AC current meter.

k. AC Voltmeter.

(1) Removal.

- (a) Tag and disconnect electrical leads to AC voltmeter.
- (b) Remove self-locking nuts (35, Figure 4-38, sheet 1 of 3) and screws (36) to remove AC voltmeter (37).

(2) Cleaning and Inspection.

- (a) Clean AC voltmeter with filtered compressed air or wipe with a clean, lint-free cloth lightly moistened with an approved solvent.
- (b) Visually inspect AC voltmeter for corrosion, cracked casing, cracked or broken glass, stripped or otherwise damaged threads, and evidence of shorting or other damage.

(3) Testing. If an AC voltmeter is suspected of being faulty, test by temporarily replacing with another which is known to be serviceable. If the incorrect reading persists, the original meter is serviceable and should be reinstalled.

(4) Installation.

- (a) Install AC voltmeter (37, Figure 4-38, sheet 1 of 3), screws (36), and self-locking nuts (35).
- (b) Reconnect electrical leads to AC voltmeter.

l. Volts-Amps Transfer Switch.

(1) Removal.

- (a) Tag and disconnect electrical leads to volts-amps transfer switch.
- (b) Loosen setscrews in control knob (38, Figure 4-38, sheet 1 of 3) and remove knob.
- (c) Remove nut (39) to remove switch (40) from panel.

(2) Cleaning and Inspection.

- (a) Clean volts-amps transfer switch with filtered compressed air or wipe with a clean, lint-free cloth lightly moistened with an approved solvent.
- (b) Visually inspect volts-amps transfer switch for cracked casing, corrosion, stripped or otherwise damaged threads, and evidence of shorting or other damage.



(3) Testing.

- (a) Rotate switch shaft counterclockwise as far as it will go. This places switch in L1-L2 volts position.
- (b) Check switch for continuity with a multimeter using schematic of Figure 4-39 as a guide.
- (c) Rotate switch shaft clockwise to the next position and again check switch continuity.

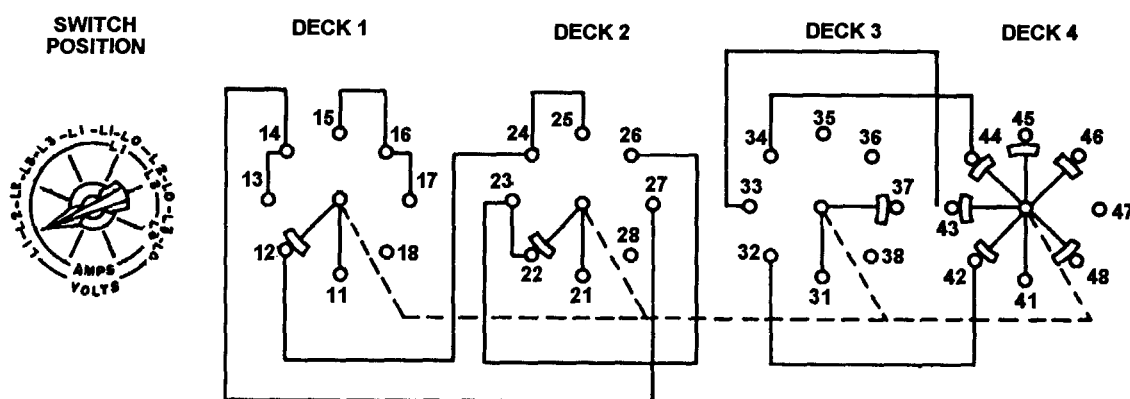
**NOTE**

The wiper contacts shown in Figure 4-39 rotate clockwise to the next set of stationary contacts when the switch shaft is rotated clockwise to the next position.

- (d) Continue rotating switch shaft and checking continuity until all six positions have been checked.
- (e) If a discontinuity is noted in any switch position, switch is unserviceable and shall be replaced.

(4) Installation.

- (a) Install switch (40, Figure 4-38, sheet 1 of 3), and nut (39) onto panel.
- (b) Install control knob (38), and tighten setscrews in control knob.
- (c) Reconnect electrical lead to volts-amps transfer switch.



**Figure 4-39. Volts-Amps Transfer Switch Schematic Diagram**

m. Panel Light Assemblies.

(1) Removal and Disassembly.

- (a) Tag and disconnect electrical leads to panel light assemblies.
- (b) Remove nut (41, Figure 4-38, sheet 1 of 3) to remove panel light assemblies (42).
- (c) Remove covers (43) and unscrew lamps (44) from bases (45).

(2) Cleaning and Inspection.

- (a) Clean panel light assemblies with filtered compressed air and a soft bristle brush or wipe with a clean, lint-free cloth lightly moistened with an approved solvent.
- (b) Visually inspect base for corrosion, cracks, stripped or otherwise damaged threads, and evidence of shorting or other damage.
- (c) Visually inspect lamp for corrosion, burned out filament, and stripped or otherwise damaged threads.
- (d) Visually inspect covers for cracks, corrosion, stripped or damaged threads and other damage.
- (e) Replace any damaged or defective parts.



- (3) Assembly and Installation.
  - (a) On bases ( 45, Figure 4-38, sheet 1 of 3), screw on lamps (44), and install cover (43).
  - (b) Install panel light assemblies (42), and nut (41).
  - (c) Reconnect electrical leads to panel light assemblies.
- n. Control Cubicle Wiring Harness Assembly.
  - (1) Removal.
    - (a) Tag and disconnect electrical leads to control cubicle assembly.
    - (b) Remove self-locking nut (46, Figure 4-38, sheet 1 of 3) and screw (47) to remove damp (48).
    - (c) Remove self-locking nut (49) to remove clamp (50). Do not remove self-locking nut (51) and screw (52) unless replacement is necessary.
    - (d) Remove self-locking nut (53) and screw (54) to remove damp (55).
    - (e) Remove self-locking nut (56) and screw (57) to remove damp (58).
    - (f) Remove self-locking nut (59) and screws (60) to remove wiring harness assembly (61).
  - (2) Cleaning and Inspection.
    - (a) Clean wiring harness assembly with filtered compressed air and a soft bristle brush or wipe with a clean, lint-free cloth lightly moistened with an approved solvent.
    - (b) Visually inspect wiring harness connector for cracks, corrosion, bent or broken pins, and stripped or damaged threads.
    - (c) Inspect insulation for burns, chafing, and deterioration.
    - (d) Check electrical leads for burned, bent, corroded, damaged or missing terminals.
  - (3) Testing. Check continuity of individual wires with a multimeter or continuity light using figures FO-1 and FO-2 as a guide.

### **CAUTION**

**Do not use acid core solder on electrical wiring. See appropriate manual in Appendix A for wiring installation practices. Equipment damage could result if caution is not observed.**

- (4) Repair. Replace damaged wires, terminals, and connector by unsoldering connections, installing replacement parts and soldering connections.

### **NOTE**

If more than 30 percent of the wires are damaged or have been repaired, replace the wiring harness and forward it to high level maintenance for rebuilding.

- (5) Installation.
  - (a) Install wiring harness assembly (61, Figure 4-38, sheet 1 of 3), screws (60), and self-locking nut (59).
  - (b) Install clamp (58), screw (57), and self-locking nut (56).
  - (c) Install clamp (55), screw (54), and self-locking nut (53).
  - (d) If removed, install screw (52) and self-locking nut (51). Install damp (50) and self-locking nut (49).
  - (e) Install damp (48), screw (47), and self-locking nut (46).
  - (f) Connect electrical leads to control cubicle assembly.



o. Frequency Adjust Rheostat (Precise Sets Only).

(1) Removal.

- (a) Tag and disconnect electrical leads to frequency adjust rheostat.
- (b) Loosen setscrew in control knob (62, Figure 4-38, sheet 2 of 3), then remove knob from rheostat shaft.
- (c) Remove nut (63), washer (64) and keyed washer (66) to remove rheostat (65) from panel.

(2) Cleaning and Inspection.

- (a) Clean rheostat with filtered compressed air and a soft bristle brush or wipe with a clean, lint-free cloth lightly moistened with an approved solvent.
- (b) Visually inspect rheostat for cracked casing, corrosion, stripped or other wise damaged threads, and evidence of shorting or other damage.

(3) Testing.

- (a) Connect an ohmmeter across outer terminals of rheostat. Ohmmeter should indicate 500 ohms resistance.
- (b) Rotate rheostat shaft counterclockwise as far as it will go.
- (c) Connect ohmmeter between center terminal and either outer terminal. Ohmmeter should indicate 0 ohms resistance.
- (d) Slowly, at an even rate, rotate the rheostat shaft clockwise as far as it will go. Ohmmeter should increase at an even rate from 0 to 500 ohms.
- (e) If ohmmeter indication changes erratically or is not 500 ohms when the rotation is completed, the rheostat is defective and shall be replaced.

(4) Installation.

- (a) Install rheostat (65, Figure 4-38, sheet 2 of 3) on panel and secure with keyed washer (66), washer (64), and nut (63).
- (b) Install control knob (62) on rheostat shaft and secure with setscrew.
- (c) Connect electrical leads to frequency adjust rheostat.

p. Voltage Adjust Rheostat.

(1) Removal.

- (a) Tag and disconnect electrical leads to voltage adjust rheostat.
- (b) Loosen setscrew in control knob (67, Figure 4-38, sheet 2 of 3) and remove knob from rheostat shaft.
- (c) Remove nut (68) to remove rheostat (69).

(2) Cleaning and Inspection.

- (a) Clean voltage adjust rheostat with filtered compressed air and a soft bristle brush or wipe with a clean, lint-free cloth lightly moistened with an approved solvent.
- (b) visually inspect rheostat for cracked casing, corrosion, stripped or othetwise damaged threads, and evidence of shorting or other damage.



(3) Testing.

- (a) Connect an ohmmeter across two outer terminals of rheostat. Indication shall be 250 ohms resistance.
- (b) Rotate rheostat shaft counterclockwise as far as it will go.
- (c) Connect ohmmeter between center terminal and either outer terminal.
- (d) Slowly, at an even rate, rotate rheostat shaft clockwise as far as it will go while observing the ohmmeter.
- (e) Ohmmeter indication shall increase, at an even rate, from 0 to 250 ohms resistance.
- (f) If ohmmeter indication changes erratically, or is not 250 ohms when rotation is complete, the rheostat is defective and shall be replaced.

(4) Installation.

- (a) Install rheostat (69, Figure 4-38, sheet 2 of 3) and nut (68).
- (b) Install control knob (67) on rheostat shaft and secure with setscrew.
- (c) Connect electrical leads to voltage adjust rheostat.

q. Battle Short Switch.

(1) Removal.

- (a) Tag and disconnect electrical leads to battle short switch.
- (b) Remove nut (70, Figure 4-38, sheet 2 of 3) and tooth lockwasher (71) to remove switch guard (72), battle short switch (73) and key washer (74).
- (c) Do not remove nut (75) unless inspection reveals damage and replacement is necessary.

(2) Cleaning and Inspection.

- (a) Clean switch and switch guard with filtered compressed air and a soft bristle brush or wipe with a clean, lint-free cloth lightly moistened with an approved cleaning solvent.
- (b) Visually inspect switch for cracked casing, corrosion, stripped or otherwise damaged threads, and evidence of shorting or damage.
- (c) Check switch guard for cracks, breaks, and other damage.

(3) Testing.

- (a) Place switch in ON position (lever away from switch mounting bushing key way).
- (b) Using an ohmmeter, check for continuity between each center terminal and the corresponding upper terminal.
- (c) Place switch in OFF position.
- (d) Check for continuity between each center terminal and corresponding lower terminal.
- (e) Replace switch if any discontinuity is noted.

(4) Installation.

- (a) If removed, install nut (75, Figure 4-38, sheet 2 of 3).
- (b) Install key washer (74), battle short switch (73), switch guard (72), tooth lockwasher (71), and nut (70).
- (c) Connect electrical leads to battle short switch.



- r. Operations Switch.
  - (1) Removal.
    - (a) Tag and disconnect electrical leads to operations switch.
    - (b) Remove nut (76, Figure 4-38, sheet 2 of 3) and tooth lockwasher (77), to remove operations switch (78) and key washer (79). Do not remove nut (80), unless inspection reveals damage and replacement is necessary.
  - (2) Cleaning and Inspection.
    - (a) Clean switch with filtered compressed air and a soft bristle brush or wipe with a clean, lint-free cloth lightly moistened with an approved cleaning solvent.
    - (b) Visually inspect switch for cracked casing, corrosion, stripped, or otherwise damaged threads, and evidence of shorting or other damage.
  - (3) Testing.
    - (a) Place switch in PARALLEL OPERATION position (lever away from mounting post key way).
    - (b) Using an ohmmeter, check for continuity between each center terminal and corresponding upper terminal.
    - (c) Place switch in SINGLE UNIT OPERATION position (lever toward mounting post key way).
    - (d) Check for continuity between each center terminal and corresponding lower terminal.
    - (e) Replace switch if any discontinuity is noted.
  - (4) Installation.
    - (a) If removed, install nut (80, Figure 4-38, sheet 2 of 3).
    - (b) Install key washer (79), operations switch (78), tooth lockwasher (77), and nut (76).
    - (c) Connect electrical leads to operations switch.
- s. Voltage Sensing Switch.
  - (1) Removal.
    - (a) Tag and disconnect electrical leads to switch.
    - (b) Remove nut (81, Figure 4-38, sheet 2 of 3) and tooth lockwasher (82) to remove switch (83) and key washer (84). Do not remove nut (85) from switch.
  - (2) Cleaning and Inspection.
    - (a) Clean switch with filtered compressed air and a soft bristle brush or wipe with a clean, lint-free cloth lightly moistened with an approved solvent.
    - (b) Visually inspect switch for cracked casing, corrosion, stripped or otherwise damaged threads, and evidence of shorting or other damage.
  - (3) Testing.
    - (a) Place voltage sensing switch in REMOTE position (lever away from mounting post key way).
    - (b) Using an ohmmeter, check for continuity between center terminal and corresponding upper terminal.
    - (c) Place switch in LOCAL position (lever toward mounting post key way).
    - (d) Check for continuity between each center terminal and corresponding lower terminal.
    - (e) Replace switch if any discontinuity is noted.



- (4) Installation.
  - (a) If removed, install nut (85). install key washer (84, Figure 4-38, sheet 2 of 3), voltage sensing switch (83), tooth lockwasher (82), and nut (81).
  - (b) Connect electrical leads to voltage sensing switch.
- t. Panel Light Switch.
  - (1) Removal.
    - (a) Tag and disconnect electrical leads to switch.
    - (b) Remove nut (86, Figure 4-38, sheet 2 of 3) and tooth lockwasher (87) to remove switch (88) and key washer (89).
    - (c) Do not remove nut (90) from switch.
  - (2) Cleaning and Inspection.
    - (a) Clean switch with filtered compressed air and a soft bristle brush or wipe with a clean, lint-free cloth lightly moistened with an approved solvent.
    - (b) Visually inspect switch for cracked casing, corrosion, stripped or otherwise damaged threads, and evidence of shorting or other damage.
  - (3) Testing.
    - (a) Place switch in OFF position (lever toward mounting post key way).
    - (b) Using an ohmmeter, check for open circuit across switch terminals.
    - (c) Place switch in ON position (lever away from key way).
    - (d) Check for continuity across switch terminals.
    - (e) Replace switch if it fails to function properly.
  - (4) Installation.
    - (a) Install key washer (89, Figure 4-38, sheet 2 of 3), panel light switch (88), tooth lockwasher (87),
    - (b) Connect electrical leads to panel light switch.
- u. Circuit Breaker Switch.
  - (1) Removal.
    - (a) Tag and disconnect electrical leads to switch.
    - (b) Remove nut (91, Figure 4-38, sheet 2 of 3) and tooth lockwasher (92) to remove switch (93) and key washer (94).
    - (c) Do not remove nut (95) unless inspection reveals damage and replacement is necessary.
  - (2) Cleaning and Inspection
    - (a) Clean switch with filtered compressed air and a soft bristle brush or wipe with a clean, lint-free cloth lightly moistened with an approved solvent.
    - (b) Visually inspect switch for cracked casing, corrosion, stripped or otherwise damaged threads and evidence of shorting or other damage.
  - (3) Testing.
    - (a) Place switch in OPEN position (lever toward mounting post key way).
    - (b) Using an ohmmeter, check for continuity between terminals 1 and 2 and between terminals 4 and 5 (figures FO-1 and FO-2).



### NOTE

Terminal markings are also on the switch.

- (c) Place switch in the CLOSED position (lever away from mounting post key way).
  - (d) Using an ohmmeter check for continuity between terminals 2 and 3 and between terminals 5 and 6.
  - (e) Place switch in CENTER position.
  - (f) Using an ohmmeter, check for continuity between terminals 1 and 2 and between terminals 5 and 6.
  - (g) Replace switch if it fails any of the above tests.
- (4) Installation.
- (a) If removed, install nut (95, Figure 4-38, sheet 2 of 3).
  - (b) Install key washer (94), circuit breaker switch (93), tooth lockwasher (92), and nut (91).
  - (c) Connect electrical leads to circuit breaker switch.
- v. START-RUN-STOP switch.
- (1) Removal.
- (a) Tag and disconnect electrical leads to switch.
  - (b) Remove nut (96, Figure 4-38, sheet 2 of 3) and tooth lockwasher (97) to remove switch (98) and key washer (99).
  - (c) Do not remove nut (100) unless inspection reveals damage and replacement is necessary.
- (2) Cleaning and Inspection.
- (a) Clean switch with filtered compressed air and a soft bristle brush or wipe with a clean, lint-free cloth lightly moistened with an approved solvent.
  - (b) Visually inspect switch for cracked casing, corrosion, stripped or otherwise damaged threads, and evidence of shorting or other damage.
- (3) Testing.
- (a) Place switch in STOP position (lever toward mounting post key way).
  - (b) Using an ohmmeter, check for open circuit between terminals 2 and 3, 5 and 6, 8 and 9, and 11 and 12 (figures FO-1 and FO-2). All circuits shall be open.
  - (c) Place switch in RUN position.
  - (d) Check for continuity between terminals 2 and 3 and terminals 8 and 9. Both circuits shall have continuity.
  - (e) Check for open circuit between terminals 5 and 6.
  - (f) Place switch in START position (lever away from mounting post key way).
  - (g) Check for continuity between terminals 2 and 3, 5 and 6, 8 and 9 and 11 and 12. All circuits shall indicate continuity.
  - (h) Replace switch if it fails any of the above tests.
- (4) Installation.
- (a) If removed, install nut (100, Figure 4-38, sheet 2 of 3).
  - (b) Install key washer (99), switch (98), tooth lockwasher (97), and nut (96).
  - (c) Connect electrical leads to START-RUN-STOP switch.



w. Engine Primer Switch.

(1) Removal.

- (a) Tag and disconnect electrical leads to ENGINE PRIMER switch.
- (b) Remove nut (101, Figure 4-38, sheet 2 of 3) and tooth lockwasher (102) to remove switch (103) and key washer (104).
- (c) Do not remove nut (105) unless inspection reveals damage and replacement is necessary.

(2) Cleaning and Inspection.

- (a) Clean switch with filtered compressed air and a soft bristle brush or wipe with a clean, lint-free cloth lightly moistened with an approved solvent.
- (b) Visually inspect switch for cracked casing, corrosion, stripped or otherwise damaged threads, and evidence of shorting or other damage.

(3) Testing.

- (a) Using an ohmmeter, check for open circuit across terminals. Ohmmeter shall indicate open circuit.
- (b) Hold switch lever in ON position (toward mounting post key way) and check ohmmeter indication. Ohmmeter shall indicate continuity.
- (c) Replace switch if it fails either of the above tests.

(4) Installation.

- (a) If removed, install nut (105, Figure 4-38, sheet 2 of 3).
- (b) Install key washer (104), engine primer switch (103), tooth lockwasher (102), and nut (101).
- (c) Connect electrical lead to engine primer switch.

x. Synchronizing Light Assemblies.

(1) Removal and Disassembly.

- (a) Tag and disconnect electrical leads to synchronizing light assemblies.
- (b) Remove nuts (106, Figure 4-38, sheet 2 of 3) and tooth lockwashers (107) to remove synchronizing light assemblies (108).
- (c) Unscrew lens (109). Depress lamps (110) and rotate counterclockwise to remove from bases (111).

(2) Cleaning and Inspection.

- (a) Clean synchronizing light assemblies with filtered compressed air and a soft bristle brush or wipe with a clean, lint-free cloth lightly moistened with an approved solvent.
- (b) Visually inspect bases for cracks, corrosion, stripped or otherwise damaged threads, and evidence of shorting.
- (c) Inspect lens for cracks, breaks, and stripped or otherwise damaged threads.
- (d) Inspect lamps for corrosion, cracked or broken glass, and burned out filament.
- (e) Replace any damaged or defective parts.

(3) Assembly and Installation.

- (a) Position and rotate lamps (110, Figure 4-38, sheet 2 of 3) clockwise to secure in bases (111 ). Install lens (109).
- (b) Install synchronizing light assemblies (108), tooth lockwashers (107), and nuts (106).
- (c) Connect electrical leads to synchronizing light assemblies.



- y. Air Cleaner Condition, Circuit Breaker and Battle Short Indicator Light Assemblies.
- (1) Removal.
    - (a) Tag and disconnect electrical leads to indicator light assemblies.
    - (b) Remove lens (112, Figure 4-38, sheet 2 of 3). Press in and rotate counterclockwise to remove lamps (113).
    - (c) Remove nuts (114) to remove bases (115), and tooth lockwashers (116) from control cubicle assembly panel (118).
    - (d) Do not remove nuts (117) unless inspection reveals damage and replacement is necessary.
  - (2) Cleaning and Inspection.
    - (a) Clean indicator light assembly with filtered compressed air and a soft bristle brush or wipe with a clean, lint-free cloth lightly moistened with an approved solvent.
    - (b) Visually inspect base for cracks, corrosion, stripped or other wise damaged threads, and evidence of shorting.
    - (c) Inspect lamp for cracked or broken glass, corrosion, and burned out filament.
    - (d) Check lens for cracked or broken glass, cracks, and stripped or otherwise damaged threads.
    - (e) Replace any damaged or defective parts.
  - (3) Installation.

**NOTE**

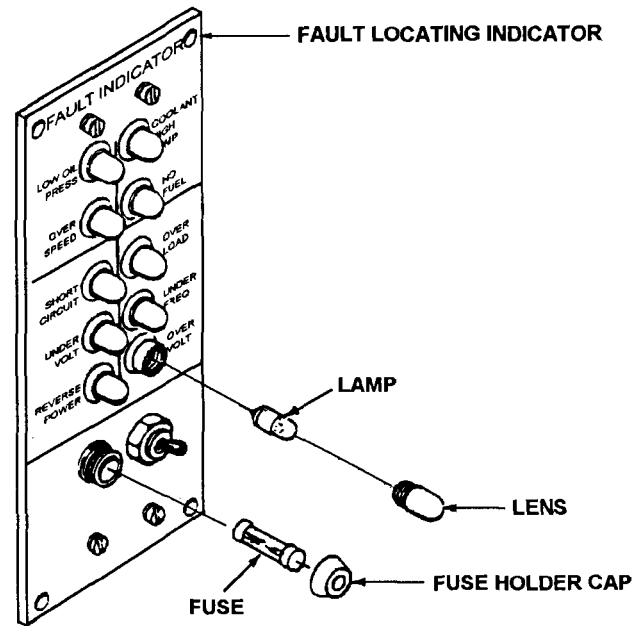
Air cleaner condition and battle short indicator lights have red lens. Circuit breaker indicator light has amber lens.

- (a) If removed, install nuts (117, Figure 4-38, sheet 2 of 3).
  - (b) Install tooth Washers (116), bases (115), and nuts (114) on control cubicle panel assembly (118).
  - (c) Position and rotate lamps (113) clockwise for installation.
  - (d) Install lens (112).
  - (e) Connect electrical leads to indicator light assemblies.
- z. Control Cubical Housing.
- (1) Removal. Remove screw (119, Figure 4-38, sheet 1 of 3), lockwasher (120) to remove housing (121).
  - (2) Cleaning and Inspection.
    - (a) Clean housing with filtered compressed air and wipe with a lint-free cloth lightly moistened with an approved solvent.
    - (b) Visually inspect housing for rust, cracks, corrosion and other damage.
  - (3) Installation. Position housing (121, Figure 4-38, sheet 1 of 3), to install lockwasher (120) and screw (119).

**4-64 FAULT LOCATING INDICATOR.**

- a. Inspection. Inspect fault locating indicator for cracks, corrosion, cracked or broken indicator light lens, missing hardware and other damage.
- b. Testing. Depress test or reset switch and check that all indicator lights are lit.
- c. Lamp Replacement.
  - (1) Unscrew lens (Figure 4-40) and remove lamp.
  - (2) Visually inspect lamp for corrosion, cracked or broken glass, and burned filament.

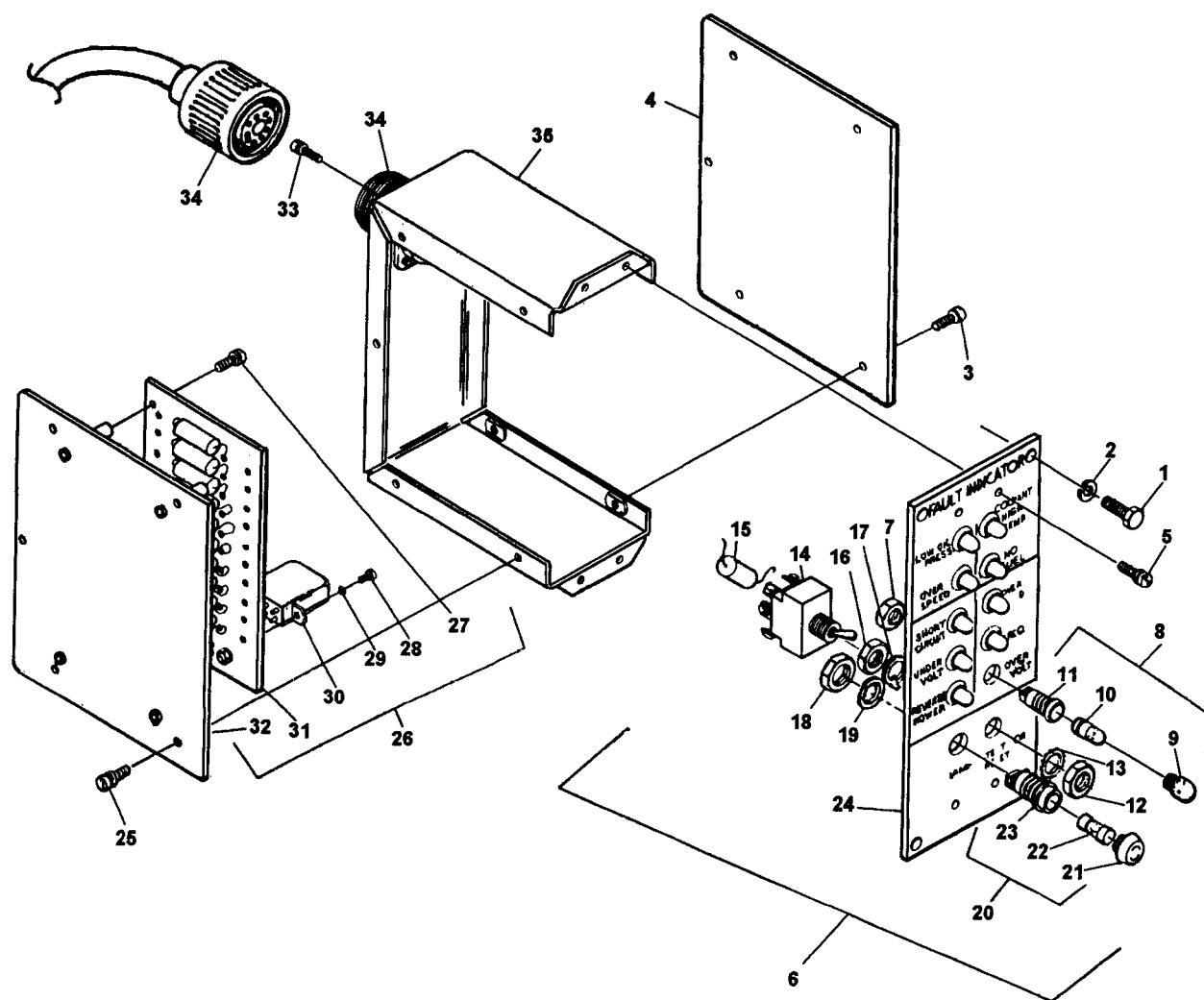




**Figure 4-40. Fault Locating Indicator Lamp and Fuse Replacement**

- (3) Replace lamp if defective.
- (4) Install lamps and lens.
- d. Fuse Replacement.
  - (1) Unscrew cap (Figure 4-40) and remove fuse.
  - (2) Visually inspect fuse for corrosion, cracked or broken glass, and melted conductor.
  - (3) Replace fuse if defective.
  - (4) Install fuse and cap.
- e. Removal.
  - (1) Disconnect wiring harness from back of fault locating indicator.
  - (2) Remove screws (1, Figure 4-41) and lockwashers (2) to remove fault locating indicator from generator set.
- f. Disassembly.
  - (1) Remove screw and captive washer assemblies (3) and cover plate (4).
  - (2) Remove screw and captive washer assemblies (5) and carefully pull indicator panel assembly (6) away from housing. Tag and disconnect electrical leads.
  - (3) Disassemble panel assembly (items 7 through 24) only as is necessary for replacement of damaged or defective components.
  - (4) Remove screw and captive washer assemblies (25) to remove cover plate assembly (26). Tag and disconnect electrical leads.
  - (5) Disassemble cover plate assembly (items 27 through 32) only as is necessary for testing and replacement of components.
  - (6) Remove screw and captive washer assemblies (33) to remove wiring harness (34) from housing (35).
- g. Installation.
  - (1) Install fault locating indicator to generator set with lockwashers (2, Figure 4-41) and screws (1).
  - (2) Connect wiring harness to back of fault locating indicator.





**Figure 4-41. Fault Locating Indicator, Exploded View (Sheet 1 of 2)**



- |                                  |                                   |
|----------------------------------|-----------------------------------|
| 1. Screw                         | 19. Tooth lockwasher              |
| 2. Lockwasher                    | 20. Fuse holder assembly          |
| 3. Screw and captive washer assy | 21. Cap                           |
| 4. Cover plate                   | 22. Fuse                          |
| 5. Screw and captive washer assy | 23. Fuse holder                   |
| 6. Indicator panel assembly      | 24. Panel                         |
| 7. Nut                           | 25. Screw and captive washer assy |
| 8. Indicator light assembly      | 26. Cover plate assy              |
| 9. Lens                          | 27. Screw and captive washer assy |
| 10. Lamp                         | 28. Screw                         |
| 11. Base                         | 29. Lockwasher                    |
| 12. Nut                          | 30. Relay                         |
| 13. Tooth lockwasher             | 31. Component board assembly      |
| 14. Test or reset switch         | 32. Cover plate                   |
| 15. Capacitor                    | 33. screw and captive washer assy |
| 16. Nut                          | 34. Wiring harness                |
| 17. Positioning washer           | 35. Housing                       |
| 18. Nut                          |                                   |

Figure 4-41. Fault Locating Indicator, Exploded View (Sheet 2 of 2)

#### 4-65 MANUAL SPEED CONTROL

- a. Inspection.
  - (1) Inspect manual speed control knob (Figure 4-42) for cracks, beaks, and other damage and condition of boot.
  - (2) Inspect Control cable assembly for corrosion, pinched, frayed, or otherwise damaged cable, pinched or damaged housing, insecure mounting, and stripped or otherwise damaged adjusting threads.
- b. Testing.
  - (1) On precise models of the generator set, the manual speed control must be connected as follows.
    - (a) Push manual speed control all the way in.
    - (b) Insert manual speed control cable through sleeve of fuel injection pump manual throttle control arm (Figure 4-42).
    - (c) Install and tighten adjustment screw.
    - (d) Install lockwire.
  - (2) Check manual speed control for unrestricted movement.
  - (3) Refer to paragraph 2-6 and start the generator set.
  - (4) Use the manual speed control to set generator output frequency.
  - (5) Rotate the control knob 90 degrees. Frequency change shall not exceed 1 percent for a 90 degree rotation (0.6 Hz for 50/60 Hz generator sets and 4 Hz for 400 Hz generator sets).
  - (6) Replace manual speed control if it fails any of the above tests or inspections.



c. Replacement.

(1) Removal.

- (a) Loosen adjustment screw (Figure 4-42) and remove cable from sleeve.
- (b) Remove nut and lockwasher, screw, and clip.
- (c) Remove nut and washer to remove manual speed control cable assembly and grommet.
- (d) Do not remove screws, lockwashers and mounting bracket unless inspection revealed damage.

**NOTE**

See paragraph 4-17 for emergency conversion from tactical precise to tactical utility and for reconfiguration back to tactical precise.

(2) Cleaning.

- (a) Clean all metal manual speed control parts in an approved solvent and dry thoroughly.
- (b) Clean boot on manual speed control knob with soap and water.

(3) Installation.

- (a) If removed, install mounting bracket, (Figure 4-42) lockwashers, and screws.
- (b) Install manual speed control cable assembly, grommet, washer, and nut.
- (c) Install dip, screw, lockwasher, and nut.
- (d) Install cable onto sleeve and tighten adjustment screw.

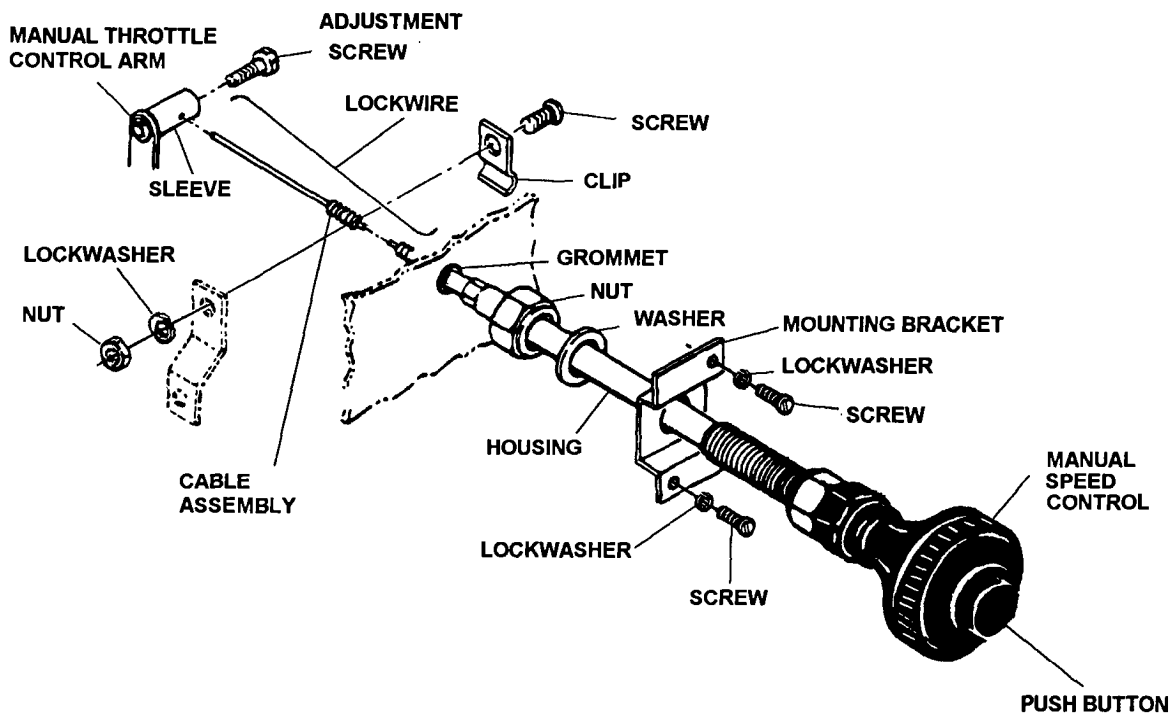


Figure 4-42. Manual Speed Control, Exploded View



#### **4-66 DC CONTROL CIRCUIT BREAKER.**

- a. Removal.
  - (1) Tag and disconnect electrical leads to DC circuit breaker Figure 4-43).
  - (2) Remove mounting nut and tooth lockwasher to remove circuit breaker.
- b. Cleaning and Inspection.
  - (1) Clean DC circuit breaker with filtered compressed air and a soft bristle brush or wipe with a clean, lint-free cloth lightly moistened with an approved solvent.
  - (2) Visually inspect circuit breaker for cracks, corrosion, stripped or damaged threads and evidence of shorting or other damage.
- c. Testing.
  - (1) Using an ohmmeter, check for open circuit across circuit breaker terminals.
  - (2) Depress circuit breaker button and check ohmmeter indication. Ohmmeter shall indicate continuity.
  - (3) Replace circuit breaker if above test requirements are not met.
- d. Installation.
  - (1) Position DC circuit breaker and install tooth lockwasher and mounting nut (Figure 4-43).
  - (2) Connect electrical leads to DC circuit breaker.

#### **4-67 LOAD MEASURING UNIT.**

- a. Removal.
  - (1) Tag and disconnect electrical connector from load measuring unit (Figure 4-44).
  - (2) Remove screws and tooth lockwashers to remove load measuring unit.
- b. Cleaning and Inspection.
  - (1) Clean load measuring unit with filtered compressed air and a soft bristle brush or wipe with a dean, lint-free cloth lightly moistened with an approved solvent.
  - (2) Visually inspect load measuring unit for cracks, dents, corrosion, stripped or damaged threads, bent or broken connector pins, and evidence of shorting or other damage.
  - (3) Replace load measuring unit if damaged or inoperable.
- c. Installation.
  - (1) Position load measuring unit and install tooth lockwashers and screws (Figure 4-44).
  - (2) Connect electrical connector to load measuring unit.



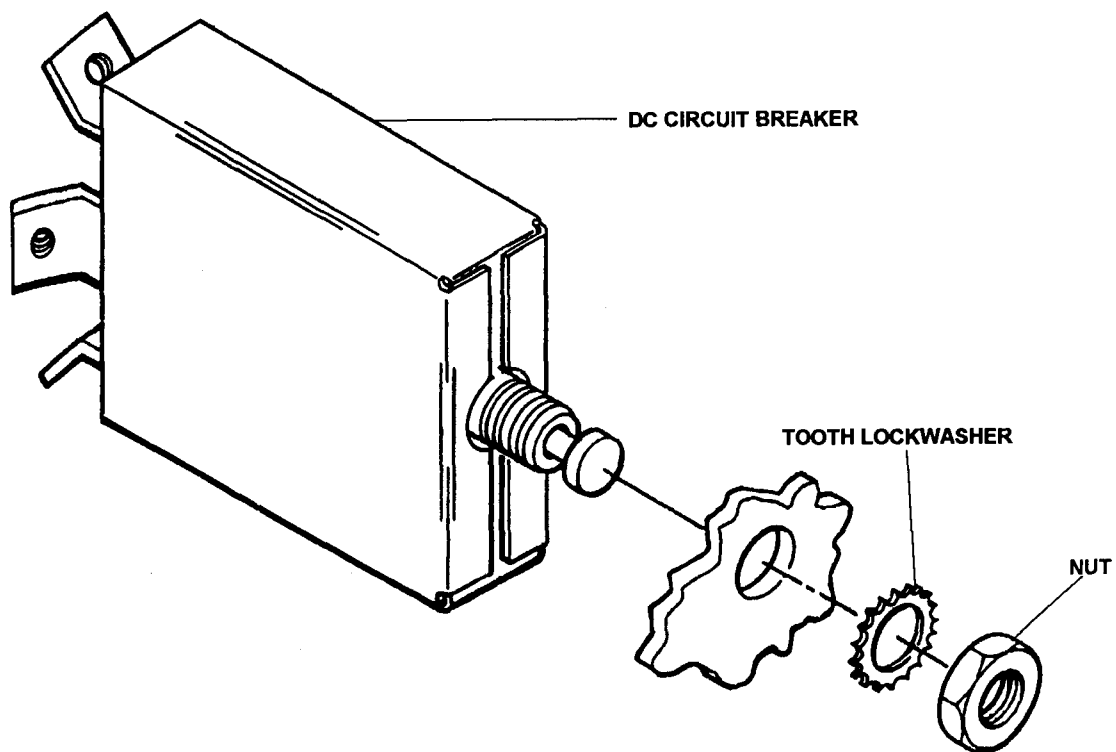


Figure 4-43. DC Circuit Breaker, Removal and Installation

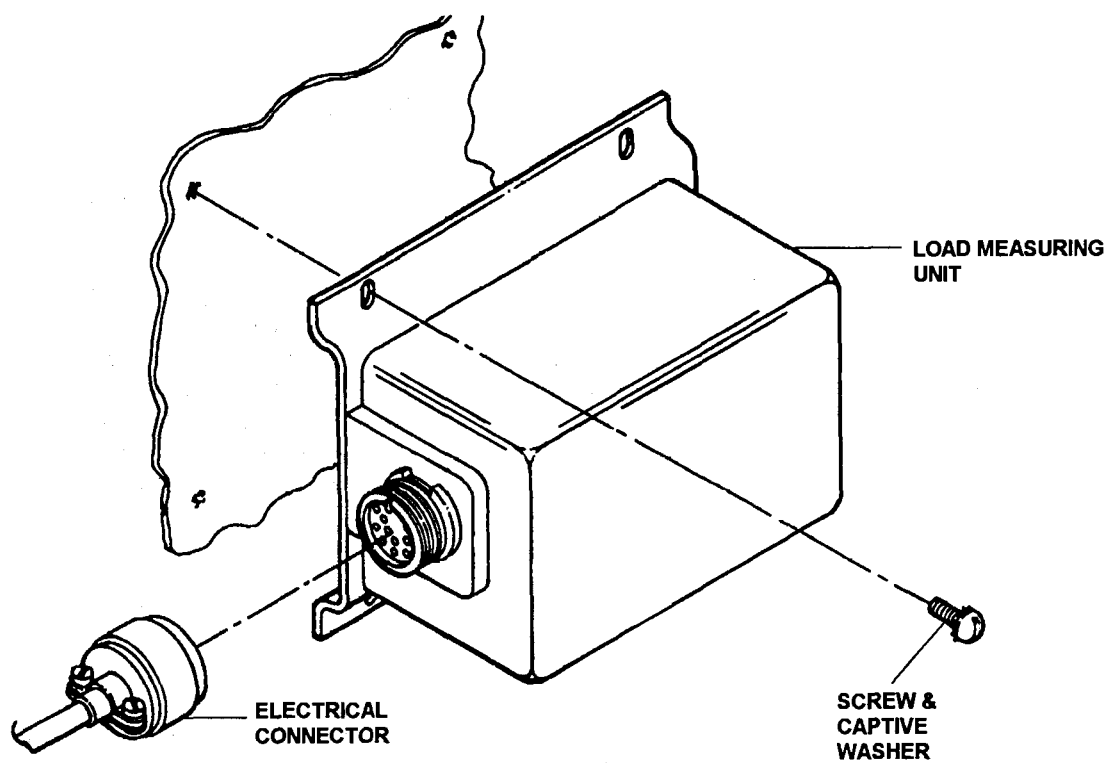


Figure 4-44. Load Measuring Unit, Removal and Installation



**4-68 GOVERNOR CONTROL UNIT (Precise Sets Only).** Inspect governor control unit for cracks, dents, insecure connectors, insecure mounting, and evidence of shorting or other damage.

**4-69 INTERCONNECTING WIRING HARNESSSES.**

- a. Removal. Remove wiring harness terminals, wires, and connectors as required for access to other components and to replace damaged parts.
- b. Cleaning and Inspection.
  - (1) Clean wiring harness with filtered compressed air and an electrician's brush or wipe with a clean, lint-free cloth lightly moistened with an approved solvent.
  - (2) Visually inspect connector for corrosion, cracks, and bent or broken pins.
  - (3) Check electrical leads for burned, bent, corroded, or missing terminals.
  - (4) Check insulation for burns, chafing, and deterioration.
- c. Testing. Test continuity of individual wires with a multimeter using figures FO-1 and FO-2.

**CAUTION**

**Do not use acid core solder on electrical wiring. Equipment damage could result if caution is not observed.**

- d. Repair. Replace wires, terminals, and connectors by unsoldering connections, installing replacement parts and soldering connections.

**NOTE**

If more than 30 percent of the wires are damaged, replace the wiring harness and forward it to higher level maintenance for rebuilding.

- e. Installation. Install connectors, wires, wiring harness terminals after damaged parts are replaced.

**Section XV. UNIT MAINTENANCE OF THE GENERATOR ELECTRICAL SYSTEM**

**4-70 GENERAL.**



**The generator set shall be shut down prior to performing maintenance on the generator electrical system. Serious injury or death by electrocution may result from failure to observe this warning.**

- a. One lead of each of the two coils of each generator phase (15 KW, 50/60 Hz Precise and Utility Sets) is connected directly to the voltage reconnection board. The remaining two leads of each phase make two passes through the windows of a three-window current transformer which serves as a current pickup for generator exciter voltage regulation. A second three-window current transformer serves as a sensor for control cubicle instruments. The leads make four passes through the windows of this transformer. Two leads of one of the phases makes two passes through a single-window crosscurrent transformer which senses current for reactive power measurement. Local voltage sensing and adjustment are accomplished across a single coil of the remaining phase. (See FO-1.)

**NOTE**

On 15 KW, 400 Hz Precise Sets, two leads of one of the phases, instead of being connected directly to the voltage reconnection board, are routed to pass through the window of the cross-current transformer.

- b. The voltage reconnection board consists of a stationary terminal board and a movable link-type board. This arrangement provides a means of connecting the two coils of each phase in series or parallel to provide 120/208 or 240/416 Vac generator output. Simultaneously, the voltage reconnection board provides reconnection of any other circuits necessary to convert the generator set from 120/208 Vac to 240/416 Vac operation.



- c. The reconnection board is connected to the load terminal board through a three pole, three phase main load contactor which is electrically controlled by the circuit breaker switch on the control cubicle panel. The main load contactor will open automatically when any of the protective devices actuates or when the START-RUN-STOP switch on the control cubicle panel is placed in the STOP position.
- d. The generator electrical system also contains a 125 V, 15 amp duplex convenience receptacle which is equipped with a spring-loaded protective cover and protected by a 15-amp circuit breaker.
- e. Generator output voltage is controlled by a solid state type regulator which is adjusted by the voltage adjust rheostat on the control cubicle panel. Voltage sensing maybe local (at the generator set) or from a remote location. The voltage regulator permits parallel operation of genetator sets by cross connection through the paralleling receptacles on the precise generator sets. Utility sets are not interconnected but the dummy plugs must be installed.

#### **NOTE**

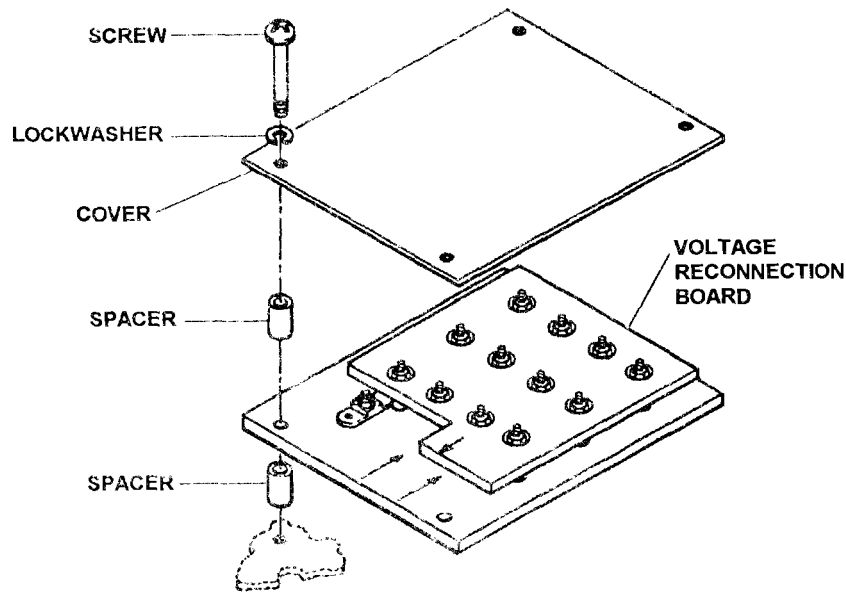
If operating on 240/416 V and remote sensing is required, a 2:1 transformer must be supplied.

- f. The tactical relay box, which is common to all three models, contains relays to shutdown the generator set upon actuation of the overvoltage, short circuit, overloaded, and reverse power protective devices. It also houses the current transformer load resistors.
- g. The special relay box, which is found on all three models of the generator sets, contains the remainder of the protective devices and the voltage regulator paralleling controls.
- h. The precise relay box, which is found only on precise models of the generator set, contains the paralleling controls for the electric govenor and the fixed resistors of the frequency-adjustment system. The precise relay box of the 50/60 Hz precise model is equipped with a frequency selector switch.

#### **4-71 VOLTAGE RECONNECTION BOARD.**

- a. Removal.
  - (1) Remove screws and lockwashers to remove voltage reconnection board and spacers.
  - (2) Tag and disconnect electrical leads to voltage reconnection board assembly (Figure 4-45).
- b. Cleaning and Inspection.
  - (1) Clean reconnection board assembly with filtered compressed air and a soft bristle brush or wipe with a clean, lint-free cloth lightly moistened with an approved solvent.
  - (2) Visually inspect terminal board for burned or corroded terminals and links, cracked or broken insulation, links and terminals, and stripped or otherwise damaged threads.
- c. Testing. Test continuity of reconnection board links with a multimeter or similar device.
- d. Installation.
  - (1) Install voltage reconnection board (Figure 4-45), spacers, lockwashers, and screws.
  - (2) Connect electrical leads to voltage reconnection board assembly.





**Figure 4-45. Voltage Rconnection Board, Removal and Installation**

#### **4-72 MAIN LOAD CONTACTOR**

- a. Inspection. visually inspect Main Load container (Figure 1-5) for insecure mounting, loose electrical connections, cracks, corrosion, and evidence of shorting or other damage.
- b. Testing.
  - (1) Using a multimeter or a continuity light, check for open circuit across terminal studs A1 and A2, B1 and B2, and C1 and C2 (figures FO-1 and FO-2).
  - (2) Check for open circuit across connector pins C and D, E and F, G and H, J and K, and R and T.
  - (3) Check for continuity between connector pins A and B, L and M, N and P, and R and S.
  - (4) Apply 24 Vdc across connector pins A and B while listening for audible indication of actuation.
  - (5) With the actuator coil energized, check for continuity between connector pins C and D, E and F, G and H, J and K, and R and T.
  - (6) Check for open circuit across connector pins L and M, N and P, and R and S.
  - (7) Check for continuity across terminal studs A1 and A2, B1 and B2, and C1 and C2.
  - (8) Disconnect 24 Vdc source from connector pins A and B.
- c. Removal.
  - (1) Remove screws (1, Figure 4-46), lockwashers (2), and flat washers (3) to remove terminal covers (4).
  - (2) Tag and disconnect electrical leads to terminals.
  - (3) Disconnect wiring harness connector from main load contactor connector.
  - (4) Remove nuts (5) and screws (6) to remove main load contactor.
- d. Installation.
  - (1) Install main load contactor and secure with screws (6, Figure 4-46) and nuts (5).
  - (2) Connect wiring harness connector to main load contactor connector.
  - (3) Connect electrical leads to terminals.
  - (4) Install terminal covers (4) and secure with flat washers (3), lockwashers (2) and screws (1).



1. Screw
2. Lockwasher
3. Flat washer
4. Terminal cover
5. Nuts
6. Screws

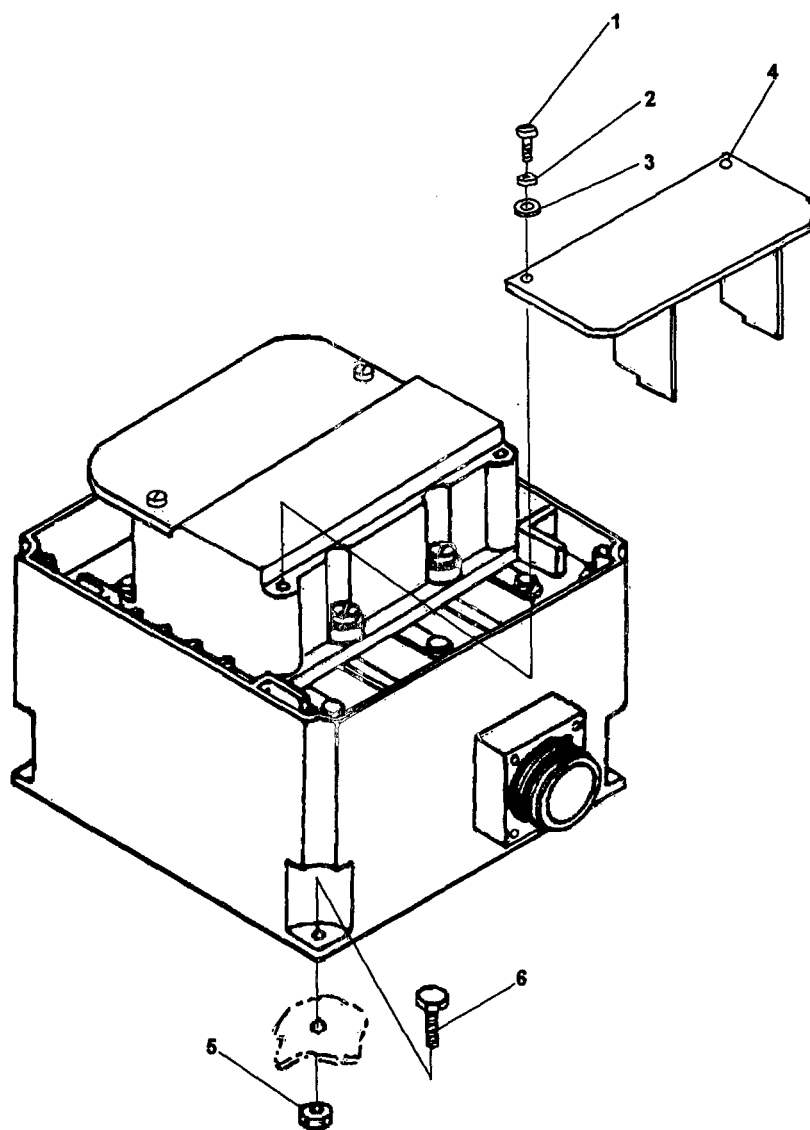


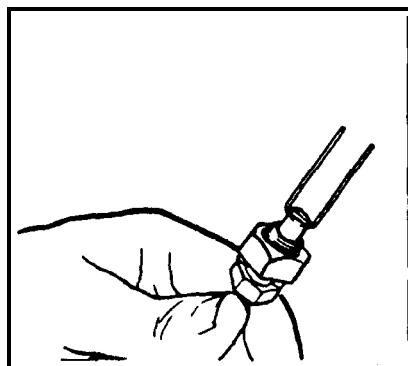
Figure 4-46. Main Load Contactor, Removal



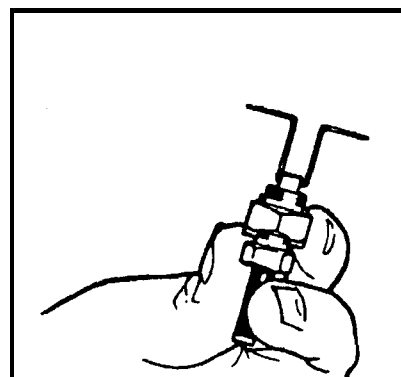
**4-73 CURRENT TRANSFORMER ASSEMBLIES.** Inspect current transformer assemblies (Figure 1-4) for cracks, breaks, corrosion, insecure mounting, loose electrical connections, and evidence of shorting or other damage.

**4-74 LOAD TERMINAL BOARD ASSEMBLY**

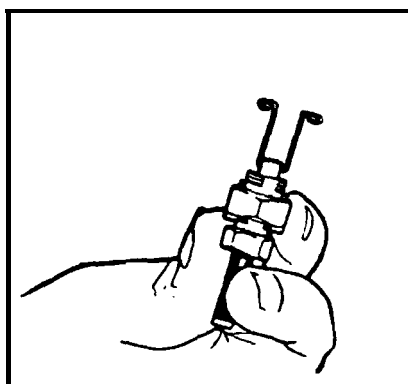
- a. Visually inspect load terminal board assembly (Figure 1 -5) for cracks, breaks, corrosion, burns, insecure mounting, loose electrical connections and other damage.
- b. Replace lost or broken terminal dip (Retainer, Safety Clip). The terminal clip is a component of both the load terminal and the ground terminal. If the terminal dip is lost or broken, fabricate as follows.
  - (1) Requisition bulk wire NSN 9505-00-804-3814 (0.042 inch diameter) for the ground terminal (ground stud). Requisition bulk wire NSN 9505-01-049-0144 (0.050 inch diameter) for the load terminal.
  - (2) Cut off about 3 inches of the wire; short enough to keep the clips from touching another terminal or the generator frame in the open or closed position.
  - (3) Slip the wire through the hole in the terminal.
  - (4) Hold the terminal as shown (Detail A, Figure 4-47) and bend both ends of the wire straight up keeping the wire in as straight a line as you can with the terminal body.
  - (5) Bend the wire into back-to-back 90° angles (Detail B, Figure 4-47) so that the legs of both angles are about one-half inch long.
  - (6) Bend the ends of each 90° angle down around into a U-shape (Detail C, Figure 4-47) so that if done properly, the clip will hold the nut when it is unscrewed to install the cable (Detail D, Figure 4-47).



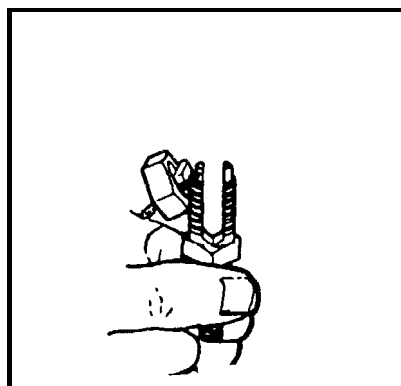
DETAIL A



DETAIL B



DETAIL C



DETAIL D

Figure 4-47. Terminal Clip Replacement



#### **4-75 CONVENIENCE RECEPTACLE AND CIRCUIT BREAKER.**

- a. Removal.
  - (1) Remove screws (1, Figure 4-48) and carefully pull convenience receptacle box out from generator set.
  - (2) Remove screws (2) and carefully pull convenience receptacle and circuit breaker away from box (17).
  - (3) Tag and disconnect electrical leads from convenience receptacle and circuit breaker.
  - (4) Remove nuts (3) and screws (4 and 5) to remove cover (6) and gasket (7).
  - (5) Remove nuts (8) and screws (9) to remove receptacle (10).
  - (6) Remove nut (11) and tooth lockwasher (12) to remove circuit breaker (13) from bracket (14).
  - (7) Remove screw (16) to disconnect wire (15) from circuit breaker (13).
- b. Cleaning and Inspection.
  - (1) Clean convenience receptacle with filtered compressed air and a soft bristle brush or wipe with a clean, lint-free cloth lightly moistened with an approved solvent.
  - (2) Visually inspect convenience receptacle for cracks, breaks, corrosion, bent terminals, burns or other indications of damage.
  - (3) Inspect cover for cracks, corrosion, damaged spring, and damaged or deteriorated gasket.
  - (4) Inspect circuit breaker for cracks, corrosion, and other damage.
  - (5) Using an ohmmeter or similar device, test circuit breaker as follows:
    - (a) Pull out circuit breaker button and check for open circuit across terminals. Ohmmeter shall indicate open circuit.
    - (b) Depress circuit breaker button and check for continuity across terminals. Ohmmeter shall indicate continuity.
  - (6) Check all threads for crossing, stripping and other damage.
  - (7) Replace any defective parts.
- c. Installation.
  - (1) Connect electrical lead (15, Figure 4-48) to circuit breaker (13) and install screw (16).
  - (2) Mount circuit breaker (13) in bracket (14) and secure with tooth lockwasher (12) and nut (11).
  - (3) Install receptacle (10), screws (9) and nuts (8).
  - (4) Install gasket (7), cover (6), screws (5 and 4) and nuts (3).
  - (5) Connect electrical leads to convenience receptacle and circuit breaker.
  - (6) Position bracket (14) in box (17) and secure with screw (2).
  - (7) Attach convenience receptacle box to generator set and secure with screws (1).



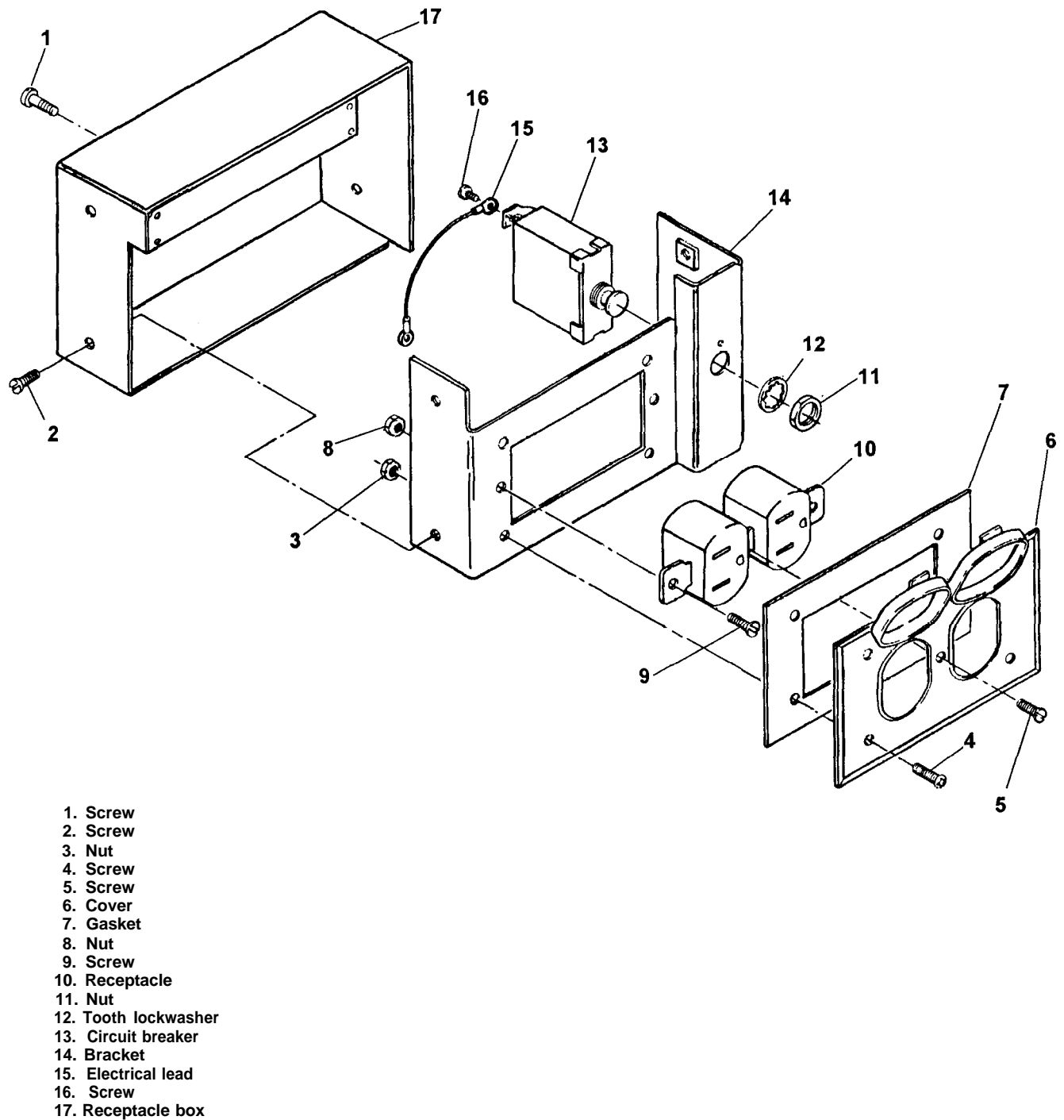


Figure 4-48. Convenience Receptacle and Circuit Breaker, Removal and Installation



#### **4-76 PARALLELING RECEPTACLES.**

- a. Removal.
  - (1) Remove screws and lockwashers (Figure 4-49).
  - (2) Unscrew protective caps and shorting plug from paralleling receptacles.
  - (3) Remove screws and pull paralleling receptacles away from generator set.
  - (4) Tag and unsolder electrical leads to receptacles.
- b. Cleaning and Inspection.
  - (1) Clean paralleling receptacles with filtered compressed air and an electrician's brush or wipe with a clean, lint-free cloth lightly moistened with an approved solvent.
  - (2) Visually inspect paralleling receptacles for cracks, corrosion, stripped or otherwise damaged threads and evidence of shorting or other damage.
  - (3) Visually inspect covers and shorting plug for cracks, corrosion, broken chains, stripped or otherwise damaged threads, and damaged or deteriorated gasket.

#### **CAUTION**

**Do not use acid core solder on electrical components. Equipment damage could result if caution is not observed.**

#### **NOTE**

Use figures FO-1 and FO-2 as a guide for proper connection.

- c. Installation.
  - (1) Solder electrical leads to receptacles.
  - (2) Attach paralleling receptacles to generator set and secure with screws (Figure 4-49).
  - (3) Attach shorting plug to paralleling receptacle and install protective caps.
  - (4) Install lockwashers and screws.

**4-77 TACTICAL RELAY ASSEMBLY.** Visually inspect tactical relay assembly (Figure 1-4) for insecure mounting, cracks, dents, corrosion, bent or broken connector pins and evidence of shorting or other damage.

**4-78 PRECISE RELAY ASSEMBLY (50/60 Hz Precise Sets).** Visually inspect precise relay assembly (Figure 1-4) for insecure mounting, cracks, dents, corrosion, bent or broken connector pins and evidence of shorting or other damage.

**4-79 SPECIAL RELAY ASSEMBLY (50/60 Hz Precise and Utility Sets).** Visually inspect special relay assembly (Figure 1-4) for insecure mounting, cracks, dents, corrosion, bent or broken connector pins, and evidence of shorting or other damage.

**4-80 SPECIAL RELAY ASSEMBLY (400 Hz Precise Sets).** Visually inspect special relay assembly (Figure 1-4) for insecure mounting, cracks, dents, corrosion, bent or broken connector pins, and evidence of shorting or other damage.

**4-81 PRECISE RELAY ASSEMBLY (400 Hz Precise Sets).** Visually inspect 400 Hz relay assembly (Figure 1-4) for insecure mounting, cracks, dents, corrosion, bent or broken connector pins, and evidence of shorting or other damage.



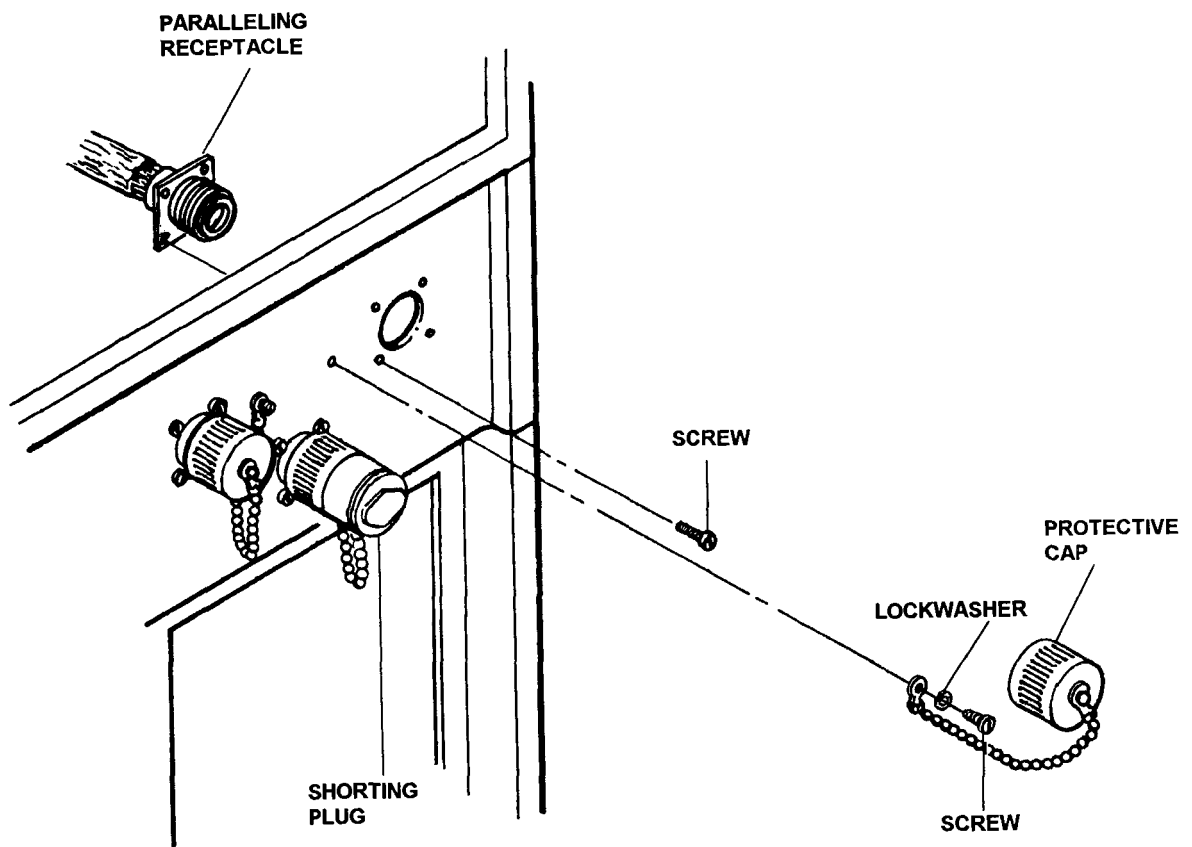


Figure 4-49. Paralleling Receptacles, Removal and Installation



## Section XVI. UNIT MAINTENANCE OF THE GENERATOR ASSEMBLY

**4-82 GENERAL.** Electrical power is generated by a single bearing, synchronous, brushless, self-ventilated generator assembly with an integral exciter assembly. Unit maintenance of the generator assembly is limited to visual inspection of the generator and the generator bearing.

### **4-83 UNIT MAINTENANCE INSPECTION OF GENERATOR ASSEMBLY**

- a. Visually inspect generator assembly for insecure mounting, cracks, corrosion, accumulations of foreign material in ventilator screens and other damage.
- b. Listen for unusual noises while operating.
- c. Notify higher level maintenance of any discrepancies found during inspection.

## Section XVII. UNIT MAINTENANCE OF THE HOUSING AND SKID BASE ASSEMBLIES

**4-84 GENERAL.** The housing assembly fully encloses the top, sides and ends of the generator set. It consists of doors, covers, and panels. The cooling air intake openings which provide access to internal components are covered by doors which are equipped with seals to prevent the entry of foreign materials when the doors are dosed. The cooling air exhaust opening is covered by the shutter and grille assemblies (paragraphs 4-36 and 4-37). The plate and sleeve assembly allows connection of load lines while excluding foreign materials. The lifting frame, located in the center of the housing assembly, is equipped with lifting clevises at the top of each side to which a hoisting sling may be attached. The housing assembly is supported on the skid base assembly which also provides support for the engine and generator assemblies. The skid base also provides the generator set grounding point and is drilled to accept attachment of the wheel mounting kit and M-200 trailer. A metal sheet near the bottom of the skid base prevents the entry of debris. Drain holes prevent the accumulation of spilled liquids on the sheet.

### **4-85 DOORS, COVERS, AND PANELS.**

#### **NOTE**

It is not necessary to completely disassemble the housing assembly. Only those parts requiring replacement need be removed.

#### **NOTE**

A wiring harness support damp on the underside of the top rear cover (88, Figure 4-50) must be removed before attempting to remove the cover.

- a. Removal.
  - (1) Remove grille, radiator and shutter assembly (paragraphs 4-36 through 4-39).
  - (2) Remove convenience receptacle and circuit breaker (paragraph 4-75).
  - (3) Remove paralleling receptacles (paragraph 4-76).
  - (4) Remove doors, covers and panels by following the ascending numerical sequence of index numbers (1 through 106) assigned to Figure 4-50.
- b. Installation.
  - (1) Install doors, covers, and panels by following the descending numerical sequence of index numbers (106 through 1) assigned to Figure 4-50.
  - (2) Install paralleling receptacles (paragraph 4-76).
  - (3) Install convenience receptacle and circuit breaker (paragraph 4-75).
  - (4) Install grille, radiator and shutter assembly (paragraphs 4-36 through 4-39).



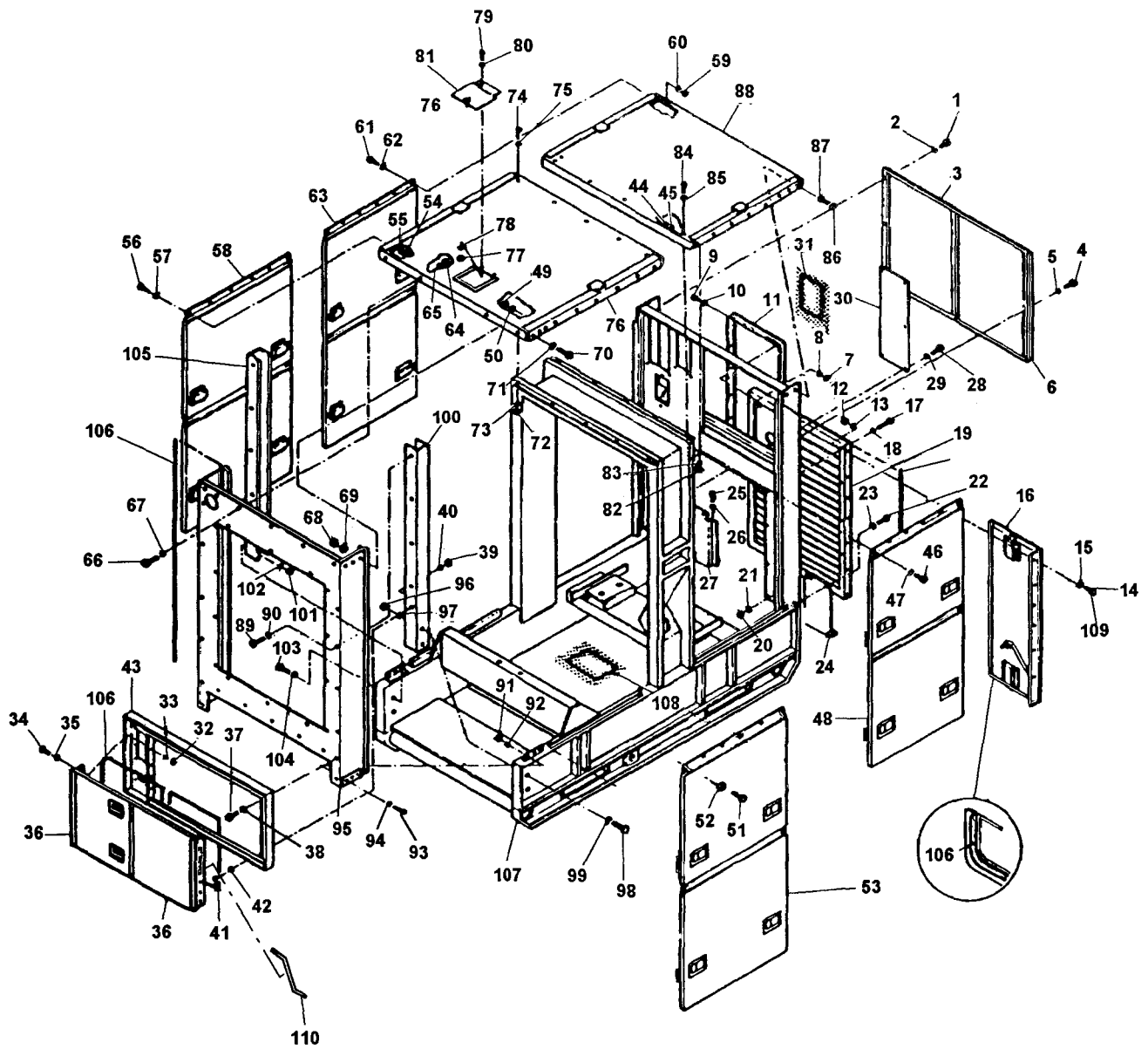


Figure 4-50. Housing Assembly, Exploded View (Sheet 1 of 2)



- |                                     |                                      |
|-------------------------------------|--------------------------------------|
| 1. Screw                            | 56. Screw                            |
| 2. Lockwasher                       | 57. Flat washer                      |
| 3. Right control cubicle door       | 58. Right engine compartment door    |
| 4. s c r e w                        | 59. Nut                              |
| 5. Lockwasher                       | 60. Lockwasher                       |
| 6. Left control cubicle door        | 61. Screw                            |
| 7. Nut                              | 62. Flat washer                      |
| 8. Flat washer                      | 63. Right generator compartment door |
| 9. Screw                            | 64. Nut                              |
| 10. Lockwasher                      | 65. Lockwasher                       |
| 11. Right ventilation door          | 66. Screw                            |
| 12. Nut                             | 67. Flat washer                      |
| 13. Flat washer                     | 68. Nut                              |
| 14. Screw                           | 69. Lockwasher                       |
| 15. Lockwasher                      | 70. Screw                            |
| 16. Left ventilation door           | 71. Flat washer                      |
| 17. Screw                           | 72. Nut                              |
| 18. Lockwasher                      | 73. Lockwasher                       |
| 19. Ventilation louver panel        | 74. Screw                            |
| 20. Nut                             | 75. Flat washer                      |
| 21. Flat washer                     | 76. Top front cover                  |
| 22. Screw                           | 77. Nut                              |
| 23. Lockwasher                      | 78. Lockwasher                       |
| 24. Cover panel                     | 79. Screw                            |
| 25. Screw                           | 80. Flat washer                      |
| 26. Lockwasher                      | 81. Radiator tiller access door      |
| 27. Cover panel                     | 82. Nut                              |
| 28. Screw                           | 83. Lockwasher                       |
| 29. Lockwasher                      | 84. Screw                            |
| 30. Cover panel                     | 85. Flat washer                      |
| 31. Cover plate                     | 86. Screw                            |
| 32. Nut                             | 87. Lockwasher                       |
| 33. Lockwasher                      | 88. Top rear cover                   |
| 34. Screw                           | 89. Screw                            |
| 35. Flat washer                     | 90. Lockwasher                       |
| 36. Battery compartment door        | 91. Nut                              |
| 37. Screw                           | 92. Lockwasher                       |
| 38. Lockwasher                      | 93. Screw                            |
| 39. Nut                             | 94. Flat washer                      |
| 40. Lockwasher                      | 95. Front housing                    |
| 41. Screw                           | 96. Nut                              |
| 42. Flat washer                     | 97. Lockwasher                       |
| 43. Battery door frame              | 98. Screw                            |
| 44. Nut                             | 99. Flat washer                      |
| 45. Lockwasher                      | 100. Left housing support            |
| 46. Screw                           | 101. Nut                             |
| 47. Flat washer                     | 102. Lockwasher                      |
| 48. Left generator compartment door | 103. Screw                           |
| 49. Nut                             | 104. Flat washer                     |
| 50. Lockwasher                      | 105. Right housing support           |
| 51. Screw                           | 106. Door seal (all doors)           |
| 52. Flat washer                     | 107. Skid base                       |
| 53. Left engine compartment door    | 108. Cover plate                     |
| 54. Nut                             | 109. Screw                           |
| 55. Lockwasher                      | 110. Rod                             |

Figure 4-50. Housing Assembly, Exploded View (Sheet 2 of 2)



#### **4-86 PLATE AND SLEEVE ASSEMBLY.**

- a. Removal and Disassembly.
  - (1) Remove screws (1, Figure 4-51) and Lockwashers (2) to remove plate and sleeve assembly.
  - (2) Remove ring (3) and bushing (4); then remove nuts (5), screws (6) and retainer (7) to remove sleeve (8) with draw string (9) from plate (10).
- b. Cleaning and Inspection.
  - (1) Clean plate and sleeve assembly with a dean, lint free cloth lightly moistened with an approved solvent.
  - (2) Visually inspect plate for cracks, dents, illegible markings, defective paint, ant other damage.
  - (3) Inspect weather sleeve for cracks, deterioration, broken or missing drawstring, and other damage.
  - (4) Check threaded parts for stripped or damaged threads.
- c. Installation.
  - (1) Install plate (10, Figure 4-51) with drawstring (9), sleeve (8), retainer (7), screws (6), nuts (5), bushings (4), and ring (3).
  - (2) Install plate and sleeve assembly with lockwashers (2), and screws (1).

**4-87 LIFTING FRAME.** Visually inspect lifting frame (Figure 1-4) for cracks, corrosion, damaged or missing lifting Clevis, insecure mounting hardware, and other damage.

#### **4-88 SKID BASE ASSEMBLY.**

- a. Visually inspect skid base assembly (Figure 1-4) for cracks, corrosion, and other damage.
- b. Check that bottom sheet drain holes are open.
- c. Inspect ground stud for stripped or otherwise damaged threads, corrosion, and other damage. Replace lost or broken terminal dip (Retainer, Safety Clip). For fabrication procedure, see Chapter 4, Section XVI Unit Maintenance of the Generator Electrical System, paragraph 4-74 Load Terminal Board Assembly.
- d. Inspect fuel tank for insecure mounting, cracks, leaks, and other damage.
- e. Check that fuel tank and engine crankcase drains are securely installed and not leaking.
- f. Test fuel level sensor as follows:
  - (1) Drain fuel tank assembly (paragraph 4-37).
  - (2) Disconnect electrical connector from fuel level sensor.
  - (3) Connect an ohmmeter or similar device between fuel level sensor casing and connector pin. Ohmmeter shall indicate 0.0 to 1.0 ohms resistance.
  - (4) Fill fuel tank with proper grade of fuel (paragraph 4-37).
  - (5) Ohmmeter shall indicate  $27 \pm 2$  ohms resistance.
  - (6) Replace fuel level sensor if it fails to meet test requirements.
- g. Replace fuel level sensor as follows:
  - (1) Drain fuel tank assembly (paragraph 4-37).
  - (2) Disconnect electrical connector from fuel level sensor.
  - (3) Remove 5 attaching screws to remove fuel level sensor and gasket from fuel tank.
  - (4) Install replacement fuel level sensor and gasket and secure with 5 attaching screws.
  - (5) Connect electrical connector to fuel level sensor.
  - (6) Service fuel tank with proper grade of fuel (paragraph 4-37).



1. Screw
2. Lockwasher
3. Ring
4. Bushing
5. Nut
6. Screw
7. Retainer
8. Sleeve
9. Draw string
10. Plate

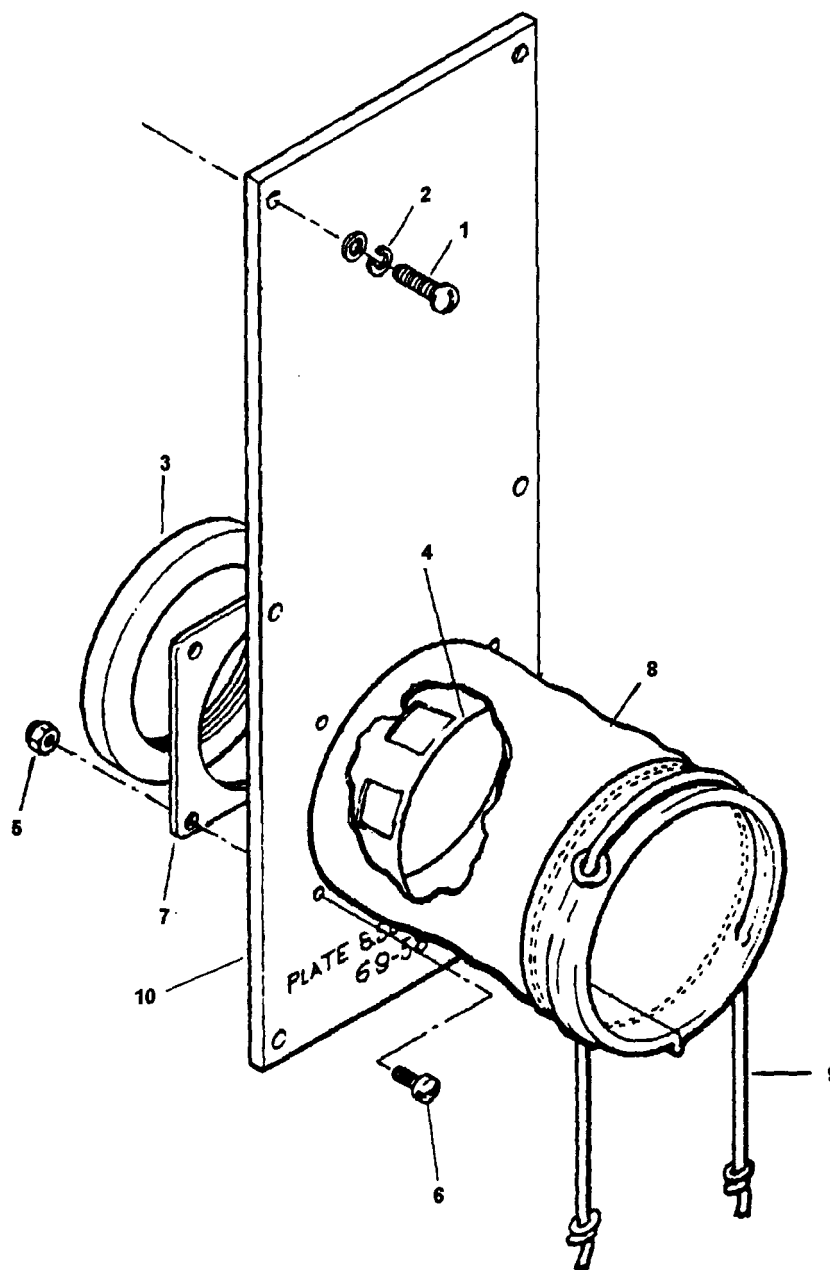


Figure 4-51. Plate and Sleeve Assembly, Exploded View



## Section XVIII. TOOL STOWAGE BOX

**4-89 GENERAL.** A tool stowage box is provided on the left side of the generator set (Figure 1 -5). The generator access door must be opened to gain access to the tool box. The dimensions of the tool box are 15.25" x 10.43" x 6.12". The tool box has a hinged cover that is held in the closed position by a single draw-pull fastener.

- a. Removal. Remove the hex nuts (1, Figure 4-52), lockwashers (2) and capscrews (3) to remove the tool box.
- b. Inspection and Cleaning.
  - (1) Inspect the tool box for damaged hinge or fastener, dents, corrosion, and deterioration of finish.
  - (2) Clean the tool box with an approved solvent and dry thoroughly.
- c. Installation. Install the tool box with capscrews (3, Figure 4-52), lockwashers (2), and hex nuts (1).

1. Nut
2. Lockwasher
3. Capscrew

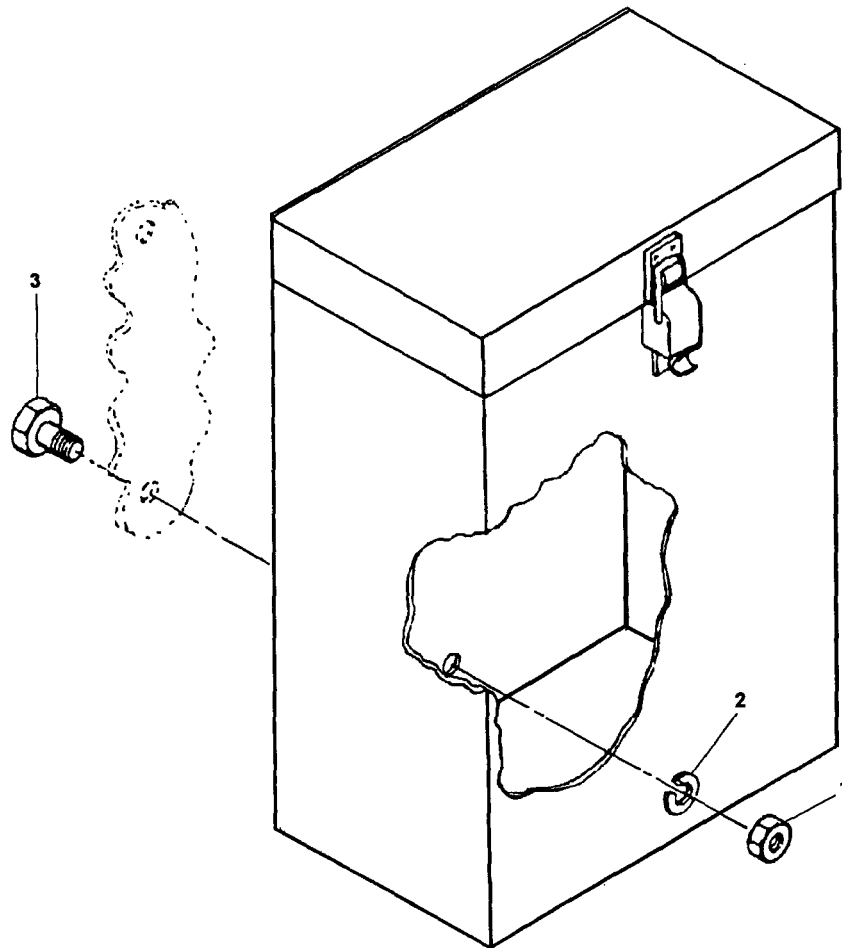


Figure 4-52. Tool Stowage Box



## Section XIX. AUXILIARY FUEL LINE

**4-90 GENERAL.** The auxiliary fuel line is a 25 foot, flexible, heat and oil resistant hose. It is used to connect the generator set to an auxiliary fuel supply. By connecting the auxiliary fuel line to the auxiliary fuel supply, the generator set may serve as a fuel source.

### 4-91 REPAIR OF AUXILIARY FUEL LINE.

- a. Remove adapter, captive chain and fittings from hose (Figure 4-53).
- b. Clean all parts in an approved solvent and dry thoroughly.
- c. Visually inspect hose for cuts, deterioration, and other damage.
- d. Check all threaded parts for stripped or otherwise damaged threads.
- e. Replace any parts found damaged.
- f. Reinstall adapter, captive chain and fittings.

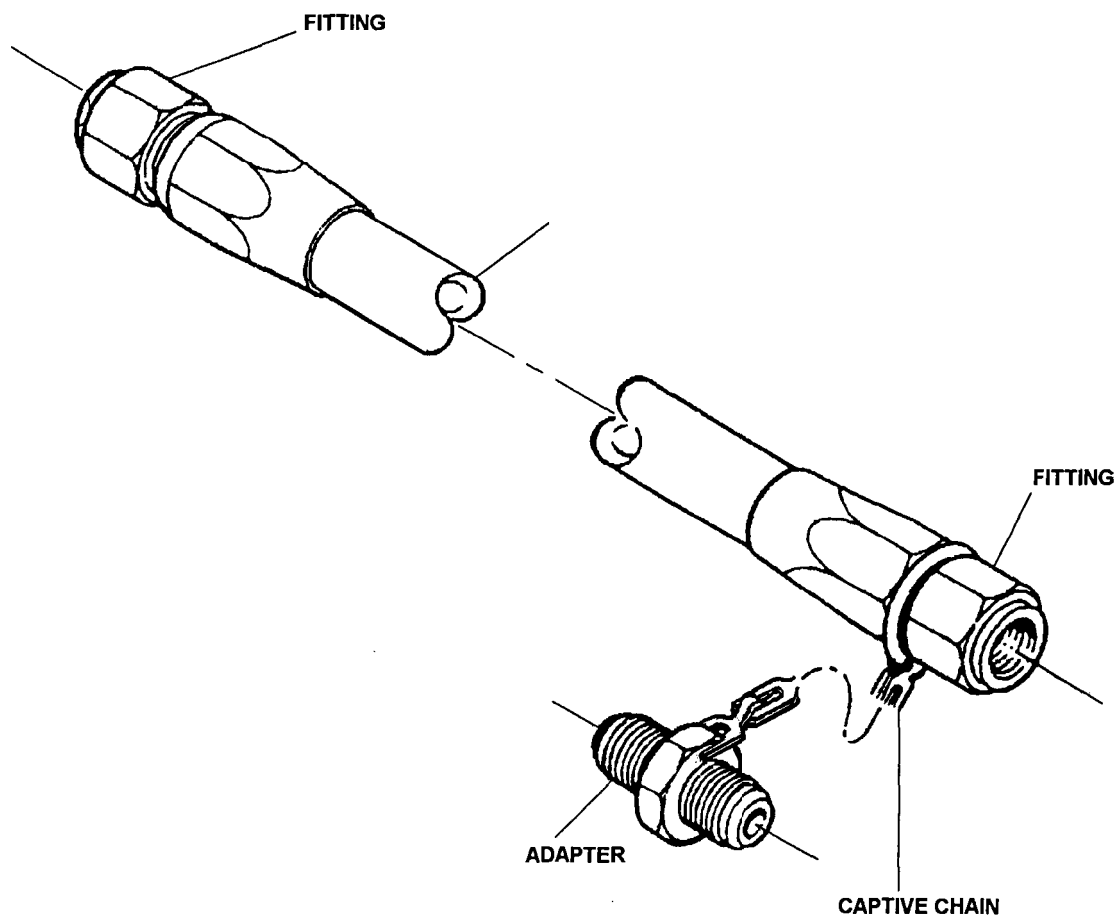


Figure 4-53. Repair of Auxiliary Fuel Line



## Section XX. PARALLELING CABLE

**4-92 GENERAL.** The paralleling cable is a 25 foot, four conductor, flexible, heat and oil resistant cable. It is used to interconnect governor and voltage paralleling circuits of generator sets operating in parallel (precise sets only).

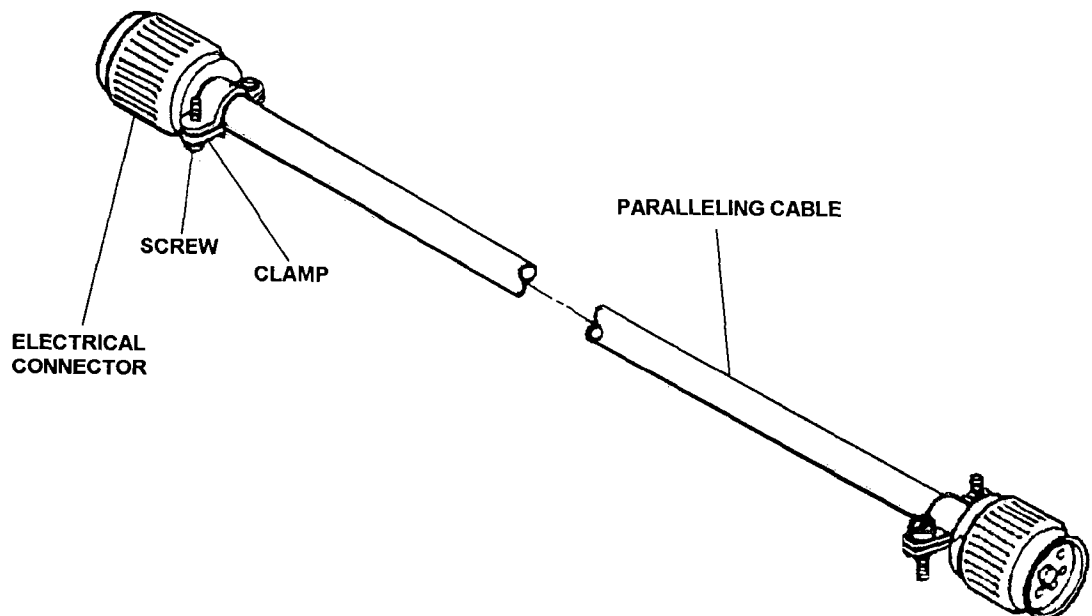
### **4-93 MAINTENANCE OF PARALLELING CABLE.**

- a. Cleaning and Inspection.
  - (1) Clean paralleling cable (Figure 4-54) with filtered compressed air and an electrician's brush or wipe with a clean, lint-free cloth lightly moistened with an approved solvent.
  - (2) Visually inspect paralleling cable for chafing, deterioration, and other damage.
  - (3) Check electrical connectors for bent or broken pins, stripped or damaged threads, cracks, corrosion and other damage.
- b. Testing.
  - (1) Test individual wires for continuity with an ohmmeter or continuity light.
  - (2) Check between pins of each terminal for short circuits.

### **CAUTION**

**Do not use acid core solder on electrical wiring. Equipment damage could result if caution is not observed.**

- c. Repair. Replace damaged wires or connectors as follows:
  - (1) Loosen saddle clamp screws (Figure 4-54).
  - (2) Tag wires and unsolder connections.
  - (3) Install replacement parts and solder connections.
  - (4) Lighten saddle clamp screws.



**Figure 4-54. Repair of Paralleling Cable**







## Chapter 5

### MATERIAL USED IN CONJUNCTION WITH THE GENERATOR SET

---

#### Section I. General

**5-1 SCOPE.** This chapter contains instructions for operator and unit maintenance of material used in conjunction with the generator set.

**5-2 SERVICE UPON RECEIPT OF MATERIAL.** The following services shall be performed upon receipt of material used in conjunction with the generator set.

- a. Remove the equipment from shipping container.
- b. Check to see that all components are present.
- c. Remove corrosion preventive compounds with an approved cleaning solvent.
- d. Visually inspect all components for damage which may have occurred during shipment and missing parts.
- e. Check all wiring for damage and loose connections.

#### Section II. FUEL BURNING WINTERIZATION KIT

**5-3 GENERAL.** The Fuel burning winterization kit is used to preheat the engine coolant and lubricating oil when ambient temperature is between -25°F (-31.7°C) and -65°F (-53.9°C). It consists of a heater coolant pump, coolant circulating lines, fuel line, electrical controls, wiring harness, and mounting hardware. The heater burn fuel from the generator set fuel tank to heat coolant from the engine block. The heated coolant is pumped through the heat exchanger in the engine oil pan, through the cylinder block and returned to the engine block.

#### 5-4 FUEL BURNING WINTERIZATION KIT INSTALLATION AND REPLACEMENT

- a. Installation.

#### CAUTION

**Disconnect negative battery cable before installing fuel burning winterization kit. Equipment damage could result if caution is not observed.**

#### NOTE

If generator set is equipped with an electric winterization kit, refer to paragraph 5-10 or installation of components which must be provided to accommodate both kits.

- (1) Refer to paragraph 5-7 and remove heater assembly protective cover (43, Figure 5-1).
- (2) Refer to paragraph 5-7 and remove heater assembly protective cover (43, Figure 5-1).
- (3) Remove "WATER" plug (44, Figure 5-1) from center, right-rear of engine cylinder block (use impact wrench if necessary).
- (4) Remove plug (45) from right side of engine water pump assembly.
- (5) Remove "WATER" plug (44) from center, left-rear of engine cylinder block.
- (6) Remove plugs (46 and 47) from engine oil pan heat exchanger.
- (7) Remove plate (48) located in skid base directly below heater mounting space.
- (8) Remove protective cap (49) from special relay assembly connector J7 (figures FO-1 and FO-2).
- (9) Remove cover (50) from heater control assembly mounting hole located to the right of the control cubicle assembly.

#### NOTE

Retain cover and attaching hardware. It is used to install heater control assembly.



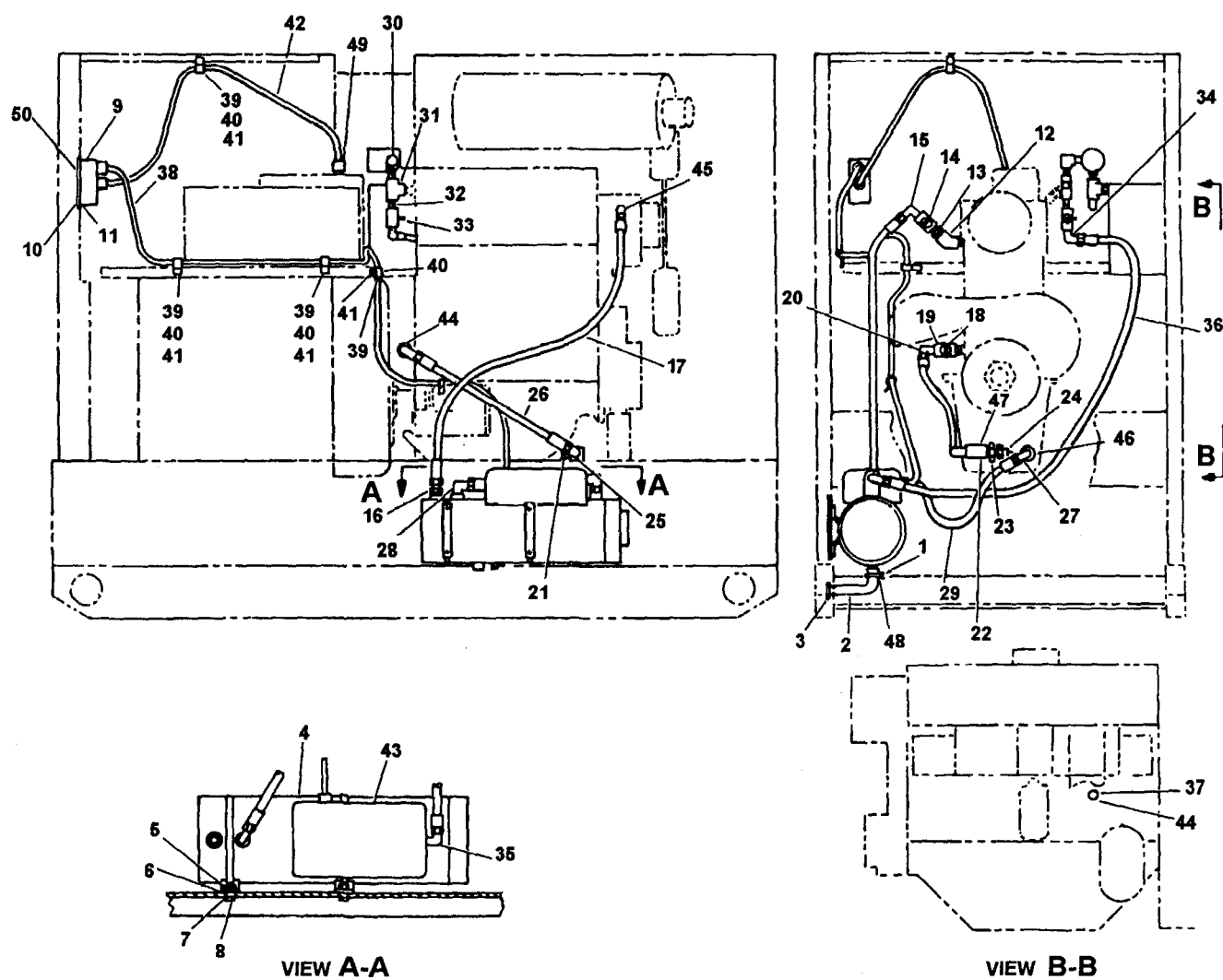


Figure 5-1. Fuel Burning Winterization Kit Installation (Sheet 1 of 2)



- |                                     |                                     |
|-------------------------------------|-------------------------------------|
| 1. clamp                            | 26. Coolant hose assembly           |
| 2. Exhaust pipe                     | 27. Elbow                           |
| 3. Rain cap                         | 28. Elbow                           |
| 4. Heater assembly                  | 29. Coolant hose assembly           |
| 5. Screw                            | 30. Street elbow                    |
| 6. Flat washer                      | 31. Tee                             |
| 7. Lockwasher                       | 32. Pipe nipple                     |
| 6. Nut                              | 33. Valve                           |
| 9. Heater control assembly          | 34. Elbow                           |
| 10. Screw & captive washer assembly | 35. Elbow                           |
| 11. Nut                             | 36. Fuel hose assembly              |
| 12. Elbow, 45 degree                | 37. Thermostat switch               |
| 13. Adapter                         | 38. Wiring harness                  |
| 14. Valve                           | 39. Clamp                           |
| 15. Elbow                           | 40. Screw & captive washer assembly |
| 16. Adapter                         | 41. Nut                             |
| 17. Coolant hose assembly           | 42. Wiring harness                  |
| 18. Pipe nipple                     | 43. Protective cover                |
| 19. Valve                           | 44. Plug "WATER"                    |
| 20. Elbow                           | 45. Plug                            |
| 21. Pipe nipple                     | 46. Plug                            |
| 22. Tee                             | 47. Plug                            |
| 23. Adapter                         | 48. Plug                            |
| 24. Pressure relief valve           | 49. Cap                             |
| 25. Elbow                           | 50. Cover                           |

**Figure 5-1. Fuel Burning Winterization Kit Installation (Sheet 2 of 2)**

- (10) Disconnect fuel line and remove elbow from fuel solenoid valve (paragraph 4-24).
- (11) Install fuel burning winterization kit following the ascending sequence of index numbers (1 through 50) assigned to Figure 5-1.

**NOTE**

Run wiring harnesses through existing clamps (39) as shown.

- (12) Install elbow removed in step (10) above and connect fuel line.
- (13) Fill cooling system with proper coolant (paragraph 3-27).
- (14) Install heater assembly protective cover (paragraph 5-7).
- (15) Loosen coolant hose (17, Figure 5-1) at water pump assembly and open valve (19) to bleed air from heater assembly and coolant lines.
- (16) Tighten coolant line and close valve.
- (17) Add coolant to radiator as necessary.
- b. Replacement.
  - (1) Removal.
    - (a) Refer to paragraph 3-27 and drain the engine cooling system.
    - (b) Remove fuel burning winterization kit in reverse order of steps (2) through (14) in paragraph 5-4a. above.
    - (c) Refer to paragraph 3-27 and service the engine cooling system with the proper coolant.
  - (2) Installation. Refer to paragraph 5-4a. above for installation procedures.



## **5-5 PREVENTIVE MAINTENANCE CHECKS AND SERVICES.**

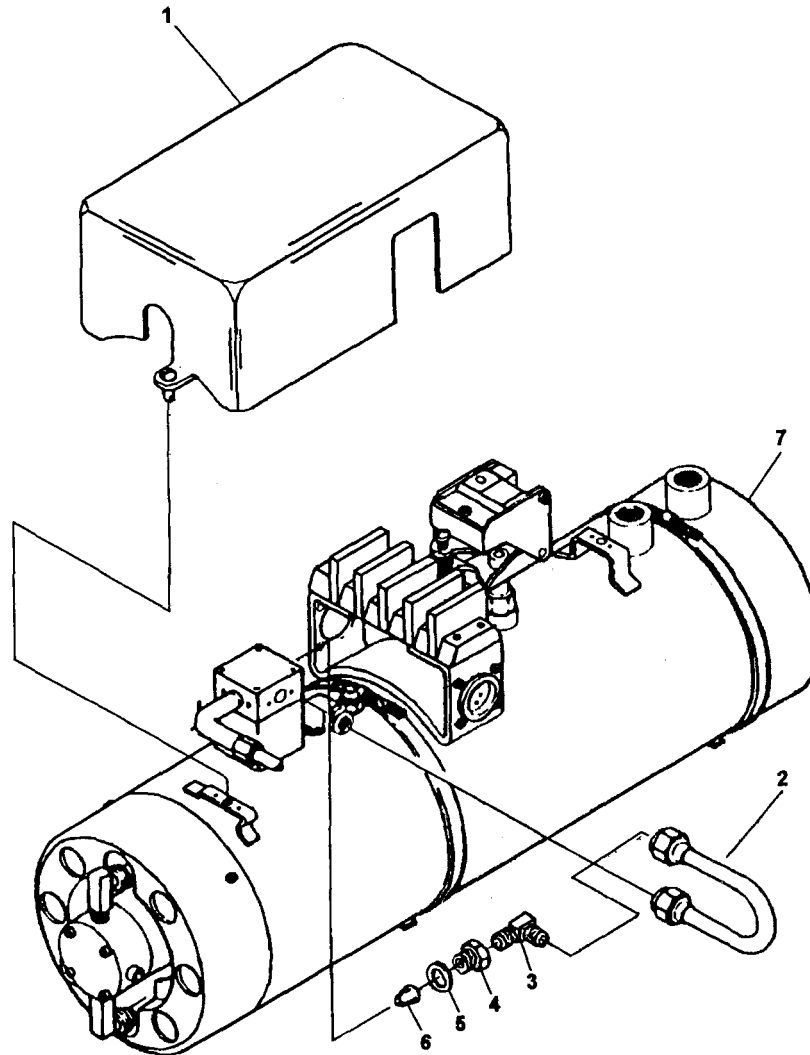
- a. General. To insure that the fuel burning winterization kit is ready for operation at all times, it must be systematically inspected in order that defects be discovered and corrected before serious damage or failure of the equipment results. Defects discovered during operation shall be noted for correction as soon as operation ceases. Operation shall be ceased immediately if a defect which may cause damage to the equipment is noted. All defects and shortcomings shall be recorded, together with the corrective action taken on the applied forms at the earliest opportunity. Army and Navy users shall accomplish the necessary preventive maintenance services listed and described in subparagraph b. below. Air Force users shall refer to the applicable inspection manual and work card sets in the T.O. 35C2-3 Series for periodic requirements and Table 5-1, Table 5-2 for detailed procedures.
- b. Preventive Maintenance Checks and Services (Army and Navy).
  - (1) Operator. Table 5-1 contains a tabulated listing of preventive maintenance checks and services which shall be performed before, during, and after operation and the weekly check and services to be performed by the operator. The item numbers are listed consecutively and indicate the sequence of minimum requirements. Refer to Table 5-1 for checks and services.
  - (2) Unit Maintenance. Table 5-2 also contains a tabulated listing of preventive maintenance checks and services which shall be performed by unit maintenance personnel at monthly and semi-annual intervals. The item numbers are listed consecutively and indicate the sequence of minimum requirements. Refer to Table 5-2 for checks and services.

**5-6 TROUBLESHOOTING.** Table 5-3 and Table 5-4 contains a list of malfunctions which is useful in diagnosing and correcting unsatisfactory operation or failure of the fuel burning winterization kit. Each malfunction is followed by an alphabetical listing of probable causes of the malfunction. The corresponding indented listing of corrective actions contains references to applicable maintenance paragraphs for correcting the malfunction. The tables list only those malfunctions, tests, or malfunctions and corrective actions which are within the scope of unit and operator maintenance. Any malfunction whose corrective action is beyond the scope of unit and operator maintenance shall be reported to higher level maintenance.

## **5-7 OPERATOR INSPECTION AND SERVICE OF FUEL BURNING WINTERIZATION KIT.**

- a. Inspection.
  - (1) Visually inspect heater assembly (4, Figure 5-1) for insecure mounting, dents, cracks, corrosion, and other damage.
  - (2) Inspect fuel lines for cracks, breaks, loose connections and support clamps and other damage.
  - (3) Inspect electrical wiring for loose terminals or connectors, burned or frayed insulation, loose support dampers and other damage.
  - (4) Check coolant lines for loose connections, leaks, deterioration, and other damage.
- b. Service.
  - (1) Loosen fasteners and remove protective cover (1, Figure 5-2).
  - (2) Disconnect burner fuel line (2) and remove metering orifice assembly (3).
  - (3) Remove filter body (4) with gasket (5) and sintered filter (6) from heater assembly (7).
  - (4) Unscrew sintered filter (6) from filter body (4). Discard gasket (5).
  - (5) Clean metering orifice assembly, screen, and sintered filter in an approved solvent and dry with filtered compressed air.
  - (6) Hold orifice up to a light and check to make sure its pin hole is unobstructed.
  - (7) Screw sintered filter (6) into filter body (4) and install with new gasket (5) into heater assembly.





- 1. Protective cover
- 2. Burner fuel line
- 3. Metering orifice assembly
- 4. Filter body
- 5. Gasket
- 6. Sintered fitter
- 7. Heater assembly

**Figure 5-2. Fuel Burning Winterization Kit Heater Assembly, Inspection and Service**

**CAUTION**

Use extreme care when installing the orifice assembly. Its pin hole can easily be dogged by any small particle of foreign matter. Equipment damage could result if caution is not observed.

- (8) Install orifice assembly (3) and connect burner fuel line (2).
- (9) Install protective cover (1) and tighten its fasteners.



## 5-8 UNIT MAINTENANCE OF FUEL BURNING WINTERIZATION KIT, HEATER CONTROL.

### a. Heater Control Assembly.

#### (1) Removal

- (a) Removal screws (Figure 5-3) and washers.
- (b) Pull control assembly out from generator set and disconnect electrical connectors.

#### (2) Cleaning and Inspection.

- (a) Clean heater control assembly with filtered compressed air and an electrician's brush or wipe with a clean, lint-free cloth lightly moistened with an approved solvent.
- (b) Visually inspect heater control assembly for cracks, corrosion, bent or broken connector pins and other damage.
- (c) Replace control assembly if damage is noted.

#### (3) Lamp Replacement.

- (a) Unscrew lens (Figure 5-3).
- (b) Depress lamp and rotate counterclockwise to remove from indicator light base.
- (c) Insert replacement lamp into base. Depress and rotate clockwise to lock in position.
- (d) Install lens.

#### (4) Installation.

- (a) Connect electrical connectors and push control assembly into generator set.
- (b) Install washers (Figure 5-3) and screws.

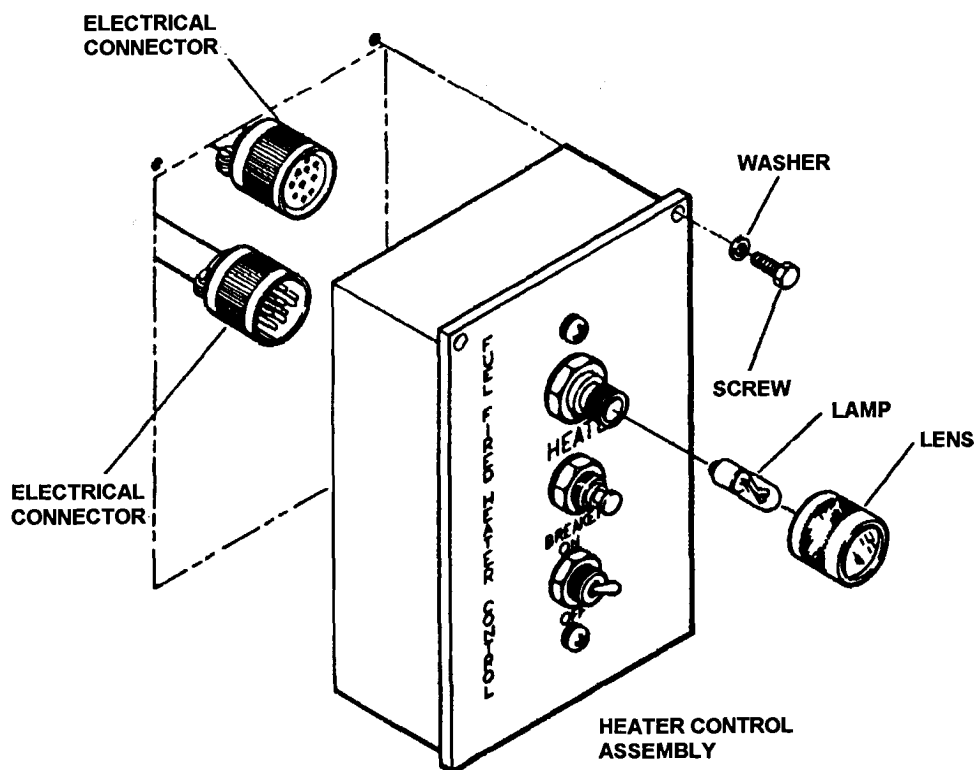


Figure 5-3. Fuel Burning Winterization Kit Heater Control Assembly Maintenance



- b. Heater Assembly Operational Testing. Refer to paragraph 2-22 and operate the heater assembly to determine if heater is operational.
- c. Regulator Valve Assembly Fuel Flow Check and Adjustment.
  - (1) Service regulator valve assembly screen, sintered filter, and metering orifice assembly (paragraph 5-7b. above). Do not install burner fuel line or protective cover.
  - (2) Tag and disconnect electrical lead to igniter assembly (Figure 5-4).
  - (3) Remove screws and cover plate to expose brass adjusting screw.
  - (4) Connect one end of burner fuel line onto metering orifice assembly and position the other end to drain into a graduated container.
  - (5) Install a jumper wire across terminals of thermostat switch (37, Figure 5-1).
  - (6) With fuel inlet line connected and fuel at the valve, place heater assembly into operation (paragraph 2-22).
  - (7) Using a stopwatch, time the fuel flow into graduated container. Flow should measure 1/2 pint in 10 to 12 minutes.
  - (8) If flow is not within specified limits, rotate adjusting screw (Figure 5-4) to obtain proper flow rate.

**NOTE**

Rotating adjusting screw clockwise increases flow rate; rotating adjusting screw counterclockwise decreases flow rate.

- (9) Stop heater assembly operation (paragraph 2-22).
- (10) Install burner fuel line (Figure 5-4).
- (11 ) Install cover plate and secure with screws.
- (12) Install igniter assembly electrical lead.
- (13) Install heater assembly protective cover.
- (14) Remove jumper wire from thermostat switch.
- d. Flame Switch Adjustment.
  - (1) Remove protective cover (Figure 5-4).
  - (2) Using a suitable screwdriver, rotate flame switch adjusting screw counterclockwise until heater motor starts.
  - (3) Rotate adjusting screw clockwise until motor stops.
  - (4) Give adjusting screw an additional 1/2 (180 degrees) turn.
  - (5) Reinstall protective cover.



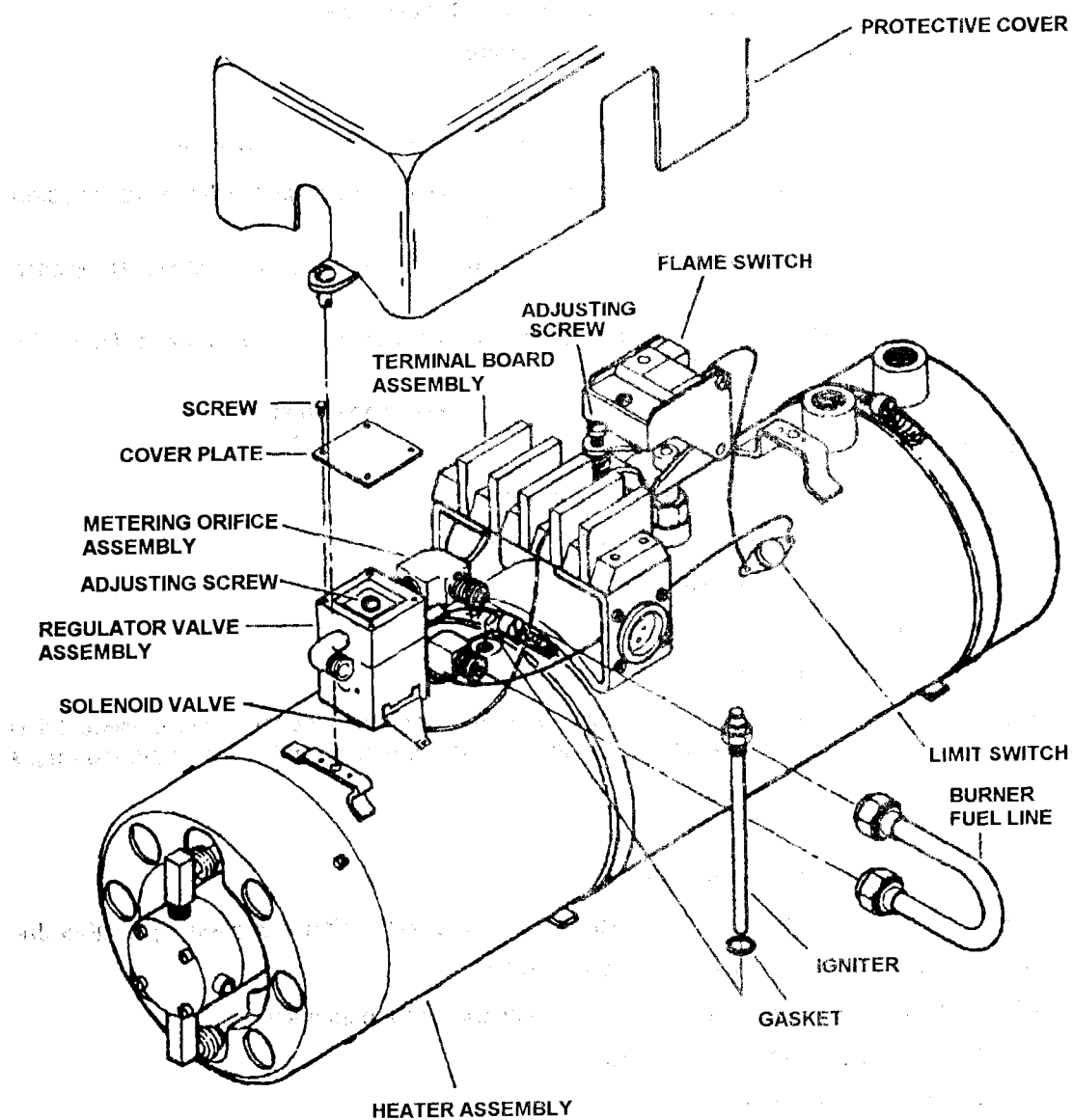


Figure 5-4. Fuel Burning Winterization Kit Heater Assembly Maintenance



- (1) Removal.
  - (a) Remove protective cover (Figure 5-4).
  - (b) Tag and disconnect electrical lead to igniter assembly.
  - (c) Remove assembly from heater assembly.
- (2) Cleaning, Inspection, and Testing.
  - (a) Clean igniter assembly in an approved solvent and dry thoroughly.
  - (b) Visually inspect igniter assembly for shorted or broken coil, cracks, corrosion, stripped or damaged terminal threads or other damage.
  - (c) Using an ohmmeter, check resistance between igniter casing and terminal. Resistance shall be two ohms.
  - (d) Ground igniter assembly casing and apply 24 Vdc to terminal. Igniter coil should heat to bright red color in a few seconds.
  - (e) Replace igniter assembly if it fails either inspection or test.
- (3) Installation.
  - (a) Install assembly into heater assembly (Figure 5-4).
  - (b) Connect electrical lead to igniter assembly.
  - (c) Install protective cover.
- f. Terminal Board Assembly.
  - (1) Remove protective cover (Figure 5-4).
  - (2) Visually inspect terminal board assembly for insecure mounting, loose electrical connections, stripped or otherwise damaged threads, cracks, corrosion, and burns or other damage.
  - (3) Install protective cover.
- g. Limit Switch.
  - (1) Remove protective cover (Figure 5-4).
  - (2) Visually inspect limit switch for cracks, corrosion and evidence of shorting or other damage.
  - (3) Tag and disconnect electrical leads to switch.
  - (4) Using a multimeter or similar device, check switch for continuity.
  - (5) Reconnect electrical leads to switch.
  - (6) Install protective cover.
  - (7) If limit switch failed continuity test, report to higher level maintenance.



h. Thermostat Switch.

(1) Removal.

- (a) Refer to paragraph 3-27 and drain the generator radiator.
- (b) Tag and disconnect electrical leads to thermostat (37, Figure 5-1).
- (c) Remove thermostat switch.

(2) Cleaning and Inspection.

- (a) Clean thermostat switch with an approved solvent and dry thoroughly with filtered compressed air.
- (b) Visually inspect switch for cracks, corrosion, stripped or damaged threads, and evidence of shorting or other damage.

(3) Testing.

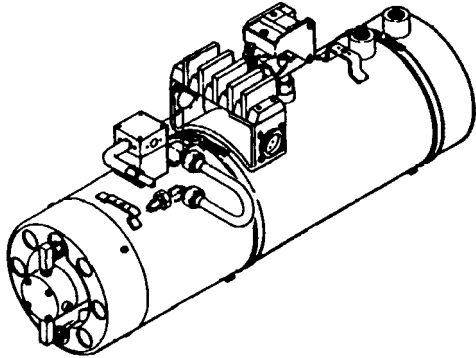
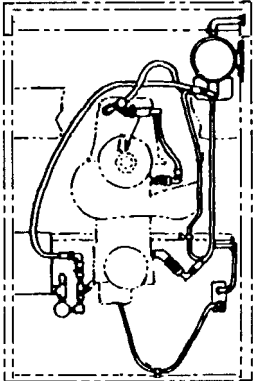
- (a) Suspend thermostat switch in a container of clean water so that its temperature sensor is completely immersed in water, but not touching the bottom or sides of the container.
- (b) Suspend a reliable thermometer in the water so that its temperature sensing end is under water but not touching the sides or bottom of the container.
- (c) Connect an ohmmeter across the terminals of the thermostat switch.
- (d) Gradually heat the water stirring constantly to evenly distribute the heat.
- (e) Observe both the ohmmeter and thermometer. The ohmmeter should indicate continuity up to a temperature of  $155 \pm 5^{\circ} \text{F}$  ( $68.4 \pm 2.8^{\circ} \text{C}$ ). Above this temperature, the ohmmeter should indicate an open circuit.
- (f) Remove the heat and allow the water to cool.
- (g) Ohmmeter should indicate continuity at a temperature of  $+135 \pm 5^{\circ} \text{F}$  ( $+56.2 \pm 2.8^{\circ} \text{C}$ ).
- (h) Replace thermostat switch if it is damaged or fails to operate properly.

(4) Installation.

- (a) Install thermostat switch (37, Figure 5-1).
- (b) Connect electrical leads to thermostat.
- (c) Refer to paragraph 3-27 and fill the generator set radiator.

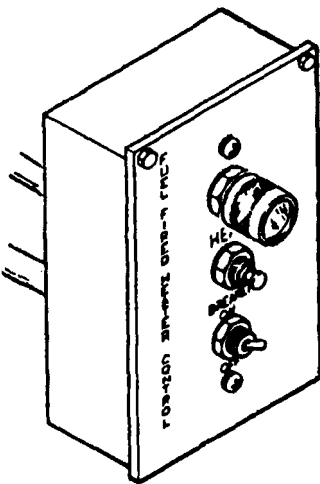
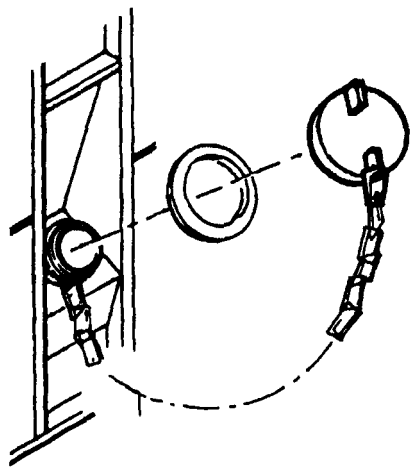


**Table 5-1. Operator Preventive Maintenance Checks and Services**

Item No.	Interval	Location	Procedure	Not Mission Capable If:
		Item to Check/Service		
1	Before	Heater Assembly	<p>Visually inspect for damage and check for proper operation quarterly (Figure 5-1).</p> 	
2	Before	Fuel and	<p>Check for leaks before operation (Figure 5-1). Inspect for damage and tighten connections and support clamps quarterly.</p> 	

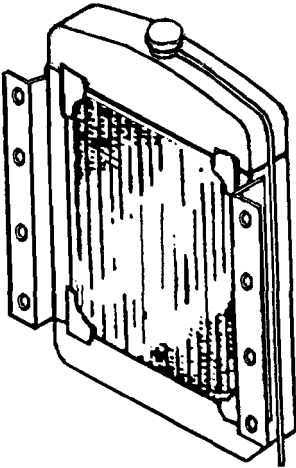


**Table 5-1. Operator Preventive Maintenance Checks and Services - Continued**

Item No.	Interval	Location	Procedure	Not Mission Capable If:
		Item to Check/Service		
3	Before	Heater Control Panel	<p>Visually inspect for damage before operation, (para 5-7).</p> 	
4	Before	Generator Set Fuel Tank	<p>Check for sufficient fuel supply (para 2-3).</p> 	



**Table 5-1. Operator Preventive Maintenance Checks and Services - Continued**

Item No.	Interval	Location	Procedure	Not Mission Capable If:
		Item to Check/Service		
5	Before	Generator Set Radiator	<p>Check for proper coolant level (para 3-27).</p> 	
6	During	Heater Control Panel	Check for indicator light during operation.	
7	After	Fuel and Coolant Lines	Check for leaks after operation (Figure 5-1).	
8	After	Generator Set Radiator	Check for proper coolant level (para 3-27).	
9	Weekly	Heater Control Panel	Visually inspect for damage weekly (para 5-7).	



**Table 5-2. Unit Preventive Maintenance Checks and Services for Fuel Burning  
 Winterization Kit**

Item No.	Interval	Location	Procedure	Not Mission Capable If:
		Item to Check/Service		
1	Semi-Annual	Flame Switch	Adjust flame switch quarterly. (More often under conditions of heavy usage (para 5-8)	
2	Semi-Annual	Limit Switch	Inspect and test limit switch quarterly. (More often under conditions of heavy usage (para 5-8)	
3	Monthly Semi-Annual	Regulator Valve Assembly	Service screen, metering orifice and sintered filtered monthly. (More often under conditions of heavy usage). Test output monthly. Service and adjust as necessary.	
4	Semi-Annual	Igniter	Inspect and test igniter quarterly. (More often under normal conditions.) Replace if necessary (para 5-8).	
5	Semi-Annual	Wiring	Inspect wiring for burned or frayed insulation and loose terminals or connectors (para 5-7).	
6	Semi-Annual	Thermostat Switch	Test switch for proper operation. Replace if necessary (para 5-8).	
7	Semi-Annual	Mounting Hardware	Check for loose or missing hardware (para 5-1).	



**Table 5-3. Operator Troubleshooting For Fuel Burning Winterization Kit**

**NOTE**

Before you use this table, make sure you have performed your PMCS.

---

**MALFUNCTION**

**TEST OR INSPECTION**

**CORRECTIVE ACTION**

---

**1. PRESS-TO-TEST INDICATOR DOES NOT LIGHT WHEN PRESSED.**

Circuit breaker open.

Reset circuit breaker (para 2-22).

**2. HEATER CONTROL SWITCH PLACED IN ON POSITION BUT HEATER DOES NOT START.**

Circuit breaker open.

Reset circuit breaker (para 2-22).

**3. BLOWER OPERATES BUT HEATER DOES NOT IGNITE.**

Step 1. Heater fuel shutoff valve closed.

Open fuel shutoff valve (para 2-22).

Step 2. Generator set fuel supply exhausted.

Service generator set fuel supply (para 3-45).

**4. SURGING HEATER COMBUSTION.**

Restriction in fuel line.

Locate and remove restriction in fuel line.

**5. FAN CONTINUES TO OPERATE AFTER PURGE CYCLE.**

Incorrect wiring connections.

Check wiring for improper connections. Correct as necessary.



**Table 5-4. Unit Troubleshooting For Fuel Burning Winterization Kit**

**NOTE**

Before you use this table, make sure you have performed your PMCS.

---

**MALFUNCTION**

**TEST OR INSPECTION**

**CORRECTIVE ACTION**

---

**1. PRESS-TO-TEST INDICATOR DOES NOT LIGHT WHEN PRESSED.**

Step 1. Discharged batteries.

Recharge or replace batteries (para 4-14).

Step 2. Defective control assembly.

Replace control assembly (para 5-8).

**2. HEATER CONTROL SWITCH PLACED IN ON POSITION BUT HEATER DOES NOT START.**

Step 1. Discharged batteries.

Recharge or replace batteries (para 4-14).

Step 2. Defective wiring harness.

Replace damaged wiring harness (para 5-4).

Step 3. Defective control assembly.

Replace control assembly (para 5-8).

**3. BLOWER OPERATES BUT HEATER DOES NOT IGNITE.**

Step 1. Restriction in fuel supply line.

Remove fuel line restriction.

Step 2. Defective thermostat switch.

Test thermostat switch. Replace if necessary (para 5-8).

Step 3. Defective igniter assembly.

Inspect and test igniter assembly. Replace if necessary (para 5-8).

Step 4. Regulator valve assembly screen, sintered filter or metering orifice clogged.

Service regulator valve assembly (para 5-8).

Step 5. Generator set fuel transfer pumps defective.

Replace fuel transfer pumps (para 4-27).



Table 5-4. Unit Troubleshooting For Fuel Burning Winterization Kit - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<hr/>		
<b>4. SURGING HEATER COMBUSTION.</b>		
Step 1. Restriction in fuel line.		Locate and remove restriction in fuel line.
Step 2. Defective generator set fuel transfer pumps.		Replace fuel transfer pumps (para 4-27).
Step 3. Defective igniter assembly.		Inspect and test igniter assembly. Replace if necessary (para 5-8).
<b>5. HEATER COMBUSTION CONTINUES AFTER HEATER CONTROL SWITCH PLACED IN OFF POSITION.</b>		
Flame switch out of adjustment.		Adjust flame switch (para 5-8).
<b>6. HEATER DOES NOT COMPLETE PURGE CYCLE.</b>		
Flame switch out of adjustment.		Adjust flame switch (para 5-8).
<b>7. FAN CONTINUES TO OPERATE AFTER PURGE CYCLE.</b>		
Step 1. Flame switch out of adjustment.		Adjust flame switch (para 5-8).
Step 2. Incorrect wiring connections.		Check wiring for improper connections. Correct as necessary.



### Section III. ELECTRIC WINTERIZATION KIT

#### 5-9 GENERAL.

The electric winterization kit uses an external power source to maintain the engine coolant and lubricating oil at normal operating temperature in situations which require immediate starting of the generator set. The kit will function effectively down to an ambient temperature of -65°F (-53.9°C). Coolant from the radiator is pumped into the heater assembly where it is heated by the heater elements. From the heater assembly, the heated coolant passes through the heat exchanger in the engine crankcase to heat the lubricating oil. After leaving the heat exchanger, the coolant is pumped through the cylinder block and returned to the radiator. The electric winterization kit may be installed on a generator set which is equipped with a fuel burning winterization kit. Power for operation of the kit may be obtained from any 205 to 240 volt, 50/60 Hz or 400 Hz, single phase source.

#### 5-10 ELECTRIC WINTERIZATION KIT INSTALLATION AND REPLACEMENT.

a. Installation.

- (1) Drain generator set cooling system (paragraph 3-27).
- (2) Remove "WATER" plug (68, Figure 5-5) from center, right-rear of engine cylinder block.
- (3) Remove plug (69) from right side of engine water pump assembly.
- (4) Remove plug (70) from engine oil pan heat exchanger.
- (5) Remove cover plate (71) from heater control assembly mounting hole located to the right of the generator set control cubicle assembly.

#### NOTE

Retain cover plate attaching hardware. It is used to install heater control assembly.

- (6) Install electric winterization kit by following the ascending sequence of index numbers (1 through 71) assigned to Figure 5-5.

#### NOTE

Coat threads of all pipe fittings with sealing compound conforming to Military Specification MIL-S-22743, Grade HVV prior to installation.

#### NOTE

Tube caps (34 and 53) are to be removed and stored in the generator set tool box and tee (32) and straight adapter (33) installed if fuel burning Winterization is to be installed.

- (7) Run wiring harness through existing clamps (62) where indicated.
- (8) Connect external power wiring harness to heater control assembly.
- (9) Slide shrink tubing (65) over all screw terminals and shrink.
- (10) Loosen coolant hose assembly (28) at elbow (26). Place three-way valve (47) in open position and open Valves (31) and (44).
- (11) Service generator set cooling system (paragraph 3-27) and allow air to bleed from winterization kit.
- (12) Tighten coolant hose assembly and close valves.
- (13) Add coolant to generator set cooling system as necessary.



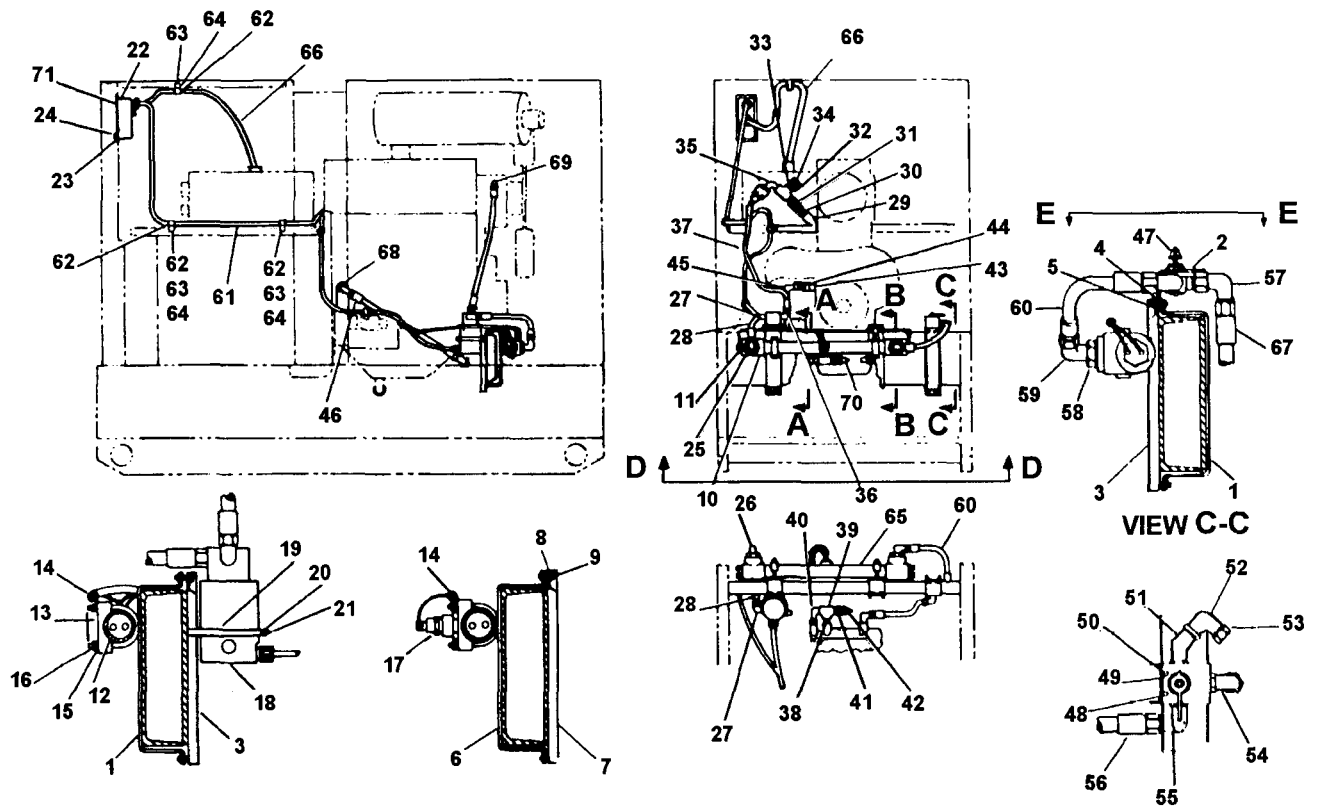


Figure 5-5. Electric Winterization Kit Installation (Sheet 1 of 2)



- |                             |                                     |
|-----------------------------|-------------------------------------|
| 1. Bracket                  | 37. Coolant hose assembly           |
| 2. Bracket                  | 38. Pipe adapter                    |
| 3. Bracket                  | 39. Tee                             |
| 4. Lockwasher               | 40. Elbow                           |
| 5. Screw                    | 41. Adapter                         |
| 6. Bracket                  | 42. Pressure relief valve           |
| 7. Bracket                  | 43. Pipe adapter                    |
| 8. Lockwasher               | 44. Valve                           |
| 9. Screw                    | 45. Elbow                           |
| 10. Pipe tee                | 46. Coolant hose assembly           |
| 11. Heating element         | 47. Three-way valve                 |
| 12. Pipe                    | 48. Screw                           |
| 13. Clamp                   | 49. Lockwasher                      |
| 14. Clamp                   | 50. Nut                             |
| 15. Lockwasher              | 51. Street elbow, 45 degree         |
| 16. Nut                     | 52. Elbow                           |
| 17. Thermostat switch       | 53. Tube cap                        |
| 18. Pump and motor assembly | 54. Elbow                           |
| 19. Clamp                   | 55. Elbow                           |
| 20. Lockwasher              | 56. Coolant hose assembly           |
| 21. Nut                     | 57. Elbow                           |
| 22. Heater control assembly | 58. Reducer                         |
| 23. Lockwasher              | 59. Elbow                           |
| 24. Screw                   | 60. Coolant hose assembly           |
| 25. Reducer                 | 61. Wiring harness                  |
| 26. Elbow                   | 62. Clamp                           |
| 27. Elbow                   | 63. Screw & captive washer assembly |
| 28. Coolant hose assembly   | 64. Nut                             |
| 29. Street elbow            | 65. Tubing                          |
| 30. Pipe coupling           | 66. Wiring harness                  |
| 31. Shutoff cock            | 67. Hose assembly                   |
| 32. Street tee              | 68. Plug                            |
| 33. Straight adapter        | 69. Plug                            |
| 34. Tube cap                | 70. Plug                            |
| 35. Elbow                   | 71. Cover plate                     |
| 36. Elbow                   |                                     |

Figure 5-5. Electric Winterization Kit Installation (Sheet 2 of 2)

- b. Replacement.
  - (1) Removal
    - (a) Drain generator set cooling system (paragraph 3-27).
    - (b) Remove electric winterization kit in reverse order of steps a. (2) through (8) above.
    - (c) Service generator set cooling system.
  - (2) Installation. Refer to paragraph 5-10a. above for installation instructions.



## **5-11 PREVENTIVE MAINTENANCE CHECKS AND SERVICES.**

- a. General. To insure that the electric winterization kit is ready for operation at all times, it must be systematically inspected in order that defects be discovered and corrected before serious damage or failure of the equipment results. Defects discovered during operation shall be noted for correction to be made as soon as operation ceases. Operation shall be ceased immediately if a defect which may cause damage to the equipment is noted. All defects and shortcomings shall be recorded together with the corrective action taken on the applicable forms at the earliest opportunity. Army and Navy users shall accomplish the preventive maintenance checks and services listed and described in subparagraph b. below. Air Force users shall refer to the applicable inspection manuals and work card sets in the T.O. 35C2-3 Series for periodic requirements and Table 5-5, Table 5-6 for detailed procedures.
- b. Preventive Maintenance Checks and Services (Army and Navy).
  - (1) Operator. Table 5-5 contains a tabulated listing of preventive maintenance checks and services which shall be performed before, during and after operation and the weekly checks and services to be performed by the operator. The item numbers are listed consecutively and indicate the sequence of minimum requirements. Refer to Table 5-5 for checks and services.
  - (2) Unit Maintenance. Table 5-6 also contains a tabulated listing of preventive maintenance checks and services which shall be performed by unit maintenance personnel at monthly and semi-annual intervals. The item numbers are listed consecutively and indicate the sequence of minimum requirements. Refer to Table 5-6 for checks and services.

**5-12 TROUBLESHOOTING.** Table 5-7 and Table 5-8 contains lists of malfunctions which are useful in diagnosing and correcting unsatisfactory operation or failure of the electric winterization kit. Each malfunction is followed by an indented listing of tests or inspections for the malfunction. The corresponding listing of corrective actions contains references to the applicable maintenance paragraphs for correcting the malfunction. The tables list only those malfunctions, tests or inspections and corrective actions which are within the scope of unit or operator maintenance. Any malfunction whose causes and corrective actions are beyond the scope of operator or unit maintenance shall be reported to higher level maintenance.

## **5-13 OPERATOR'S MAINTENANCE OF ELECTRIC WINTERIZATION KIT.**

- a. Coolant Pump Assembly.
  - (1) Inspect pump (18, Figure 5-5) for cracks, breaks, corrosion and leaks.
  - (2) Check pump for discoloration or other signs of overheating.
- b. Coolant Hoses and Fittings.
  - (1) Inspect coolant hoses (46, Figure 5-5) for damage and deterioration.
  - (2) Check fittings and valves for loose connections and leaks.
- c. Wiring Harnesses. Check wiring harness (61, 66, Figure 5-5) for frayed, burned, or deteriorated insulation, insecure support dampers, and loose connections.
- d. Indicator Lights.
  - (1) Inspection. Inspect indicator lights (Figure 5-6) for cracked or broken lens, corrosion, and other damage.
  - (2) Testing.
    - (a) Close circuit breaker (Figure 5-6) to apply power to control assembly.
    - (b) Depress indicator light lens. If lamp is operating, it will illuminate.
    - (c) Open circuit breaker.



- (3) Lamp Replacement.
  - (a) Unscrew lens (Figure 5-6).
  - (b) Depress and rotate lamp counterclockwise to remove.
  - (c) Insert replacement lamp. Depress and rotate clockwise to lock.
  - (d) Install lens.
- e. Fuse.
  - (1) Remove fuse holder cap (Figure 5-6).
  - (2) Withdraw fuse from fuse holder.
  - (3) Clean fuse with a clean, lint-free cloth lightly moistened with an approved solvent.
  - (4) Visually inspect fuse for cracks or broken glass, corrosion, and melted conductor.
  - (5) Use an ohmmeter, check fuse for continuity.
  - (6) Replace fuse if unserviceable.
  - (7) Insert fuse into fuse holder and install fuse holder cap.

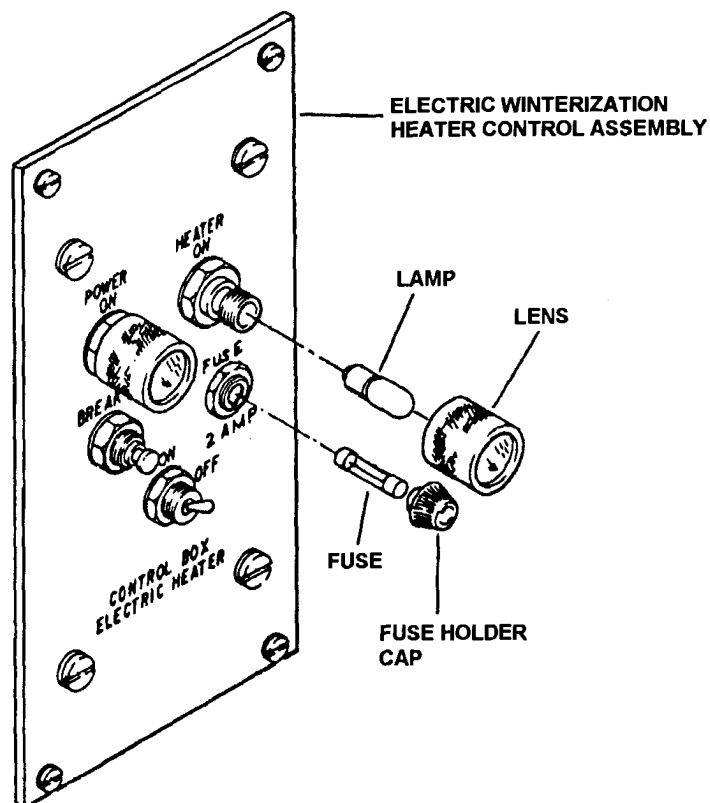


Figure 5-6. Electric Winterization it Control Assembly Indicator Lamp Fuse Replacement



**Table 5-5. Operator Preventive Maintenance Checks and Services For Electric Winterization Kit**

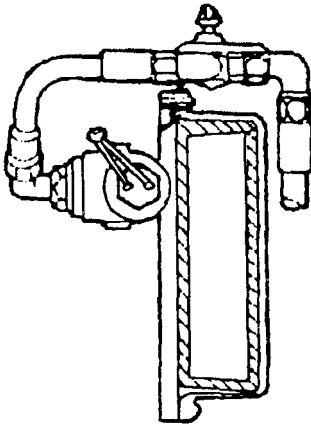
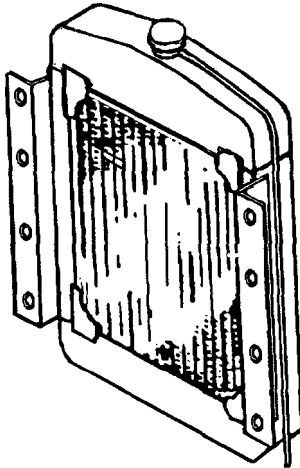
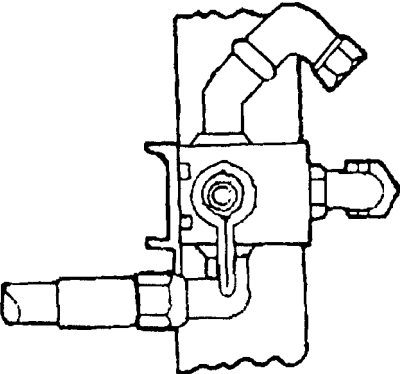
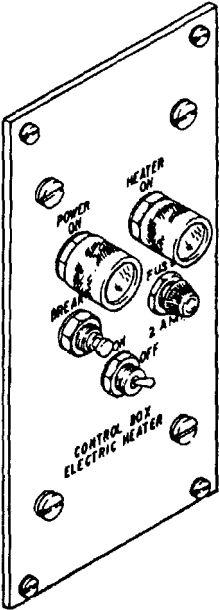
Item No.	Interval	Location	Procedure	Not Mission Capable If:
		Item to Check/Service		
1	Before	Power Cable	Check that power is connected to power supply before operation.	
2	Before	Coolant Line Valves	Check that all coolant line valves are in the proper position for operation.  	
3	Before	Generator Set Radiator	Check for proper coolant level (para 3-27).  	



Table 5-5. Operator Preventive Maintenance Checks and Services For Electric Winterization Kit - Continued

Item No.	Interval	Location	Procedure	Not Mission Capable If:
		Item to Check/Service		
4	Before	Coolant Lines	<p>Check coolant lines for leaks before operation. Inspect condition and tighten connections quarterly (para 5-5).</p> 	
5	Before	Control Assembly	<p>Check for damage and test indicator lights (para 5-13).</p> 	
6	During	Coolant Lines	<p>Check coolant lines for leaks during operation.</p>	



**Table 5-5. Operator Preventive Maintenance Checks and Services For Electric Winterization Kit - Continued**

Item No.	Interval	Location	Procedure	Not Mission Capable If:
		Item to Check/Service		
7	After	Power Cable	Disconnect after operation (para 5-10).	
8	After	Coolant Line Valves	Close all coolant line valves after operation (para 5-10).	
9	After	Generator Set Radiator	Check for proper coolant level after operation.	
10	After	Coolant Lines	Check coolant lines for leaks after operation.	
11	Weekly	Wiring Harnesses	Check for frayed insulation and loose connectors or terminals (para 5-5).	
12	Weekly	Control Assembly	Check for damage and test indicator lights (para 5-13).	



#### **5-14 UNIT MAINTENANCE OF ELECTRIC WINTERIZATION KIT.**

a. Indicator Light Assembly.

(1) Removal.

- (a) Remove screws (1, Figure 5-7) and washers (2) and pull control box out from generator set.
- (b) Tag and disconnect electrical connectors from control box.
- (c) Remove screws (3) and carefully pull panel assembly (4) away from control box.
- (d) Tag and disconnect electrical leads to indicator light assembly.
- (e) Unscrew lens (5) and remove lamp (6).
- (f) Remove nut (7) and tooth lockwasher (9) to remove nut (10) and base (8).
- (g) Do not remove nut from base.

(2) Cleaning and Inspection.

- (a) Clean indicator light assembly with filtered compressed air and a soft bristle brush or wipe with a clean, lint-free cloth lightly moistened with an approved solvent.
- (b) Visually inspect indicator light assembly for cracks, corrosion, stripped or damaged threads and evidence of shorting or other damage.
- (c) Replace indicator light assembly if damaged beyond simple repair.

(3) Installation.

- (a) Nut should still be installed on base.
- (b) Install base (8, Figure 5-7) and nut (10), tooth lockwasher (9), and nut (7).
- (c) Install lamp (6) and screw on lens (5).
- (d) Connect electrical leads to indicator light assembly.
- (e) Carefully push panel assembly (4) onto control box and install screw (3).
- (f) Connect electrical connectors to control box.
- (g) Push control box into generator set and install washers (2) and screws (1).

b. Circuit Breaker.

(1) Removal.

- (a) Gain access to interior of control box (paragraph (a) through (c) above).
- (b) Tag and disconnect electrical leads to circuit breaker.
- (c) Remove nut (11, Figure 5-7) and tooth lockwasher (12) to remove circuit breaker (13).

(2) Cleaning and Inspection.

- (a) Clean circuit breaker with filtered compressed air and electrician's brush or wipe with a clean, lint-free cloth lightly moistened with an approved solvent.
- (b) Visually inspect circuit breaker for cracks, corrosion, stripped or damaged threads and evidence of shorting or other damage.



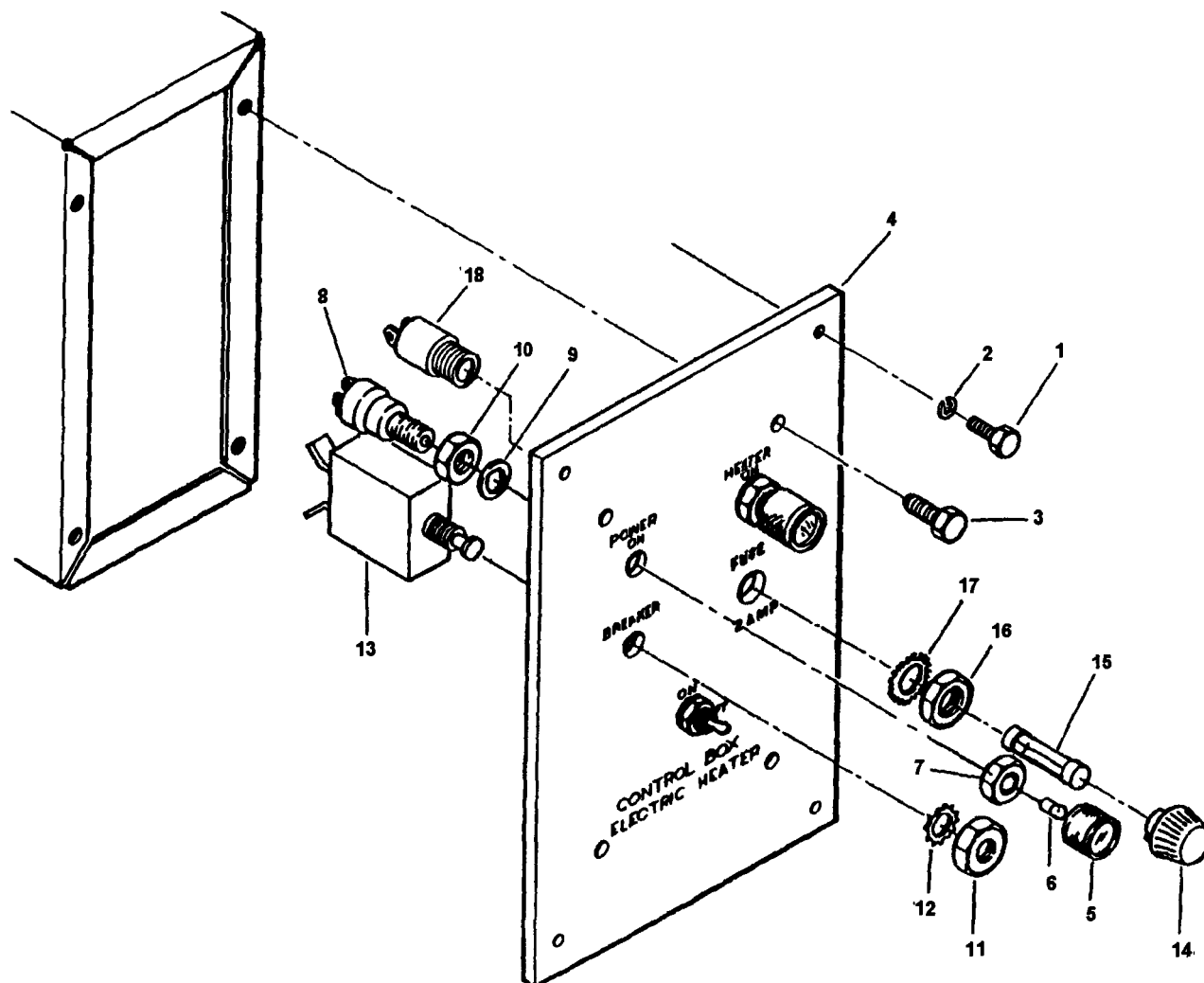
- (3) Testing.
  - (a) Connect an ohmmeter or similar device across circuit breaker terminals.
  - (b) Pull out circuit breaker button and check ohmmeter indication. Ohmmeter shall indicate open circuit.
  - (c) Depress circuit breaker button and check ohmmeter indication. Ohmmeter shall indicate continuity.
  - (d) Replace circuit breaker if the above continuity requirements are not met.
- (4) Installation.
  - (a) Install circuit breaker (13), tooth lockwasher (12), and nut (11).
  - (b) Connect electrical leads to circuit breaker.
  - (c) Close access to interior of control box (paragraph (a) to (c) above).
- c. Fuse Holder Assembly.
  - (1) Removal.
    - (a) Tag and disconnect electrical leads to fuse holder assembly.
    - (b) Remove fuse holder cap (14, Figure 5-7) and fuse (15).
    - (c) Remove nut (16) and tooth lockwasher (17) to remove fuse holder (18).
  - (2) Cleaning, Inspection, and Repair.
    - (a) Clean fuse holder assembly parts with a clean, lint-free cloth lightly moistened with an approved solvent.
    - (b) Visually inspect fuse holder and fuse holder caps for cracks, corrosion, and stripped or otherwise damaged threads.
    - (c) Inspect fuse for cracked or broken glass, corrosion, and melted conductor.
    - (d) Use an ohmmeter to check fuse for continuity.
    - (e) Replace damaged or defective parts.
  - (3) Installation.
    - (a) Install fuse holder (18, Figure 5-7), tooth lockwasher (17), and nut (16).
    - (b) Install fuse (15), and fuse holder cap (14).
    - (c) Connect electrical leads to fuse holder assembly.
- d. ON-OFF Switch. Visually inspect ON-OFF switch (Figure 5-7) for insecure mounting, loose electrical connections, cracks, corrosion and other damage.
- e. Coolant Pump and Motor assembly.
  - (1) Motor Brushes Replacement.

**NOTE**

Note position of brushes as they are removed to facilitate installation.

- (a) Remove brush retainer caps, springs, and brushes from pump assembly motor.
- (b) Measure brush length. Brushes shall be replaced if length is 3/16 inch or less.
- (c) Install brushes, springs, and brush retainer caps.





- |                     |                      |
|---------------------|----------------------|
| 1. Screw            | 10. Nut              |
| 2. Washer           | 11. Nut              |
| 3. Screw            | 12. Tooth lockwasher |
| 4. Panel assembly   | 13. Circuit breaker  |
| 5. Lens             | 14. Fuse holder cap  |
| 6. Lamp             | 15. Fuse             |
| 7. Nut              | 16. Nut              |
| 8. Base             | 17. Tooth lockwasher |
| 9. Tooth lockwasher | 18. Fuse holder      |

Figure 5-7. Electric Winterization Kit Control Assembly, Exploded View



- (2) Cleaning and Inspection.
  - (a) Clean coolant pump and motor assembly with an approved solvent and dry with filtered compressed air.
  - (b) Visually inspect motor for cracks, corrosion, evidence of shorting and other damage.
  - (c) Visually inspect pump for cracks, corrosion, and other damage.
- (3) Testing.
  - (a) Check that three-way valve (47, Figure 5-5) is in the CLOSED position.
  - (b) Disconnect coolant hose assembly (67) from elbow (57) in three-way valve and position to drain into a three gallon container.
  - (c) Remove generator set radiator cap.
  - (d) Place ON-OFF switch (Figure 5-7) in the ON position.
  - (e) Note time required to fill container. Time shall be approximately three minutes.
  - (f) Place ON-OFF switch in the OFF position and reconnect coolant hose assembly.
  - (g) Replace pump and motor assembly if it fails to function properly.
  - (h) Service generator set cooling system (paragraph 3-27).
  - (i) Install coolant hoses and service cooling system (paragraph 3-27) if pump functions properly.
- f. Thermostat Switch.
  - (1) Removal
    - (a) Refer to paragraph 3-27 and drain the radiator.
    - (b) Tag and disconnect electrical leads to thermostat switch (17, Figure 5-5).
    - (c) Remove thermostat.
  - (2) Cleaning and Inspection.
    - (a) Clean thermostat switch with an approved solvent and dry thoroughly with filtered compressed air.
    - (b) Visually inspect thermostat switch for cracks, corrosion, evidence of shorting, stripped or damaged threads and other damage.
  - (3) Testing.
    - (a) Suspend thermostat switch in a container of clean water so that its temperature sensor is completely immersed but not touching the sides or bottom of the container.
    - (b) Suspend a reliable thermometer in the container so that its temperature sensing end is immersed but not touching the sides or bottom of the container.
    - (c) Connect an ohmmeter across the terminals of the thermostat switch. Check that ohmmeter indicates continuity.
    - (d) Gradually heat container, stirring constantly to evenly distribute heat.
    - (e) Observe both thermometer and ohmmeter. Ohmmeter should indicate continuity up to a temperature of  $150^{\circ}\text{F} \pm 5^{\circ}\text{F}$  ( $65.6^{\circ}\text{C} \pm 2.8^{\circ}\text{C}$ ). Above this temperature, ohmmeter should indicate open circuit.
    - (f) Remove heat and allow the container to cool while observing thermometer and ohmmeter.
    - (g) Ohmmeter should indicate continuity at a temperature of  $+35^{\circ}\text{F}$  ( $+1.7^{\circ}\text{C}$ ) and below.
    - (h) Replace thermostat switch if it fails to operate properly.



(4) Installation.

- (a) Install thermostat.
- (b) Connect electrical leads to thermostat switch (17, Figure 5-5).
- (c) Refer to paragraph 3-27 and fill the radiator.

g. Heating Elements

(1) Removal.

- (a) Drain engine cooling system (paragraph 3-27).
- (b) Tag and disconnect electrical leads to heating elements (11, Figure 5-5).
- (c) Unscrew heating elements from pipe (12).

(2) Cleaning and Inspection.

- (a) Clean heating elements with an approved solvent and dry thoroughly with filtered compressed air.
- (b) Visually inspect heating elements for cracks, breaks, corrosion, stripped or damaged threads, evidence of shorting, or other damage.

(3) Testing.

- (a) Using an ohmmeter, check for open circuit between heater element terminal and casing. Ohmmeter shall indicate open circuit.
- (b) Check resistance across terminals. Resistance shall be  $30 \pm 3$  ohms.
- (c) Replace heater element which does not test properly.

(4) Installation.

- (a) Screw heating elements onto pipe (12, Figure 5-5).
- (b) Connect electrical leads to heating elements (11).
- (c) Fill engine cooling system (paragraph 3-27).

h. Coolant Hoses and Fittings.

- (1) Removal. Remove damaged coolant hoses and fittings by following the ascending numerical sequence of index numbers assigned to Figure 5-5.

**NOTE**

Only those hoses and fittings requiring replacement need be removed.

- (2) Installation. Install coolant hoses and fittings by following the descending numerical sequence of index numbers assigned to Figure 5-5.



i. Wiring Harnesses.

**NOTE**

Tag or otherwise identify electrical leads, terminals, and connectors and wiring harness support clamps before removal to facilitate installation.

- (1) Removal. Remove wiring harness assembly terminals and connectors as required for access to other components and testing or replacement of damaged parts.
- (2) Cleaning and Inspection.
  - (a) Clean wiring harness with filtered compressed air and an electrician's brush or wipe with a clean, lint-free cloth lightly moistened with an approved solvent.
  - (b) Visually inspect wiring harness for burned, bent, corroded or otherwise damaged terminals.
  - (c) Inspect connectors for cracks, corrosion, stripped or otherwise damaged threads, bent or broken pins and other damage.
  - (d) Check insulation for burns, deterioration and chafing.
  - (e) Replace any damaged parts.
- (3) Testing. Test continuity of individual wires using a multimeter or continuity light, using Figure 5-8 as a guide.

**CAUTION**

**Do not use acid core solder on electrical components. Equipment damage could result if caution is not observed.**

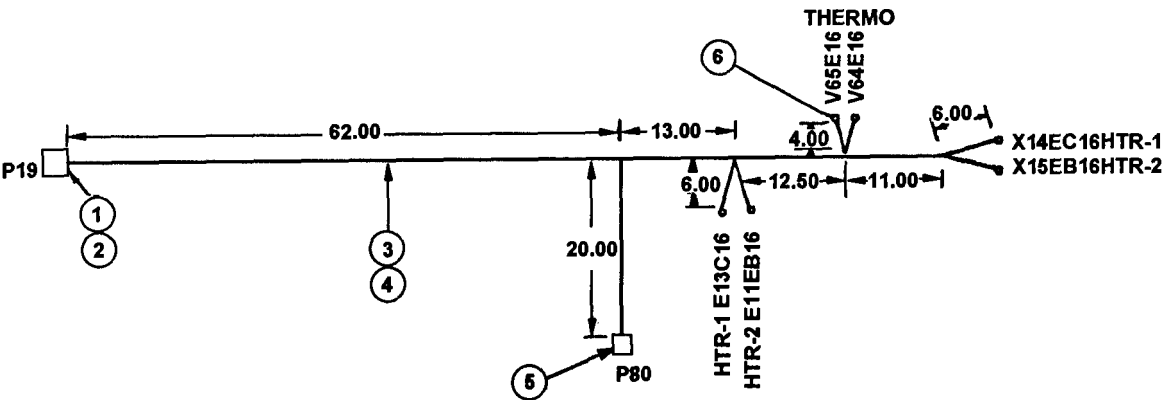
- (4) Repair. Replace damaged wires, terminals, and connectors by unsoldering connections, installing replacement parts and soldering.

**NOTE**

If more than 30 percent of the wires are damaged, the wiring harness shall be replaced.

- (5) Installation. Install parts that are damaged only.





- NOTES:
- 1. ALL SOLDERED CONNECTIONS SHALL BE IN ACCORDANCE WITH MIL-STD-454, REQUIREMENT 5.
  - 2. INSTALL STRAP, FIND NO. 4, AT A 3.00 MAXIMUM INTERVALS AND AT EACH CABLE BREAK-OUT.
  - 3. WIRE MARKING TO BE IN ACCORDANCE WITH MIL-W-5088 EXCEPT THAT LENGTH BETWEEN GROUPS OF NUMBERS SHALL NOT EXCEED 6 INCHES.
  - 4. CRIMPED TERMINAL SHALL MEET THE PERFORMANCE REQUIREMENTS OF MIL-T-7928.
  - 5. INSTALL END SEAL PLUGS, FIND NO. 2, IN UNUSED HOLES OF CONNECTOR, FIND NO. 1.
  - 6. INTERPRET DRAWING PER MIL-STD-100.
  - 7. REFERENCES:
    - A) FOR WIRING DIAGRAM SEE DRAWING 72-2826.
    - B) FOR SCHEMATIC DIAGRAM SEE DRAWING 72-2827

RUNNING WIRE LIST							
WIRE MARKING	FROM	TERMINATION			WIRE FIND NO. REF	WIRE LENGTH REF.	MARKING COLOR REF
		FIND NO. REF	TO	FIND NO. REF			
P90B16	P19-J	1	P80-A	5	3	84.00	BLACK
P91B16	P19-K	1	P80-B	5	3	84.00	BLACK
E13EC16	P19-B	1	HTR1-2	6	3	82.00	BLACK
E11EB16	P19-L	1	HTR1-1	6	3	82.00	BLACK
V64E16	P19-H	1	THERMO	6	3	92.50	RED
V65E16	P19-A	1	THERMO	6	3	92.50	RED
X14EC16	P19-M	1	HTR2-1	6	3	105.50	BLACK
X15EB16	P19-C	1	HTR2-2	6	3	105.50	BLACK

FIND NO	SYM	CODE IDENT	DWG SIZE	PART OR IDENTIFYING NO	QTY REQD	NOMENCLATURE OR DESCRIPTION	SPECIFICATION	MATERIAL
1				MS3106R28-9P	1	PLUG, END SEAL, 12 AWG	MIL-W-5086/2	
2				MS25251-12	4	WIRE, ELECT. 16 AWG WHITE		
3				MS086/2-16-9	AR	STRAP, CABLE ADJUSTABLE		
4				MS3367-1-9	AR	CONNECTOR, ELEC P80		
5				MS3106R10SL-45	1	TERMINAL, LUG		
6				MS2506-153	6			

Figure 5-8. Electric Winterization Kit Wiring Harness, Dwg. No. 72-2855



**Table 5-6. Unit Preventive Maintenance Checks and Services For Electric Winterization Kit**

Item No.	Interval	Location	Procedure	Not Mission Capable If:
		Item to Check/Service		
1	Semi-Annual	Wiring Harnesses	Check for frayed insulation and loose connectors or terminals (para 5-5).	
2	Semi-Annual	Coolant Pump	Check for proper operation (para 5-14).	
3	Semi-Annual	Control Assembly	Check for damage and test indicator lights (para 5-13).	
4	Semi-Annual	Thermostat	Inspect and test (para 5-10).	
5	Semi-Annual	Attaching Hardware	Check for loose or missing attaching hardware. Tighten or replace as necessary (para 5-5).	

**Table 5-7. Operator Troubleshooting for Electric Winterization Kit**

**NOTE**

Before you use this table, make sure you have performed your PMCS.

**MALFUNCTION**

**TEST OR INSPECTION**

**CORRECTIVE ACTION**

**1. ON-OFF SWITCH ON POSITION BUT HEATERS AND PUMP NOT OPERATING.**

Step 1. Power cable not connected to power supply.

Connect Power cable (Figure 5-5).

Step 2. Circuit breaker not closed.

Close circuit breaker (para 2-20).



**Table 5-8. Unit Troubleshooting for Electric Winterization Kit**

**NOTE**

Before you use this table, make sure you have performed your PMCS.

---

**MALFUNCTION**

**TEST OR INSPECTION**

**CORRECTIVE ACTION**

---

**1. ON-OFF SWITCH ON POSITION BUT HEATERS AND PUMP NOT OPERATING.**

- Step 1. Power cable not connected to power supply.  
 Connect power cable (Figure 5-5).
- Step 2. Circuit breaker not closed.  
 Close circuit breaker (para 2-20).
- Step 3. Defective circuit breaker.  
 Replace circuit breaker (para 5-14).
- Step 4. Defective ON-OFF switch.  
 Replace ON-OFF switch (para 5-14).
- Step 5. Blown fuse.  
 Replace fuse (para 5-14).
- Step 6. Defective wiring.  
 Check wiring. Repair or replace if necessary (para 5-13).

**2. HEATERS INOPERATIVE.**

- Step 1. Defective ON-OFF switch.  
 Replace ON-OFF switch (para 5-14).
- Step 2. Defective thermostat switch.  
 Replace thermostat switch (para 5-14).
- Step 3. Defective wiring.  
 Test wiring. Repair or replace if necessary (para 5-14).
- Step 4. Defective heater element.  
 Test heater elements, Replace if necessary (para 5-14).



Table 5-8. Unit Troubleshooting for Electric Winterization Kit - Continued

<b>MALFUNCTION</b>		
<b>TEST OR INSPECTION</b>		
<b>CORRECTIVE ACTION</b>		
<b>3. PUMP INOPERATIVE.</b>		
Step 1. Defective ON-OFF switch.		
Replace ON-OFF switch (para 5-14).		
Step 2. Defective wiring.		
Inspect and test wiring. Repair or replace as necessary (para 5-14).		
<b>4. INDICATOR LIGHT INOPERATIVE.</b>		
Step 1. Defective lamp.		
Replace lamp (para 5-13).		
Step 2. Defective wiring.		
Inspect and test wiring. Repair or replace if necessary (para 5-14).		



## Section IV. WHEEL MOUNTING KIT

**5-15 GENERAL.** The wheel mounting kit provides added mobility for the generator set. It consists of two wheel axle assemblies. The front axle is equipped with a towbar, pintle and safety chain for towing. The front wheels are free to pivot up to 40 degrees for steering. A mechanical parking brake locks the rear wheels against rotation and is actuated by a hand lever located at the right rear of the kit. The kit provides the generator set with 8 inches of ground clearance.

### **5-16 PREVENTIVE MAINTENANCE CHECKS AND SERVICES.**

- a. General. To insure that the wheel mounting kit is ready for use at all times, it must be systematically inspected in order that defects be discovered and corrected before serious damage or failure of the equipment results. Defects discovered during use shall be noted for correction to be made as soon as use is over. Use of the wheel mounting kit shall be terminated immediately if a defect which could cause damage to the equipment is noted. All defects and shortcomings shall be recorded, together with the corrective action taken on the applicable forms at the earliest opportunity. Army and Navy users shall accomplish the preventive maintenance checks and services listed and described in subparagraph b. below. Air Force users shall refer to the applicable inspection manuals and work card set in the T.O. 35C2-3 Series for periodic requirements and Table 5-9 and Table 5-10 for detailed procedures.
- b. Preventive Maintenance Checks and Services (Army and Navy).
  - (1) Operator Maintenance. Table 5-9 contains a tabulated listing of preventive maintenance checks and services which shall be performed before, during, and after operation and the weekly checks and services to be performed by the operator. The item numbers are listed consecutively and indicate the sequence of minimum requirements. Refer to Table 5-9 for checks and services.
  - (2) Unit Maintenance. Table 5-10 also contains a tabulated listing of preventive maintenance checks and services which shall be performed by unit maintenance personnel at monthly and semi-annual intervals. The item numbers are listed consecutively and indicate the sequence of minimum requirements. Refer to Table 5-10 for checks and services.

**5-17 TROUBLESHOOTING.** Table 5-11 and Table 5-12 contain lists of malfunctions which are useful in diagnosing and correcting unsatisfactory operation or failure of the wheel mounting kit. Each malfunction is followed by an alphabetical listing of probable causes. The corresponding alphabetical listing of corrective actions contains references to the applicable maintenance paragraph for correcting the malfunction. The tables list only those malfunctions, tests or inspections and corrective actions within the scope of operator or unit maintenance. Any malfunction whose causes and corrective actions are beyond the scope of operator and unit maintenance shall be reported to higher level maintenance.

### **5-18 OPERATOR'S MAINTENANCE OF WHEEL MOUNTING KIT.**

- a. Wheels and Tires.
  - (1) Visually inspect wheels for cracks, dents, corrosion, loose lug nuts, and other damage.
  - (2) Inspect tires for tread wear, cuts, breaks, blisters and imbedded material.
  - (3) Check tire pressure with standard tire pressure gauge. Tire pressure shall be 60 psig.
- b. Front Axle and Tow Bar Assembly.
  - (1) Inspection and Repair.
    - (a) Visually inspect tow bar (28, Figure 5-9) for cracks, corrosion, or other damage.
    - (b) Check tow bar locking mechanism for proper operation.
    - (c) Inspect safety chains (30) for security of attachment, cracked or broken links or hook, damaged or missing hook latch (25) and corrosion or damage.
    - (d) Check tie rod assemblies (31) for excessive play.



**NOTE**

Excessively worn tie rod ends (10 and 16) and king pins (14) maybe indicated by excessive and uneven wear on the front tires.

- (e) The generator's front end must be raised until the front wheels are clear of the ground in order to check excessive wearing of king pins. (See paragraph 5-19 for jacking procedures.)

**NOTE**

Care must be exercised when checking excessive wear on king pins to avoid mistaking wheel bearing play or loose wheel for excessively worn king pins.

- (f) Replace excessively worn king pins and tie rod ends.
- (2) Adjustment. If tie rod ends have been replaced, or adjustment is deemed necessary, adjust the tie rods using the following procedures:
- (a) Adjust the tie rod assemblies to as near their original length as possible, with an equal number of threads showing on each tie rod end (10 and 16).

**NOTE**

With the tow bar aligned with the center line of the generator set, a preliminary check can be made to see if the tie rod assemblies are approximately the right length.

- (b) Install the tie rod assemblies (31) with bolts (3 and 9) and nuts (2 and 8).
- (c) With the tow bar aligned with the centerline of the generator, and anchored so that it will not move, measure the distance from center to center of the tread of the two front wheels, in front of the wheels.
- (d) Measure the distance from center to center of the tread of the two front wheels, behind the wheels.

**NOTE**

There is no tow in, therefore, these distances should be the same,

- (e) If they are not identical, adjust tie rods until they are identical. The distance from the center of the front axle to each wheel must also be the same.
- (f) With the wheels on the ground, and tires evenly inflated, a taut string from front to rear of the wheel mounting kit should touch the sidewall of the aft and forward curvation of both front and rear tires simultaneously, as near the hubs as possible.

(3) Lubrication.

- (a) Lubricate all grease fittings (11, 12, and 17) on both sides of the wheel mounting kit with grease (GAA).
- (b) Lubricate tow bar mechanism and safety chain with an oil can.

c. Rear Axle Assembly.

- (1) Visually inspect parking brake handle for insecure mounting, cracks, corrosion, and other damage.
- (2) Inspect brake control rods for cracks, corrosion, bends and signs of wear at joints.
- (3) Lubricate brake linkage with an oil can.



- |                    |                         |                      |
|--------------------|-------------------------|----------------------|
| 1. Cotter pin      | 12. Grease fitting      | 22. Center arm       |
| 2. Nut             | 13. Roll pin            | 23. Roll pin         |
| 3. Bolt            | 14. King pin            | 24. Spring           |
| 4. Tube            | 15. Spindle and knuckle | 25. Latch            |
| 5. Nut             | 16. Tie rod end         | 26. Cotter pin       |
| 6. Nut             | 17. Grease fitting      | 27. Hinge pin        |
| 7. Cotter pin      | 18. Cotter pin          | 28. Tow bar          |
| 8. Nut             | 19. Pin                 | 29. Front axle       |
| 9. Bolt            | 20. Spacer washer       | 30. Safety chain     |
| 10. Tie rod end    | 21. Tow bar assembly    | 31. Tie rod assembly |
| 11. Grease fitting |                         |                      |

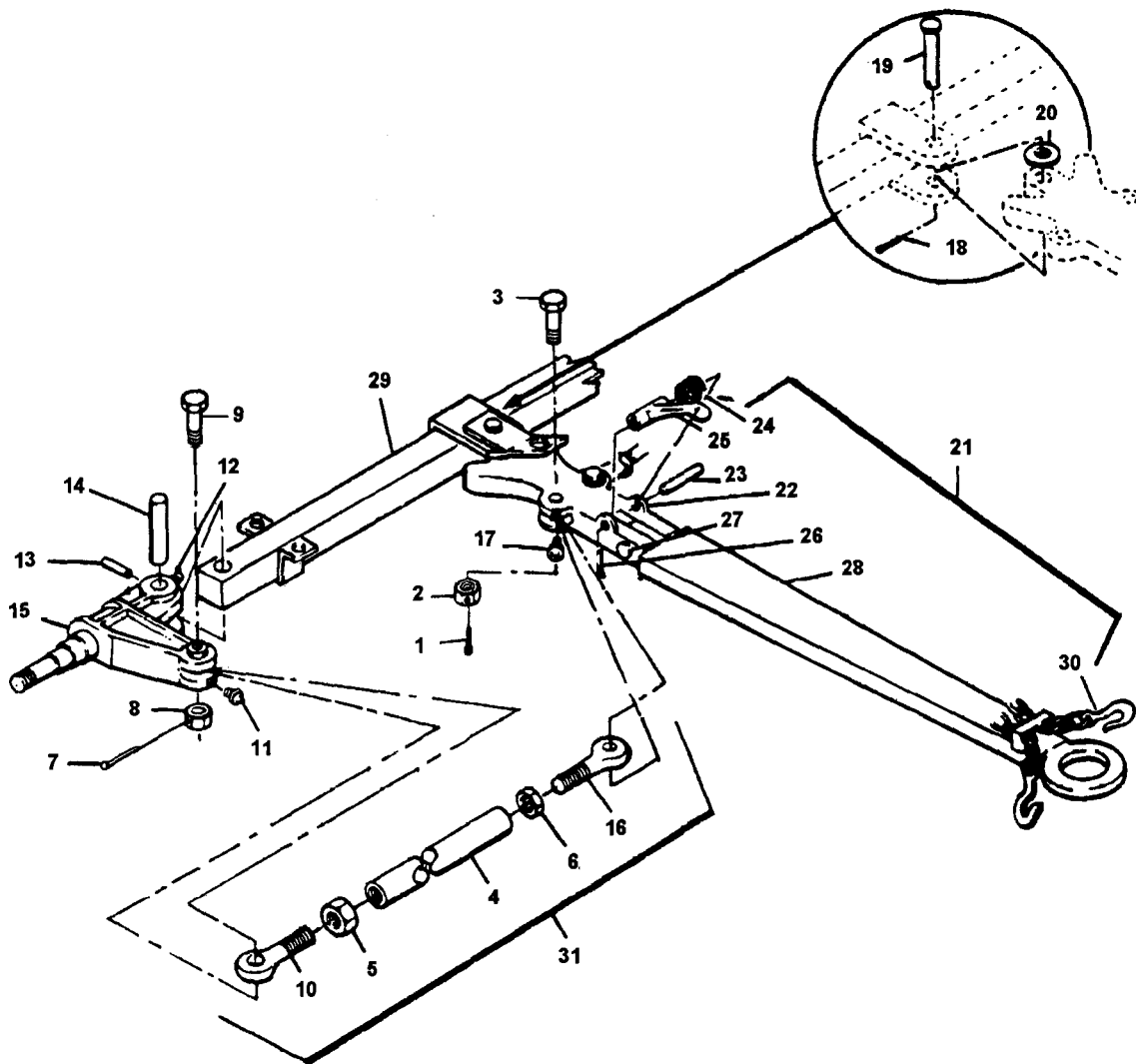
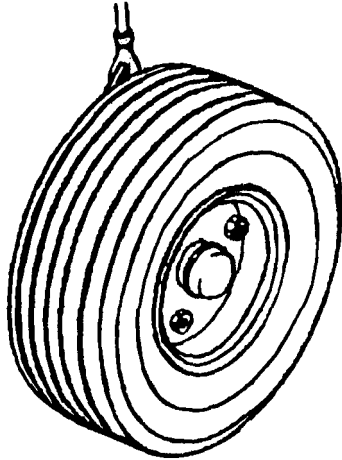
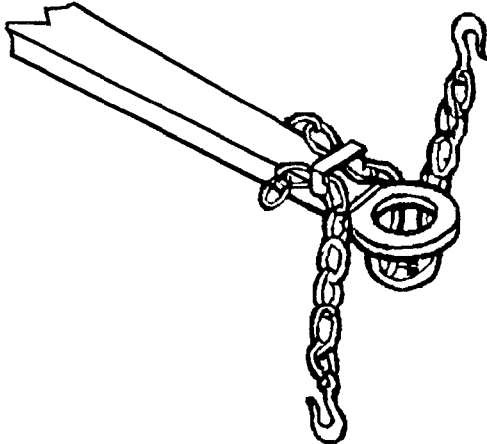


Figure 5-9. Wheel Mounting Kit, Front Axle and Tow Bar Assembly, Exploded View

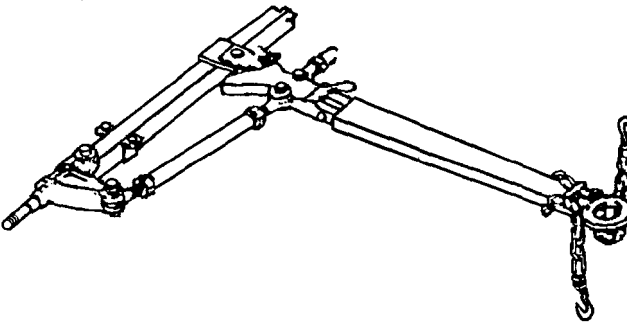


**Table 5-9. Operator Preventive Maintenance Checks and Services for Wheel Mounting Kit**

Item No.	Interval	Location	Procedure	Not Mission Capable If:
		Item to Check/Service		
1	Before	Tires	<p>Inspect tires. Service tires quarterly (para 5-19).</p> 	
2	Before	Safety Chain	<p>Inspect for secure attachment and condition (para 5-18).</p> 	



**Table 5-9. Operator Preventive Maintenance Checks and Services for Wheel Mounting Kit  
 - Continued**

Item No.	Interval	Location	Procedure	Not Mission Capable If:
		Item to Check/Service		
3	Before	Steering Linkage	<p>Inspect steering linkage before operation (para 5-18).</p> 	



**Table 5-10. Unit Preventive Maintenance Checks and Services for Wheel Mounting Kit**

Item No.	Interval	Location	Procedure	Not Mission Capable If:
		item to Check/Service		
1	Monthly	Tires	Inspect tires. Service tires quarterly, para 5-19.	
2	Monthly	Safety Chain	Inspect for secure attachment and condition (para 5-18).	
3	Monthly	Steering Linkage	Inspect steering linkage before operation, lubricate linkage and pivot points monthly (para 5-19).	
4	Monthly	Parking Brake Linkage	inspect parking brake linkage. Lubricate monthly (para 5-19).	
5	Semi-annual	Tires	Inspect tires. Service tires quarterly (para 5-19).	
6	Semi-annual	Wheel Bearings	Clean, inspect, and lubricate (para 5-19).	
7	Semi-annual	Attaching Hardware	Inspect for loose or missing hardware. Tighten any found loose, para 5-19.	
8	Semi-annual	Brakes	Inspect linings for wear. Adjust brakes, para 5-19.	

**Table 5-11. Operator Troubleshooting For Wheel Mounting Kit**

**NOTE**

Before you use this table, make sure you have performed your PMCS.

**MALFUNCTION**

**TEST OR INSPECTION**

**CORRECTIVE ACTION**

**1. ABNORMAL TIRE WEAR.**

Improper tire pressure.

Correct tire pressure (para 5-18).

**2. KIT PULLS TO ONE SIDE OR WANDERS.**

Improper tire pressure.

Correct tire pressure (para 5-18).



**Table 5-12. Unit Troubleshooting For Wheel Mounting Kit**

**NOTE**

Before you use this table, make sure you have performed your PMCS.

---

**MALFUNCTION**

**TEST OR INSPECTION**

**CORRECTIVE ACTION**

---

**1. PARKING BRAKE WILL NOT HOLD.**

Step 1. Improperly adjusted or defective brake linkage.

Adjust or repair brake linkage (para 5-19).

Step 2. Improperly adjusted brakes.

Adjust or repair brake linkage (para 5-18, 5-19).

Step 3. Worn brake lining.

Replace brake linings and adjust brakes (para 5-19).

**2. PARKING BRAKE WILL NOT RELEASE.**

Step 1. Improperly adjusted brake linkage.

Adjust brake linkage (para 5-19).

Step 2. Improperly adjusted brakes.

Adjust or repair brake linkage (para 5-19).

**3. ABNORMAL TIRE WEAR.**

Step 1. Improper tire pressure.

Correct tire pressure (para 5-18).

Step 2. Loose attaching hardware.

Tighten attaching hardware.

Step 3. Wheel wobbles.

See "Wheel wobbles" below.

Step 4. Worn or improperly adjusted tie rods.

Replace worn tie rods ends or adjust tie rods (para 5-18b).

Step 5. Excessively worn king pins.

Replace king pins (direct support maintenance).



Table 5-12. Unit Troubleshooting For Wheel Mounting Kit - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<hr/>		
<b>4. WHEEL WOBBLES.</b>		
Step 1.	Loose lug nuts.	Tighten lug nuts.
Step 2.	Defective wheel bearing or loose hub nut.	Inspect wheel bearing. Replace if necessary. Tighten hub nut to obtain proper bearing pressure (para 5-19).
Step 3.	Bent wheel.	Replace wheel (para 5-18).
<b>5. KIT PULLS TO ONE SIDE OR WANDERS.</b>		
Step 1.	Improper tire pressure.	Correct tire pressure (para 5-18).
Step 2.	Wheel brake dragging.	Adjust brake (para 5-19).
Step 3.	Loose attaching hardware.	Tighten hardware.



## 5-19 UNIT MAINTENANCE OF WHEEL MOUNTING KIT.

### a. Wheels and Tires.

#### (1) Removal.



Set parking brake and block wheels before jacking the generator set. Never perform maintenance on the wheel mounting kit with the generator set supported by the jack alone.

- (a) Place a suitable jack under the generator set skid base and raise until wheel is well clear of the ground.
- (b) Situate a support which is high enough to keep wheel clear of ground under skid base.
- (c) Lower generator set until skid base is resting on support.
- (d) Remove lug nuts (1, Figure 5-10) and lockwashers (2) to remove wheel and tire.

#### **CAUTION**

Remove valve core and allow air to escape from tire. Equipment damage could result if caution is not observed.

- (e) Remove nuts (4), lockwashers (5) and screws (6) to separate wheel halves (7 and 8) and pneumatic tire (9).
  - (f) Inspect lug nut studs (3) for crossed, stripped, or peened threads or other damage.
  - (g) Refer to paragraph b. below and replace any defective studs.
- (2) Repair. Refer to Appendix A for listing of applicable manual for pneumatic tire repair.
- (3) Installation.
- (a) All defective parts should be replaced, refer to paragraph b.
  - (b) If damaged, install new lug nut studs (3, Figure 5-10).
  - (c) Install pneumatic tire (9), wheel halves (8 and 7), screws (6), lockwashers (5), and nuts (4).
  - (d) Position tire and wheel to install lockwashers (2) and lug nuts (1).
  - (e) Lift generator set until skid base is not resting on support.
  - (f) Remove supports from skid base.
  - (g) Remove jack from under generator set skid base.

### b. Wheel Bearings.

#### (1) Removal.

#### **NOTE**

Front wheels are not equipped with brakes.

- (a) Remove wheel and tire as outlined in paragraph 5-19a (1) above.
- (b) Remove grease cap (10, Figure 5-10), cotter pin (11) and castellated nut (12) and key washer (13) to remove outer bearing (14).



- (c) Remove drum (15) and hub (16) as an assembly with grease seal (17), inner bearing (18) and races (19 and 20). Remove grease seal and inner bearing.

**NOTE**

Adjust brakes on rear wheels as loose as possible before removing drum and hub assembly.

- (d) Do not remove lug nut studs (3) unless replacement is necessary.

(2) Cleaning and Inspection.

- (a) Clean bearings, castellated nut, cotter pin, grease cap, axle, and drum and hub assembly with an approved solvent and dry thoroughly.
- (b) Visually inspect bearings for corrosion, scored rollers, wear and other damage.
- (c) Inspect castellated nut for cracks, corrosion, and stripped or otherwise damaged threads.
- (d) Check axle for corrosion, cracks, and stripped or otherwise damaged threads.
- (e) Inspect drum and hub assembly for cracks, breaks, corroded or damaged bearing races and other damage.

**NOTE**

Check rear drum assemblies for deep scores or excessive wear on surface which mates with brake lining.

**CAUTION**

**Do not drive bearing races from drum assembly. Use a puller instead. Equipment damage could result if caution is not observed.**

(3) Repair. Replace any damaged parts.

**NOTE**

Bearings and races are matched sets and shall be replaced as such.

(4) Installation.

- (a) If bearing races (19 and 20) were removed, press into drum assembly.
- (b) Pack inner bearing (18) with Grease Automotive and Artillery (GAA).
- (c) Install grease seal (17).

**CAUTION**

**On rear wheel, make sure that brake lining and drum assembly are clean and free of grease before installing drum assembly. Equipment damage could result if caution is not observed.**

- (d) Apply light film of grease to axle and install drum and hub assembly (15 and 16).
- (e) Pack outer bearing (14) with grease and install.
- (f) Install key washer (13) and castellated nut (12).
- (g) Tighten nut until snug, then back off until next cutout is aligned with cotter pin hole in axle.
- (h) Check that drum assembly rotates freely.
- (i) Install cotter pin (11) and grease cap (10).
- (j) Install wheel and tire as outlined in paragraph 5-19a. (3) above.



#### NOTE

Adjust brakes on rear wheels as outlined in paragraph 5-19c below before removing supports and jack

c. Brakes.

(1) Removal.

- (a) Remove wheel and tire with drum assembly as outlined in paragraph 5-19b. (1) above.
- (b) Remove return springs (21, Figure 5-10).
- (c) Remove hold-down springs (22) and brake shoes (23) from axle and plate assembly (24).

(2) Cleaning and Inspection.

- (a) Clean brake shoes with filtered compressed air.
- (b) Clean remaining parts with dry cleaning solvent (Federal Specification P-D-680) and dry thoroughly.
- (c) Inspect brake shoe linings for wear. If lining is 1/16 inch or less, brake shoes shall be replaced.
- (d) Inspect return springs for cracks, corrosion and distortion.
- (e) Check spring clip for cracks, corrosion, and other damage.
- (f) Check adjustment bolts and abutment pins for cracks, corrosion, stripped or otherwise damaged threads and other damage.
- (g) Check control lever and wedge for cracks, breaks, corrosion, and other damage.
- (h) Inspect backing plate for cracks, corrosion, warping, missing or deteriorated dust covers and other damage.

(3) Repair. Replace any parts found defective.

(4) Installation.

- (a) Install brake shoes (23, Figure 5-10) and springs (22) onto axle plate assembly (24).
- (b) Install return springs (21).
- (c) Install tire and wheel with drum assembly as outlined in paragraph 5-19b. (1) above.

#### CAUTION

**Make sure that drum assembly and brake shoe linings are clean and free of grease before installing drum assembly. Equipment damage could result if caution is not observed.**

- (d) Install drum assembly with wheel and tire attached as outlined in paragraph 5-19b. (4) above.

#### NOTE

Clean and inspect wheel bearings as outlined in paragraph 5-19b. (2) above before installing drum assembly.

(5) Adjustment.

- (a) Rotate adjustment knob on brake control lever to provide minimum movement of brake linkage.

#### NOTE

Rotating adjustment knob clockwise increases brake linkage movement. Rotating adjustment knob counterclockwise decreases linkage movement.

- (b) Loosen lock nuts (25, Figure 5-10) on both wheels and rotate rod (26) until both brake shoes lightly rub drums. Tighten lock nuts (25).
- (c) Actuate brake control lever to ascertain that brakes function properly. Additional adjustment is provided by adjustment knob on brake control lever.



- |                    |                              |
|--------------------|------------------------------|
| 1. Nut             | 14. Outer bearing            |
| 2. Lockwasher      | 16. Brake drum               |
| 3. Stud            | 16. Hub                      |
| 4. Nut             | 17. Grease seal              |
| 5. Lockwasher      | 18. Inner bearing            |
| 6. Screw           | 19. Inner bearing race       |
| 7. Wheel half      | 20. Outer bearing race       |
| 8. Wheel half      | 21. Return spring            |
| 9. Tire            | 22. Hold-down spring         |
| 10. Grease cap     | 23. Brake shoe               |
| 11. Cotter pin     | 24. Axle and back plate assy |
| 12. Catellated nut | 25. Lock nut                 |
| 13. Key washer     | 26. Linkage rod              |

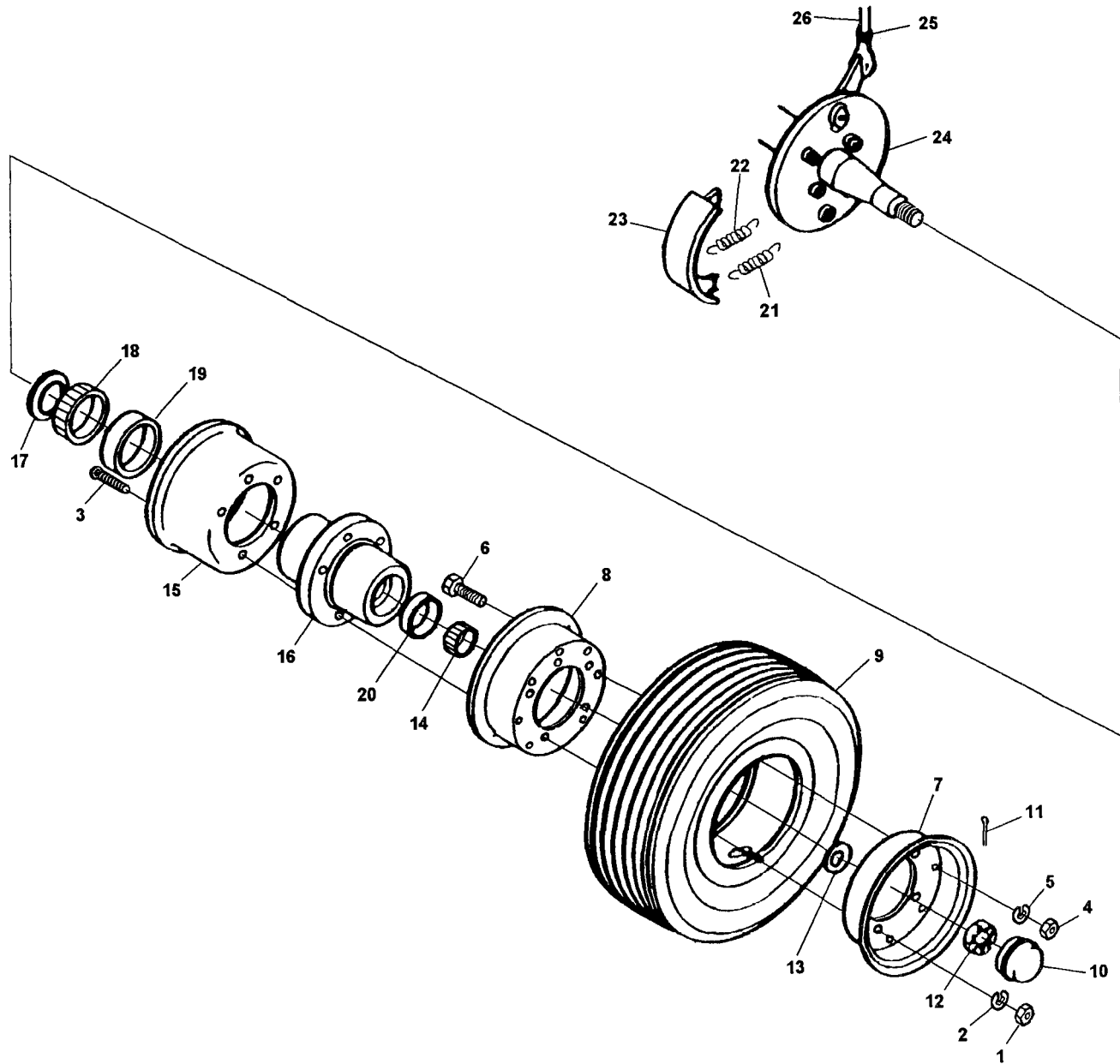


Figure 5-10. Wheel Mounting Kit, Wheels and Brakes, Exploded View



## Section V. LOAD BANK KIT

**5-20 GENERAL.** The load bank is a balanced three phase, four wire, air cooled, resistive load which maintains the generator up to approximately 50 percent of its rated load to prevent excessive engine carbonizing due to light loads. It maybe operated at 120/208 or 240/416 volts as determined by the voltage selector connectors. Generator load may be selected in 12.5 percent increments by use of the load selector switch.

### **5-21 INSTALLATION, TESTING, AND REPLACEMENT OF LOAD BANK.**

- a. Installation.



**Do not attempt to install load bank assembly while the generator set is operating. Serious electrical shock or death by electrocution may result from failure to observe this warning.**

- (1) Install load bank assembly (Figure 5-11) onto generator set radiator grille and secure with screws and Lockwashers.
- (2) Connect wiring harness leads to load terminal board assembly load measuring unit and tactical relay assembly (see Figure 5-13).

- b. Testing. Refer to paragraph 2-25 and operate the load bank to see if it is functional.

- c. Replacement.

- (1) Removal.



**Do not attempt to remove load bank while generator set is operating. Serious electrical shock or death by electrocution may result from failure to observe this warning.**

- (a) Disconnect load bank wiring harness from generator set load terminal board load measuring unit and tactical relay assembly.
  - (b) Remove screws (Figure 5-11) and lockwashers to remove load bank assembly.
- (2) Installation. Install load bank as outlined in paragraph 5-21a. above.



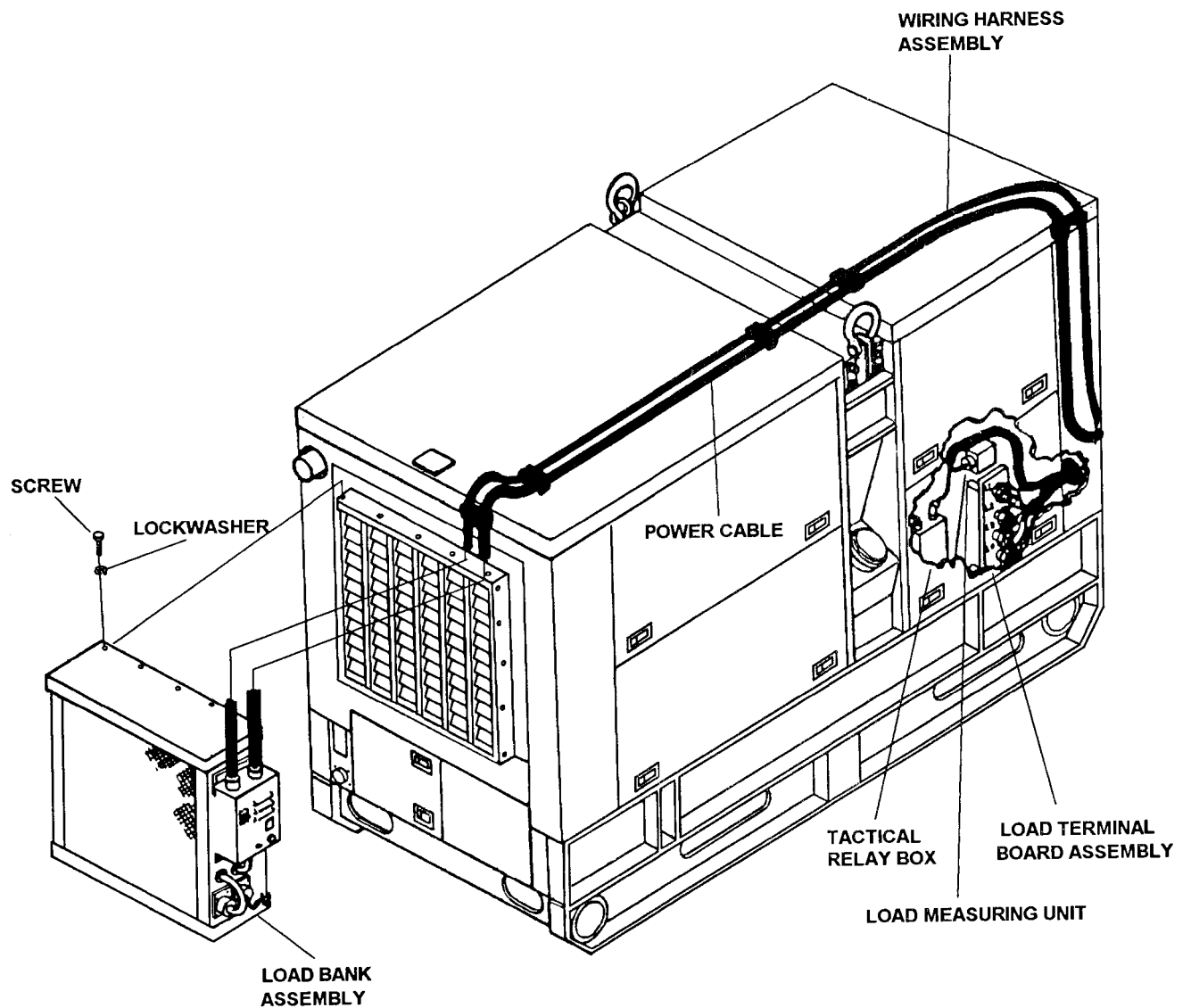


Figure 5-11. Load Bank Installation



## **5-22 PREVENTIVE MAINTENANCE CHECKS AND SERVICES.**

- a. General. To insure that the load bank is ready for operation at all times, it must be systematically inspected in order that defects be discovered and corrected before serious damage or failure of the equipment results. Defects discovered during operation shall be noted for correction to be made as soon as operation has ceased. Operation shall be terminated immediately if a defect which could cause damage to the equipment is noted. All defects and shortcomings shall be recorded, together with the corrective action taken, on the applicable forms at the earliest opportunity. Army and Navy users shall accomplish the preventive maintenance checks and services listed and described in subparagraph b. below. Air Force users shall refer to the applicable inspection manuals and work card set in the T.O. 35C2-3 Series for periodic requirements and Table 5-13, Table 5-14 for detailed procedures.
- b. Preventive Maintenance Checks and Services (Army and Navy).
  - (1) Operator Maintenance. Table 5-13 contains a tabulated listing of preventive maintenance checks and services which shall be performed before, during, and after operation and the weekly checks and services to be performed by the operator. The item numbers are listed consecutively and indicate the sequence of minimum requirements. Refer to Table 5-13 for checks and services.
  - (2) Unit Maintenance. Table 5-14 also contains a tabulated listing of preventive maintenance checks and services which shall be performed by unit maintenance personnel at monthly and semi-annual intervals. The item numbers are listed consecutively and indicate the sequence of minimum requirements. Refer to Table 5-14 for checks and services.

**5-23 TROUBLESHOOTING.** Table 5-15 contains a list of malfunctions which are useful in diagnosing and correcting unsatisfactory operation or failure of the load bank. Each malfunction is followed by an alphabetical listing of probable causes. The corresponding alphabetical listing of corrective actions contain references to the applicable maintenance paragraphs for correcting the malfunction. The table lists only those malfunctions whose causes and corrective actions are within the scope of unit maintenance. Any malfunction whose corrective action is beyond the scope of unit maintenance shall be reported to higher level maintenance.

## **5-24 OPERATOR MAINTENANCE INSPECTION OF LOAD BANK.**

- a. Visually inspect wiring harness assembly (Figure 5-11) for frayed or burned insulation, loose support clamps and connections or other damage.
- b. Visually inspect voltage selector connectors (3, Figure 5-12) and load selector switch (13, Figure 5-12) for freedom of movement between positions, insecure mounting, loose connections, loose or broken control knob and other damage.

## **5-25 UNIT MAINTENANCE OF LOAD BANK.**

- a. Transformers. Visually inspect transformers for corrosion, frayed wires, signs of overheating, discoloration, and other damage.
- b. Voltage Selector Connectors.
  - (1) Removal.
    - (a) Refer to paragraph 5-21 c. (1) above and remove load bank assembly from generator set.
    - (b) Remove nuts (1, Figure 5-12) and screws (2) and pull voltage selector connectors (3) out from load bank.
    - (c) Tag electrical leads and unsolder connections to connector.
    - (d) Do not remove screw and captive washer assembly (4) and protective cap (5) unless inspection reveals damage.
  - (2) Cleaning and Inspection.
    - (a) Clean voltage selector connectors with filtered compressed air and a soft bristle brush or wipe with a dean, lint-free cloth lightly moistened with an approved solvent.
    - (b) Visually inspect connectors for cracks, corrosion, stripped or damaged threads and other damage.



**Table 5-13. Operator Preventive Maintenance Checks and Services for Load Bank**

Item No.	Interval	Location	Procedure	Not Mission Capable If:
		Item to Check/Service		
1	Before	Guard	Inspect for foreign materials (Figure 5-12).	
2	Before	Control Panel	Inspect for damage (para 5-24).	

**Table 5-14. Unit Preventive Maintenance Checks and Services for Load Bank**

Item No.	Interval	Location	Procedure	Not Mission Capable If:
		Item to Check/Service		
1	Semi-Annual	Mounting Hardware	Inspect for loose mounting hardware (para 5-25).	
2	Semi-Annual	Control Panel Assembly	Inspect for damage (para 5-25).	
3	Semi-Annual	Wiring Harness	Check for damage or evidence of shorting (para 5-25).	
4	Semi-Annual	Heater Element	Visually inspect for damage and signs of overheating or shorting (para. 5-25).	



**NOTE**

There are no load bank troubleshooting procedures for the operator.

**Table 5-15. Unit Troubleshooting For Load Bank.**

**NOTE**

Before you use this table, make sure you have performed your PMCS.

---

<b>MALFUNCTION</b>
<b>TEST OR INSPECTION</b>
<b>CORRECTIVE ACTION</b>

---

**1. LOAD BANK DOES NOT APPLY LOAD TO GENERATOR.**

- Step 1. Defective load selector switch.  
Replace switch (para 5-25).
- Step 2. Defective wiring.  
Repair or replace wiring (para 5-25).

**2. INDICATOR LIGHT DOES NOT ILLUMINATE WHEN LOAD BANK IS IN OPERATION.**

- Step 1. Defective lamp.  
Replace lamp (para 5-25).
  - Step 2. Defective wiring.  
Repair or replace wiring (para 5-25).
-



1. Nut
2. Screw
3. Voltage selector connector
4. Screw & captive washer assembly
5. Protective cap
6. Screw
7. Lockwasher
8. Control box cover
9. Setscrew
10. Control knob
11. Screw
12. Load selector plate
13. Load selector switch

14. Screw
15. Cover
16. Circuit breaker
17. Lens
18. O-ring
19. Lamp
20. Nut
21. Base
22. Nut
23. Screw
24. Plastic washer
25. Nut
26. Flat washer

27. Lockwasher
28. Terminal board assembly
29. Nut
30. Screw & captive washer assembly
31. Thermostat switch
32. Screw
33. Flat washer
34. Nut & captive washer assembly
35. Heater element
36. Load bank housing assembly
37. Load reject relay

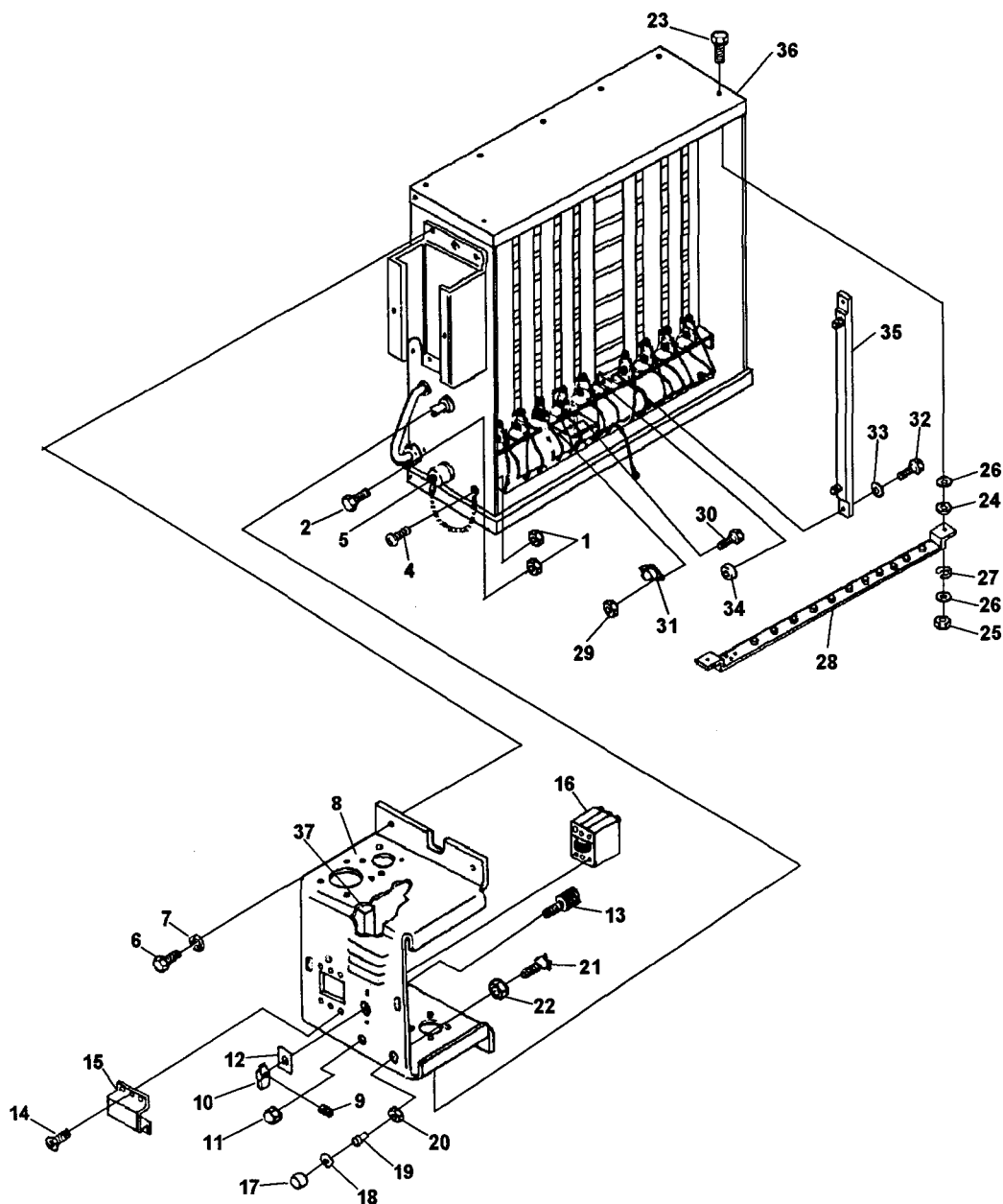


Figure 5-12. Load Bank Assembly, Exploded View



- (3) Installation.
  - (a) If removed, install protective cap (5, Figure 5-12) and screw and captive washer assembly (4).
  - (b) Solder connections to connectors.
  - (c) Push voltage selector connectors (3) onto load bank and install screws (2) and nuts (1).
  - (d) Refer to paragraph 5-21c and install load bank assembly onto generator set.
- c. Load Selector Switch.
  - (1) Removal.
    - (a) Remove screws (6, Figure 5-12) and lockwashers (7) and pull control box cover (8) away from load bank
    - (b) Tag and disconnect electrical leads to load selector switch.
    - (c) Remove setscrew (9) and control knob (10).
    - (d) Remove screws (11) to remove load selector plate (12) and switch (13).
  - (2) Cleaning and Inspection.
    - (a) Clean switch with filtered compressed air and a soft bristle brush or wipe with a clean, lint-free cloth lightly moistened with an approved solvent.
    - (b) Visually inspect switch for cracks, corrosion, stripped, or damaged threads and other damage.
  - (3) Testing.
    - (a) Rotate switch to the OFF position.
    - (b) Using an ohmmeter or similar device, check for continuity using Figure 5-13 as a guide.
    - (c) Replace switch if it fails to meet continuity requirements.
  - (4) Installation.
    - (a) Install switch (13, Figure 5-12), load selector plate (12), and screws (11).
    - (b) Install control knob (10), and setscrew (9).
    - (c) Connect electrical leads to load selector switch.
    - (d) Install control box cover (8) onto load bank with lockwashers (7), and screws (6).
- d. Circuit Breaker.
  - (1) Removal.
    - (a) Remove control box cover as outlined in subparagraph c. (1) (a) above.
    - (b) Tag and disconnect electrical leads to circuit breaker.
    - (c) Remove screws (14, Figure 5-12) to remove cover (15) and circuit breaker (16).
  - (2) Cleaning and Inspection.
    - (a) Clean circuit breakers with filtered compressed air and a soft bristle brush or wipe with a clean, lint-free cloth lightly moistened with an approved solvent.
    - (b) Visually inspect circuit breakers for cracks, corrosion, stripped, or damaged threads and evidence of shorting or other damage.



- (3) Testing.
  - (a) Place circuit breaker in OPEN position.
  - (b) Using an ohmmeter or similar device, check for open circuit between terminals using Figure 5-13 as a guide.
  - (c) Place circuit breaker in CLOSED position and check for continuity between terminals.
  - (d) Replace circuit breaker if it fails to meet the above continuity requirements.
- (4) Installation.
  - (a) Install circuit breaker (16, Figure 5-12), cover (15), and screws (14).
  - (b) Connect electrical leads to circuit breaker.
  - (c) Install control box cover as outlined in subparagraphs c. (4) (a) above.
- e. Indicator Light.
  - (1) Removal.
    - (a) Remove control box cover as outlined in subparagraph c. (1) (a) above.
    - (b) Tag and disconnect electrical leads to indicator light.
    - (c) Unscrew lens (17) and remove O-ring (18) and lamp (19).
    - (d) Remove nut (20) to remove base (21) and nut (22).
  - (2) Cleaning and Inspection.
    - (a) Clean indicator light with filtered compressed air and a soft bristle brush or wipe with a clean, lint-free cloth lightly moistened with an approved solvent.
    - (b) Visually inspect light for cracks, corrosion, cracked or broken lens, stripped or damaged threads, burns and other damage.
    - (c) Check lamp for burned out filament.
    - (d) Replace only parts found damaged.
  - (3) Installation.
    - (a) Install nut (22, Figure 5-12), base (21), and nut (20).
    - (b) Install lamp (19), O-ring (18), and screw lens (17).
    - (c) Connect electrical leads to indicator light.
    - (d) Install control box cover as outlined in subparagraph c. (4) (a) above.
- f. Terminal Board Assembly.
  - (1) Removal.
    - (a) Remove load bank assembly as outlined in paragraph 5-21 c. (1) above.
    - (b) Tag and disconnect electrical leads to terminal board assembly.
    - (c) Remove screws (23, Figure 5-12), plastic washers (24), nuts (25), flat washers (26) and washers (27) to remove terminal board assembly (28).
  - (2) Cleaning and Inspection.
    - (a) Clean terminal board with filtered compressed air and a soft bristle brush or wipe with a clean, lint-free cloth lightly moistened with an approved solvent.
    - (b) Visually inspect terminal board for cracks, corrosion, burns and stripped or damaged threads.
    - (c) Replace terminal board if damaged beyond simple repair.



- (3) Installation.
  - (a) Install terminal board assembly (28, Figure 5-12), washers (27), flatwashers (26), nuts (25), plastic washers (24), and screws (23).
  - (b) Connect electrical leads to terminal board assembly.
  - (c) Install load bank assembly as outlined in paragraph 5-21a.
- g. Thermostat switch.
  - (1) Removal.
    - (a) Remove load bank assembly as outlined in paragraph 5-21 c. (1) above.
    - (b) Tag and disconnect electrical connections to thermostat switch.
    - (c) Remove nuts (29, Figure 5-12) and screw and captive washer assemblies (30) to remove thermostat switch (31 ).
  - (2) Cleaning and Inspection.
    - (a) Clean thermostat by flushing with an approved solvent and drying thoroughly with filtered compressed air.
    - (b) Visually inspect thermostat for cracks, corrosion, stripped or damaged threads, and other obvious damage.
    - (c) Replace thermostat if damage is found.
  - (3) Installation.
    - (a) Install thermostat switch (31, Figure 5-12), screw and captive washer assemblies (30) and nuts (29).
    - (b) Connect electrical leads to thermostat switch.
    - (c) Install load bank assembly as outlined in paragraph 5-21a. above.
- h. Heater Element.
  - (1) Removal.
    - (a) Remove load bank assembly as outlined in paragraph 5-21 c. (1) above.
    - (b) Tag and disconnect electrical leads to terminal board assembly.
    - (c) Remove screws (32, Figure 5-12), flat washers (33) and nut and captive washer assemblies (34) to remove heater elements (35) from housing (36).
  - (2) Cleaning and Inspection.
    - (a) Clean heater elements with filtered compressed air and an electrician's brush or wipe with a clean, lint-free cloth lightly moistened with an approved solvent.
    - (b) Visually inspect heater elements for cracks, breaks, corrosion, stripped or damaged threads and other damage.
  - (3) Testing.
    - (a) Using an ohmmeter, check resistance between terminals of heating elements. Resistance shall be approximately 37 ohms.
    - (b) Replace any heater element which does not test correctly.



- (4) Installation.
  - (a) Position housing (36, Figure 5-12), install heater elements (35), nut and captive washers assemblies (34), flatwashers (33) and screws (32).
  - (b) Connect electrical leads to terminal board assembly.
  - (c) Install load bank assembly as outlined in paragraph 5-21a above.
- i. Load Reject Relay. Visually inspect load reject relay (37, Figure 5-12) for insecure mounting, loose electrical connections, dents, cracks and evidence of shorting or other damage.
- j. Wiring Harness.
  - (1) Removal. Tag and disconnect wiring harness wires, connectors, and terminals as required for access to other components or replacement of damaged parts.
  - (2) Cleaning and Inspection.
    - (a) Clean wiring harness with filtered compressed air and a soft bristle brush or wipe with a clean, lint-free cloth lightly moistened with an approved solvent.
    - (b) Visually inspect wiring harness for burns, bent, corroded or otherwise damaged connectors and terminals.
    - (c) Check insulation for burns, chafing, and deterioration
  - (3) Testing. Check continuity of individual wires with a multimeter or continuity light using Figure 5-13 as a guide.

**CAUTION**

**Do not use acid core solder on electrical components. Equipment damage could result if caution is not observed.**

- (4) Repair. Replace damaged wires, terminals, and connectors by unsoldering connections, installing replacement parts and soldering connections.

**NOTE**

If more than 30 percent of the wires are damaged, replace the wiring harness and forward it to higher level for rebuilding.

- (5) Installation. Connect wiring harness wires, connectors and terminals after replacement of damaged parts.



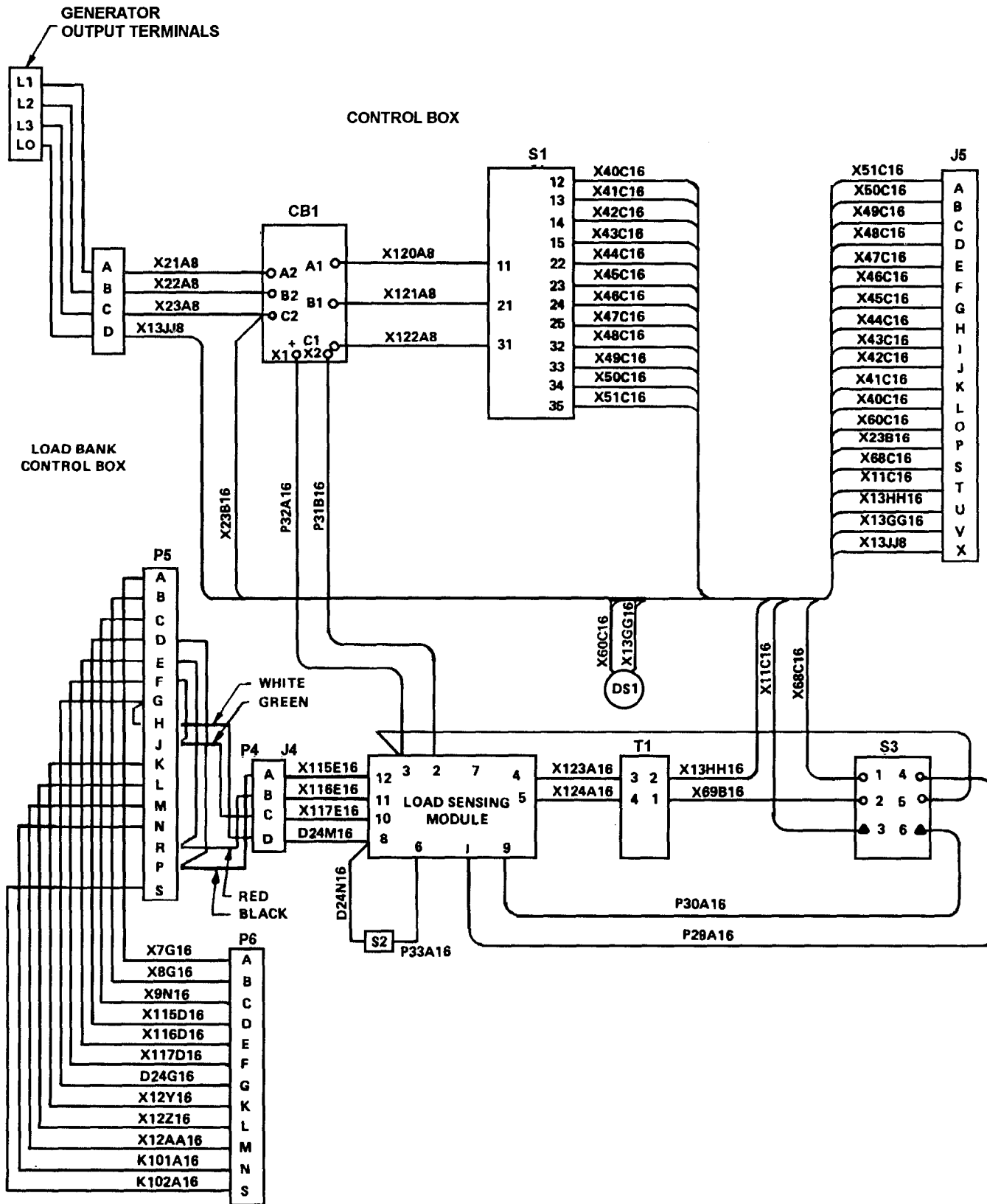


Figure 5-13. Load Bank Wiring Diagram, Dwg. No. 72-2826 (Sheet 1 of 2)



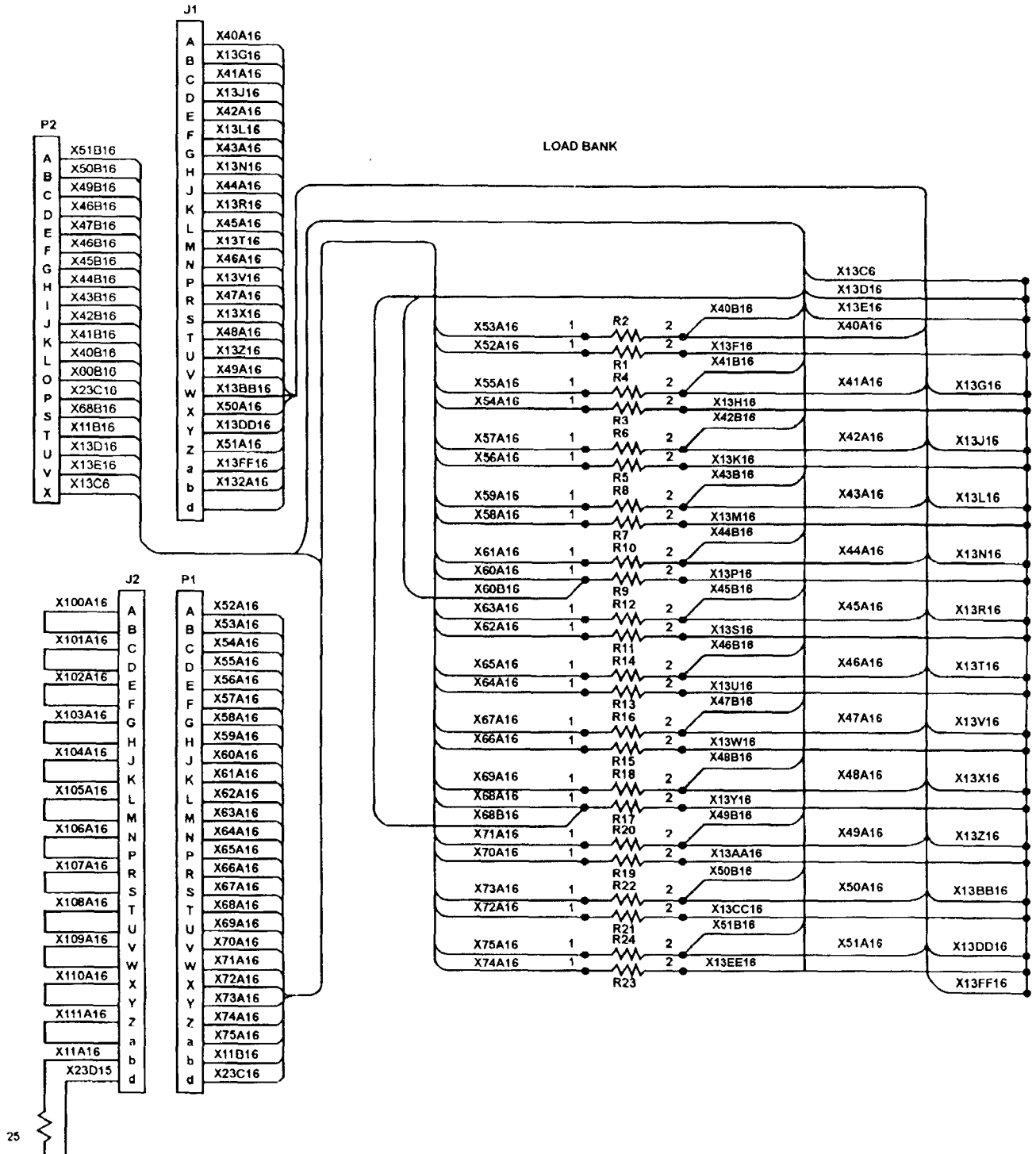
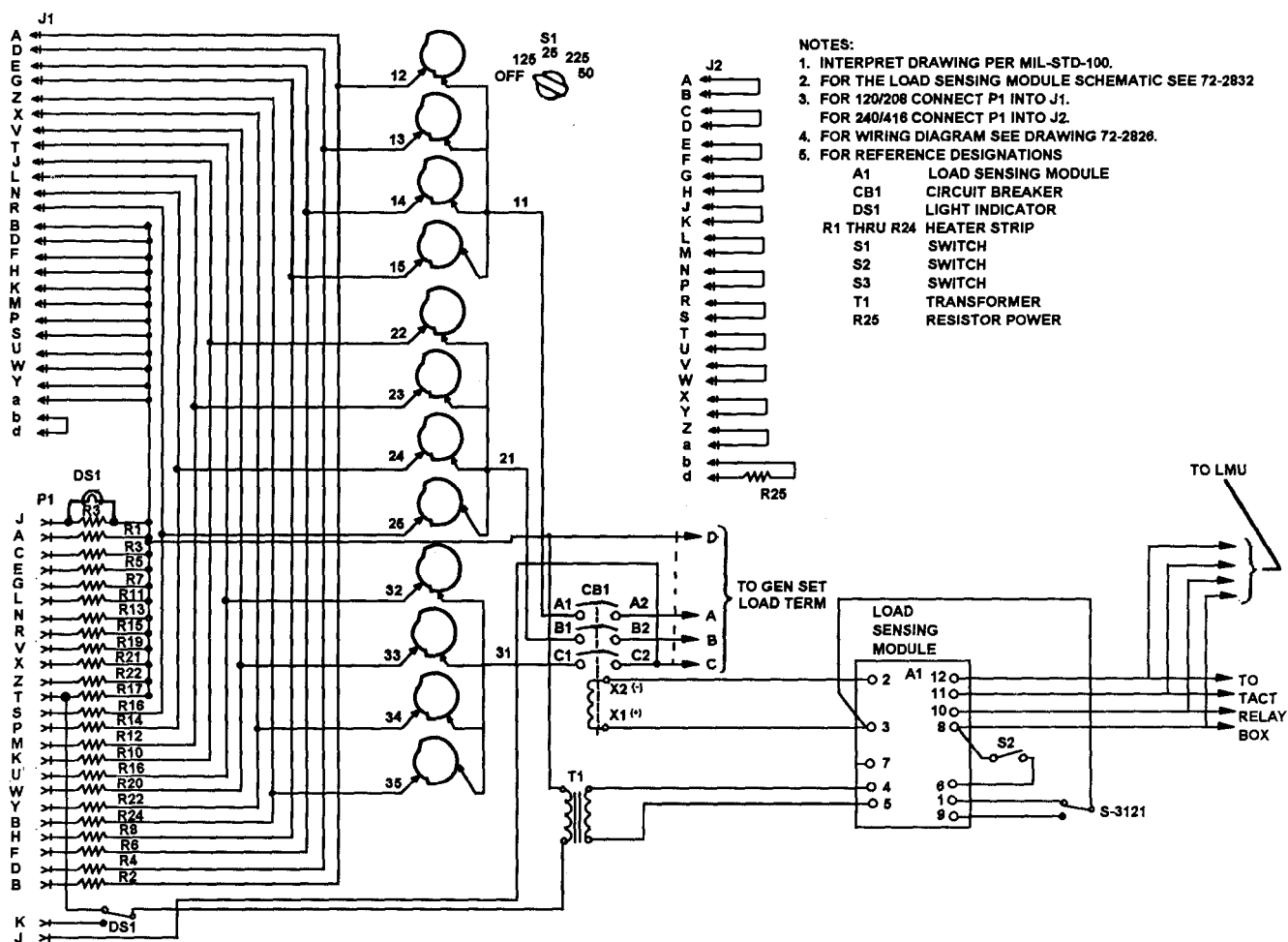


Figure 5-13. Load Bank Wiring Diagram, Dwg. No. 72-2826 (Sheet 2 of 2)





**Figure 5-14. Load Bank Schematic Diagram, Dwg. No. 72-2827**



## Section VI. APPLICATIONS KIT

**5-26 GENERAL.** The applications kit provides a remote stop capability, remote battle short capability, and remote fuel monitoring capability. It consists of a connector plate, cable harness assembly, and remote housing assembly.

**5-27 TROUBLESHOOTING.** Table 5-16 contains a list of malfunctions which is useful in diagnosing and correcting unsatisfactory operation or failure of the applications kit remote functions assembly. Each malfunction is followed by an alphabetical listing of test or inspection. The corresponding alphabetical listing of corrective actions contains references to the applicable maintenance paragraph for correcting the malfunction. The table lists only those malfunctions, test or inspection and corrective actions within the scope of unit maintenance. Any malfunction whose corrective actions are beyond the scope of unit maintenance shall be reported to higher level maintenance.

### NOTE

There are no operator's troubleshooting procedures for the Applications Kit.

**Table 5-16. Unit Troubleshooting For Applications Kit**

### NOTE

There are no operator's preventive maintenance checks and services for the applications kit.

---

#### MALFUNCTION

#### TEST OR INSPECTION

#### CORRECTIVE ACTION

---

##### 1. LOW FUEL MONITOR DOES NOT FUNCTION.

Defective fuel level gage, fuel level gage wiring, or fuel level transmitter on generator set.  
Defective cable assembly.

Refer to paragraph 4-63c.

##### 2. GENERATOR SET DOES NOT RESPOND TO REMOTE EMERGENCY STOP SIGNAL.

Defective speed switch.

Refer to paragraph 4-18.

##### 3. GENERATOR SET DOES NOT RESPOND TO REMOTE BATTLE SHORT SIGNAL.

Defective circuit breaker.

Refer to paragraph 4-63c.

---



## 5-28 UNIT MAINTENANCE OF APPLICATIONS KIT.



**Do not attempt to perform maintenance tasks on the applications kit while generator set is operating. Serious electrical shock or death by electrocution may result from failure to observe this warning.**

- a. Inspect Applications Kit (Refer to Figure 2-14).
  - (1) Remove dust cap from connector J1 and inspect for dirt, loose pins, discoloration, and loose hardware. Make sure dust cover retaining chain is mounted on lower right hand mounting screw of connector J1.
  - (2) Inspect interior of generator set for dust, dirt, water, and excessive oil or grease.
  - (3) Inspect cables and wire harness connectors for loose connectors and plugs.
  - (4) Inspect cables and wires for frayed insulation, bum marks, and loose wires and pins.
  - (5) Inspect cable connector strain relief screws for tightness.
  - (6) Inspect relays K1, K2, and K3 (Figure 5-15) on remote functions housing for discoloration, bent pins, and loose fittings.

## Section VII. ACOUSTIC SUPPRESSION KIT

### 5-29 GENERAL

The acoustic suppression kit lowers the noise level of the generator set to 70 dB(a) at 7 meters. It consists of panels, doors, and components that cover or replace original components of the generator set. The generator set is operated and maintained in the same manner, however, access to components and operation will change slightly due to configuration changes.

The overall weight and cube of the generator set will increase with the acoustic suppression kit installed. (Refer to para 1-11.) Inspect the components of the acoustic suppression kit upon delivery for bends, cracks, dents, missing components, or other damage.

All side doors on the generator set must be closed for the acoustic suppression kit to function properly.

The inlet and discharge doors on the roof of the acoustic suppression kit must be open during operation and closed during periods of nonuse. The discharge door must also be open to gain access to the radiator access door.

Other doors on the acoustic suppression kit provide for access to components on the generator set. (Refer to figure 2-15.)

The generator set is operated and maintained in the same manner; however, access to components and operation will change slightly.

The ground wire must be installed on the generator set prior to mounting on a trailer. The ground stud cannot be reached due to the side panel skirts.

For the best sound attenuation results, tape all loose tools or anything that may rattle. Ensure all trailer hardware is checked for tightness. Ensure fire extinguisher bracket is free of rattles.

When moving generator set with a forklift, both side panel skirts must be in the raised position.

When positioning or moving generator set, 1 inch ground clearance must remain between bottom tray and surface to prevent damage.

Do not skid unit with bottom tray installed.



- |                    |                           |
|--------------------|---------------------------|
| 1. Connector plate | 11. Relay K2              |
| 2. Connector J1    | 12. Relay K1              |
| 3. Capscrew        | 13. Relay K3              |
| 4. Lockwasher      | 14. Relay socket          |
| 5. Capscrew        | 15. Remote functions assy |
| 6. Lockwasher      | 16. Connector J2          |
| 7. Screw           | 17. Connector P2          |
| 8. Lockwasher      | 18. Cable harness         |
| 9. Screw           |                           |
| 10. Lockwasher     |                           |

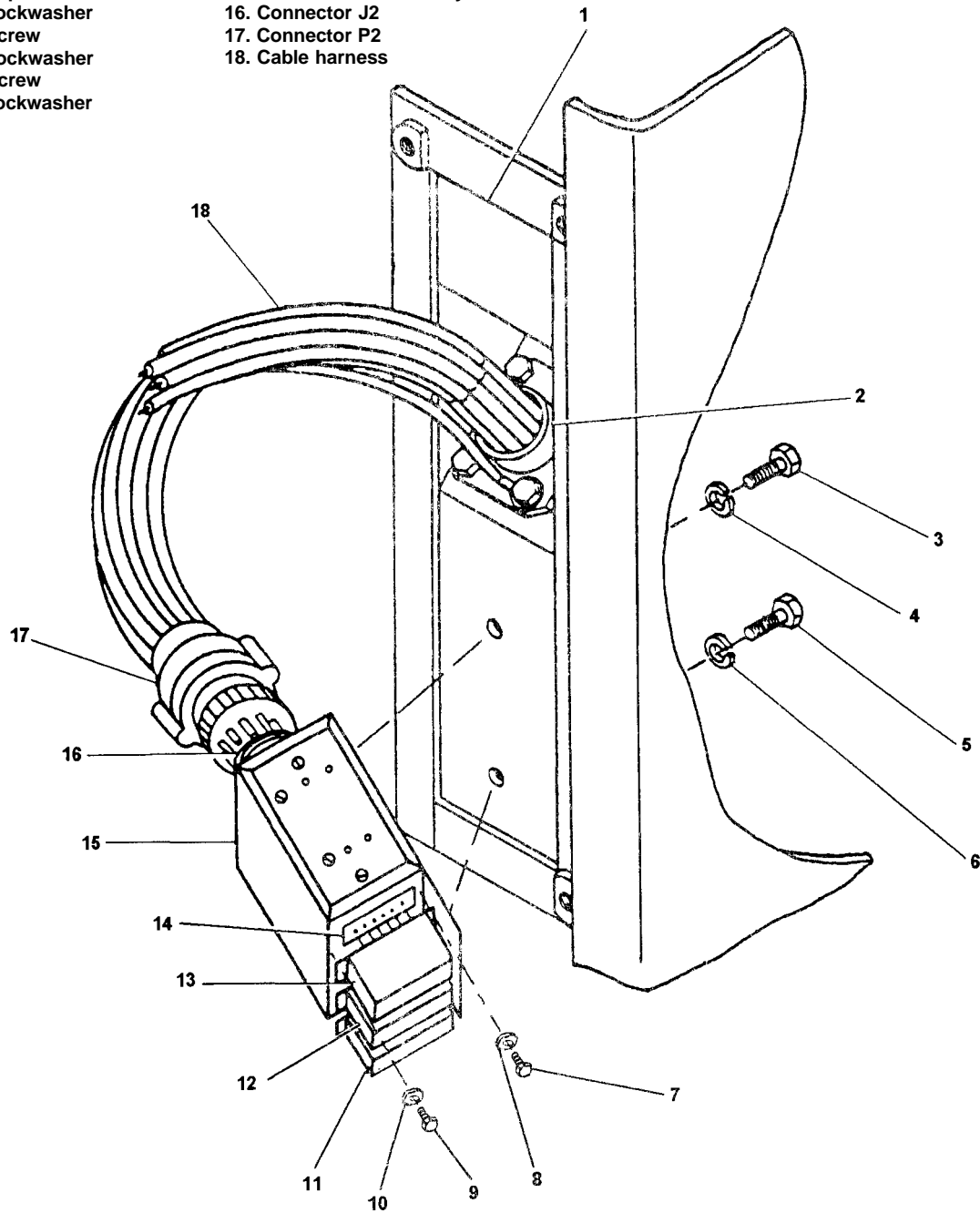


Figure 5-15. Remote Functions Assembly



When troubleshooting the generator set with the acoustic suppression kit installed, schematics are stored behind the document box mounted on the rear panel.

- a. Inspect the acoustic suppression kit components. (Refer to figure 2-15).
  - (1) Open doors and inspect for dirt, oil, water, or other foreign material.
  - (2) Inspect for defective seals, proper mounting, and loose, damaged, or missing components.
  - (3) Close doors and inspect for proper seal with enclosure.
  - (4) Inspect controls access door window for cracks, improper seal, or other damage.
- b. Service the acoustic suppression kit. (Refer to figure 2-15).
  - (1) Carefully clean controls access door window with a mild cleaner.
  - (2) Wipe controls access door window dry with a clean, soft cloth.
  - (3) Clean all surfaces of the acoustic suppression kit with mild soap and water to remove deposits of grease, oil, or other foreign material. Allow to air dry.

#### NOTE

When acoustic suppression kit is installed, draining of cooling system and fuel system is difficult. Drain lines must be fabricated to drain fluids overboard.

### 5-30 ACOUSTIC SUPPRESSION KIT INSTALLATION AND REMOVAL.



**Do not use hoisting equipment with maximum capacity less than 5,000 pounds. Do not allow generator set to awing while suspended. Do not allow personnel under generator set or components of acoustic suppression kit when hoisted or lifted. Death or severe injury may result.**

- a. Prepare generator set for installation of acoustic suppression kit.

#### CAUTION

**Do not allow components with rubber seals to slide on surfaces. Damage to rubber seals will result. Equipment damage could result if caution is not observed.**

#### CAUTION

**Use a minimum bridle of 5 feet on the hoisting sling to avoid undue side pressure on the lifting frame. Equipment damage could result if caution is not observed.**

#### NOTE

If generator set is trailer-mounted, generator set must be removed from trailer, and rubber isolators supplied with kit placed between the generator set and trailer mounting surface. When installing the generator set, attach anti-rotation dip, and attach the mounting bolts. Bolts should be torqued to 5 ft-lb (6.80 N•m) and jam nuts installed. (Jam nuts are common hardware items.) Once the acoustics suppression kit is installed, gen set will require 1 inch ground clearance. Do not skid gen set with acoustic suppression kit installed. Do not forklift unless both side panel skirts are in the raised position. If generator set is trailer-mounted, the trailer brackets supplied with kit must be installed. The brackets allow for the extended length when the acoustic suppression kit is installed.



- |                                      |                                       |
|--------------------------------------|---------------------------------------|
| 1. Fuel Level Sensor<br>Wire (to P9) | 10. Connector P2                      |
| 2. Connector P7                      | 11. Connector J2                      |
| 3. Connector J29                     | 12. Load Terminal<br>Board Assy Leads |
| 4. Connector J41                     | 13. Chassis Ground                    |
| 5. Connector P4                      | 14. Connector P37                     |
| 6. Connector J3                      | 15. Connector J5                      |
| 7. Connector P41                     | 16. Connector J37                     |
| 8. Connector J1                      | 17. Connector P6                      |
| 9. Generator Ground                  |                                       |

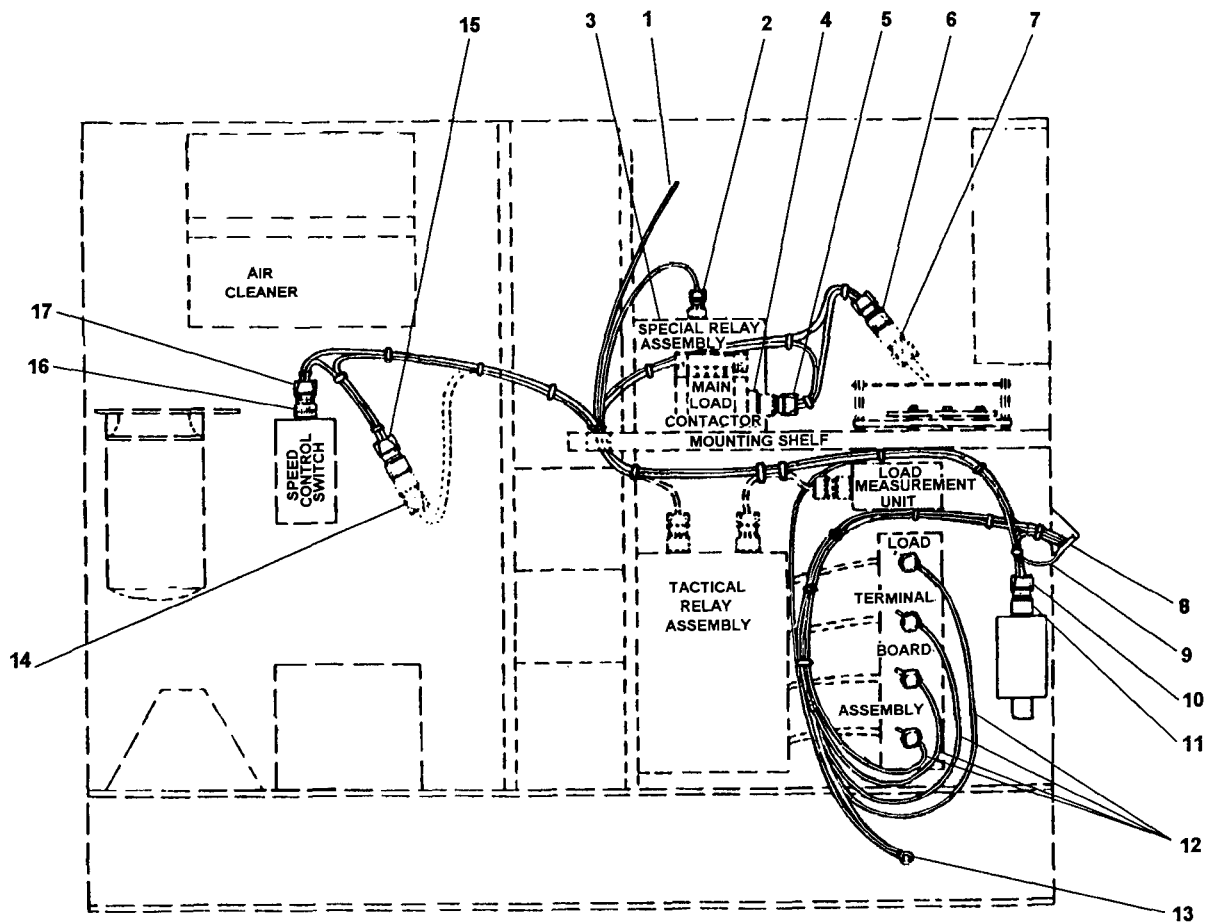
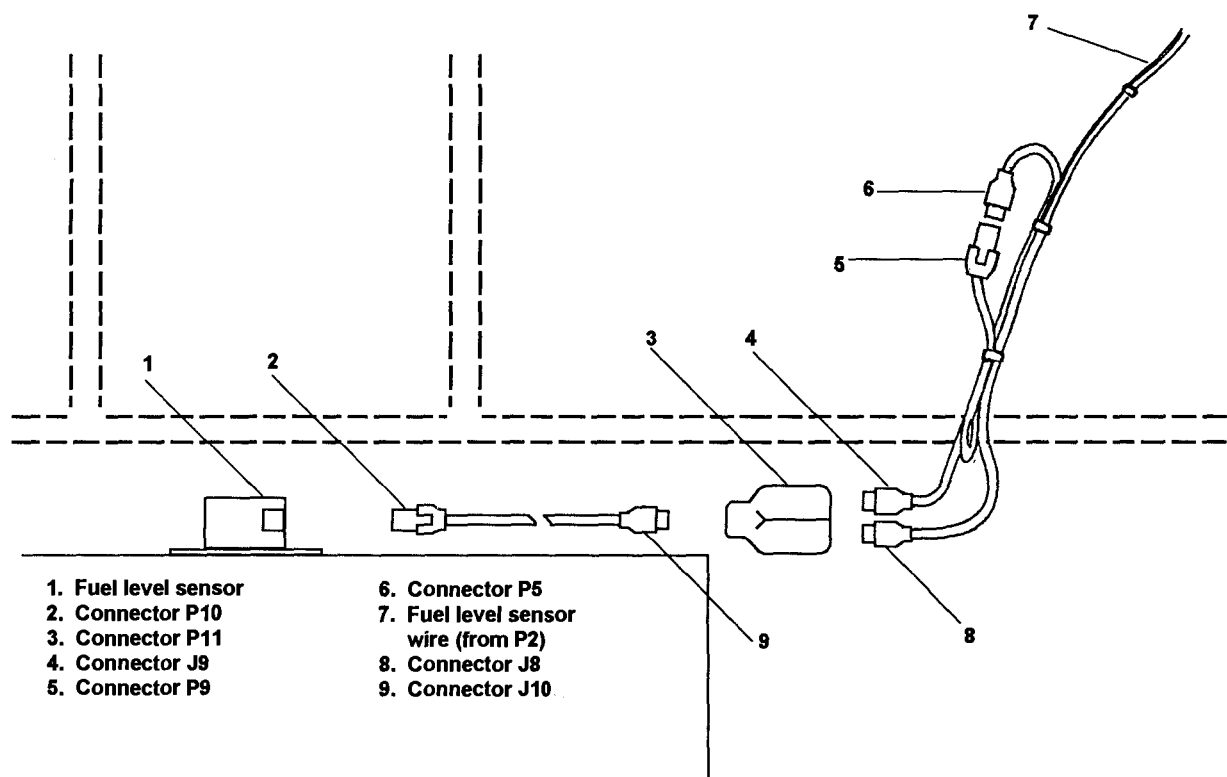


Figure 5-16. Applications Kit Cable Harness Assembly Installation (Right Side)





**Figure 5-17. Applications Kit Cable Harness Assembly Installation (Left Side)**

- b. Install acoustic suppression kit on generator set.

**NOTE**

Bottom tray assembly will only go onto unit one way. Note location of weld nuts in relation to fork lift tunnels. Bottom tray assembly must be cleaned and rubber seal greased with GAA prior to installing.

- (1) Using a suitable lifting device, raise generator set and place 6"x6" blocks under skids. Lower generator set onto blocks.
- (2) Grease inside of generator set skids with grease (GAA).
- (3) Using a suitable lifting device, raise generator set, remove 6"x6" blocks, and place 2"x4" blocks under skids of generator set. Lower generator set onto 2"x4" blocks. Ensure blocks are under skids only. Do not remove tension from lifting device.



- (4) Slide bottom tray under generator set. Ensure weld nuts are positioned in down position. Weld nuts should be centered on fork lift tunnel holes.
- (5) Raise bottom tray assembly, and install keepers, washers, and capscrews to secure on side of bottom tray assembly. (Refer to Figure 5-18.)
- (6) Raise generator set, and remove 2"x4" blocks. Place a 1"x4" block under bottom tray assembly on other side and slowly lower generator set to push bottom tray assembly into position. Rubber must not bend or be allowed to tear loose when generator set is lowered.
- (7) Install keepers, washers, and capscrews to secure the bottom tray assembly. (Refer to Figure 5-18.)
- (8) Raise generator set, and remove 1"x4" block Lower generator set and remove lifting device.

**CAUTION**

**Do not allow side panel to fall from mounting members or set side panels on threaded studs Equipment damage could result if caution is not observed.**

- (9) Raise side panel skirt 90° and remove screws, capscrews, washers, keepers, and remove upper side panel skirt. (Refer to Figure 5-19). Attach lifting sling, and carefully raise and position side panel assembly on mounting member.
- (10) Install three rubber washers, three flat- washers, and three locking nuts in bottom side panel. Ensure rubber flaps are flat against radiator and are pointed forward. Remove plastic plug and feed oil drain hose through side panel hole.
- (11) Remove lifting sling from side panel.
- (12) Repeat steps (9) thru (11) to install other side panel.

**CAUTION**

**Do not allow front lower panel to drop or set on ground. Damage to brackets could result. Equipment damage could result if caution is not observed.**

- (13) Position front lower panel assembly on generator set. Ensure top rubber flat is in raised position on radiator shell lip. Remove plastic plugs from rotolocks holes. Align male and female rotolocks and, using hex tool, turn rotolock to secure the front lower panel assembly. (Refer to Figure 5-19.) Install plastic plugs. Ensure mounting zee is below bottom tray assembly.
- (14) Attach lifting strap to front top panel, and raise front top panel assembly on side panels. Ensure alignment pins fit in holes for proper alignment. Remove plastic plugs from rotolockholes. Align male and female rotolocks and using hex tool, turn rotolock to secure the front top panel assembly. Remove lifting strap. (Refer to Figure 5-19.) Install plastic plugs.
- (15) Position exhaust extension on engine exhaust. Install and tighten damp to secure the exhaust extension. Exhaust extension opening must be pointed down and must not interfere with other components later.

**CAUTION**

**Do not allow rear panel assembly to drop or set on ground. Damage to brackets could result. Equipment damage could result if caution is not observed.**

- (16) Attach lifting strap on rear panel assembly, and position rear panel assembly on generator set. Ensure alignment pins are in holes for proper alignment. Remove plastic plugs from rotolock holes. Align male and female rotolocks and, using hex tool, turn rotolocks to secure the rear panel assembly. Remove lifting strap. (Refer to Figure 5-19.) Install plastic plugs. Ensure mounting zee is below bottom tray assembly.

**NOTE**

Ensure lifting clevises are in the raised position before installing the roof panel assembly.



- (17) Attach lifting sling to roof panel assembly, and position on generator set. Ensure alignment pins are in holes. It may be necessary to use C-clamps to pull the side panels into position using the lifting clevis as an anchor for the C-clamp. Remove plastic plugs from rotolock holes. Align male and female rotolocks and, using hex tool, turn rotolocks to secure the roof panel assembly. Remove the lifting sling. (Refer to Figure 5-19.) Install plastic plugs. Install two socket head capscrews to secure roof panel assembly.
- (18) Slide sealing angle into position, and tighten capscrews.
- (19) Tighten capscrews securing mounting members.
- (20) Attach lifting sling to inlet turn assembly, and position on roof assembly. Remove the lifting sling. Remove plastic plugs from rotolock holes. Align male and female rotolocks and, using hex tool, turn rotolocks to secure the inlet turn assembly. (Refer to Figure 5-19.) Install plastic plugs.
- (21) Attach lifting sling to discharge turn assembly, and position on roof assembly. Remove the lifting sling. Remove plastic plugs from rotolock holes. Align male and female rotolocks and using hex tool, turn rotolocks to secure the discharge turn assembly. (Refer to figure 5-19.) Install plastic plugs.

#### NOTE

Keepers, washers, and capscrews must be moved to end panels to secure side panel skirts.

- (22) Position upper side panel skirt on side panels and install screws, keepers, washers, and capscrews.
- (23) Install side panel skirts on slip-joint hinge and secure with keepers.
- (24) Lower side panel skirts.
- (25) Ensure inlet door, discharge door, control panel access door, and access doors are closed.
- (26) Reconnect battery cables.

#### NOTE

When bottom panel tray assembly is installed, generator set will require one inch clearance. Stones, debris, or other material may damage bottom tray assembly. Generator set may not be skidded with bottom panel tray installed.

- c. Remove acoustic suppression kit from generator set by reversing installation procedures.
- d. If generator set is to be trailer mounted, the following must be performed.
  - (1) Raise side panel skirts, and install ground wire. Install anti-rotation clips and fiber washer on capscrews, and install capscrews. Lower side panel skirts.
  - (2) Glue isolators on skid base or surface of trailer. (Refer to Figure 5-18.)
  - (3) Lower generator set onto trailer. Attach ground wire to trailer.
  - (4) Install washers and nuts on capscrews to secure generator set.

#### NOTE

Do not overtighten nuts. Tighten to 5 ft-lb torque (6.80 N•m). install jam nuts.

- (5) Remove hex nuts, capscrews, and locking pins from trailer platform.
- (6) Position trailer brackets, and install capscrews, hex nuts, and locking pins on trailer brackets.



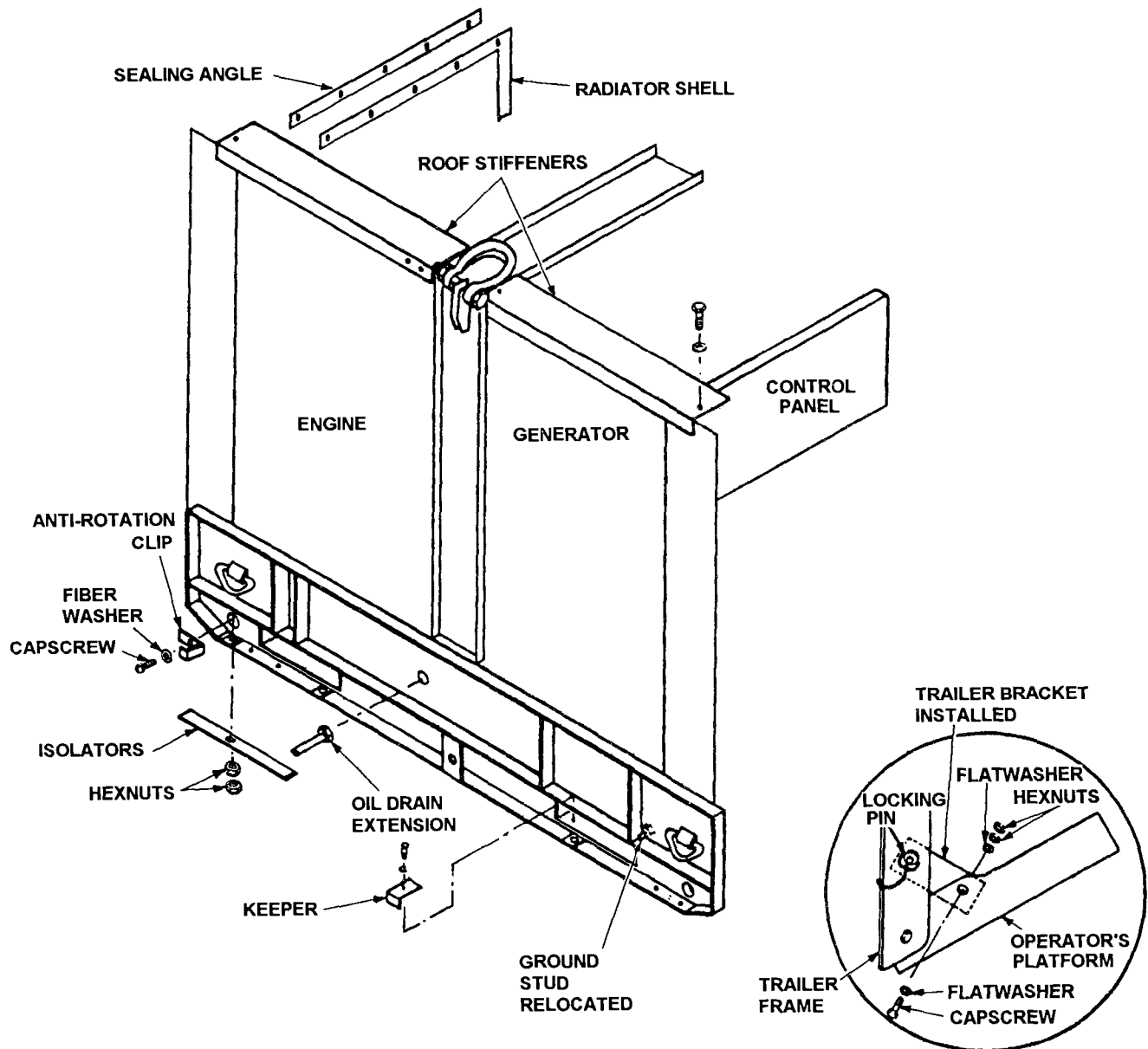


Figure 5-18. Roof Stiffeners, Sealing Angle, Oil Drain, Isolators, Bottom Panel Tray Assembly, and Trailer Brackets



1. Discharge Turn Assembly
2. Inlet Turn Assembly
3. Roof Panel Assembly
4. Rear Panel Assembly
5. Side Panel Skirt
6. Side Panel
7. Rod Stiffeners
8. Sealing Angle
9. Isolators

10. Bottom Panel Tray Assembly
11. Front Lower Panel Assembly
12. Front Upper Panel Assembly
13. Lifting Strap
14. Mounting Zee
15. Capscrew
16. Upper Side Panel Skirt
17. Document Box

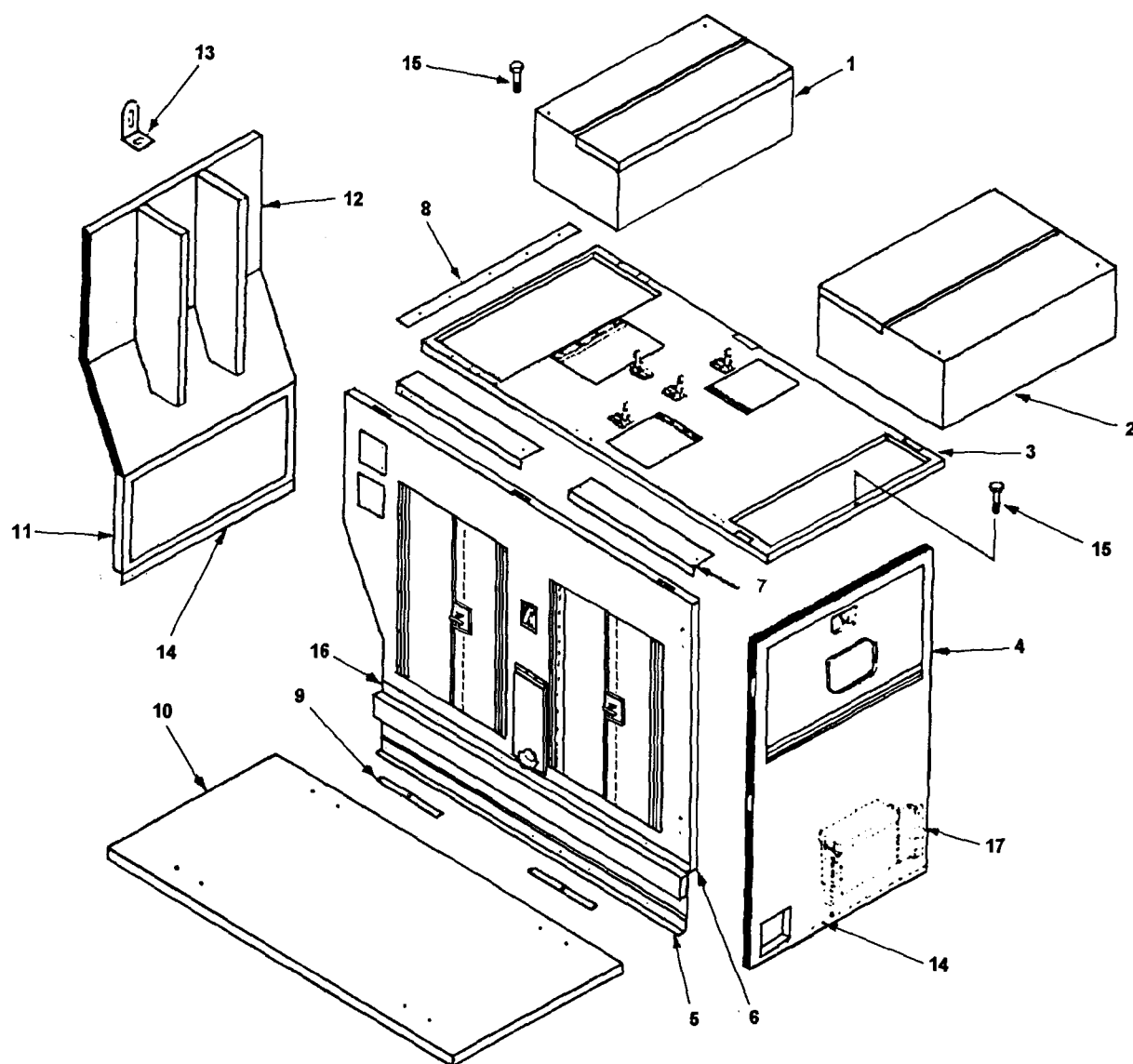


Figure 5-19. Acoustic Suppression Kit Major Components



## Appendix A REFERENCES

This Appendix contains a list of reference manuals that may be used in conjunction with this TM in the operation and maintenance of the 15 KW DOD Generator Set. Those manuals not coded are applicable for use by all services. The manuals are coded (A) for Army use, (F) Air Force use, and (N) Navy use.

### **A-1 FIRE PROTECTION.**

TB 5-4200-200-10 (A) Hand Portable Fire Extinguishers Approved for Army Use

### **A-2 LUBRICATION.**

C9100-IL Petroleum, Petroleum Base Products and Related Materials  
C6800-IL Chemicals and Chemical Products  
LO 9-6115-464-12 (A) Lubrication Order

### **A-3 PAINTING.**

T.O. 35-1-3 (F) Painting and Marking of USAF Aerospace Ground Equipment  
TM 43-0139 (A) Painting Instructions for Army Materiel

### **A-4 RADIO SUPPRESSION.**

TM 11-65 (A) Radio Interference Suppression  
T.O. 31-1-141-13 (F) Basic Electronics Technology

### **A-5 MAINTENANCE.**

DA PAM-738-750 (A) The Army Maintenance Management System  
TM 9-6140-200-14 (A) Maintenance of Storage Batteries; Lead Acid Type  
TO. 36Y-4-1-194 (F)  
T.O. 00-25-225 (F) Repair of External Power Cables, Aerospace Ground Equipment  
T.O. 00-25-234 (F) General Shop Practice Requirements for the Repair, Maintenance,  
and Test of Electronic Equipment  
NAVW EPS 01-1A-505 (N) Installation Practices for Aircraft Electric and Electronic Wiring  
T.O. 1-1A-14(F)  
TM 55-1500-323-24 (A)  
T.O. 35-1-11 (F) Organizational, Intermediate and Depot Level Maintenance for  
FSC 6115 Non-Airborne Equipment  
T.O. 35-1-12 (F) Compounds and Procedures for Cleaning Aerospace Ground Equipment  
T.O. 35-1-26 (F) Repair/Replacement Criteria for FSC 6115 Aerospace Ground Equipment  
T.O. 35-1-524 (F) USAF Equipment Registration Number System Applicable to FSC 6115 Equipment  
T.O. 36-1-7 Operation in Cold Weather Areas  
TM 11-6625-3197-13&P  
T.O. 36Y32-1-142 (F) Organizational Care, Maintenance and Repair of Pneumatic  
Tires and Inner Tubes  
TM 9-6115-464-24P (A) Unit, Intermediate (Field) (Direct Support and  
TO. 35C2-3-445-4 (F) General Support) and Depot Maintenance Repair Parts and  
NAVFAC P-8-624-24P (N) Special Tools List  
TM 9-6115-624-BD (A) Battlefield Damage Assessment and Repairs  
TM 9-6115-464-34 (A) Direct and General Support and Depot Level Maintenance Manual  
T.O.35C2-3-445-2 (F)  
NAVFAC-P-8-624-34 (N)



**A-5. MAINTENANCE - (Continued)**

TB 750-651 (A)	Use of Anti-freeze Solutions, Antifreeze Extender and Cleaning Compounds and Test Kit In Engine Assembly
TM 5-6115-588-14 (A)	Maintenance Manual Including Repair Parts and Special Tools
T.O. 35CA-1-111 (F)	List for Auxiliary Equipment 15 through 200 KW, DOD
NAVFAC P-8-601 (N)	Family Generator Sets
SF 368 (A)	Equipment Improvement Recommendations
AFR 66-1 (F)	Air Force Maintenance Management Policy
DA Form 2028-2 (A)	Recommended Changes to Publications
T.O. 00-5-1 (F)	AFTO Form 22
DA Form 2404 (A)	Equipment Inspection and Maintenance Worksheet

**A-6 SHIPMENT AND STORAGE.**

TM 38-230 (A)	Preservation, Packaging and Packing of Military Supplies and Equipment
TB 740-97-2 (A)	Preservation of USAMECOM Mechanical Equipment for Shipment and Storage
AR 750-1 (A)	Administrative Storage of Equipment
T.O. 35-1-4 (F)	Processing and Inspection of Aerospace Ground Equipment for Storage and Shipment
TO. 38-1-5 (F)	Processing and Inspection of Non-Mounted, Non-Aircraft Gasoline and Diesel Engines for Storage and Shipment

**A-7 DESTRUCTION TO PREVENT ENEMY USE**

TM 750-244-3 (A)	Procedures for Destruction of Equipment to Prevent Enemy Use
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## Appendix B MAINTENANCE ALLOCATION CHART (MAC)

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### Section 1. INTRODUCTION

#### **B-1 THE ARMY MAINTENANCE SYSTEM MAC.**

a. This introduction (Section 1) provides a general explanation of all maintenance and repair functions authorized at various maintenance levels under the standard Army Maintenance System concept.

b. The Maintenance Allocation Chart (MAC) in Section II designates overall authority and responsibility for the performance of maintenance functions on the identified end item or component. The application of the maintenance functions to the end item or component will be consistent with the capacities and capabilities of the designated maintenance levels, which are shown on the MAC in column (4) as:

Unit - includes two subcolumns, C (operator/crew) and O (unit) maintenance.

Direct Support - includes an F subcolumn.

General Support - includes an H subcolumn.

Depot - includes a D subcolumn.

c. Section III lists the tools and test equipment (both special tools and common tool sets) required for each maintenance function as referenced from Section II.

d. Section IV contains supplemental instructions and explanatory notes for a particular maintenance function.

**B-2 MAINTENANCE FUNCTIONS.** Maintenance functions will be limited to and defined as follows: (See 3.2.5.2g for ammunition MAC explanation.)

a. Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination (e.g., by sight, sound, or feel).

b. Test. To verify serviceability by measuring the mechanical, pneumatic, hydraulic, or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. Operations required periodically to keep an item in proper operating condition; i.e., to clean (includes decontaminate, when required), to preserve, to drain, to paint, or to replenish fuel, lubricants, chemical fluids, or gases.

d. Adjust. To maintain or regulate, within prescribed limits, by bringing into proper position, or by setting the operating characteristics to specified performance.

e. Align. To adjust specified variable elements of an item to bring about optimum or desired performance.

f. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments or test, measuring, and diagnostic equipment used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. Remove/Install. To remove and install the same item when required to perform service or other maintenance functions. Install may be the act of emplacing, seating, or fixing into position a spare, repair part, or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.

h. Replace. To remove an unserviceable item and install a serviceable counterpart in its place. "Replace" is authorized by the MAC and assigned maintenance level is shown as the 3d position code of the SMR code.



i. Repair. The application of maintenance services including fault location/troubleshooting<sup>2</sup>, removal/installation, and disassembly/assembly<sup>3</sup> procedures, and maintenance actions<sup>4</sup> to identify troubles and restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item, or system.

j. Overhaul. That maintenance effort (service/action) prescribed to restore an item to a completely serviceable/operational condition as required by maintenance standards in appropriate technical publications (i.e., DMWR). Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k. Rebuild. Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (e.g., hours/miles) considered in classifying Army equipment/components.

### **B-3 EXPLANATION OF COLUMNS IN THE MAC, SECTION II.**

a. Column 1, Group Number. Column 1 lists functional group code numbers, the purpose of which is to identify maintenance significant components, assemblies, subassemblies, and modules with the next higher assembly.

b. Column 2, Component Assembly. Column 2 contains the item names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. Column 3, Maintenance Function. Column 3 lists the functions to be performed on the item listed in Column 2. (For detailed explanation of these functions, see paragraph B-2.)

d. Column 4, Maintenance Level. Column 4 specifies each level of maintenance authorized to perform each function listed in Column 3, by indicating work time required (expressed as man-hours in whole hours or decimals) in the appropriate subcolumn. This work-time figure represents the active time required to perform that maintenance function at the indicated level of maintenance. If the number or complexity of the tasks within listed maintenance function vary at different maintenance levels, appropriate work-time figures will be shown for each level. The work-time figure represents the average time required to restore an item (assembly, subassembly, component, module, end item, or system) to a serviceable condition under typical field operating conditions. This time includes preparation time (including any necessary disassembly/assembly time), the troubleshooting/fault location time, and quality assurance time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart. The symbol designations for the various maintenance levels are as follows:

- C . . . . Operator maintenance
- O . . . . Unit maintenance
- F . . . . Direct support maintenance
- L . . . . Specialized Repair Activity (SRA)<sup>5</sup>
- H . . . . General support maintenance
- D . . . . Depot maintenance

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<sup>1</sup> Services - Inspect, test, service, adjust, align, calibrate, and/or replace.

<sup>2</sup> Fault location/troubleshooting - The process of investigating and detecting the cause of equipment malfunctioning; the act of isolating a fault within a system or unit under test (UUT).

<sup>3</sup> Disassembly/assembly - The step-by-step breakdown (taking apart) of a spare/functional group coded item to the level of its least component, that is assigned an SMR code for the level of maintenance under consideration (i.e., identified as maintenance significant.)

<sup>4</sup> Actions - Welding, grinding, riveting, straightening, facing, machining, and/or resurfacing.

<sup>5</sup> This maintenance level is not included in Section 11, column (4) of the Maintenance Allocation Chart. Functions to this level of maintenance are identified by a work-time figure in the "H" column of Section II, column (4), and an associated reference code is used in the Remarks column (6). This code is keyed to Section IV, Remarks, and the SRA complete repair application is explained there.



e. Column 5, Tools and Equipment. Column 5 specifies, by code, those common tools sets (not individual tools), common TMDE, and special tools, special TMDE, and special support equipment required to perform the designated function.

f. Column 6, Remarks. When applicable, this column contains a letter code, in alphabetical order, which is keyed to the remarks contained in Section IV.

**B-4 EXPLANATION OF COLUMNS IN TOOL AND TEST EQUIPMENT REQUIREMENTS SECTION III.**

a. Column 1, Reference Code. The tool and test equipment reference code correlates with a code used in the MAC, Section 11, Column 5.

b. Column 2, Maintenance Level. The lowest level of maintenance authorized to use the tool or test equipment.

c. Column 3, Nomenclature. Name or identification of the tool or test equipment.

d. Column 4, Tool Number. The manufacturer's part number.

**B-5 EXPLANATION OF COLUMNS IN REMARKS, SECTION IV.**

a. Column 1, Reference Code. The code recorded in column 6, Section II.

b. Column 2, Remarks. This column lists information pertinent to the maintenance function being performed as indicated in the MAC, Section II.



**Section II. MAINTENANCE ALLOCATION CHART FOR 15KW, TACTICAL, PRECISE AND UTILITY, 50/60 AND 400 HZ**

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
01	Batteries and Related Items	Inspect Test Service Install Replace	.1  .1  	 .1 .1 .2 .3				1	A, B
	Slave Receptacles	Inspect Replace	.1	 .3					A
02	Exhaust and Breather Pipes	Inspect Replace	.2	 .8				A	
03	Convenience Receptacles 50/60 Hz	Inspect Replace	.1	 .5					A
04	Convenience Receptacles 400 Hz	Inspect Replace	.1	 .5					A
05	Plate and Sleeve Assy	Inspect Replace	.2	 .5					A
06	Paralleling Receptacles	Inspect Replace	.2	 .5					A
07	Generator Set Controls								
	Circuit Breaker, dc	Test Replace		.5 .5					
	Manual Speed Control	Inspect Test Replace		.1 .2 .5					
	Fault Indicator	Inspect Test Replace Repair		.1 .2 4.0					A, C, D
	Wiring Harness	Inspect Test Replace Repair Rebuild			4.0 .1 .5 1.5 4.0				
	Lamps	Test Replace	.1	 .3					
	Fuse	Test Replace		.1 .2					



**Section II. MAINTENANCE ALLOCATION CHART FOR 15KW, TACTICAL, PRECISE AND  
UTILITY, 50/60 AND 400 HZ - Continued**

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
	Control Box Assembly	Inspect		1.0					C
		Test		1.5					
		Replace			1.5				
		Repair		1.5					
	Wiring Harness	Inspect		.1					A, H
		Replace		1.0					
		Repair		2.0					
		Rebuild			1.0				
	Voltmeter, ac	Inspect	.1						E
		Test		.5					
		Adjust	.1						
		Replace		.5					
	Wattmeter, ac	Inspect	.1						C, E
		Test			.5				
		Adjust	.1						
		Replace		.5					
	Ammeter, ac	Inspect	.1						C, E
		Test			.5				
		Adjust	.1						
		Replace		.5					
	Wattmeter Converter	Inspect		.1					C, E
		Test			.5				
		Replace		.5					
	Rheostats/ Potentiometer	Inspect		.1				2	F
		Test		.2					
		Replace		.5					
	Frequency Meter	Inspect	.1						C
		Test			.5				
		Adjust			.2				
		Replace		.2					
	Frequency Transducer	Inspect		.1				2	F
		Test			.5				
		Replace		.2					
	Switches	Inspect	.1					2	F
		Test		.2					
		Replace		.2					
	Gauges	Inspect	.1						C
		Test		.2					
		Replace		.2					
	Hourmeter	Inspect	.1						C
		Test		.2					
		Replace		.2					



**Section II. MAINTENANCE ALLOCATION CHART FOR 15KW, TACTICAL, PRECISE AND  
UTILITY, 50/60 AND 400 HZ - Continued**

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
08	Ammeter, dc	Inspect	.1						C
		Test		.2					
		Replace		.2					
09	Housing Group								
		Doors	.1					3	G
		Inspect Replace Repair		2.0	1.5				
09	Covers								
		Inspect	.1					3	G
		Replace Repair		2.0	1.5				
09	Panels								
		Inspect	.1					3	G
		Replace Repair		2.0	1.5				
10	Wiring Harnesses								
		Engine	.1					4	A, H
		Inspect Test Replace Repair		.5 2.0 1.0					
10	Generator								
		Inspect	.1					4	A, H
		Test Replace Repair Rebuild		.5 1.0		2.0 8.0			
10	Interconnecting								
		Inspect	.1					4	A, H
		Test Replace Repair Rebuild		.5 2.0 1.0	8.0				
10	Load Connection Group								
		Main Load Contactor		.1 .5 1.5	1.5			2.0	A, C
		Inspect Test Replace Repair Rebuild							
10	Load Terminal Board Assembly								
		Inspect		.1					
		Replace Repair Overhaul			1.5 1.5	2.0			
10	Current XMFR Assembly								
		Inspect		.1				2	A, I
		Test Replace			.5 1.5				



**Section II. MAINTENANCE ALLOCATION CHART FOR 15KW, TACTICAL, PRECISE AND UTILITY, 50/60 AND 400 HZ - Continued**

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
11	Reconnection Board	Inspect		.1					
		Test		.5					
		Repair			1.5				
12	Governor Control Unit	Inspect		.3				2, D,I	J
		Test			1.5				
		Adjust			.6				
		Replace			3.0				
		Repair			2.0				
		Overhaul				3.0			
12	Air Cleaner Assembly	Inspect	.2						A
		Service		.2					
13	Element	Replace		1.0					
		Inspect	.2						
	Relay Table Group	Service		.2					
		Replace		.3					
	Tactical Relay Assembly	Inspect		.2				2	I
		Test			.5				
		Replace			1.0				
		Repair				2.0			
	Special Relay Assembly	Overhaul				3.0			
		Inspect		.2				2	I
		Test			.5				
		Replace			1.0				
		Repair				2.0			
13	Precise Relay Assembly	Overhaul				3.0			
		Inspect		.2				2	I
		Test			.5				
		Replace			1.0				
	Excitation Assembly Exciter	Repair				2.0			
		Overhaul				3.0			
	Voltage Regulator	Inspect		.2				2, 5	C
		Test			.5				
		Replace			1.0				
		Repair				2.0			
		Overhaul				3.0			
		Rebuild				8.0			
13	Voltage Regulator	Inspect		.2				2, 5	C
		Test			.4				
		Adjust			.4				
		Replace			.3				
		Repair			1.2				
		Overhaul				2.0			
							2.5		



**Section II. MAINTENANCE ALLOCATION CHART FOR 15KW, TACTICAL, PRECISE AND  
UTILITY, 50/60 AND 400 HZ - Continued**

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			UNIT		DS	GS	DEPOT		
			c	o	F	H	D		
14	Load Measuring Unit	Inspect Test Replace Repair		.2 1.0	.3 2.0				D
	Generator Assembly	Inspect Test Replace Repair Overhaul Rebuild		.5	1.5 2.5 4.0	10.0	18.0	6, 7, 8, 9	C
	Bearing	Inspect Replace		.2	1.0			10	K
	Rectifier Rotating	Inspect Test Replace Repair Overhaul			.2 .3 1.5 1.5	2.5		2, 11	F
	Fan Generator	Inspect Replace			2.0				
	Rotor Assembly	Inspect Test Replace Repair Rebuild			.8 2.0 3.0		4.0 5.0	2	L, M
	Stator Exciter Assembly	Inspect Test Replace Repair Rebuild			.1 .5 1.0		2.0 3.0	2	L, M
	Stator Generator Assembly	Inspect Test Replace Repair Rebuild			1.0 1.0 2.0		2.0 3.0		
	Day Tank and Fuel Filter Assy								
	Solenoid Valve	Inspect Test Replace		.1 .2 .3				2	F
	Day Tank	Inspect Service Replace Repair	.1 .2	1.0	1.2				N



**Section II. MAINTENANCE ALLOCATION CHART FOR 15KW, TACTICAL, PRECISE AND UTILITY, 50/60 AND 400 HZ - Continued**

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
16	Float switch	Inspect Test Replace		.1 .2 .5					
	Fuel Filter As- sembly	Inspect Service Replace	.1 .4	.4 .5					N
	Center Support								
	Start Aid Assembly	Inspect Service Replace	.1 .2		.5				N
	Lifting Frame	Inspect Replace Repair		.2	2.0 2.0				
	Fuel Transfer Pump	Inspect Test Service Replace	.1	1.0 .5 1.2					
17	Cooling Group								
	Grille	Inspect Replace Repair	.1	1.5 1.0					
	Shuttter Thermostat	Inspect Test Replace	.1	.4 .6				12	O
	Shutter Assembly	Inspect Test Adjust Replace Repair	.1	.3 .3 .6	.5				C
	Radiator	Inspect Test Service Replace Repair	.1 .5	1.0	1.0 3.0				
	Hydraulic Acuator	Inspect Test Service Adjust Replace Repair Overhaul Rebuild	.1	1.0	1.0 .3 .5 3.5	4.0	5.0	13	



**Section II. MAINTENANCE ALLOCATION CHART FOR 15KW, TACTICAL, PRECISE AND  
UTILITY, 50/60 AND 400 HZ - Continued**

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
19	Hydraulic Sump and Filter	Inspect Service Replace Repair	.1 .3		2.0 3.0				Q
20	Engine Assembly	Inspect Test Service Replace Repair Overhaul Rebuild	1.0 1.0	1.0	3.0 4.0	12.0	12.0		C
	Belts, Fan	Inspect Adjust Replace	.1	.2 .4				14	R
	Alternator/Battery Charging	Inspect Test Adjust Replace Repair Overhaul Rebuild	.1	.2 .3 .5	1.0	2.0	3.0	2, 15	C, R
	Diodes	Inspect Test Replace			.2 .1 .2			2, 11	F
	Rotors	Inspect Test Replace Repair Overhaul			.1 .2 .3	.5 .6			
	Field Assembly	Inspect Test Replace Repair Overhaul			.1 .1 1.0	2.0 2.0		2	F
	Voltage Regulator, dc	Inspect Test Replace Repair			.2 .4 .3 1.2			2, 15	C
	Hydraulic Pump Assembly	Inspect Test Adjust Replace Repair Overhaul Rebuild	.2		.2 .3 .5 1.2	2.5	3.5	16	S, T



**Section II. MAINTENANCE ALLOCATION CHART FOR 15KW, TACTICAL, PRECISE AND UTILITY, 50/60 AND 400 HZ - Continued**

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
20	Speed Switch and Drive	Inspect	.1					2, 17, 18	F, U
		Test		.2					
		Adjust			.3				
		Replace		.3					
		Repair			.3				
	Adapter	Overhaul				1.0		2.0	
		Rebuild							
		Inspect	.1						
		Replace		.2					
		Oil Level Gage and Filler	.1						
	Electric Starter and Adapter	Replace	.5					2, 19	C, D
		Starter Assembly	.1						
		Inspect							
		Test		.1					
		Replace		.2					
	Brushes	Repair		.8				4.0	6.0
		Overhaul							
		Rebuild							
		Inspect		.2					
		Replace		.5					
	Starter, Solenoid	Test		.1				2	C
		Replace		.3					
		Repair			.4				
		Starter, Armature			.3				
		Test			.3			21	W
	Drive Starter	Replace			.3				
		Repair			.3				
		Overhaul				2.0			
		Inspect			.2				
		Replace			.3				
	Field Assembly	Repair			.5				
		Inspect			.1			2	F
		Test			.2				
		Replace			.5				
		Repair			1.2				
	Oil Filters and Sensors	Inspect	.1					2	F
		Test		.2					
		Replace		.2					
		Switch Pressure		.1				2	F
		Test		.2					
		Replace		.3					



**Section II. MAINTENANCE ALLOCATION CHART FOR 15KW, TACTICAL, PRECISE AND  
UTILITY, 50/60 AND 400 HZ - Continued**

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
	Filter Assemblies								
	Oil, Lube/ Hydraulic	Inspect Service Replace	.1	.2 .2					X
	Secondary Fuel Filter	Inspect Service Replace	.1 .2	.2					X
	Lube Oil Cooler	Inspect Replace Repair Overhaul		.2 .3	.4 1.2				
	Injector Nozzle, Sleeve and Lines								
	Injector Nozzle	Inspect Test Adjust Replace Repair Overhaul	.1 .3  .3	.3 1.0 2.0				22	Y
	Nozzle Sleeve	Inspect Test Replace		.1 .2 .5					
	Lines	Inspect Replace		.2 1.5					
	Pump, Fuel Injection	Inspect Test Adjust Replace Repair Overhaul Rebuild	.1		.5 .5 1.5	2.0 3.0	4.0		D, J
	Water Pump and Fan								
	Fan	Inspect Replace Repair	.1	.5	1.5				
	Pump	Inspect Replace Repair	.1	1.5	2.5				



**Section II. MAINTENANCE ALLOCATION CHART FOR 15KW, TACTICAL, PRECISE AND UTILITY, 50/60 AND 400 HZ - Continued**

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL				(5) TOOLS AND EQUIPMENT	(6) REMARKS
			UNIT		DS	GS		
			C	O	F	H	D	
	Thermostat and Housing							
	Thermostat	Test Replace		.1 .6				12 O
	XMTR, Temperature	Inspect Test Replace	.1	.2 .3				2 F
	SW, Temperature	Inspect Test Replace	.1 .2 .3					2 F
	Idler Pulley	Inspect Replace		.1 1.8				
	Intake Manifold	Inspect Replace		.1 .3				
	Exhaust Manifold	Inspect Replace		.1 .3				
	Engine Front support	Inspect Replace			.2 2.0			
	Oil Pan Assembly	Inspect Replace Repair	.1		1.8 1.8			
	Oil Pump	Test Replace Repair				.2 3.0 3.5		
	Flywheel and Housing Flywheel Assembly							
	Ring Gear	Inspect Replace			.1 2.8			
	Flywheel	Inspect Replace			.1 2.8			
	Housing	Inspect Replace			.1 2.8			
	Timing Gear and Cover							
	Cover, Timing	Inspect Replace			.1 1.4			
	Gears, Timing	Inspect Replace			.3 1.8			



**Section II. MAINTENANCE ALLOCATION CHART FOR 15KW, TACTICAL, PRECISE AND  
UTILITY, 50/60 AND 400 HZ - Continued**

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
	Cylinder Head Valve Operating Mechanism								
	Rocker Arm As- sembly	Inspect Service Install Replace Repair		.1 .4	2.0 2.0 3.0				
	Rocker Arm	Inspect Adjust Replace		.2 .5	.8			21	R
	Push Rod	Inspect Replace			.3 .5				
	Cylinder Head Assembly	Inspect Replace Repair Overhaul Rebuild			.5 2.5 2.5			23,24	Z
	Valve Intake and Exhaust	inspect Test Replace Repair			.4 .4 1.0 2.0		3.5	25	C
	Spring Valve	Test Replace			.2 1.0			26	AA
	Seat Intake and Exhaust Valves	Inspect Replace			.4	4.0		27	
	Guide Valve	Inspect Replace			.4	2.0		28	
	Head Cylinder	Inspect Replace Repair Overhaul Rebuild			.5 2.5 2.0	3.0	4.0		
	Lifters, Valve	Inspect Replace				.3 .5			
	Camshaft	Inspect Replace				.5 4.0			
	Piston and Rings								
	Piston Pin	Inspect Replace				.2 .6		29	
	Connecting Rod	Inspect Replace				.2 1.8		30,31	



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**Section II. MAINTENANCE ALLOCATION CHART FOR 15KW, TACTICAL, PRECISE AND  
UTILITY, 50/60 AND 400 HZ - Continued**

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
23	Part Kit (Itemized)								
24	Fire Extinguisher	Install		.2					
25	Winterization Kit								
	Fuel Burning (Regular)	Inspect	.2						
		Install		2.0					
		Replace		3.0					
		Repair			3.0				
		Overhaul				4.0			
	Heater Control Box Assembly	Inspect		.1					
		Replace		.3					
		Repair		.3					
		Overhaul			.4				
	Light Assembly	Inspect		.1					
		Test		.1					
		Replace			.2				
	Lamp	Test	.1						
		Replace		.1					
	Circuit Breaker	Inspect		.1					
		Test			.1				
		Replace			.2				
	Power Switch	Test			.2				
		Replace			.4				
	Heater Assembly	Inspect	.2						
		Test		.3					
		Service	.2						
		Adjust		.2					
		Replace			.4				
		Repair			.3				
		Overhaul				.4			
	Valve	Inspect			.2				
		Replace			.3				
	Nozzle	Inspect			.2				
		Replace			.3				
	Terminal Board	Inspect		.1					
		Replace			.2				
	Switch	Inspect		.1				2	F
		Test		.2					
		Replace			.2				
	Burner Assembly	Inspect		.1					
		Replace			.2				
		Repair			.3				



**Section II. MAINTENANCE ALLOCATION CHART FOR 15KW, TACTICAL, PRECISE AND  
UTILITY, 50/60 AND 400 HZ - Continued**

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
26	Igniter Assembly	Inspect Replace		.2 .4				2	F, R  A, H
	Head Assembly	Inspect Replace			.1 .3				
	Switch, Flame	Inspect Replace			.1 .2				
	Wiring Harness	Inspect Replace Repair Rebuild		.1 .2 .3					
	Blower	Inspect Replace Repair			.4 .1 .3 .3				
	Coolant Pump and Motor Assembly								
	Pump	Inspect Test Replace Repair			.1 .2 .2 .3				
	Relief Valve	Test Replace			.2 .2				
	Fan Motor As- sembly	Inspect Replace Repair			.2 .4 1.0				
	Fan	Inspect Replace			.1 .2				
	Motor	Inspect Replace			.1 .2				
	Thermostat Switch	Inspect Test Replace		.1 .2 .2				2	C
	Heater Kit, Winterization								
	Electric	Install Replace Repair Overhaul Rebuild		2.0 3.0 2.0					
						.4			
							.5		
	Coolant Pump and Motor Assembly	Inspect Install Replace Repair		.1 .3 .3					



**Section II. MAINTENANCE ALLOCATION CHART FOR 15KW, TACTICAL, PRECISE AND  
UTILITY, 50/60 AND 400 HZ - Continued**

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
26	Pump	Inspect		.1					
		Test		.2					
		Repair			.3				
		Overhaul			.4				
	Relief Valve	Test			.2				
		Repair			.2				
	Motor	Inspect		.1					
		Test			.2				
		Repair			.3				
		Overhaul		1.0					
	Heating Elements	Inspect		.1					C
		Test		.2					
		Repair		.3					
	Thermostat Switch	Inspect		.1				2	C
		Test		.2					
		Replace		.2					
	Hose Lines Fitting	Inspect	.1						
		Replace		.3					
		Repair		.2					
	Electric Wiring Cables and Harness	Inspect	.1					2	
		Test		.2					
		Replace		.3					
		Repair		.3					
		Rebuild			.3				
	Electric Winterization Control Box	Inspect		.1				2	
		Test		.2					
		Install		.3					
		Replace		.3					
		Repair			.3				
	Transformers	Inspect			.1				
		Test			.2				
		Replace			.2				
	Relay	Inspect			.1			2	F
		Test			.2				
		Replace			.2				
	Semi-conductors	Inspect			.1				
		Test			.2				
		Replace			.2				
	Circuit Breaker	Inspect		.1				2	F
		Test		.2					
		Replace		.2					



**Section II. MAINTENANCE ALLOCATION CHART FOR 15KW, TACTICAL, PRECISE AND  
UTILITY, 50/60 AND 400 HZ - Continued**

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			UNIT		DS	GS	DEPOT		
			c	o	F	H	D		
27	Switch Toggle	Inspect		.1					
		Test			.1				
		Replace			.2				
	Fuse Holder	Inspect		.1					
		Replace			.2				
	Fuse	Test		.1					
		Replace		.1					
	Light Assembly	Inspect	.1					2	F
		Test		.1					
		Replace		.2					
	Indicating Lamps	Inspect	.1						
		Test	.1						
		Replace	.1						
	Kit- Wheel Mounting	Inspect	.2						
		Test	.2						
		Service	.3						
		Install			.4				
		Replace			.5				
28	Wheels and Tires	Repair		1.0					
		Inspect	.1					39	AC
		Test	.1						
		Service	.2						
		Replace		.3					
	Bearings, Wheel	Repair		.3					
		Inspect		.1					
		Service		.3					
	Brakes	Replace		.4					
		Inspect		.2					
		Service		.3					
	Load Bank	Adjust		.2					
		Replace		1.5					
		Repair		1.0					
28	Wiring Harness	Inspect	.1						
		Test		.2					
		Replace		.2					
		Repair		.2					
		Rebuild			1.0				
		Overhaul			2.0	3.0			



**Section II. MAINTENANCE ALLOCATION CHART FOR 15KW, TACTICAL, PRECISE AND UTILITY, 50/60 AND 400 HZ - Continued**

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
	Control Panel As- sembly								
	Switch rotary	Inspect Test Replace	.1	.1 .2				2	F
	Semi-conductors	Inspect Test Replace						2	F
	Transformers	Inspect Test Replace		.1				2	I
	Terminal Board	Inspect Replace		.1 .2					
	Diodes	Test Replace							
	Breakers, Circuit	Inspect Test Replace		.1 .1 .2				2	F
	Fan and Motor Assembly	Inspect Test Replace Repair		.1 .2 .2 .3					
	Brushes	Inspect Replace		.1 .3					
	Fan	Inspect Replace		.1 .3					
	Indicating Light	Inspect Test Replace		.1 .1 .1					
	Lamp	Test Replace		.1 .1					
	Load Reject Relay	Inspect Test Replace		.1				2	F
	Thermostat	Test Replace		.1 .2					
	Heater Elements	Inspect Test Replace		.1 .2 .2				2	F
29	Applications Kit	Inspect Install Repair		.1				40,42,43, 44,45	A, J



**Section II. MAINTENANCE ALLOCATION CHART FOR 15KW, TACTICAL, PRECISE AND UTILITY, 50/60 AND 400 HZ - Continued**

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
30	Remote Functions Assy Cable Assembly	Test			.4			46	C
		Replace			.3				
		Inspect		.1					
	Acoustic Sup- pression Kit	Test			.3			4,46,42, 49,50	A, F
		Replace			.3				
		Repair			.5				
		Inspect	.1					51,6,52, 53	A, D
		Service	.3						
		Install		4.0	4.0				
		Replace							
		Repair					5.0		



**Section III. TOOLS AND TEST EQUIPMENT FOR 15KW, 50/60 AND  
400 HZ GENERATOR SETS**

(1) TOOL OR TEST EQUIPMENT REF CODE	(2) MAINTENANCE CATEGORY	(3) NOMENCLATURE	(4) NATIONAL STOCK NUMBER	(5) TOOL NUMBER
1	O	Tester, Battery Electrolyte Solution (Component of Tool Set L/I T13152)	6630-00-171-5126	171E
2	O	Multimeter	6625-00-581-2036	ANURM105
3	F	Torch Outfit, Cutting and Welding (Tool Set L/I W67706)	3433-00-357-6311	SC 3433-90- CL-NO1
4	O	Tool Kit, Electrical Connector Repair	5180-00-876-9336	7550526
5	F	Oscilloscope	6625-00-643-1740	902-110
6	F	Hoist, Chain, 3 Ton	3950-00-292-9879	FTG
7	F	Trestle, Hoist, Portable 5 Ton	3950-00-449-7005	MILT21080
8	F	Multimeter, Split Core	6625-00-892-1497	
9	F	Ohmmeter	6625-00-643-1030	ZM-21A/U
10	F	Puller Attachment (Component of Puller Kit 5180-701-8046)	5120-00-711-6753	7116753
11	F	Soldering Outfit, Electric	3439-00-853-8760	W60
12	O	Thermometer, Self-Indicating 50-400 F. Range	6685-00-291-6816	G24508
13	F	Test Stand, Actuator	4940-00-142-2107	BDL812121
14	O	Scale, Dial Indicating 0-50 lb	6670-00-254-4634	AAA-S-133
15	O	Test Set Generator and Voltage Regulator	4910-00-270-3780	WT215
16	F	Test Gage and Hose Assembly	4910-00-774-9343	GH24
17	F	Tachometer, Stroboscopic	6680-00-799-7616	8518131-1
18	F	Test Stand, Ignition Magneto	4910-00-912-3960	D13400
19	O	Test Spring, Resiliency	6635-00-918-2788	DPP80
20	F	Gage, Thickness	5120-00-221-1999	599-647
21	F	Test Set, Amature	6625-00-233-1459	
22	F	Tool Kit, Diesel Injector Repair	4910-00-317-8265	5910359
23	F	Grinding Kit, Valve Seat	4910-00-473-6437	QCI
24	F	Wrench, Torque	5120-00-542-5577	6017F
25	F	Grinding Machine, Valve Face	4910-00-540-4679	KK
26	F	Lifter, Valve Spring	5120-00-239-8686	GGG-L-350
27	H	Remover and Replacer, Insert Valve Seat	5120-00-473-7393	J-35231
28	H	Remover and Replacer, Valve Guide	5120-00-219-8404	8051993



**Section III. TOOLS AND TEST EQUIPMENT FOR 15KW, 50/60 AND  
400 HZ GENERATOR SETS- Continued**

(1) TOOL OR TEST EQUIPMENT REF CODE	(2) MAINTENANCE CATEGORY	(3) NOMENCLATURE	(4) NATIONAL STOCK NUMBER	(5) TOOL NUMBER
29	H	Caliper Micrometer, Outside 1" thru 2"	5210-00-243-2933	1942V
30	H	Indicator, Connecting Rod Alignment	4910-00-733-2487	U30BRS1
31	H	Wrench, Torque	5120-00-640-6364	A-A-241
32	H	Gage Set, Telescoping	5120-00-473-9350	599-590
33	H	Gage, Thickness	5210-00-517-8097	667
34	H	Compressor, Piston Ring	5120-00-116-7676	ST755
35	H	Expander, Piston Ring	5120-00-393-0549	AC2505
36	H	Caliper, Micrometer	5120-00-255-7564	MT-310
37	H	Puller, Mechanical Cylinder, Sleeve	5120-00-417-2952	7FI 857
38	H	Caliper, Micrometer	5210-00-221-1934	MT-308
39	c	Gage, Tire Pressure	4910-00-204-3170	GPW18325
40	F	Shears, Metal Cutting	5110-00-221-1085	B107.16-1985
41	F	C-Clamp	5120-00-180-0907	A-A-429
42	F	Ty-Wrap Tool	5120-00-781-7891	VG95387-T105
43	F	Rivet Gun, Hand	5120-00-970-6423	368665
44	F	Drill, Electric	5130-00-889-8996	WD661
45	F	Drill Set, Twist	5133-00-227-9654	DBF3/16B
46	F	Multimeter	6625-00-553-0142	4155500-1
47	F	Power Supply, Adjustable	6130-01-022-7532	HP6255
48	F	Circuit Card Holder		BA177BO03
49	F	Solder/Desolder Set	3439-00-460-7198	W-TCP-K
50	F	Heat Gun		37N1447
51	F	Shop Equipment, Electrical	4940-00-294-9517	SC 4940-97-CL-E06
52	F	Installation Tool, Hex, 5/16 Hex		4940-268
53	F	Sling, Lifting	1670-00-622-3632	SP4435-2
54	F	Strap, Lifting		4940-407



**Section IV. REMARKS**

FOR:15 KW, 50/60 and 400 Hz DOD Generator Set	
REFERENCE CODE	REMARKS
A	Visual Inspection
B	Hydrometer Test
C	Operational Test
D	Repair by Replacement of Components
E	Zero Adjust
F	Continuity Test
G	Weld and Straighten
H	Fabricate New Harness
I	Test for Known Voltage at Terminals
J	In Accordance with Procedures in Applicable TM
K	Visual, Audible and Physical Heat Detection
L	Insulation Breakdown and Continuity Tests
M	Rewind
N	Drain Condensation
O	Thermometer Test
P	Adjust After Replacement or Repair
Q	Check Fluid Level
R	Adjust to Specifications in Applicable TM
S	Test Pressure Output
T	Adjust Pressure Output
U	Overspeed Only
V	Inspect for Minimum Length
W	Growler Test
X	Replace Element
Y	Adjust Injector Pressure Setting
Z	Includes Replacing Valves and Springs
AA	Spring Tension and Length
AB	Include Replacement of Sleeves
AC	Pressure Test



Appendix C  
REPAIR PARTS AND SPECIAL TOOLS LIST

---

For detailed parts breakdown refer to TM 9-6115-464-24P manual.







## Appendix D

### EXPENDABLE AND DURABLE ITEMS LIST

---

#### Section 1. INTRODUCTION

##### **D-1. SCOPE.**

This appendix lists expendable and durable items you will need to maintain the generator set. This listing is for informational purposes only and is not authority to requisition the listed items. These items are authorized to you by CTA 50-970, expendable items (except Medical, Class V, Repair Parts, and Heraldic Items).

##### **D-2. EXPLANATION OF COLUMNS.**

- a. Column (1) - Item number. This number is assigned to the entry in the listing for referencing when required.
- b. Column (2)- Level. This column identifies the lowest level of maintenance that requires the listed item.
  - C - Operator
  - O- Unit Maintenance
  - F - Direct Support Maintenance
  - H - General Support Maintenance
- c. Column (3) - National Stock Number. This is the national stock number assigned to the item; use it to request or requisition the item.
- d. Column (4) - Description. Indicates the federal item name and, if required, a description to identify the item. The last line for each item indicates the Commercial and Government Entity Code (CAGEC) parentheses followed by the part number.
- e. Column (5) - Unit of Measure (U/M)/Unit of Issue (U/I). This measure is expressed by a two-character alphabetical abbreviation (e.g., EA, IN, PR). If the unit of measure differs from the unit of issue as shown in the Army Master Data File (AMDF) requisition the lowest unit of issue that will satisfy your requirements.



**Section II. EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST**

(1) ITEM NO.	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) (U/M)/ (U/I)
1	O	9130-00-256-8613	Fuel, JP-4, MIL-J-5624 (MILT5624) 81349	GL
2	O	9140-00-286-5294	Fuel Oil, Diesel, Regular Grade, DF2, VV-F-800 (VVF800GRADEDFAAR) 81348	GL
3	O	9140-00-296-5286	Winter Grade, DF1, VV-F-80081348	GL
4	O	9140-00-286-5283	Artic Grade, DFA, VV-F-800 (VVF800GRADEDFAAR) 81348	GL
5	O	9150-00-265-9435	Oil Lubricating Grade OE/HDO 30 (MIL-L-2104) 81349	GL
6	O	9150-00-265-9428	Grade OE/HDO10(MIL-L-2104) 81348	GL
7	O	9150-00-242-7603	Grade OES (MIL-L-10295) 81348	GL
8	O	9150-00-265-9436	Grade OE/HDO30 (MIL-L-2104) 81349	GL
9	O	9150-00-191-2772	Grade OE/HDO10 (MIL-L-2104) 81349	GL
10	O	9150-00-242-7604	Grade OES (MIL-L-10295) 81349	GL
11	O	9150-00-190-0905	Grease, Automotive Artillery (MIL-G-10924) 81349	GL
12	O	6950-00-281-1985	Solvent cleaning, FED-P-D-680	GL
13	O	2910-00-646-9727	Starting Aid, Tank Ether (O-F-1044B Type III) 81348	CT
14	O	6810-00-249-9354	Electrolyte (A11760) 34623	GL
15	O	9150-00-223-4134	Oil Hydraulic, OHA-MIL-H-5606, (MIL-H-5606) 81349	GL
16	O	6850-00-243-1992	Coolant, Antifreeze, inhibited glycol 81349	GL
17	O	6850-00-174-1806	Antifreeze, compound arctic (MIL-A-11755) 81349	GL
18	O	8030-00-889-3534	Anti-seizing tape (MIL-T-27730) 81349	EA



## Appendix E ADDITIONAL AUTHORIZATION LIST

---

### Section I. INTRODUCTION

**E-1 SCOPE.** This appendix lists additional items you are authorized for the support of the generator set.

**E-2 GENERAL.** This list identifies items that do not have to accompany the generator set and that do not have to be turned in with it. These items are authorized to you by CTA, MTOE, TDA, or JTA.

**E-3 EXPLANATION OF LISTING.** National stock number, descriptions and quantities are provided to help you identify and request the additional items you require to support this equipment. "USABLE ON" code-s are identified as follows:

CODE	USED ON
A	MEP-004A
B	MEP-103A
C	MEP-113A



## Section II. ADDITIONAL AUTHORIZATION LIST

(1) National Stock Number	(2) Description CAGEC and Part Number	Usable On Code	(3) U/I	(4) Qty rqr
5935-00-322-8959	ADAPTER CONNECTOR		EA	1
4910-00-204-3170	GAGE: Tire, Pressure 10 to 60 lbs range 800648 (34623)	A,B,C	EA	1
4930-00-253-2478	GREASE GUN: Hand lever operated, 1603 41G1330-72 (10001)	A,B,C	EA	1
4930-00-141-8311	HOSE ASSEMBLY Grease 1083LII (39428)	A,B,C	EA	1
6150-00-463-9088	LOAD BANK KIT MEP005ALM (30554)	A,B,C A,B,C	EA EA	1 1
4120-00-708-0031	REPLACEMENT CYLINDER KIT For 4210-00-555-8837 MILE52031 (99539)			
6115-00-463-9094	WHEEL MOUNTING KIT MEP005AWM (30554)	A,B,C	EA	1
6115-00-463-9085	WINTERIZING KIT, Electric MEP005AWE (30554)	A,B,C	EA	1
6115-00-463-9083	WINTERIZING KIT, Fuel burning MEP005AWF (30554)	A R C	EA	1
6115-01-096-9015	APPLICATIONS KIT 13220E8189 (97403)	C	EA	1
6115-01-233-8274	ACOUSTIC SUPPRESSION KIT (Army Only) MEP004AAS (02032)	A,B,C	EA	1
5975-00-878-3791	Rod, Ground, FS0216B122-1 (15277)	A,B,C	E A	1
5995-00-123-0108	Cable, Power, Electrical 13208E4816 (97403)	A,B,C	EA	1
5120-01-013-1676	Puller, Ground Rod P74-144 (45225)	A,B,C	EA	1
4120-00-555-8837	Extinguisher, Fire Monobromotrifluori- methane, with bracket. Operating range minus 50° F (-46° C) to plus 120° F (49° C) 10596569-1 (18876)	A,B,C	EA	1
	TM 9-6115-464-12 TO 35C2-3-445-1 NAVFAC P-8-624-12	A,B,C	EA	1
	Operator and Unit Maintenance Manual from Generator Set, Diesel Engine Driv- en, Tactical Skid Mtd,15 KW, 3 Phase, 4 Wire 120/208 and 140/416 volts.			



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ASSEMBLIES

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A2 CONVERTOR FREQUENCY  
A3 CONTROL CUBICLE  
A4 CONTROL PANEL RELAY ASSY  
A5 DC RELAY ASSY  
A6 RESISTOR ASSY GOV  
A7 RESISTOR ASSY CURRENT TRANSFORMER LOAD  
A8 GOVERNOR LMU  
A9 FAULT INDICATOR SYSTEM  
A11 STATIC EXCITER  
A12 REMOTE CONTROL BOX  
A15 LOAD TEPMINALS  
A16 HEATER CONTROL BOX  
A17 FUEL FIRED WINTERIZATION  
A22 CONVENIENCE RECEPTACLE BOX  
A23 GOVERNOR CONTROL UNIT  
A24 GOVERNOR ACTUATOR  
A25 PRECISE RELAY BOX  
A27 SET SPECIAL RELAY BOX

B1 STARTER MOTOR  
B2 FUEL PUMP  
B3 FUEL PUMP

C1 CAPACITORS GOVERNOR

CB1 CIRCUIT BREAKER D C CONTROL  
CB2 CONTACTOR MAIN AC OUTPUT  
CB3 CIRCUIT BREAKER CONVENIENCE RECEPTACLE

CR1 DIODE FULL WAVE BRIDGE REMOTE SENSING CIRCUIT  
CR3 DIODE START CIRCUIT  
CR4 DIODE FULL WAVE BRIDGE K7 CIRCUIT  
CR6 DIODE FUEL PUMPS  
CR27 DIODE MODULE RVS POLARITY INDUCTIVE SPIKE SUPPR

CT1 INSTRUMENTS  
CT2 INSTRUMENTS  
CT3 INSTRUMENTS  
CT4 EXCITER  
CT5 EXCITER  
CT6 EXCITER  
CT7 CROSS CURRENT

LIGHTS

DS1 PANEL  
DS2 PANEL  
DS3 PANEL  
DS4 SYNCHRONIZING  
DS5 INDICATOR CIRCUIT BREAKER (CONTACTOR)  
DS6 PROTECTION BY PASS  
DS8 INDICATOR AIR CLEANER

E6 GENERATOR SET GROUND STUD  
E4 SET SPECIAL BOX GROUND STUD  
E3 TACTICAL RELAY BOX GROUND ST  
E2 PRECISE RELAY BOX GROUND STU  
E1 ENGINE GROUND

G1 MAIN ALTERNATOR  
G2 BATTERY CHARGING ALTERNATOR

RELAYS

K1 STOP-RUN  
K2 OVERVOLTAGE  
K3 CRANK  
K5 FIELD FLASH  
K6 REMOTE VOLTAGE SENSING  
K7 PARALLEL LIGHTS VOLTAGE SENSOR  
K8 FUEL LEVEL  
K11 UNDERVOLTAGE  
K12 UNDERFREQUENCY  
K13 SHORT CIRCUIT  
K14 OVERLOAD  
K15 REVERSE POWER  
K16 PERMISSIVE PARALLELING

L1 ENGINE FUEL SOLENOID  
L2 DAY TANK FUEL SOLENOID  
L3 ETHER SOLENOID  
L4 STARTER SOLENOID

METERS

M1 OIL PRESSURE  
M2 COOLANT TEMPERATURE  
M3 FUEL LEVEL  
M4 BATTERY CHARGING  
M5 TOTAL TIME  
M6 FREQUENCY  
M7 KILOWATT  
M8 AMMETER  
M9 VOLTMETER

MT1 OP SENDING UNIT  
MT2 WT SENDING UNIT  
MT3 FL SENDING UNIT

RESISTORS

R1 RHEOSTAT FREQ ADJUST 500  
R2 RHEOSTAT VOLTAGE ADJUST 250  
R3 RESISTOR DROPPING FOR CR4 (K7) 1500  
R4 RESISTOR FREQ ADJUST CIRCUIT 250  
R5 RESISTOR FREQ ADJUST CIRCUIT 250  
R6 RESISTOR PARALLELING LIGHT 5000  
R7 RESISTOR PARALLELING LIGHT 2500  
R8 RESISTOR PARALLELING LIGHT 2500  
R9 RESISTOR PARALLELING LIGHT 5000  
R10 RESISTOR DROPPING FOR CR1 (K6) 1500  
R23 RESISTOR GOVERNOR 7.5  
R24 RESISTOR GOVERNOR 7.5  
R25 RESISTOR GOVERNOR 7.5  
R28 RHEOSTAT LOAD SHARING 25000  
R29 RHEOSTAT REACTIVE CURRENT SHARING 12  
R31 RHEOSTAT RATE ADJUST VOLTAGE REGULATOR 100  
R13 SHUNT INSTRUMENT

SWITCHES

FL-1 FUEL LEVEL  
FL-2 FUEL LEVEL  
OP LOW OIL PRESSURE  
WT HIGH COOLANT TEMPERATURE

S1 ENGINE PRIMER  
S2 START-RUN-STOP  
S3 CONTACTOR  
S4 PANEL LIGHTS  
S5 LOCAL-REMOTE VOLTAGE  
S6 UNIT-PARALLEL  
S7 BATTLE SHORT  
S8 VOLT-AMP SELECTOR  
S9 ENGINE SPEED  
S10 50/60 HERTZ  
S17 AIR CLEANER

TERMINAL BOARDS

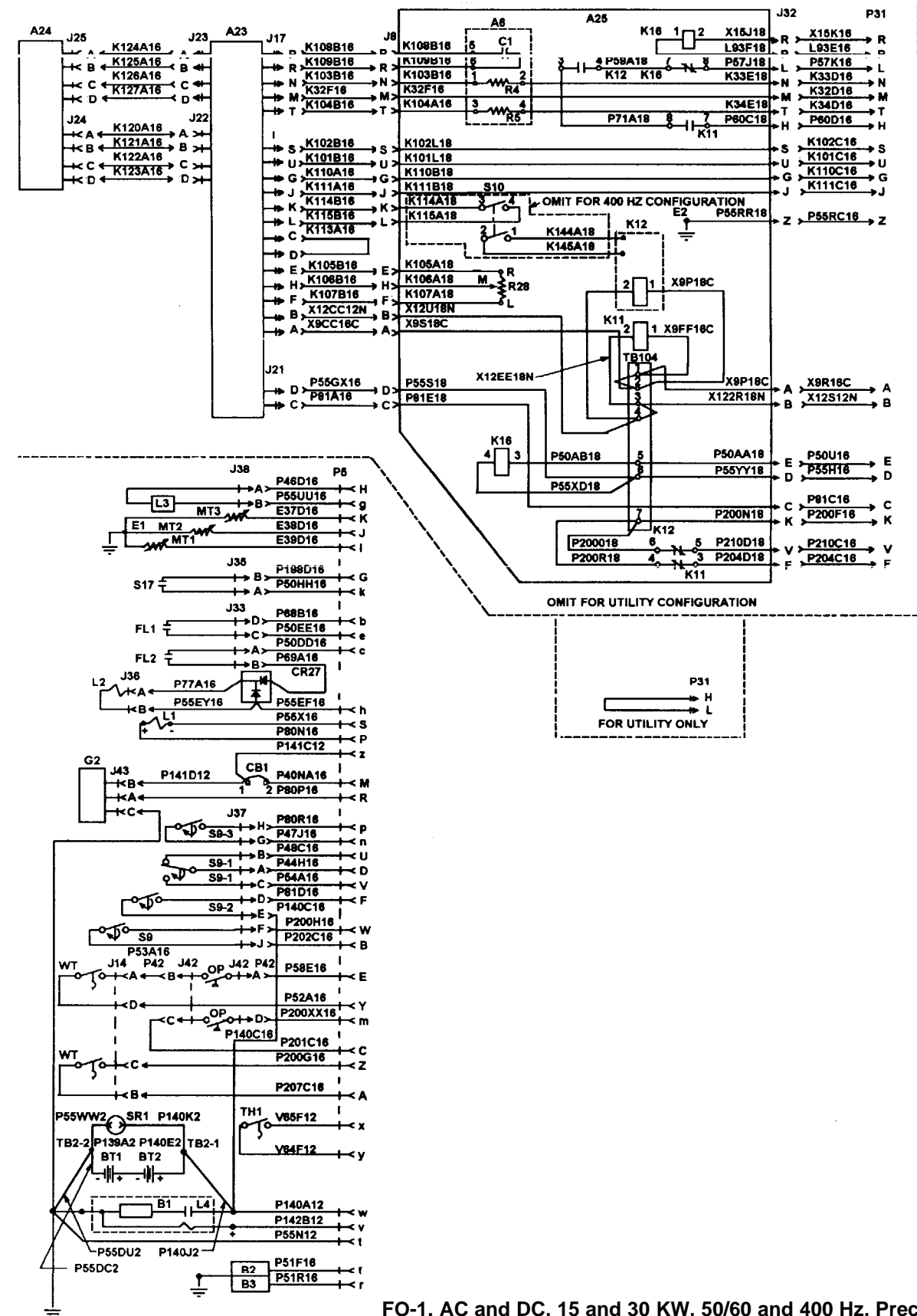
TB5 TERMINAL BOARD LOAD  
TB6 TERMINAL BOARD RECONNECTION  
TB16 TERMINAL BOARD FIELD

NOTES:

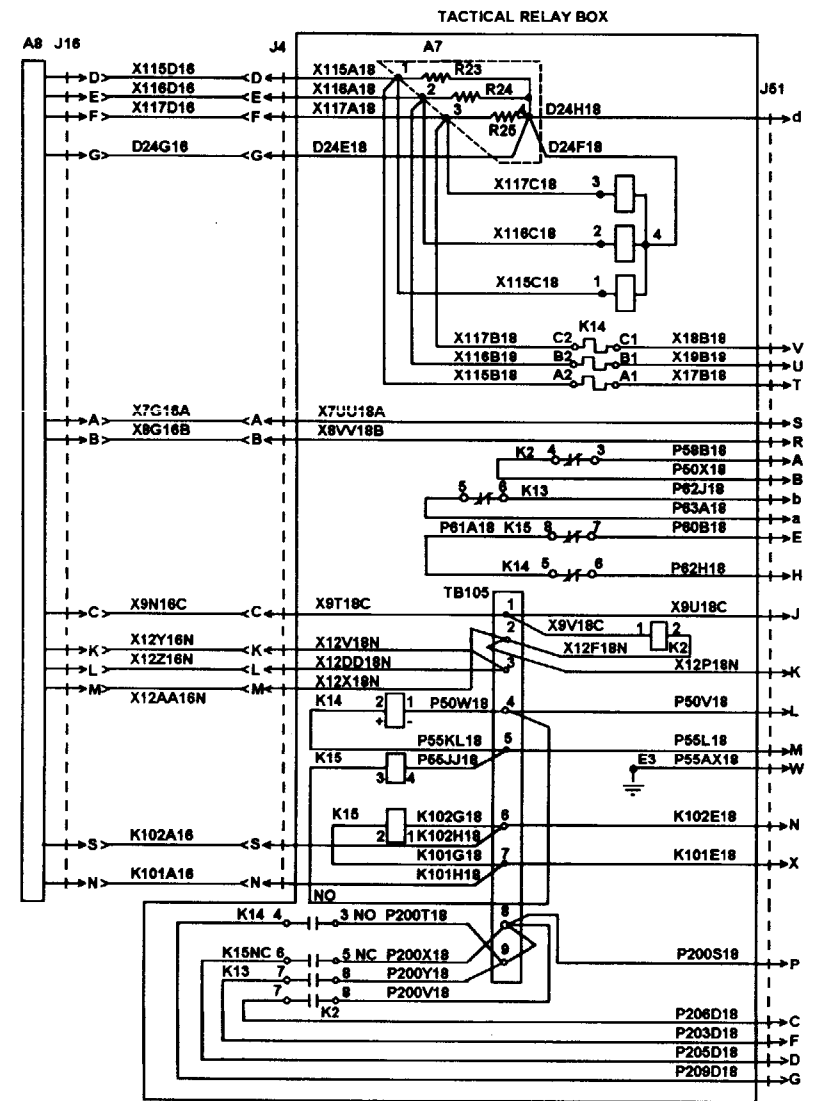
1. INTERPRET DRAWING PER MIL-STD-100.
2. FOR UTILITY CONFIGURATION, OMIT THE FOLLOWING FROM THE LIST: A23, A24, A25, E2, K11, K12, R28, K16, S10, C1, R5.
3. FOR 400 Hz CONFIGURATION OMIT SWITCH S10 FROM THE LIST.
4. FOR 50/60 Hz SET, T5 AND T11 CONNECT DIRECTLY TO TB6 AND DO NOT PASS THROUGH CT7.

FO-1. AC and DC, 15 and 30 Kw, 50/60 and 400 Hz, Precise and Utility, Wiring Diagram, Dwg. No. 72-2205 (Sheet 1 of 4)

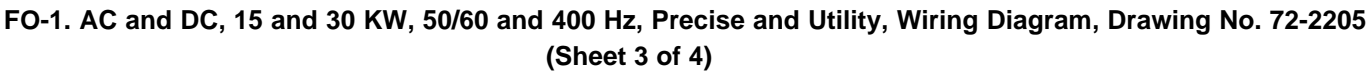




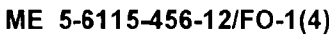
FO-1. AC and DC, 15 and 30 KW, 50/60 and 400 Hz, Precise and Utility, Wiring Diagram, Drawing No. 72-2205  
(Sheet 2 of 4)





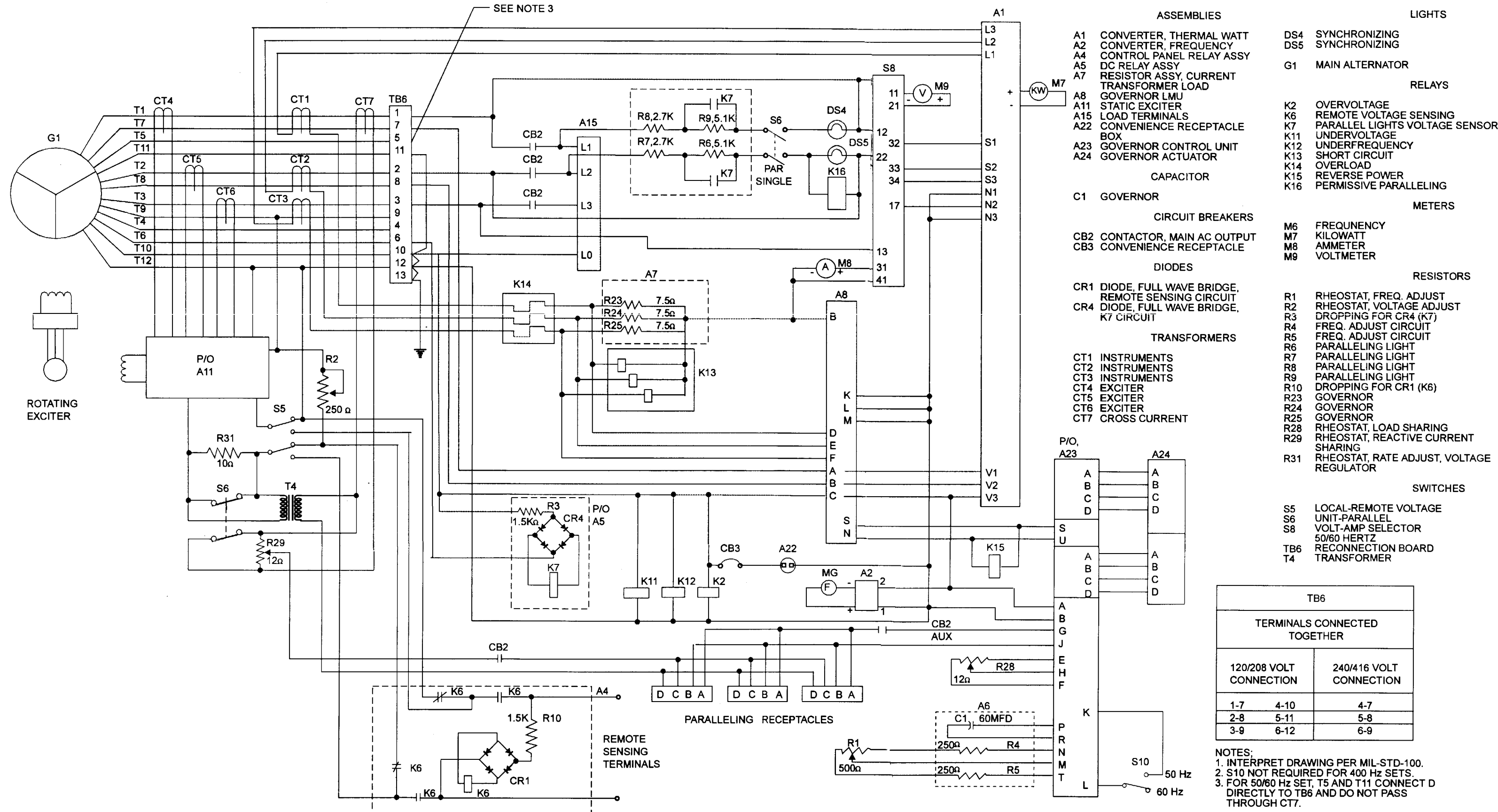






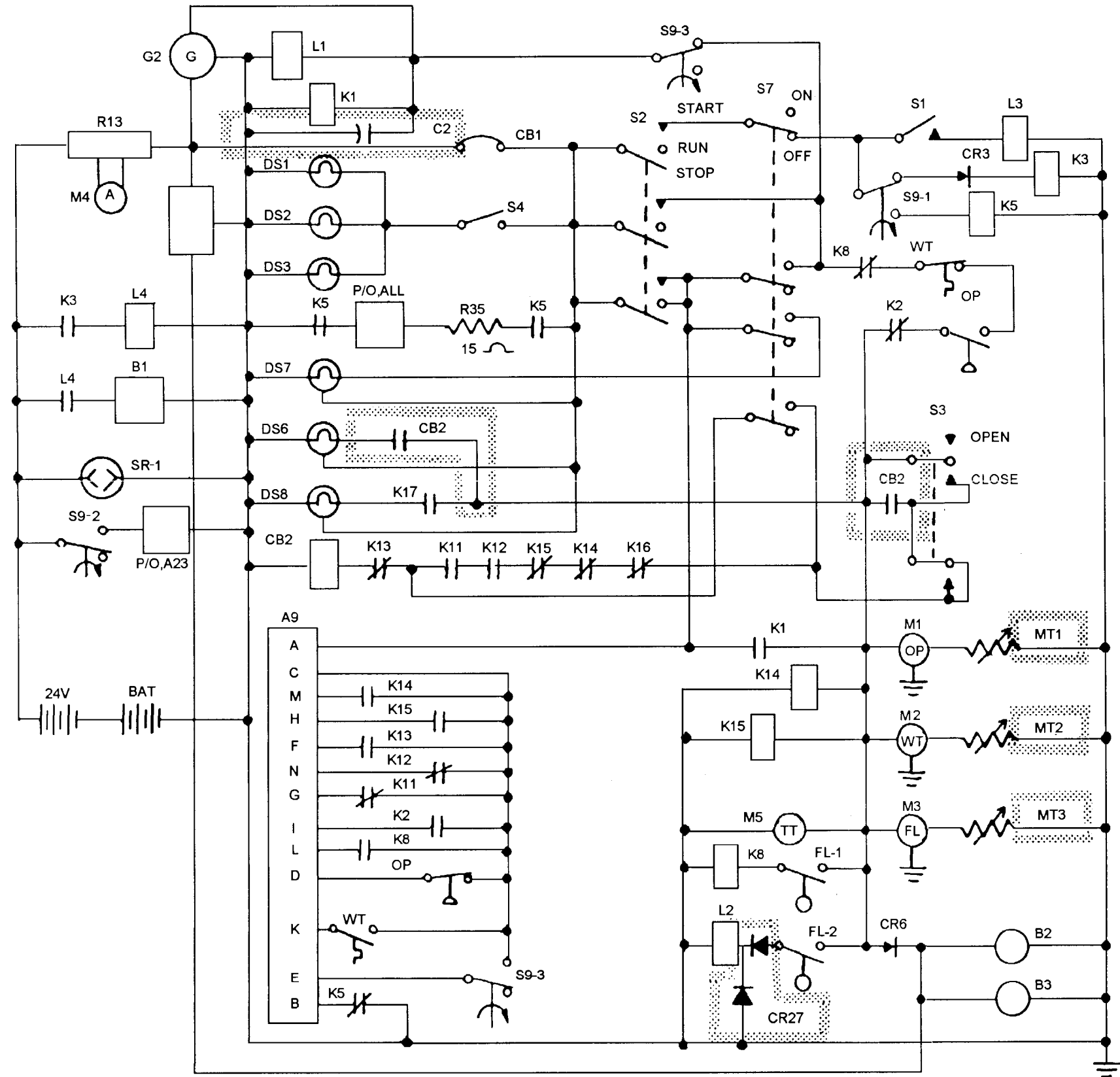
**FO-1. AC and DC, 15 and 30 KW, 50/60 and 400 Hz,  
Precise and Utility, Wiring Diagram, Dwg. No. 72-2205  
(Sheet 4 of 4)**





F0-2. AC Schematic Diagram, 15 and 30 KW, Precise Generator Sets, Drawing No. 72-2200





**ASSEMBLIES**  
A9 FAULT INDICATOR SYSTEM  
A11 STATIC EXCITER  
A16 HEATER CONTROL BOX  
A23 GOVERNOR CONTROL UNIT

B1 STARTER MOTOR  
B2 FUEL PUMP  
B3 FUEL PUMP  
C2 CAPACITOR

**CIRCUIT BREAKERS**  
CB1 D.C. CONTROL  
CB2 CONTACTOR, MAIN AC OUTPUT

**DIODES**  
CR3 START CIRCUIT  
CR6 FUEL PUMPS  
CR27 RECTIFIER ASSY

**LIGHTS**  
DS1 PANEL  
DS2 PANEL  
DS3 PANEL  
DS6 INDICATOR, CIRCUIT BREAKER  
(CONTACTOR)  
DS7 PROTECTION BY PASS  
DS8 INDICATOR, AIR CLEANER

G2 BATTERY CHARGING ALTERNATOR

**RELAYS**  
K1 STOP RUN  
K2 OVERVOLTAGE  
K3 CRANK  
K5 FIELD FLASH  
K8 FUEL LEVEL  
K11 UNDERVOLTAGE  
K12 UNDERFREQUENCY  
K13 SHORT CIRCUIT  
K14 OVERLOAD  
K15 REVERSE POWER  
K16 PERMISSIVE PARALLELING  
K17 SWITCH, AIR CLEANER RESTRICTION

**NOTES:**  
1. INTERPRET DRAWING PER MIL-STD-100.

**SOLENOIDS**  
L1 ENGINE FUEL  
L2 DAY TANK FUEL  
L3 ETHER  
L4 STARTER

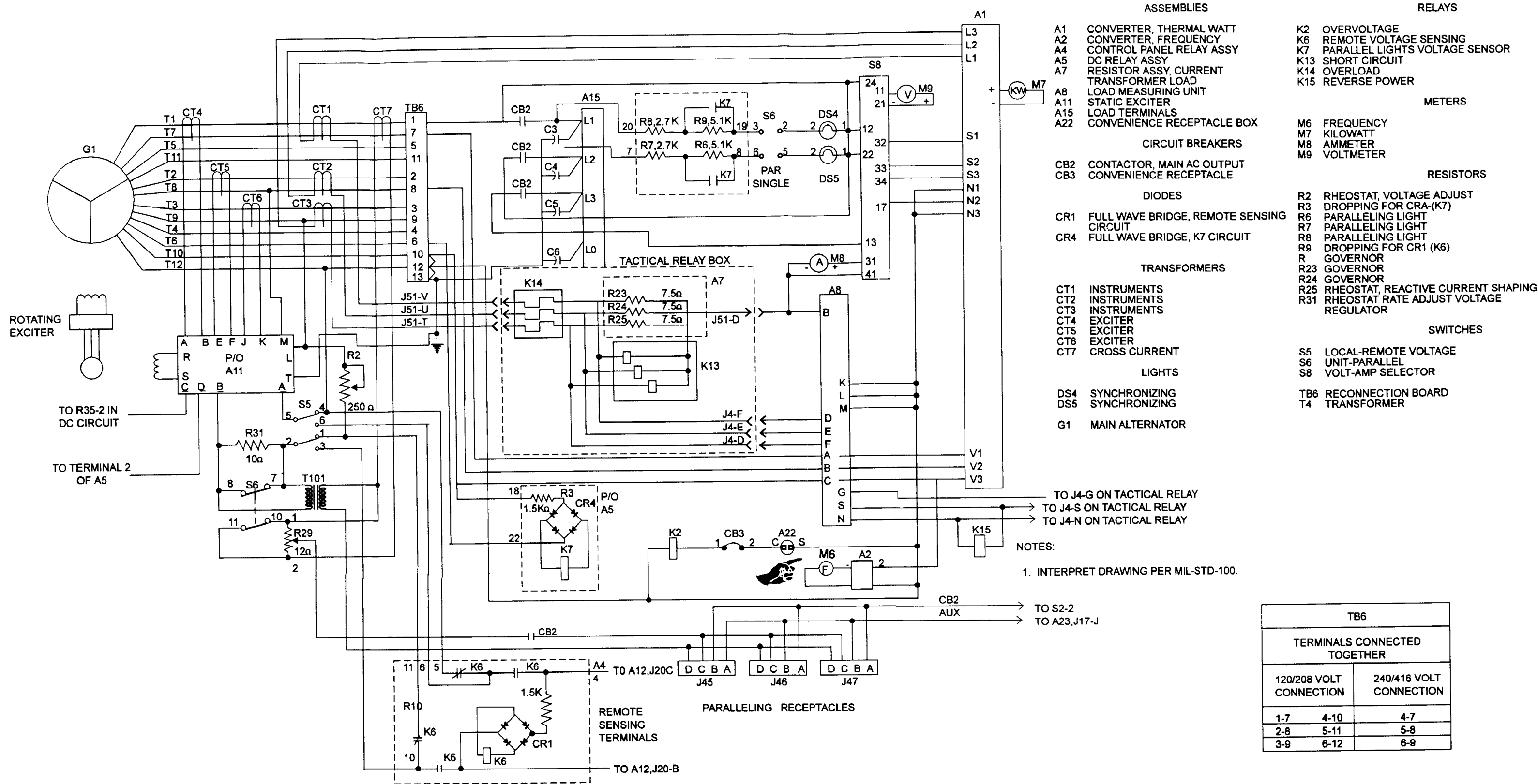
**METERS**  
M1 OIL PRESSURE  
M2 COOLANT TEMPERATURE  
M3 FUEL LEVEL  
M4 BATTERY CHARGING  
M4 TOTAL TIME  
MT1 TRANSDUCER, OIL PRESSURE  
MT2 TRANSDUCER, COOLANT TEMP  
MT3 TRANSDUCER, FUEL LEVEL

**RESISTORS**  
R13 SHUNT, INSTRUMENT  
R35 FIELD FLASH CURRENT LIMITING

**SWITCHES**  
FL1 FUEL LEVEL  
FL2 FUEL LEVEL  
OP LOW OIL PRESSURE  
WT HIGH COOLANT TEMPERATURE  
S1 ENGINE PRIMER  
S2 START-RUN-STOP  
S3 CONTACTOR  
S4 PANEL LIGHTS  
S7 BATTLE SHORT  
S9 ENGINE SPEED  
SR1 SLAVE RECEPTACLE

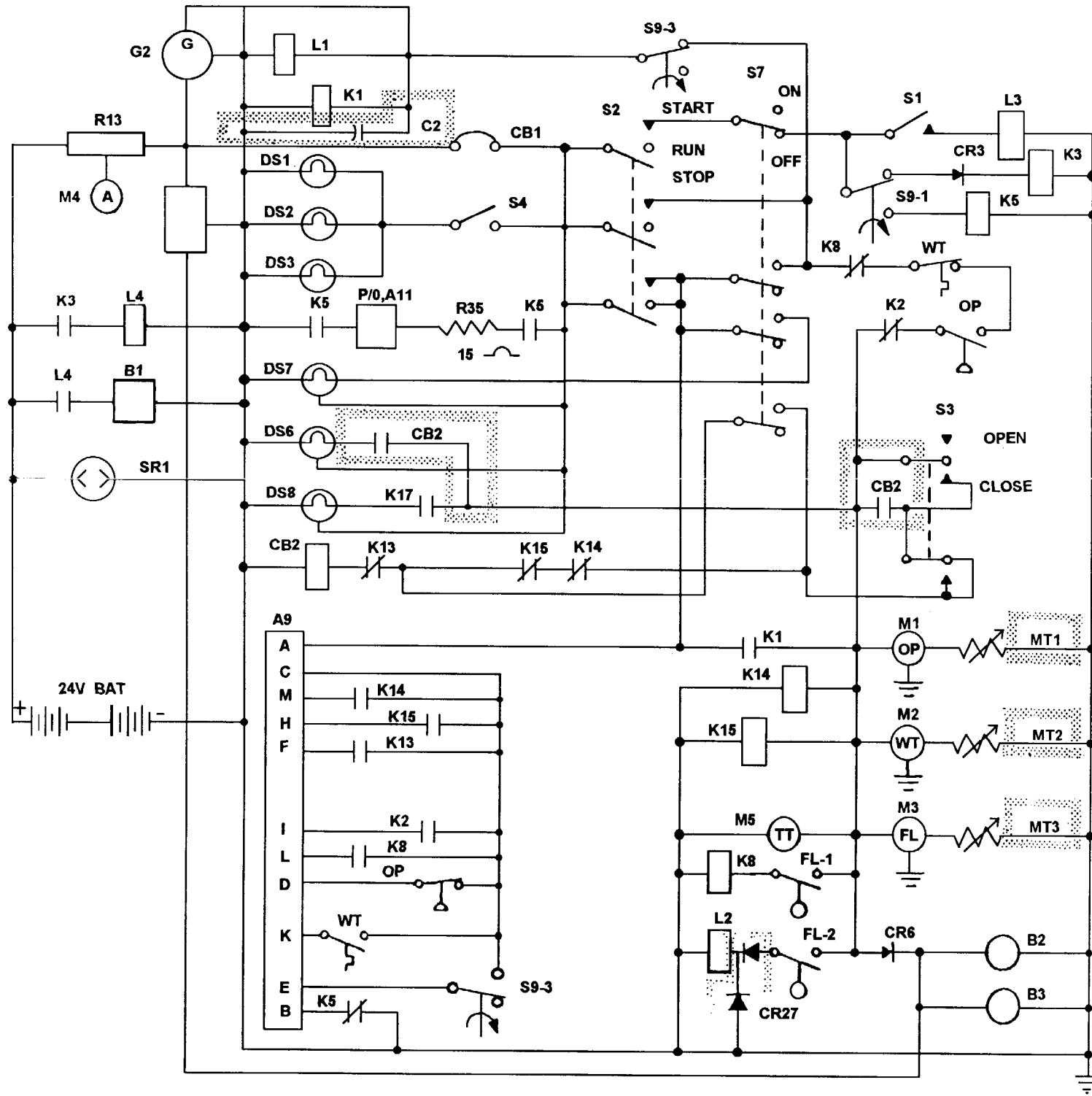
FO-3. DC Schematic Diagram, 15 and 30 KW, Precise Generator Sets, Drawing No. 72-2269





F0-4. AC Schematic Diagram, 15 and 30 KW, Utility Generator Sets, Drawing No. 72-2295





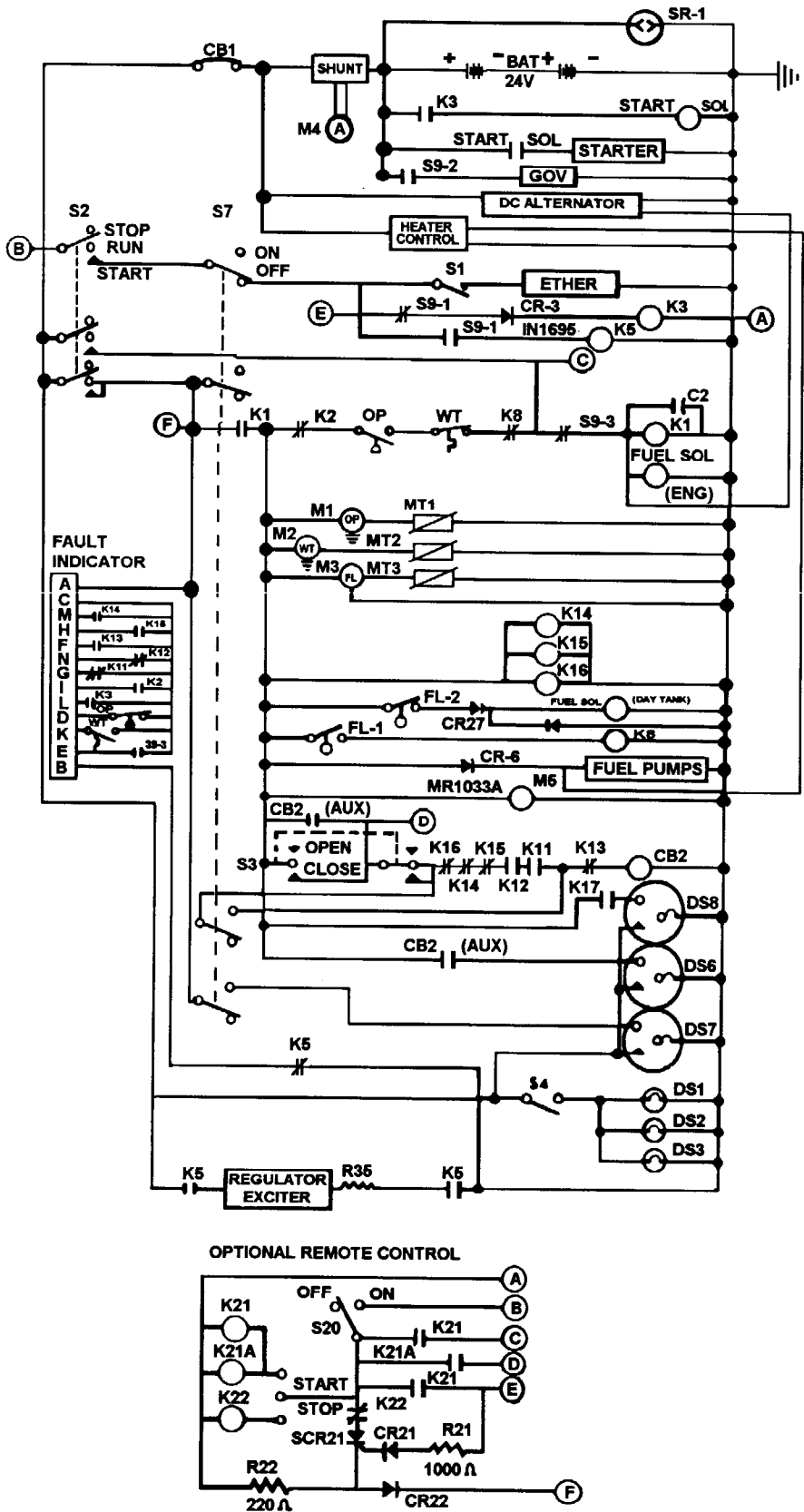
ASSEMBLIES		SOLENOIDS	
A9	FAULT INDICATOR SYSTEM	L1	ENGINE FUEL
A11	STATIC EXCITER	L2	DAY TANK FUEL
A16	HEATER CONTROL BOX	L3	ETHER
		L4	STARTER
B1	STARTER MOTOR	METERS	
B2	FUEL PUMP	M1	OIL PRESSURE
B3	FUEL PUMP	M2	COOLANT TEMPERATURE
		M3	FUEL LEVEL
C2	CAPACITOR	M4	BATTERY CHARGING
		M5	TOTAL TIME
CIRCUIT BREAKERS		MT1	TRANSDUCER, OIL PRESSURE
CB1	D.C. CONTROL	MT2	TRANSDUCER, COOLANT TEMP
CB2	CONTACTOR, MAIN AC OUTPUT	MT3	TPANDUCER, FUEL LEVEL
DIODES		RESISTORS	
CR3	START CIRCUIT	R13	SHUNT, INSTRUMENT
CR6	FUEL PUMPS	R35	FLASH FIELD CURRENT LIMITING
CR27	RECTIFIER ASSY		
LIGHTS		SWITCHES	
DS1	PANEL	FL1	FUEL LEVEL
DS2	PANEL	FL2	FUEL LEVEL
DS3	PANEL		
DS6	INDICATOR, CIRCUIT BREAKER (CONTACTOR)	OP	LOW OIL PRESSURE
DS7	PROTECTION BYPASS	WT	HIGH COOLANT TEMPERATURE
DS8	INDICATOR, AIR CLEANER	S1	ENGINE PRIMER
		S2	START-RUN-STOP
G2	BATTERY CHARGING ALTERNATOR	S3	CONTACTOR
		S4	PANEL LIGHTS
		S7	BATTLE SHORT
		S9	ENGINE SPEED
RELAYS		SR1	SLAVE RECEPTACLE
K1	STOP-RUN		
K2	OVERVOLTAGE		
K3	CRANK		
K5	FIELD FLASH		
K8	FUEL LEVEL		
K13	SHORT CIRCUIT		
K14	OVERLOAD		
K15	REVERSE POWER		
K17	SWITCH AIR CLEANER RESTRICTION		

NOTES:  
1. INTERPRET DRAWINGS PER MIL-STD-100.  
2. DIAGRAM APPLIES TO 15 KW AND 30 KW GENERATOR SETS MODEL NUMBERS MEP 004A AND MEP 005A RESPECTIVELY

FO-5. DC Schematic Diagram, 15 and 30 KW,  
Utility Generator Sets, Drawing No. 72-2277.

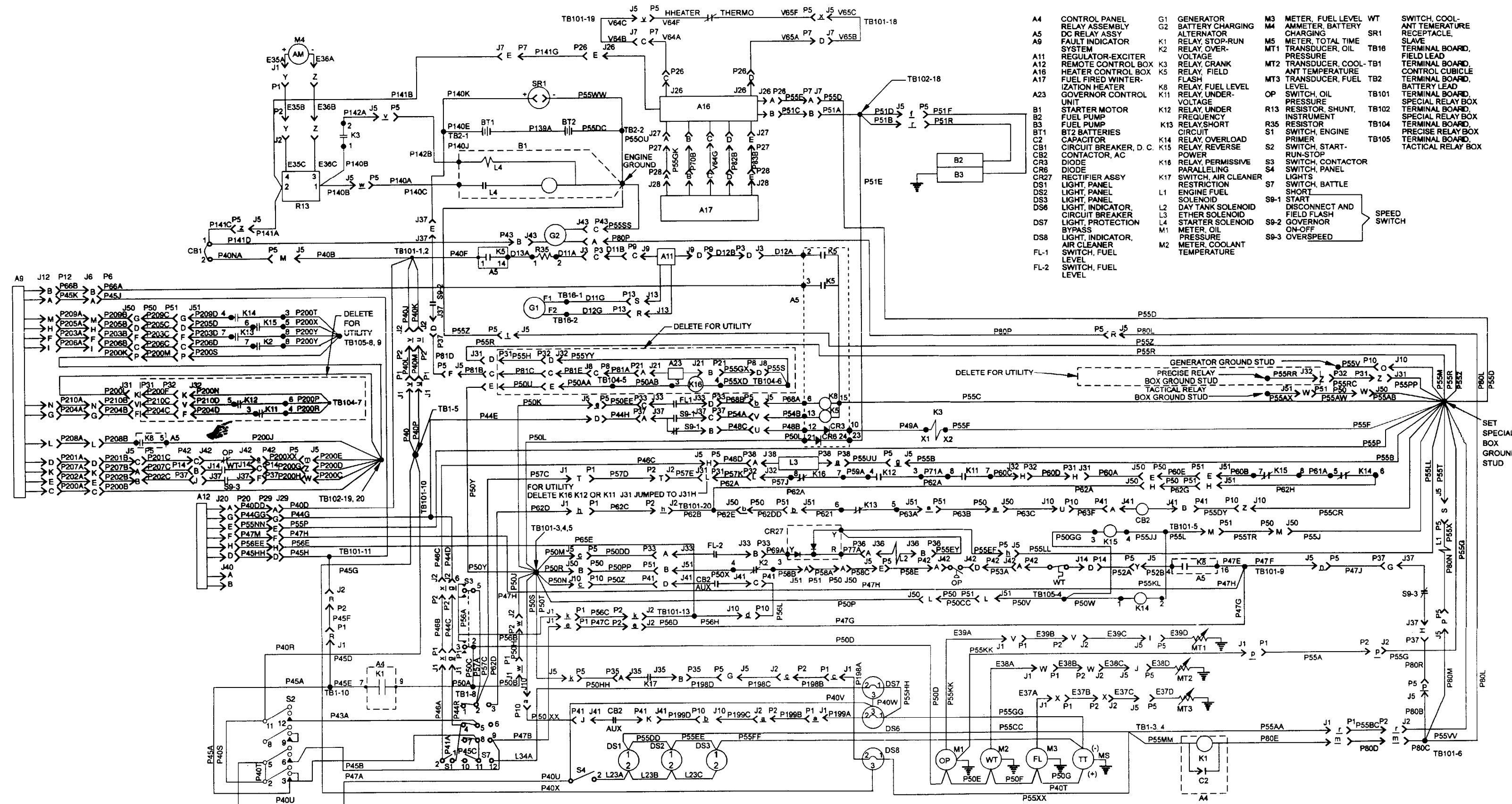


C2	CAPACITOR	M1	METER, OIL PRESSURE
CB1	CIRCUIT BREAKER, DC	M2	METER, COOLANT TEMPERATURE
CB2	CONTACTOR, AC	M3	METER, FUEL LEVEL
CR3	DIODE	M4	AMMETER, BATTERY CHARGING
CR6	DIODE	M6	METER, TOTAL TIME
CR21	DIODE	MT1	TRANSDUCER, OIL PRESSURE
CR22	DIODE	MT2	TRANSDUCER, COOLANT TEMPERATURE
CR27	RECTIFIER ASSEMBLY	MT3	TRANSDUCER, FUEL LEVEL
DS1	LIGHT, PANEL	R21	RESISTER
DS2	LIGHT, PANEL	R22	RESISTER
DS3	LIGHT, PANEL	R36	RESISTER, FIELD FLASH
DS6	LIGHT, INDICATOR, CIRCUIT BREAKER	FL-1	SWITCH, FUEL LEVEL
DS7	LIGHT, PROTECTION BYPASS	FL-2	SWITCH, FUEL LEVEL
DS8	LIGHT, INDICATOR, AIR CLEANER	OP	SWITCH, OIL PRESSURE
K1	RELAY, STOP-RUN	WT	SWITCH, COOLANT TEMPERATURE
K2	RELAY, OVER VOLTAGE	S1	SWITCH, ENGINE PRIMER
K3	RELAY, CRANK	S2	SWITCH, START-RUN-STOP
K5	RELAY, FIELD FLASH	S3	SWITCH, CONTACTOR
K8	RELAY, FUEL LEVEL	S4	SWITCH, PANEL LIGHTS
K11	RELAY, UNDER VOLTAGE	S7	SWITCH, BATTLE SHORT
K12	RELAY, UNDER FREQUENCY	S9-1	START-DISCONNECT AND FIELD FLASH
K13	RELAY, SHORT CIRCUIT	S9-2	GOVERNOR ON-OFF
K14	RELAY, OVERLOAD	S9-3	OVERSPEED
K15	RELAY, REVERSE POWER	S20	SWITCH, REMOTE ON-OFF
K16	RELAY, PERMISSIVE PARALLELING	SCR21	SILICON CONTROL RECTIFIER
K17	SWITCH, AIR CLEANER RESTRICTION	SR1	RECEPTACLE, SLAVE
K21	RELAY, REMOTE START		
K22	RELAY, REMOTE STOP		



FO-6. DC Schematic





TROUBLESHOOTING DIAGRAM, DC, 15KW AND 30KW, 50/60 HZ AND 400 HZ, DOD GENERATOR SETS, TACTICAL PRECISE AND TACTICAL UTILITY

FO-7. DC Troubleshooting Diagram

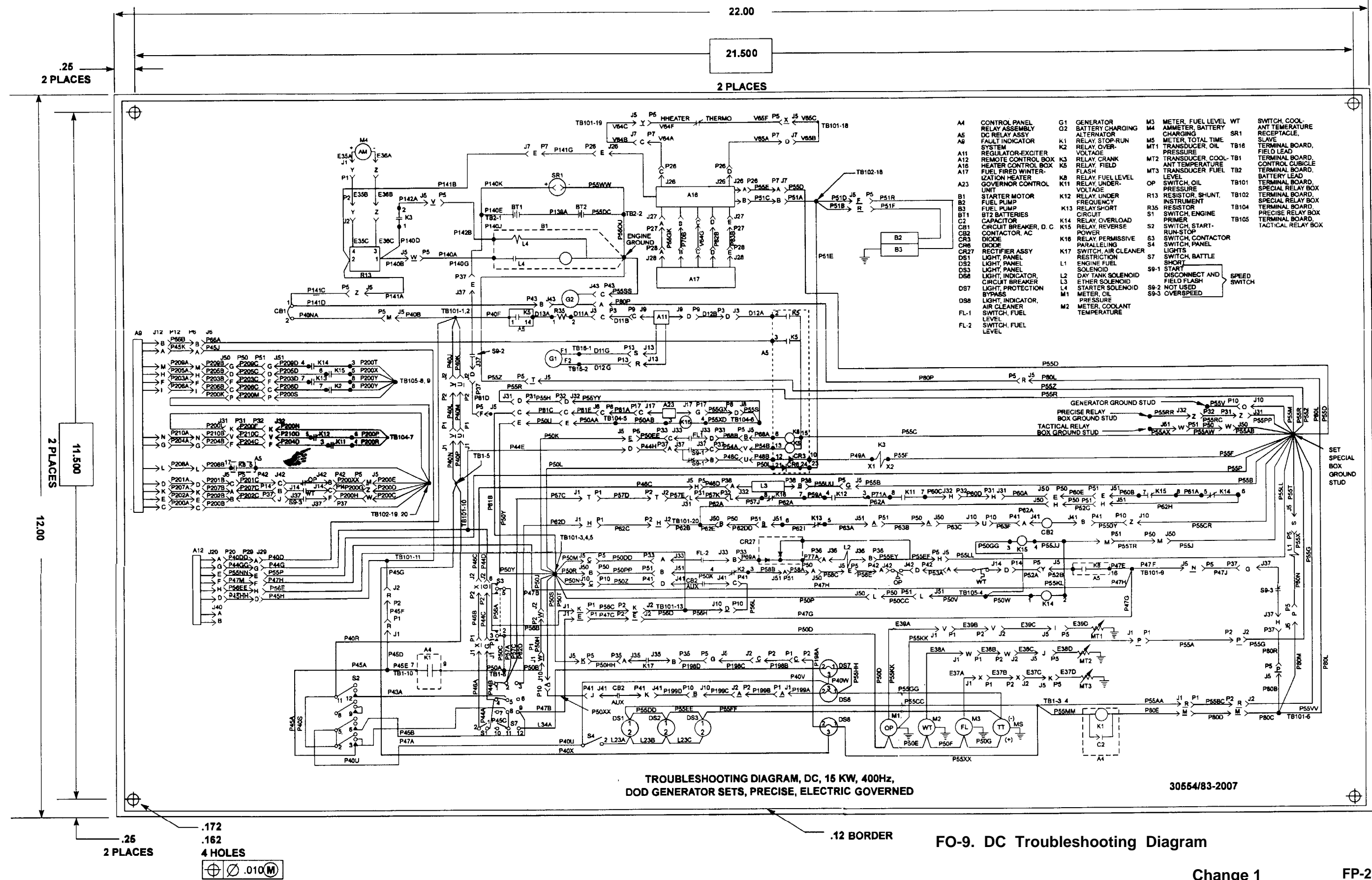


















## ***These are the instructions for sending an electronic 2028***

The following format must be used if submitting an electronic 2028. The subject line must be exactly the same and all fields must be included; however only the following fields are mandatory: 1, 3, 4, 5, 6, 7, 8, 9, 10, 13, 15, 16, 17, and 27.

From: "Whomever" <whomever@avma27.army.mil>

To: mpmt%avma28@st-louis-emh7.army.mil

Subject: DA Form 2028

1. *From:* Joe Smith
2. *Unit:* home
3. ***Address:*** 4300 Park
4. ***City:*** Hometown
5. ***St:*** MO
6. ***Zip:*** 77777
7. ***Date Sent:*** 19-OCT-93
8. ***Pub no:*** 55-2840-229-23
9. ***Pub Title:*** TM
10. ***Publication Date:*** 04-JUL-85
11. *Change Number:* 7
12. *Submitter Rank:* MSG
13. ***Submitter FName:*** Joe
14. *Submitter MName:* T
15. ***Submitter LName:*** Smith
16. ***Submitter Phone:*** 123-123-1234
17. ***Problem:*** 1
18. *Page:* 2
19. *Paragraph:* 3
20. *Line:* 4
21. *NSN:* 5
22. *Reference:* 6
23. *Figure:* 7
24. *Table:* 8
25. *Item:* 9
26. *Total:* 123
27. ***Text:***

This is the text for the problem below line 27.

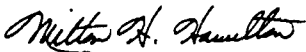






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TM 9-6115-464-12.









# SOMETHING WRONG WITH THIS PUBLICATION?

THEN . . . JOT DOWN THE DOPE ABOUT IT ON THIS FORM, CAREFULLY TEAR IT OUT, FOLD IT AND DROP IT IN THE MAIL!

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

PFC John DOE  
CO A 3rd Engineer Bn  
Ft. Leonardwood, MO 63108

DATE SENT

22 August 1992

PUBLICATION NUMBER

TM 1-1520-250-10

PUBLICATION DATE

15 June 1992

PUBLICATION TITLE

Operator's manual MH60K Helicopter

BE EXACT PIN-POINT WHERE IT IS

PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO
6	2-1 a		
B1		4-3	

IN THIS SPACE, TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

In line 6 of paragraph 2-1a the manual states the engine has 6 cylinders. The engine on my set only has 4 cylinders. Change the manual to show 4 cylinders.

Callout 16 in figure 4-3 is pointed out as bolt. In key to figure 4-3, item 16 is called a shim. Please correct one or the other

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER

JOHN DOE, PFC (268) 317-7111

SIGN HERE

JOHN DOE *John Doe*

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## SOMETHING WRONG WITH THIS PUBLICATION?

DATE SENT

**PUBLICATION TITLE** Generator Set, Diesel  
Engine Driven, Tactical, Skid Mtd, 15kW,  
3 Phase, 4 Wire, 120/208 & 240/416 Volts

**IN THIS SPACE, TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:**

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IT OUT, FOLD IT AND  
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DATE SENT

PUBLICATION NUMBER

TM9-6115-464-12

PUBLICATION DATE

30 July 1993

PUBLICATION TITLE Generator Set, Diesel  
Engine Driven, Tactical, Skid Mtd, 15kW,  
3 Phase, 4 Wire, 120/208 & 240/416 Volts

BE EXACT PIN-POINT WHERE IT IS

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AND WHAT SHOULD BE DONE ABOUT IT:

PAGE  
NO

PARA-  
GRAPH

FIGURE  
NO

TABLE  
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# The Metric System and Equivalents

## Linear Measure

1 centimeter = 10 millimeters = .39 inch  
 1 decimeter = 10 centimeters = 3.94 inches  
 1 meter = 10 decimeters = 39.37 inches  
 1 dekameter = 10 meters = 32.8 feet  
 1 hectometer = 10 dekameters = 328.08 feet  
 1 kilometer = 10 hectometers = 3,280.8 feet

## Weights

1 centigram = 10 milligrams = .15 grain  
 1 decigram = 10 centigrams = 1.54 grains  
 1 gram = 10 decigram = .035 ounce  
 1 dekagram = 10 grams = .35 ounce  
 1 hectogram = 10 dekagrams = 3.52 ounces  
 1 kilogram = 10 hectograms = 2.2 pounds  
 1 quintal = 100 kilograms = 220.46 pounds  
 1 metric ton = 10 quintals = 1.1 short tons

## Liquid Measure

1 centiliter = 10 milliliters = .34 fl. ounce  
 1 deciliter = 10 centiliters = 3.38 fl. ounces  
 1 liter = 10 deciliters = 33.81 fl. ounces  
 1 dekaliter = 10 liters = 2.64 gallons  
 1 hectoliter = 10 dekaliters = 26.42 gallons  
 1 kiloliter = 10 hectoliters = 264.18 gallons

## Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch  
 1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches  
 1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet  
 1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet  
 1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres  
 1 sq. kilometer = 100 sq. hectometers = .386 sq. mile -

## Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch  
 1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches  
 1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

# Approximate Conversion Factors

<i>To change</i>	<i>To</i>	<i>Multiply by</i>	<i>To change</i>	<i>To</i>	<i>Multiply by</i>
inches	centimeters	2.540	ounce-inches	newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29.573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	newton-meters	1.356	metric tons	short tons	1.102
pound-inches	newton-meters	.11296			

# Temperature (Exact)

°F	Fahrenheit	5/9 (after	Celsius	°C
	temperature	subtracting 32)	temperature	







