ARMY	*TM 9-6115-464-34
AIR FORCE	TO-35C2-3-445-2
NAVY	NAVFAC P-8-624-34

TECHNICAL MANUAL

DIRECT AND GENERAL SUPPORT AND DEPOT LEVEL MAINTENANCE MANUAL

GENERATOR SET, DIESEL ENGINE DRIVEN, TACTICAL

Skid MTD., 15 KW, 3 PHASE, 4 WIRE, 120/208 AND 240/416 VOLTS

DOD MODELS	CLASS	HERTZ	NSN
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

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

DISTRIBUTION STATEMENT A. Approved for public release, distribution is unlimited.

*This manual supersedes TM 5-6115-464-34/TO 35C2-3-455-2/TM 07523A-34, dated 31 January 1975.

HEADQUARTERS, DEPARTMENTS OF THE ARMY, AIR FORCE AND NAVY

18 JANUARY 1994

WARNING

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 reconnection of wires or cables until generator set is shut-down and completely deenergized.

DANGEROUS GASES

Batteries generate explosive gas during charging; therefore, utilize extreme caution, do not smoke, or use open flame in vicinity when servicing batteries. 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.

LIFTING

Do not allow personnel under or near generator set or equipment used in conjunction with generator set when hoisting or lifting. Death or severe injury may result.

WARNING

DRILLING

When drilling holes in skid base, do not allow drill bit to enter fuel tank. Death or serious injury may result.

HEAT

Do not allow personnel to open or close exhaust discharge door when unit is hot. Serious burns or personal injury may result.

CAUTION

DAMAGE

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

WARNING

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 equipemnt may result.

WARNING

Generator maintenance solvents (Methyl Ethyl Ketone and dry cleaning solvent) may prosent fire and chemical hazards if used without proper precautions. Observe manufacturer's warning labels and the warnings and cautions in this manual. Ensure sufficient ventilation exists, protective equipment is used, and sources of ignition are removed.

AIR UNDER PRESSURE

Objects propelled by compressed air are may produce severe personal injury. When used for cleaning and drying, compressed air shall not exceed 30 psig and be used with adequate chip guards and eye protection.

CHANGE

NO 1

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

DIRECT AND GENERAL SUPPORT AND DEPOT LEVEL MAINTENANCE MANUAL

GENERATOR SET, DIESEL ENGINE DRIVEN, TACTICAL
SKID MTD., 15 KW, 3 PHASE, 4 WIRE, 120/208 AND 240/416 VOLTS

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MEP-103A	PRECISE	50/60	6115-00-118-1245
MEP-113A	PRECISE	400	611500-118-1244

DOD MODELS	**NOMENCLATURE**	**NSN**
MEP-005AWF	WINTERIZATION KIT, FUEL BURNING	6115-00-463-9083
MEP-005AWE	WINTERIZATION KIT, ELECTRIC	6115-00-463-9085
MEP-004ALM	LOAD BANK KIT	6115-00-291-9201
MEP-005AWM	WHEEL MOUNTING KIT	61150-463-9094
	APPUCATIONS KIT	61151-096-9015
MEP-015ASK	ACOUSTIC SUPPRESSION KIT	6115-01-233-8274

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TM 9-6115-464-34/T.O 35C2-3-445-2/NAVFAC P-8-624-34, dated 18 January 1994, is changed as follows:

1 Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
i and ii	i and ii
1-13 and 1-14	1-13 and 1-14
3-59 and 3-60	3-59 and 3-60
3-111 and 3-112	3-111 and 3-112
3-309 and 3-3110	3-309 and 3-310
------------------------	3-310.1/ (3-310.2 blank)
A-1 and A-2	A-1 and A-2

2. Retain this sheet in front of manual for reference purposes.

ARMYTM 9-6115 464 34
AIR FORCE TO 35C2-3-445-2
NAVY NAVFAC P-8-624-34
C1

By Order of the Secretaries of the Army, Air Force, and Navy:

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To be distributed in accordance with DA Form 12-25-E, block no. 6195, requirements for TM 9-6115-46434.

TECHNICAL MANUAL

HEADQUARTERS, DEPARTMENTS OF
THE ARMY, THE AIR FORCE, AND THE NAVY
WASHINGTON D.C., 18 JANUARY1994

Technical Manual

DIRECT AND GENERAL SUPPORT AND DEPOT LEVEL MAINTENANCE MANUAL

GENERATOR SET, DIESEL ENGINE DRIVEN, TACTICAL SKID MTD, 15 KW, 3 PHASE, 4 WIRE, 120/208 AND 240/416 VOLTS

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	APPLICATIONS KIT	6115-01-096-9015
MEP-O15ASK	ACOUSTIC SUPPRESSION KIT	6115-01-233-8274

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.

For AIR FORCE, Submit AFTO Form 22 directly to: COMMANDER, SACRAMENTO AIR LOGISTICS CENTER, ATTN: TILBA MCCLELLAN AFB, CA 956-5990.

For Navy, mail comments to the Commander, Naval Construction Battalion Center, ATTN: Code 157411, Bldg. 1443, Port Hueneme, CA 93043-5000.

*This manual supersedes TM 5-6115-464-34/TO 35C2-3-455-2/rM 07523A-34, dated 31 January 1975.

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LIST OF ILLUSTRATIONS (Cont.)

LIST OF ILLUSTRATIONS (Cont.)

LIST OF ILLUSTRATIONS (Cont.)

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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 observation of symptoms of trouble, troubleshooting procedures, and maintenance procedures to correct a malfunction.

You must familiarize yourself with the maintenance procedures before beginning the maintenance tasks.

To help you become familiar with this 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 maintain or service those item(s) and component(s) that are the responsibility of the (Direct and General Support) and Depot Level Maintenance 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. Appendix A

   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, regarding the complete generator set.

   b. Chapter 2. Operating Instructions. Contains maintenance instructions and troubleshooting procedures.

   c. Chapter 3. Engine and Generator Repair Instructions. Contains detailed repair procedures for the Direct and General Support and Depot Level Maintenance.

   d. Chapter 4. Generator set test after Overhaul Repair Instructions. Contains inspection procedures, operrating tests for the Generator Set after it has been overhauled.

   e. Chapter 5. Repair Instructions for Auxiliary Equipment. Contains troubleshooting procedures for optional kits. Each kit has procedures for removal, disassembly, cleaning, inspection, and repair.

   f. Appendix A contains references to all forms and publications referred to in this manual.

   g. An Index lists all subjects in the manual in alphabetical order.

h. Wiring diagrams and schematics located in 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.

(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. 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 in 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 3 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

Section I. GENERAL INFORMATION

1-1. SCOPE.

a. This manual contains instructions for the use of (direct and general support) and depot maintenance personnel responsible for maintaining the 15 KW Diesel Engine Generator Sets, Models MEP-004A, MEP-103A, and MEP–113A. The maintenance information provided herein is normally beyond the scope of the tools, equipment, personnel and supplies available at the operator and unit levels. This manual must be used in conjunction with the operator and unit manual for complete maintenance instructions for the generator sets.

NOTE

Accomplishment of actions /tasks at designated maintenance levels as directed in this manual does not apply to the Air Force. Air Force users shall accomplish maintenance at user level consistent with their capability in accordance with policies established by AFR 66-1.

b. Appendix A contains a list of publications applicable to this manual.

1-2. LIMITED APPLICABILITY.

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

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. Reporting of errors, omissions, and recommendations for improvement of this publication by the user is encouraged. Reports should be submitted 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, U.S. Army Aviation and Troop Command, ATTN: AMSAT-I-MTS, 4300 Goodfellow Boulevard, St. Louis, MO 63120-1798.

b. (F) Air Force - AFTO Form 22 directly to Commander, Sacramento Air Logistics Center, SM-ALC-TILBA, McClellan Air Force Base, CA 95652-5990 in accordance with TO-00-5-1.

c. (N) Navy - By letter directly to Commander, Officer, Naval Construction Battalion Center, ATTN: Code 157411 Building 1443, Port Hueneme, CA 93043-5000.

1-5. DESTRUCTION OF MATERIAL 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.

1-6. SHIPMENT AND STORAGE.

a. (F) Preparation for shipment and storage of the generator set for US Air Force will be in accordance with TO 35-1-4.

b. (A) Shipment and storage for US Army and the US Marine Corps will be in accordance with TB 740-97-2.

1-7. EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIRs)

a. (A) EIRs 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 simply tell why the design is unfavorable or why the procedure is difficult. EIRs maybe submitted on SF 368. Mail directly to US Army Avaition and Troop Command, ATTN: AMSAT-I-MDO, 4300 Goodfellow Blvd, St. Louis, MO 63120-1798.

1-8. LEVELS OF MAINTENANCE.

The user shall refer to the Maintenance Allocation Chart (MAC) of TM 9-6115-464-12 (appx B) for tasks and categories of maintenance to be performed.

Section II. EQUIPMENT DESCRIPTION AND DATA

1-9. DESCRIPTION.

The generator set is a fully enclosed, self-contained, skid mounted, portable unit. It is equipped with controls, instruments, and accessories which enable it to be operated as a single unit or in parallel with two or more units of the same size, class, and mode. In addition, the generator sets will accept and operate with fuel and electric winterization kits, load bank kit, wheel mounting kit, automatic transfer panel kits, a remote control box, and an application kit. For a more detailed description of the generator sets, refer to the Operator and Unit Maintenance Manual. A more detailed description of specific components and assemblies is found in the applicable maintenance paragraphs of this manual.

1-10. TABULATED DATA.

a. General. This paragraph contains all maintenance data pertinent to (Direct and General Support), and Depot maintenance personnel. For additional tabulated data, refer to the Operator and Unit Maintenance Manual.

b. Engine Classification and Rating.

Model	D198ERX51
Installation drawing	40-A-8875
Bore and Stroke	3-3/4 x 4-1/2 inch
Number of cylinders	4
Piston displacement (cu. in.)	1
Dry weight (approx)	772 pounds
Lubricating oil capacity (with filters)	8 quarts
Low idle recommendations	1100 to 1200 rpm
Fuel consumption (gals/hr):	
1500 rpm (50 HZ, 12.5 KW)	1.15
1800 rpm (60HZ,15KW)	1.50
2000 rpm(400HZ, 15 KW)	1.60
Heat rejection to coolant (BTU/MIN):	
1500 rpm (50HZ,12.5KW)	806
1800 rpm (60HZ,15KW)	981
2000 rpm (400HZ, 15 KW)	1,040
Air consumption (CFM):	
1500 rpm (50HZ,12.5KW)	76.8
1800 rpm (60HZ,15KW)	90.8
2000 rpm (400HZ,15KW)	100.5
Water pump delivery(GPM):	
1500 rpm (50HZ,12.5KW)	16
1800 rpm (60HZ,15KW)	19.5
2000 rpm (400HZ,15KW)	22
Crankcase:	
Material	Alloy cast iron
How cast	Integral with block
Crankshaft:	
Material	Special steel, hardened bearing surfaces
Number of bearings.	5
Bearing diameter	2-7/8 inches
Bearing lengths:	
Front	1-1/32 inches
Center	2-1/8 inches
Rear	1-1/32 inches
Intermediate	1-1/32 inches
Connecting rod:	
Material	Heat treated steel
Bearing diameter	2-3/8 inches
Bearing length	1-11/64 inches
Rod length (c to c)	8 inches

Piston and piston pin:
Piston material . . . Heat treated aluminum alloy
Pin material . . . Alloy steel
Pin type . . . Full floating

Camshaft:
Number of bearings . . . 4
Bearing diameter . . . 2-1/16 inches

Bearing lengths:
Front . . . 1-1/16 inches
Intermediate . . . 13/16 inch
Rear . . . 1-1/16 inches

Cylinder head:
Material . . . Alloy casting
Type . . . One piece casting
Valve arrangement . . . Overhead (E-I-I-E-E-I-I-E)
Valve material (intake and exhaust) . . . High alloy forging

c. Starter Assembly Classification and Rating.

Stailed current . . . 500 amps(max)
Stalled torque . . . 18 lbs.-ft. (min)
Duty classification . . . 15 sec on-15 sec off(2 starting cycle sper minute)
Drive type . . . Positive indexing with overrun clutch

d. Fuel injector Pump Classification and Rating.

Manufacturer . . . Hartford Machine Screw Co. Div. of Standard Screw Co., Inc.
Model . . . DBGFC433X1LK
Line pressure . . . 2500 to 2950psig
Transfer pump pressure . . . 130 psig(max)
Transfer pump lift . . . 15 inches HG (min)
Full load rpm. . . . 1800
Delivery variation between cylinders at full load . . . 5% (max)

e. Static Exciter and Voltage Regulator Assembly Classification and Rating.

Type	Solid state
Voltage regulation:	
MEP-004A	3 percent of rated voltage
MEP-103A	1 percent of rated voltage
MEP-113A	1 percent of rated voltage
Voltage stability:	
Short term:	
MEP-004A	Within 2 percent of rated voltage
MEP-103A	Within 1 percent of rated voltage
MEP–113A	Within 1 percent of rated voltage
Long term:	
MEP-004A	Within 4 percent of rated voltage
MEP-103A	Within 2 percent of rated voltage
MEP-113A	Within 2 percent of rated voltage
Voltage drift (8 hour period,with temperature variation of up to 60°F) (15.5°C)	1 percent
Transient performance:	
Resumption of steady state:	
MEP-004A	Within 3 sec.
MEP-103A	Within 0.5 sec.
MEP-113A	Within 0.5 sec.
Overshoot/undershoot	
MEP-004A	20 percent rated voltage
MEP-103A	15 percent rated voltage
MEP-113A	12 percent rated voltage

f. Electro-hydraulic Governor Control Unit Classification and Rating.

DOD Drawing Numbers:	
50/60 Hz	69-784-2
400Hz	69-784-1
Type	Solid state
Input volts	24 Vdc and 120 Vac
Frequency regulation	0.25 percent
Power dissipation	115 watts (max)
Enclosure	Water-proof, wax-filled casing

g. Electric Governor Control Unit Classification and Rating.

DOD Drawing Numbers:	
Governor control unit	81–4903
Magnetic actuator	81–705
Magnetic pickup	81–4904
Type:	Solid state
Input volts	11–40 Vdc
Frequency regulation	0.25°
Temperature range	–65° to 185°F (–55° to 85°C)

h. Overvoltage Relay Classification and Rating.

DOD Drawing number	72–2257
Nominal voltage	120 Vac
Actuation voltage	153 ± 3 Vac over frequency range of 50 to 450 Hz
Time delay	200 m sec sustained over–voltage (min)
Trip time	Less than 1.0 sec. after sustained pull–in voltage
Contact rating	10 amp, 28.5V, resistive
Temperature range	–65°F (–58.5°C) to +170°F (76.7°C)

i. Undervoltage Relay Classification and Rating.

DOD drawing number	70–1120
Nominal voltage	120 Vac
Frequency range	50 to 450 Hz
Drop–out voltage	99 ± 4 Vac
Pull–in voltage	110 ± 3 Vac
Time delay	6 ± 2 sec. after drop–out (instantaneous at 40 Vac and below)
Contact rating	10 amp, 28V, resistive
Contact arrangement	2 pole, double throw
Temperature range	–65°F (–58.5°C) to +170°F (76.7°C)
Trip voltage variation over temperature range	± 2% max.

j. Underfrequency Relay Classification and Rating.

DOD drawing number:	
50/60 Hz	70-1119
400 Hz	70-1141
Input voltage (nominal)	120 Vac
Trip frequency:	
400 Hz	370±5Hz
60 HZ	48±3Hz
50 Hz	43±3Hz
Voltage input limits	± 10 percent
Temperature range	-65°F(-58.5°C) to-170°F(76.7°C)
Trip frequency variation over temperature range	±2Hz

k. Short Circuit Relay Classification and Rating.

DOD drawing number	72-2256
Trip voltage	10±Vac(any phase to neutral)
Contact rating	10 amp, 28Vdc
Frequency range	50 Hz to 450 Hz
Temperature range	-65°F(-58.5°C) to 170°F(76.7°C)
Trip variation over temperature range	5 percent maximum

l. Reverse Power Relay Classification and Rating.

DOD drawing number	72-2255
DC input voltage	0 to 10 Vdc
AC superimposition	Up to 20 Vac
Reverse polarity	20 percent (approximate)
Temperature range	-65°F(-58.8°C) to 170°F(76.7°C)
Variations in trip voltage over temperature range	±3 Vdc (max)
Contact rating	10 amp, 28 Vdc, resistive

m. Permissive Paralleling Relay Classification and Rating.

DOD drawing number	70-1118
Input power	24 Vdc
Actuation point	8±1 Vac (falling)
Frequency range	50 Hz to 400 Hz
Temperature range	-65°F(-58.8°C) to 170°F (76.7°C)
Variation of actuation point over temperature range	Less than 1 Vac
Contact rating	10 amp, 28 Vdc, resistive

n. Thermal Watt Converter Classification and Rating.

DOD drawing number:	
50/60 Hz	69–589–1
400 Hz	69–589–2
Operating voltage	100 to 130 Vac
Current	1 amp
Elements	3
Phase	3
Number of wires	4
Output	20 MVdc, open circuit
Circuit resistance (output)	4.97 ohm
Watts per element:	
50/60 Hz	96.26
400 Hz	96.3

o. Main Load Contactor Classification and Rating.

DOD drawing number	69–680
Enclosure	Gasket sealed casing
KVA	125 (max)
Main contact type	Double break, magnetic
Voltage range	120 Vac to 416 Vac
Frequency range	50 Hz to 400 Hz
Continuous current	350 amp
Interruption current	5000 amp (max)
Auxiliary contacts:	
Operating voltage	28 Vdc
Operating current	7.5 amp
AC voltage	120 Vac
Lamp current	7.5 amp
Operational lag behind main contacts	0.001 to 0.003 sec.
Coil data:	
Operating voltage	18 to 30 Vdc
Actuation time	0.035 to 0.050 sec.
Close coil resistance	8 ohm

p. 50/60 Hz Generator Classification and Rating.

Rating	15 KW
Kilovolt amperes:	
1500 rpm (50 Hz)	18.75
1800 rpm (60 Hz)	15.63

q. 50/60 Hz Generator Classification and Rating (Cont):

Winding resistances (total)	
Winding	nominal value, in ohms at 77° F (25° C)
Generator field (rotor)	3.31
Generator armature (stator)	196
Phase	3
Temperature rise	167° F (75° C)
Degree of enclosure	Drip–proof
Lubrication requirements	None

r. 400 Hz Generator Classification and Rating:

Rating	15 KW
Kilovolt amperes	18.75
Winding resistances (total):	
Winding	Nominal value, in ohms, at 77° F (25° C)
Generator field (rotor)	2. 61
Generator armature (stator)	.079
Phase	3
Temperature rise	167°F (75°C)
Degree of enclosure	Drip–proof
Lubrication requirements	None

s. 50/60 Hz and 400 HZ Generator Exciter Classification and Rating.

Manufacturer	Electric Machinery Mfg. Co., Inc.
Type	Rotating armature with externally mounted static excitation and voltage regulation assembly
Kilovolt amperes	1.63
Winding resistances:	
Winding	Nominal value, in ohms at 77°F (25°C)
Exciter field (total)	2.19
Exciter armature (single coil)	0.10
Phase	3
Operating frequency:	
50 Hz generator	100 Hz
60 Hz generator	120 Hz
400 Hz generator	133 Hz
Volts	62.5
Amperes	26
Duty classification	Continuous
Field winding (stator)	Series
Degree of enclosure	Drip–proof
Cooling	Convection

t. 50/60 Hz Generator Repair and Replacement Standards.

Rotor:

Number of coils	4
Turns per coil	335
Wires per turn	2
Wire size	#15 Rd.
Number of slots	8
Coils per slot	2
Turns per coil	710
Coil connection	Series
Field volts	53
Total resistance	3.31 ohms
Pole length	3.25 inches
Insulating materials	Varnish, type M, Grade CL155, MIL-I-24092
Dripping compound	Varnish, fungus-resistant, MIL-V-173

Stator

Number of poles	4
Number of slots	54
Number of coils	54
Turns pe rcoil	7
Coils per slot	1
Turns per slot	7
Wires per turn	3
Wires pe rslot	3
Pitch of coils	1 and 12
Grouping of coils	12 groupsof 2 6 groups of 5
Wire size	#16 Rd.
Gap bore	11.0 inches
Skew at gap	0.64 inches

Insulating materials:

Slot insulators	54
Phase insulators	12
Varnish	Type M, Grade CL155, MIL-V-173.

u. 50/60 Hz Generator Repair and Replacement Standards (cont):

Dipping compound	Varnish, fungus-resistant, MIL-V-173

v. <u>400 Hz Generator Repair and Replacement Standards</u>.

Rotor:	
Number of coils	24
Turns per coil	56
Wires per turn	2
Wire size	#10 Rd.
Number of slots	108
Coils per slot	2
Turns per slot	102
Coil connection	Series
Field volts	53
Total resistance	2.61 ohms
Pole length	3.5 inches
Insulating material	Varnish, type M, Grade CL155, MIL–I–24092
Dipping compound	Varnish, fungus–resistant, MIL–V–173
Stator:	
Number of poles	24
Number of slots	108
Number of coils	108
Turns per coil	8
Coils per slot	1
Turns per slot	8
Wires per turn	2
Wires per slot	2
Pitch of coils	1 and 4
Grouping of coils	36 groups of 1; 36 groups of 2 (1–2–1–2–1–2 repeated 12 times)
Wire size	#16 Rd.
Gap bore	13.5 inches
Skew at gap	0.40 inches
Insulating materials:	
Slot insulators	108
Phase insulators	12
Varnish	Type M, Grade CL155, MIL–I–24092
Dipping compound	Varnish, fungus–resistant, MIL–V–173

w. <u>50/60 Hz and 400 Hz Generator Exciter Repair and Replacement Standards</u>.

Rotor:	
Number of coils	4
Turns per coil	200
Wires per turn	1
Wire size	#15 Rd.
Number of slots	8
Coils per slot	1
Turns per slot	200

Coil connection	Series
Field volts	62.5
Total resistance	2.19 ohms
Pole length	1.6 inches
Rotor diameter	7.42 inches
Insulating material	Varnish, type M, Grade CL155, MIL–I–24092
Dipping compound	Varnish, fungus–resistant, MIL–V–173

Stator:

Number of poles	8
Number of slots	24
Number of coils	8
Turns oer coil	8
Coils per slot	1
Turns per slot	8
Wires per turn	3
Pitch of coils	1 and 3
Grouping of coils	24 groups of 1 (1 group repeated 24 times)
Wire size	#18 Rd.
Gap bore	7.5 inches
Skew at gap	0

Insulating materials:

Slot insulators	24
Phase insulators	12
Varnish	Type M, Grade CL155 MIL–I–24092
Dipping compound	Varnish, fungus resistant, MIL–V–173

x. Engine Repair and Replacement Standards. Table 1–1 lists manufacturer's sizes, maximum allowable wear, and maximum allowable clearances for the engine assembly.

y. Nut and Bolt Torque Data.

Engine:

Cylinder head nuts:

9/16 dia. studs	160 ft–lb
5/8 dia. stud	175 ft–lb
Nozzle holder attaching screw	23 ft–lb
Connecting rod bolt	70 ft–lb
Main bearing cap bolt:	
9/16 inch	130 ft–lb
1/2 inch	100 ft–lb
Camshaft gear nut	130 ft–lb
Flywheel bolts	80 ft–lb
Manifold attaching nut	18–20 ft–lb
Fuel pump gear nut	60–65 ft–lb
Crankshaft pulley nut	125 ft–lb
Bellhousing screw	75 ft–lb
Idler shaft screw	24–27 ft–lb

Fuel injection pump:	
Fuel injection mounting screw	30–40 ft–lb
End plate capscrew	30 in–lb
Body plugs (side)	215–265 in–lb
Body plug (bottom)	40–50 in–lb
Connector screw	420 in–lb
Cam advance screw	400 in–lb
Cap and filter assy	240 in–lb
Guide stud	115 in–lb
Cover hold down screw	40 in–lb
Shutoff lever retaining screw	30 in–lb
Pivot shaft retainer nut	25 in–lb
Torque screw nut	25 in–lb
Timing line cover screw	20 in–lb
Head locating screw	300 in–lb
Head locking screws	175 in–lb
Cam locking screw	500 in–lb
End plate plug	60 in–lb
End plate pipe plug	360 in–lb
Fuel pump to drive gear nut	35–40 ft–lb
Generators:	
Lockplate attaching screw	120 ft–lb
Main rotor diode	30 ft–lb
Stator mounting screw	17 ft–lb
Rotor mounting screw	17 ft–lb
Balance weight attaching screw	31 ft–lb
Exciter stator mounting screw	17 ft–lb
Exciter rotor mounting screw	17 ft–lb
Exciter rotor diode	28 in–lb
Exciter rotor to rotor shaft	60 in–lb
Rectifiers	28 in–lb
Blower assembly screws	75 ft–lb
End bell assembly to stator	31 ft–lb
Bearing housing screws	31 ft–lb
Bearing adapter	88 ft–lb
Mounting screws (and nuts)	200–220 ft–lbs

z. Wiring Diagrams and Schematic Diagrams. Refer to the Operator and Unit Maintenance Manual for the Generator Set wiring diagrams and schematic diagrams.

Table 1-1. FITS AND TOLERANCES

Component	Mfg's Tolerances		Desired Clearance		Maximum Allowable Wear	Maximum Allowable Clearance
	Minimum	Maximum	Minimum	Maximum		
CYLINDER BLOCK:	3.7490	3.7510				
Cylinder bore dia.	3.7505	3.7515			0.0050	
Cylinder bore dia.(Bohn)		0.0005				
Cylinder bore out of round		0.0005			0.0030	
Cylinder bore taper	3.0665	3.0670			0.0020	
Main brg. bore - less brgs.	2.1870	2.1880				
Camshaft brg. bore - less brgs.	2.0000	2.0005				
Oil pump bore	0.7494	0.7500				
Valve tappet bore		0.003				
Warpage		0.0005				
Milling						
CRANKSHAFT:	2.8734	2.8744				
Main brg. journal dia.		0.0003			0.0030	
Main brg. journal out of round		0.0003			0.0020	
Main brg. journal taper		0.0020			0.0015	
Main brg. run-out at center	2.3730	2.3740			0.0030	
Conn. rod journal dia.		0.0003			0.0020	
Conn. rod journal out of round		0.0003			0.0020	
Conn. rod journal taper	0.1400	0.1700			0.0015	
Fillet radii			0.0009	0.0034		
Crankshaft main brg. clearance			0.0050	0.0100		0.0070
Crankshaft thrust clearance	4.3100	4.3150				0.0150
Seal surface dia.- rear	1.8740	1.8750			0.0150	
Seal surface dia. - front					0.0150	
CONN.ECTING ROD:	7.9980	8.0020				
Length - c to c	2.5260	2.5270				
Bearing bore - less bearings			0.0010	0.0030		
Br to crankshaft clearance			0.0050	0.0120		0.0050
Conn. rod side clearance						0.0200
Piston pin bushing bore - less	1.4370	1.4380				
bushing	1.2503	1.2508				
Piston pin bushing bore					0.0015	
CAMSHAFT:	2.0530	2.0540				
Bearing journal dia.	1.6890	1.7250			0.0020	
Lobe dia. meter - base to tip		0.0010			0.0100	
Journal run-out in vee blocks			0.0015	0.0035	0.0040	
Bearing clearance			0.0015	0.0055		0.0060
End thrust						0.0120
Back lash camshaft to crank gear			0.001	0.003		
PISTON:						
Clearance in cyl. bore (pull on 1/2 x 0.0050 ribbon) -	5 lb.	8 lb.				
Clearance in cyl. bore (pull on1/2 x 0.005 ribbon bore)	3.7445	3.7455				
Piston pin bore	1.2500	1.2502			0.0010	
Width of ring groove - top - Keystone	1/8 nom.					
Width of ring groove - 2nd & 3rd comp	0.0975	0.0990			0.0050	
Width of ring groove - top - oil control	0.1880	0.1895			0.0050	
Width of ring groove - lower oil control	0.1880	0.1890			0.0050	
PISTON PIN:						
Length	**3.0350**	**3.0400**		'		
Diameter	1.2498	1.2499			0.0020	
Clearance in piston			0.0000	0.0005		0.0020
Clearance in connecting rod			0.0005	0.0012		0.0050

Table 1-1. FITS AND TOLERANCES (CONTINUED)

Component	Mfg's. Tolerances		Desired Clearance		Maximum Allowable Wear	Maximum Allowable Clearance
	Minimum	Maximum	Minimum	Maximum		
PISTON RING:						
Clearance in groove – top	Keystone	Taper				
Clearance in groove – 2nd & 3rd comp.	0.0040	0.0060				0.0080
Clearance in groove – oil control	0.0015	0.0030				0.0080
Gap	0.0100	0.0200				0.0400
VALVE, INTAKE:						
Head diameter	1.6825	1.6925				
Stem diameter	0.3725	0.3735			0.0025	
Stem to guide clearance			0.0005	0.0025		0.0050
Stem to rocker arm clearance – hot			0.0150			
Seat diameter in head	1.6470	1.6530				
Seat width in head		7/64			1/8	
Top of valve recessed below cyl. hd deck	0.0210					
Valve seat angle	30°					
VALVE, EXHAUST:						
Head diameter	1.4950	1.5050				
Stem diameter	0.3725	0.3732			0.0025	
Stem to guide clearance			0.0015	0.0035		0.0060
Stem to rocker arm clearance - hot			0.0150			
Seat diameter in head	1.4510	1.4560				
Seat width in head		7/64			1/8	
Top of valve recessed below cyl. hd deck	0.0210					
Valve seat angle	45°					
VALVE GUIDE:						
Length	2.0325	2.9524				
Outside diameter	0.6265	0.6270				
Bore diameter - intake - ream	0.3740	0.3750			0.0030	
Bore diameter – exhaust – ream	0.3750	0.3760			0.0030	
Depth below cyl. head deck	1.3700	1.3800				
TAPPET, VALVE LIFTER (PUSH ROD):						
Body diameter	0.7485	0.7490			0.0030	
Overall length	2.2450	2.2550				
Clearance m bore (block)			0.0005	0.0015		0.0050
VALVE SPRINGS - INTAKE & EXHAUST:						
Free length	1.7960	1.8360				
Total coils	6-1/4					
Diameter wire	0.1770					
Outside diameter	1.2920	1.3020				
Test load at 1.4920 inches (lbs)	72	82				
Test load at 1.0820 inches (lb)	163	180				

Table 1-1. FITS AND TOLERANCES (CONTINUED)

Component	Mfg's. Tolerances		Desired Clearance		Maximum Allowable Wear	Maximum Allowable Clearance
	Minimum	Maximum	Minimum	Maximum		
OIL PUMP BODY:						
Shaft bore diameter – main	0.6255	0.6265			0.0030	
Shaft bore diameter - idler	0.6255	0.6265			0.0030	
Pump gear bore diameter	1.5005	1.5015			0.0050	
Pump gear bore depth	1.5640	1.5650			0.0040	
Mounting flange & top of drive flange			4.83375	4.85373	0.010	
SHAFTS:						
Length – main	9.2400	9.2500				
Length – idler	2.7450	2.7550				
Diameter - main	0.6240	0.6245			0.0020	
Diameter – idler	0.6240	0.6245			0.0020	
Shaft clearance in body			0.0010	0.0025	0.0030	0.0060
GEARS:						
Outside diameter – both	1.4975	1.4985			0.0020	
Length – both	1.5610	1.5620				
Clearance in body bore			0.0020	0.0040		0.0070
End clearance to body			0.0020	0.0040		0.0080
Backlash, drive gear to cam-			0.0060	0.0120		0.0200
FLYWHEEL:						
Clutch face run out at 6 in. rad.		0.0080				
Pilot bore eccentricity		0.0050				
FLYWHEEL HOUSING:						
Clutch attaching face deviation		0.0080				
Clutch housing ore eccentricity		0.0050				
ROCKER ARM MECHANISM:						
Rocker shaft length – 4 cyl.	19.4900	19.5100				
Rocker shaft diameter	0.8590	0.8600			0.0030	
Rocker arm bore diameter	0.8625	0.8635			0.0030	
Rocker arm clearance on shaft			0.0025	0.0045		0.0120
Tappet adjusting screw torque	3	10				
STARTER:						
Commutator diameter	1.6470					
FUEL PUMP:						
Throttle shaft and linkage hook	0.210	0.225	0.217			
Impeller to cover plate			0.010			
CYLINDER HEAD:						
Warpage longitudinally)					0.005	
Warpage laterally)					0.003	
GENERATOR ASSEMBLIES:						
Bearing housing, ID			3.19492	3.19502		
Bearing adapter, OD			1.3780	1.3784		
FUEL BURNING WINTERIZATION KIT:						
Heater assembly, metering orifice pin hole diameter			0.012	0.012		
Adapter face (parallel)					0.001	
Adapter bore diameter			0.315	0.318		

Table 1-1. FITS AND TOLERANCES (CONTINUED)

Component	Mfg's. Tolerances		Desired Clearance		Maximum Allowable Wear	Maximum Allowable Clearance
	Minimum	Maximum	Minimum	Maximum		
FUEL BURNING WINTERIZATION KIT (CONT)						
Adapter face (parallel with rotor side of adapter)					0.001	
Pump, cam ring to rotor clearance			0.002			
FUEL PUMP:						
Roller to roller dimension	1.9635	1.9645				
Transfer pump blades (determine wear by measuring length)			0.538			
MAIN BEARING:						
Clearance			0.0009	0.0034		

CHAPTER 2
GENERAL MAINTENANCE INSTRUCTIONS
Section I. REPAIR PARTS, SPECIAL TOOLS, AND EQUIPMENT

2-1. TOOLS AND SUPPORT EQUIPMENT.

There are no special tools or support equipment required to perform any level of maintenance on generator set Models MEP-004A, MEP-103A, and MEP-113A. Table 2-1 contains a list of recommended tools and support equipment normally required to maintain the generator sets at the (direct and general support) and depot maintenance levels. References or illustrations indicating the need or use of these or similar tools areas listed in the table.

2-2. DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE REPAIR PARTS.

Direct support, general support and depot maintenance repair parts are listed and illustrated in the, Unit, (Direct and General Support) and Depot Maintenance Repair Parts and Special Tools List).

2-3. FABRICATED TOOLS AND EQUIPMENT.

A breakdown cable is required to troubleshoot the electric governor system of MEP-113A. The breakout cable is used to gain access to the Governor Control Unit's MS3106R20-29 connector. Appendix B gives fabrication instructions for the breakout cable.

Table 2-1. TOOLS AND SUPPORT EQUIPMENT

Item	FSN or Part No.	Reference		Use
		Figure	Para.	
Torch outfit, cutting and welding (Tool Set L/W67706)	3433-00-357-6311 or equal		3-98	Removing extensively damaged housing components
Oscilloscope	6625-00-643-1740 or equal		3-92	Testing voltage regulators
Hoist, chain, 3 ton	3950-00–292-9879 or equal	2-12	2-6, 2-7	Removing and installing engine and generator assemblies
Trestle, hoist, port–able, 5 ton	3950-00-449-7005 or equal	2-2,2-3	2-6, 2-7	Removing and installing engine and generator assemblies
Multimeter, split core	6625-00-892-1497 or equal		3-95	Testing resistance of generator assembly windings
Multimeter, digital	6625-00-495-3513		3-65	Troubleshooting electric governor system (MEP-113A only).
Ohmmeter	6625-00-643-1030 or equal		3-95	Testing continuity of generator assembly components
Puller attachment (component of puller kit 5180-701-8046)	5120-00-711-6753 or equal		3-95	Removing generator bearing
Solder outfit, electric	3439-00-853-8760 or equal		3-95	Soldering electrical leads to generator assembly rectifiers
Test stand, actuator	4940-00-152-2107 or equal		3-43	Testing performance of hydraulic actuator

Table 2-1. TOOLS AND SUPPORT EQUIPMENT (CONTINUED)

Item	FSN or Part No.	Reference Figure	Reference Para.	Use
Test gauge and hose assy	4910-00-799-7616 or equal		3-41	Testing hydraulic pump assembly
Tachometer, stroboscopic	6680-00-892-1510 or equal		3-7	Testing speed switch elements trip
Test stand, ignition magneto	4910-00-912-3960 or equal		3-7	Testing of speed switch
Gauge, thickness	5210-00-221-1999 or equal		3-84	Adjusting main load contactor
Test set, armature	6625-00-233-1459 or equal		3-4	Testing starter assembly armature
Tool kit, diesel injector repair	4910-00-317-8265 or equal		3-23	Repair of fuel injection nozzle holder
Grinding kit, valve seat	4910-00-473-6437 or equal		3-52	Regrinding cylinder head assembly valve seat
Wrench, torque	5120-00-542-5577 or equal		3-54	Tightening cylinder head nuts
Grinding machine, valve face	4910-00-540-4679 or equal		3-54	Refacing valves
Lifter, valve spring	5120-00-239-8686 or equal		3-54	Removing and installing valve springs
Remover and replacer valve guide	5120-00-219-8404 or equal		3-54	Removing and installing valve guides
Caliper, micrometer, outside, 1 inch to 2 inch	5210-00-243-2933 or equal		3-56 3-55	Checking piston pins, camshaft and crankshaft for wear
Indicator, connecting rod alignment	4910-00-733-2487 or equal		3-57	Checking connecting rod alignment
Wrench, torque	5120-00-640-6364 or equal		3-56	Tightening connecting rod bearing cap screws
Gauge set, telescoping	5210-00-473-9350 or equal		3-57	Checking taper and out-of-roundness of cylinder bores
Gauge, thickness	5210-00-517-8097 or equal		3-56	Checking thickness of piston rings
Compressor, piston ring	5120-00-116-7676 or equal		3-57	Installing piston into cylinder bores
Expander, piston ring	5120-00-393-0549 or equal		3-57	Installing rings on pistons

Table 2-1. TOOLS AND SUPPORT EQUIPMENT (CONTINUED)

Item	FSN or Part No.	Reference Figure	Reference Para.	Use
Caliper, micrometer	5210-00-255-7564 or equal		3-57	Checking main bearings
Caliper, micrometer	5210-00-221-1934 or equal		3-57	Checking crankshaft main bearing journals for wear
Wrench, torque, 0-150 in-lb	5120-542-4489 or equal		3-22	Maintenance of fuel injection pump
Wrench, torque, 100-700 in-lb	5120-821-3441 or equal		3-22	Maintenance of fuel injection pump
Dial Indicator			3-22	Checking of fuel injection pump
Oven			3-95	Used for rotor and stator disassembly
Ring groove tool			3-56	Used for cleaning piston ring grooves
Shop equipment, electrical	4940-00-294-9517 or equal		5-30	Used to install acoustic suppression kit
Installation tool, hex, 5/16 inch	4940-268		5-30	Used to install acoustic suppression kit
Sling, lifting	1670-00-622-3632 or equal		5-30	Used to install acoustic suppression kit
Strap, lifting	4940-407		5-29	Used to install acoustic suppression kit
Cable, breakout	N/A		2-1	Used for troubleshooting.

Section II. TROUBLESHOOTING

2-4. GENERAL.

This section provides information useful in diagnosing and correcting unsatisfactory operation or failure of the generator sets and their components. Malfunctions which may occur are listed in table 2-2. Each malfunction is followed by test or inspections and corrective actions. The corresponding listing of corrective actions contains references to applicable maintenance paragraphs for correction of the malfunction.

NOTE

Refer to Operator and Unit Maintenance Manual for troubleshooting information applicable to lower levels of maintenance.

Table 2-2 below contains information for locating and correcting operating troubles that may develop in the generator set. Each malfunction listed for a component, a unit, or a system is followed by a troubleshooting procedure that may help you determine what caused the trouble. Corrective action is provided to help you remedy the problem.

Table 2-2. TROUBLESHOOTING

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

1. ENGINE FAILS TO CRANK

Step 1. Defective cranking relay K3 (34, figure 3-119).

Replace defective cranking relay (para. 3-90).

Step 2. Defective reverse polarity diode (CR3) (see figure 3-121).

Replace reverse polarity diode (para. 3-90).

Step 3. Defective starter solenoid (7 figure 3-1).

Repair or replace starter solenoid (para. 3-4).

Step 4. Defective starter motor (figure 3-1).

Repair or replace starter motor (para. 3-4).

Step 5. Defective starter drive assembly (figure 3-1).

Repair or replace starter drive assembly (para. 3-4).

2. ENGINE CRANKS BUT FAILS TO START.

Step 1. Defective fuel nozzle assembly (figure 3-25).

Clean, adjust, repair, or replace fuel nozzle assemble (para. 3-23).

Table 2-2. TROUBLESHOOTING (CONTINUED)

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

Step 2. Defective speed switch (figure 3-15).

Repair or replace speed switch (para. 3-7).

Step 3. Defective fuel injection pump (figure 3-21).

Repair or replace fuel injection pump (para. 3-22).

Step 4. Governor actuator improperly positioned.

Check governor (para. 3-64, electro-hydraulic governor or 3-65, electric governor equipped with precise sets).

3. ENGINE CRANKS BUT STOPS WHEN START-RUN-STOP SWITCH IS RELEASED.

Step 1. Defective relay (K1).

Replace relay K1 (para. 3-59).

Step 2. Defective relay (K2).

Replace relay K2 (para. 3-89).

Step 3. Defective relay (K8).

Replace relay K8 (para. 3-90).

NOTE

See DC schematic diagram on left engine cover door for location of relays.

4. ENGINE MISSES OR RUNS ERRATICALLY.

Step 1. Dirty or defective fuel injection nozzle holder (figure 3-25).

Clean, repair or replace fuel injection nozzle holders (para. 3-23).

Step 2. Fuel injection pump out of time or defective (figure 3-21).

Correct timing, repair or replace fuel injection pump (para. 3-22).

Step 3. Burned or sticking valves (26 and 27, figure 3-46).

Repair or replace valves (para. 3-54).

Step 4. Defective head gasket (11, figure 3-46).

Replace head gasket (para. 3-54).

Table 2-2. TROUBLESHOOTING (CONTINUED)

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

Step 5. Improper governor adjustment.

Adjust governor (para. 3-64, Electro-hydraulic governor, or 3-65, electric governor equipped precise sets).

5. ENGINE STOPS SUDDENLY.

Step 1. Defective fuel injection pump (Figure 3-21).

Repair or replace fuel injection pump (para 3-22).

Step 2. Defective speed switch (figure 3-15).

Repair or replace speed switch (para 3-7).

Step 3. Defective protective relay assembly (24, figure 3-119).

Test and replace relay assembly (para. 3-90).

6. ENGINE LACKS POWER.

Step 1. Defective fuel injection pump (figure 3-21).

Repair or replace fuel injection pump (para 3-22).

Step 2. Dirty or defective fuel injection nozzles (figure 3-23).

Clean, repair or replace fuel injection nozzles (para. 3-23).

Step 3. Burned or sticking valves (26 and 27, figure 3-46).

Repair or replace valves (para. 3-54).

Step 4. Weak or broken valve springs (24 and 25, figure 3-46).

Replace valve springs (para. 3-54).

Step 5. Worn or broken piston rings (20, figure 3-52).

Replace piston rings (para. 3-56).

Step 6. Hydraulic actuator unit defective or out of adjustment (Electro-hydraulic governor equipped precise sets only) (figure 3-36).

Adjust or repair hydraulic actuator unit (para. 3-43).

Table 2-2. TROUBLESHOOTING (CONTINUED)

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

Step 7. Defective hydraulic pump (Electro-hydraulic governor equipped precise sets only) (figure 3-34).

Test and repair hydraulic pump (para. 3-41).

Step 8. Defective cylinder head gasket (11, figure 3-46).

Replace defective cylinder head gasket (para. 3-54).

Step 9. Improper governor adjustment.

Adjust governor (para. 3-64, Electro-hydraulic governor, or 3-65, electric governor equipped precise sets).

7. ENGINE WILL NOT IDLE SMOOTHLY.

Step 1. Burned or sticking valves (26 and 27, figure 3-46).

Repair or replace valves (para. 3-54).

Step 2. Weak or broken valve springs (24 and 25, figure 3-46).

Replace valve springs (para. 3-54).

Step 3. Fuel injection nozzles out of adjustment, dirty or defective (figure 3-25).

Clean, adjust or replace fuel injection nozzles (para. 3-23).

Step 4. Defective camshaft (figure 3-50).

Replace camshaft (para. 3-55).

Step 5. Fuel injection pump defective or out of time (figure 3-21).

Adjust, repair, or replace fuel injection pump (para. 3-22).

8. ENGINE OVERHEATS.

Step 1. Defective shutter control or linkage (figure 3-26).

Replace shutter control linkage (para. 3-30).

Step 2. Defective water pump assembly (figure 3-28).

Repair or replace water pump assembly (para. 3-32).

Step 3. Clogged or defective radiator.

Clean, repair or replace radiator (para. 3-29).

Table 2-2. TROUBLESHOOTING (CONTINUED)

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

Step 4. Oil pump defective.

Repair or replace oil pump (para. 3-39).

9. ENGINE KNOCKS.

Step 1. Fuel injection nozzle sticking (figure 3-25).

Clean, repair or replace fuel injection nozzles (para. 3-23).

Step 2. Fuel injection pump timing advanced (figure 3-21).

Adjust fuel injection pump timing (para. 3-22).

Step 3. Main bearings worn (figure 3-52).

Replace main bearings (para. 3-56).

Step 4. Connecting rod bearings or wrist pins worn (figure 3-52).

Replace connecting rod bearings or wrist pins (para. 3-56).

Step 5. Worn timing gear train (figure 3-44)

Replace timing gears (para. 3-51).

Step 6. Loose flywheel (figure 3-42).

Tighten flywheel mounting hardware (para. 3-51).

Step 7. Loose generator coupling.

Tighten generator coupling (para. 2-6).

Step 8. Incorrect valve adjustment.

Check valve adjustment. (Operator/Crew and Unit Maintenance Manual).

10. ENGINE EXHAUST SMOKE IS EXCESSIVE.

Step 1. Fuel injection nozzle holders out of adjustment, dirty, or defective (figure 3-25).

Clean, adjust, or replace fuel injection nozzles (para. 3-23).

Step 2. Worn, broken or stuck piston rings (20, figure 3-52).

Replace piston rings (para. 3-56).

Table 2-2. TROUBLESHOOTING (CONTINUED)

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

Step 3. Worn valve guides or seals (figure 3-46).

Replace valve guides and seals (para. 3-54).

Step 4. Burned valves (figure 3-46).

Replace or repair burned valves (para. 3-54).

Step 5. Defective head gasket (11, figure 3-46).

Replace defective head gasket (para. 3-54).

11. ENGINE OIL CONSUMPTION EXCESSIVE.

Step 1. Leaking seals (figure 3-44).

Check crankshaft seals in timing gear cover. Check bell housing for dripping oil. Replace seals as necessary (para 3-50, 3-51).

Step 2. Sticking, dirty or defective oil pump pressure relief valve (figure 3-31).

Clean, repair or replace oil pump pressure relief valve (para. 3-38).

Step 3. Worn, broken or stuck piston rings (20, figure 3-52).

Replace piston rings (para. 3-56).

Step 4. Worn valve guides, valve stems, or valve stem seals (figure 3-46).

Replace valve guides, valves and seals (para. 3-54).

Step 5. Oil return passages clogged (figure 3-53).

Clean oil passages (para. 3-57).

12. ENGINE OIL PRESSURE LOW.

Step 1. Dirty, sticking or defective oil pump pressure relief valve (4, figure 3-31).

Clean, repair or replace defective oil pump pressure relief valve (para. 3-39).

Step 2. Main bearings worn (figure 3-52).

Replace main bearings (para. 3-56).

Step 3. Defective oil pump (figure 3-31).

Repair or replace oil pump (para. 3-39).

Table 2-2. TROUBLESHOOTING (CONTINUED)

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

Step 4. Worn camshaft bearings (figure 3-53).

Replace camshaft bearings (para. 3-55).

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

Step 1. Battery changing alternator voltage regulator out of adjustment or defective.

Adjust or replace battery charging alternator voltage regulator and cover assembly (para.3-6).

Step 2. Defective alternator rotor (figure 3-4).

Repair or replace alternator (para. 3-6).

Step 3. Worn alternator brushes (figure 3-4).

Replace alternator brushes (para. 3-6).

Step 4. Defective diode rectifier assembly (figure 3-4).

Replace diode rectifier and plate assembly.

14. GENERATOR FAILS TO BUILDUP RATED VOLTAGE OR VOLTAGE GOES TO 0 WHEN START-RUN-STOP SWITCH IS RELEASED.

Step 1. Defective voltage regulator assembly (figure 3-130).

Test and repair regulator (para. 3-92).

15. GENERATOR NO-LOAD TERMINAL VOLTAGE TOO LOW OR TOO HIGH.

Step 1. Defective voltage regulator (figure 3-130).

Test and repair voltage regulator (para 3-92).

16. GENERATOR TERMINAL VOLTAGE UNSTABLE.

Step 1. Defective voltage regulator (figure 3-130).

Test and repair voltage regulator (para. 3-92).

17. MAIN LOAD CONTACTOR FAILS TO CLOSE.

Step 1. Defective main load contactor (figure 3-100).

Repair or replace load contactor (para. 3-64).

Table 2-2. TROUBLESHOOTING (CONTINUED)

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

Step 2. Defective undervoltage, short circuit (K-13) or overload relay (K-14).

Replace defective relay assembly (para. 3-89).

NOTE

See DC schematic diagram on left engine cover door for location of relays.

Step 3. Defective contactor switch S3.

Check switch S3. Replace if defective.

Step 4. Defective main load contactor (figure 3-100).

Repair or replace main load contactor (para 3-84).

Step 5. Defective short circuit relay K13.

Check relay K13. Replace if defective (para. 3-89).

Step 6. Defective overload reload relay K14.

Check relay K14. Replace if defective (para. 3-89).

Step 7. Defective reverse power relay K15.

Check relay K15. Replace if defective (para. 3-89).

Step 8. Defective undervoltage relay K11 (Precise sets only).

Check relay K11. Replace if defective (para. 3-91).

Step 9. Defective under-frequency relay K12.

Check relay K12. Replace if defective (para. 3-91).

Step 10. Defective permissive paralleling relay K16.

Check relay K16. Replace if defective (para. 3-91).

NOTE

See DC schematic diagram on left engine cover door for location of relays.

18. GENERATOR TERMINAL VOLTAGE DROPS WHEN LOAD IS APPLIED.

Step 1. Defective voltage regulator assembly (figure 3-130).

Repair voltage regulator assembly (para. 3-92).

Table 2-2. TROUBLESHOOTING (CONTINUED)

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

Step 2. Loose electrical connection (figure 3-130).

Check and tighten electrical connection.

19. POOR VOLTAGE REGULATION.

Step 1. Operations switch set to parallel operation.

Place switch to single unit position (para. 3-59).

Step 2. Defective voltage regulator (figure 3-130).

Repair voltage regulator assembly (para. 3-92).

Step 3. Defective current transformer CT4, CT5 OR CT6 (figure 3-108).

Replace current transformer assembly (para. 3-86).

20. GENERATORS DO NOT PARALLEL PROPERLY.

Step 1. Governor control unit defective or out of adjustment (Precise).

Align or replace governor control unit (para. 3-64, elecro–hydraulic governor, or 3-65, electric governor equipped precise sets).

Step 2. Improper speed droop or voltage droop adjustment (Utility).

Check and adjust voltage and speed droop as necessary (para. 3-22).

21. FREQUENCY METER DOES NOT REGISTER.

Step 1. Defective control cubicle wiring harness assembly (figure 3-59).

Repair or replace control cubicle wiring harness assembly (para. 3-59).

Step 2. Defective frequency converter or frequency meter.

Test or replace frequency converter and frequency meter (para. 3-59).

22. AC AMMETER FAILS TO REGISTER.

Step 1. Defective control cubicle wiring harness assemlby (figure 3-59).

Repair or replace control cubicle wiring harness assembly (para 3-59).

Step 2. Defective volts–amps transfer switch.

Replace volts-amp transfer switch (para. 3-59).

Table 2-2. TROUBLESHOOTING (CONTINUED)

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

Step 3. Defective ac ammeter.

Replace ac ammeter (para. 3-59).

Step 4. Defective current transformer CT1, CT2, OR CT3 (10, figure 3-108).

Test and replace defective transformers (para. 3-86).

23. WATT METER FAILS TO REGISTER.

Step 1. Defective control cubicle wiring harness assembly (figure 3-59).

Repair or replace control cubicle wiring harness assembly (para. 3-59).

Step 2. Defective thermal watt converter or watt meter.

Replace thermal watt converter and watt meter (para. 3-59).

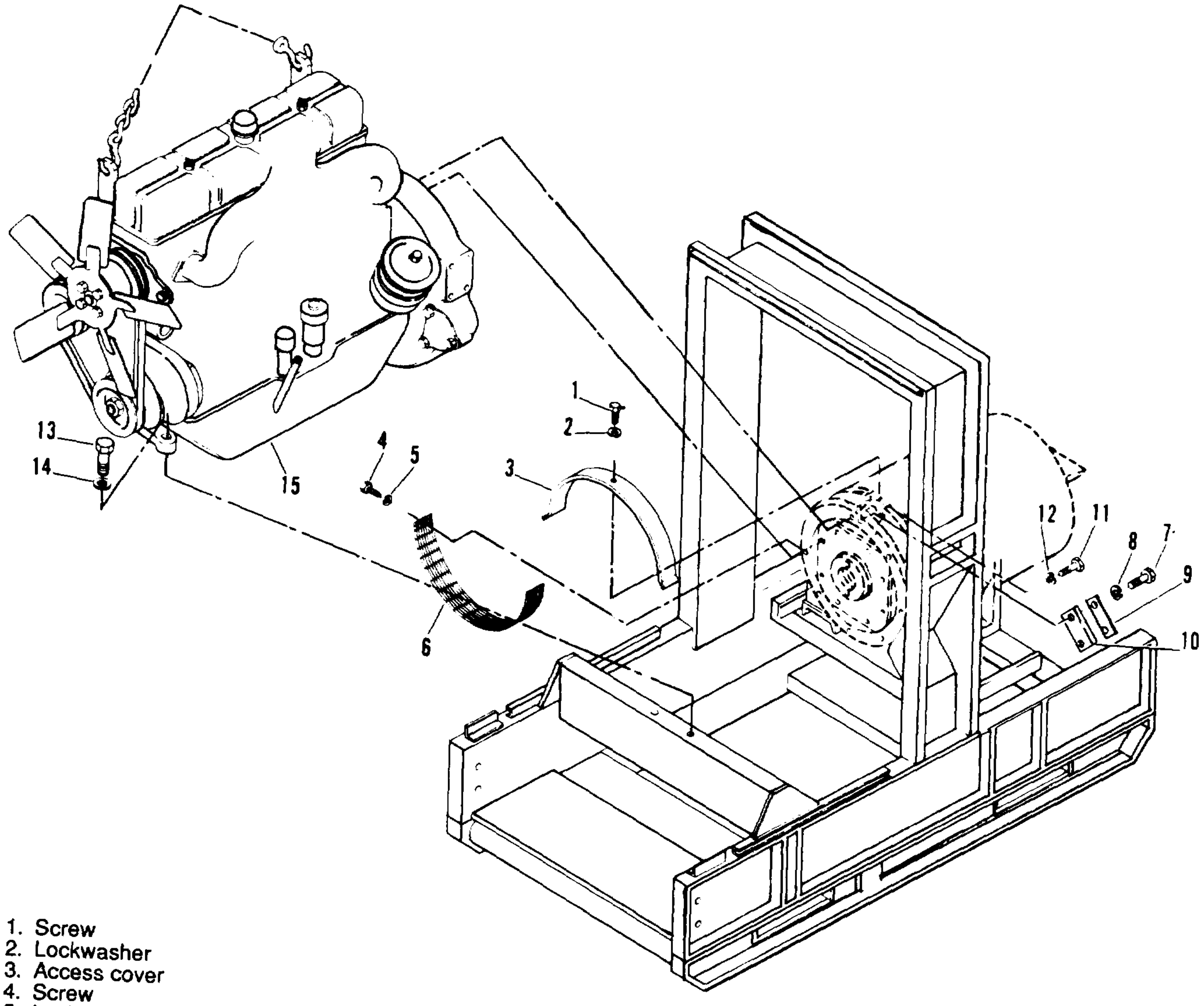
24. FREQUENCY DRIFTS.

Step 1. Governor control unit out of alignment (Precise sets only).

Align governor control unit (para. 3-64, electro–hydraulic governor or 3-85, electric governor equipped precise sets).

Step 2. Engine runs erratically.

See Malfunction 4 of this table.



1. Screw
2. Lockwasher
3. Access cover
4. Screw
5. Lockwasher
6. Screen
7. Screw
8. Lockwasher
9. Lockplate
10. Pressure plate
11. Screw
12. Lockwasher
13. Bolt
14. Lockwasher
15. Engine

Figure 2-1. Engine Assembly, Removal and Installation

Section Ill. REMOVAL AND INSTALLATION OF MAJOR COMPONENTS

2-5. GENERAL.

a. The engine and generator are rigidly bolted together at the engine flywheel housing. This assembly is mounted on the skid base at three points, the front engine trunnion and the two generator feet. Rotation and cooling of the generator is accomplished by a blower and coupling disc assembly which is bolted to the engine flywheel. This arrangement allows the engine and generator to be removed as an assembly or independently of each other.

b. To remove the engine, it is first necessary to remove the radiator and shell assembly and disassemble the front housing assembly, rear housing assembly, and relay table (including relay table components, see Section XII, Chapter 3). Engine accessories may either be removed or remain on the engine during removal.

c. To remove the generator, remove the rear housing assembly with cooling grille as a single unit. The relay table with the two side brackets can be removed as a unit by removing four bolts at base of side brackets and disconnecting wiring harness. Prior to loosening the bolts which couple the generator housing to the engine flywheel housing, the engine supporting bracket must be installed between the engine rear lifting bracket and the center support assembly.

d. In rare cases, it maybe beneficial to remove the engine and generator as an assembly. To accomplish this, the housing assembly must be disassembled completely (a combination of the disassembly of sub-paragraphs b. and c. above) and the center support assembly removed. The lifting mechanism must be so arranged as to support both the engine and the generator to avoid undue stress on the engine-generator coupling.

2-6. ENGINE ASSEMBLY REMOVAL AND INSTALLATION.

a. Removal.

(1) Refer to the operator and unit maintenance manual TM 9-6115-464-34, sections 8,9 and 10 and accomplish the following.

(a) Drain engine lubricating and cooling systems.

WARNING

To avoid short circuits which could damage equipment or injure personnel, always disconnect negative battery cable before performing maintenance on the electrical system. Failure to observe this warning could result in servere personnel injury or death by electrocution.

(b) Remove radiator, radiator hoses, shell assembly, and shutter assembly.

(c) Remove front housing, doors and top panel.

(d) Disconnect fuel lines to fuel strainer, filter assembly, secondary fuel filter, and remove day tank.

(e) Drain hydraulic sump and disconnect hydraulic lines to hydraulic pump assembly (precisegenerator sets only).

(f) Tag and disconnect electrical leads to engine accessories and remove any clamps securing leads to engine.

(g) Remove air cleaner assembly and muffler.

(h) Disconnect starting aid tube assembly from engine intake manifold.

(i) If winterization kits are installed, tag and disconnect electrical leads to engine sensors and disconnect coolant lines from engine oil pan.

CAUTION

Do not use a lifting device of less than 1000 lb. capacity. Failure to observe this caution could result in damage to the equipment.

(2) Attach a suitable lifting device to engine lifting brackets.

(3) Disconnect engine crankcase oil drain tube from fitting in skid base.

(4) Remove screw (1, figure 2-1), lockwasher (2), and access cover (3).

(5) Remove screws (4), lockwashers (5) and air inlet screen (6).

(6) Remove screws (7) and lockwashers (8), lockplate (9) and pressure plate (10).

CAUTION

Take slack from hoisting sling prior to loosening generator and engine coupling bolts. Failure to observe this caution could result in damage to the equipment .

(7) Remove screws (11) and lockwasher (12).

(8) Remove bolts (13) and lockwashers (14).

CAUTION

Make a final, thorough check to ascertain that the engine is completely disconnected from the generator set prior to attempting to hoist it clear. Failure to observe this caution could result in damage to the equipment.

(9) Carefully move the engine up and forward until generator coupling disc clears engine flywheel housing.

CAUTION

Do not use a lifting device of less than 1000 lb. capacity. Failure to observe this caution could result in damage to the equipment.

b. Installation.

(1) To install engine, use a suitable lifting device to lift engine by the hooks located on the engine.

(2) Carefully lower the engine (15, figure 2-1) until generator coupling and engine flywheel housing alignment matches.

(3) .Alignment pins with 5/8 inch headless bolt should be screwed into holes in the flywheel to facilitate alignment.

(4) Tighten down engine bolts lecated in front of the engine to secure alignment. Torque according to paragraph 1-10y

(5) Install lockwashers (14), and bolts (13).

(6) Install lockwashers (12), and screws (11).

(7) Install pressure plate (10), lockplate (9), lockwashers (8), and screws (7).

(8) Install air inlet screen (6), lockwashers (5), and screws (4).

(9) Install access cover (3), Iockwashers (2), and screw (1).

(10) Connect engine crankcase oil drain tube to fitting on skid base.

(11) Remove lifting device from hook located on the engine.

(12) Refer to the operator and unit maintenance manual TM 9-6115-464-12, sections 8,9 and 10 and accomplish the following:

(a) Install winterization kits and connect electrical leads to engine sensors and connect coolant lines to engine oil pan.

(b) Connect starting aid tube assembly to engine intake manifold.

(c) Install air cleaner assembly and muffler.

(d) Connect electrical leads to engine accessories and install clamps.

(e) Connect hydraulic lines to hydraulic pump assembly and fill jydralic sump (precise generator sets only).

(f) Connect day tank, secondary fuel filter, filter assembly and connect fuel lines to fuel strainer.

(g) Install top panel, doors and front housing.

(h) Install radiator, radiator hoses, shell assembly and shutter assembly.

(i) Fill engine and lubrication systems.

2-7. GENERATOR ASSEMBLY.

a. Removal.

(1) Refer to the Operator and Unit Maintenance Manual and accomplish the following:

(a) Remove rear housing assembly, doors, top panel, and grille.

(b) Tag and disconnect wiring harness from control cubicle and relay table components.

NOTE

Record location and position of wiring harness support clamps prior to removal to facilitate installation.

(2) Tag and disconnect generator leads to voltage reconnection board.

NOTE

Record routing of generator leads through current transformers to facilitate installation.

(3) Tag and disconnect electrical leads between voltage reconnection board and load terminal board.

(4) Remove voltage reconnection board (see the Operator and Unit Maintenance Manual TM 9-6115-464-12, para. 4-71).

(5) Remove main load contactor and special relay assembly (paragraphs 3-84 and 3-90).

(6) Remove nuts (1, figure 2-2) Iockwashers (2), flat washers (3) and screws (4) to remove rear housing support (5).

(7) Remove screws (6), lockwashers (7) and flat washers (8).

(8) Remove screw (9), Iockwasher (10), flat washer (11) and standoff (12) to remove top relay table (13).

(9) Remove nuts (14), Iockwashers (15), screws (16) and flat washers (17) to remove right relay table (18).

(10) Remove nuts (19), Iockwashers (20), screws (21) and flat washers (22) to remove left relay table (23).

(11) Remove screw (24), Iockwasher (25) and access cover (26).

(12) Remove screws (27), Iockwashers (28), and air inlet screen (29).

(13) Install engine support bracket (30), flat washer (31), Iockwasher (32) and nut (33).

(14) Remove screws (34), Iockplates (35) and pressure plates (36).

(15) Remove eyebolt (37), from generator set tool box and install into generator.

CAUTION

Do not use a lifting device of less than 1000 lb. capacity. Failure to observe this caution could result in damage to the equipment.

(16) Attach a lifting device to generator lifting eyebolt.

(17) Remove screws (38), Iockwashers (39), nuts (40), Iockwashers (41), screws (42) and flat washers (43).

(18) Carefully lift generator while moving it to the rear until coupling disc clears engine flywheel housing.

CAUTION

Do not use a lifting device of less than 1000 lb. capacity. Failure to observe this caution could result in damage to the equipment.

b. Installation.

(1) Attach a lifting device to generator lifting eye bolt.

(2) Carefully lift generator and lower it ilntiel coupling disc engages engine flywheel housing.

(3) Install flatwashers (43, figure 2-2) screws (42) and torque screw to 200-220 ft-lb, Iockwasher (41), nut (40) and torque to 200-220 ft-lb, Iockwashers (39), and screw (38).

(4) Remove eyebolt (37), from generator and install into generator set tool box.

(5) Install pressure plates (36), Iockplates (35), and screws (34). Torque Iockplate attaching screws (34) to 120 ft-lb.

(6) Remove nut (33), Iockwasher (32), and flat washer (31) from engine support bracket (30).

(7) Install air inlet screen (29), Iockwashers (28), and screws (27).

(8) Install access cover (26), Iockwasher (25), and screw (24).

(9) Position left relay table (23), to install flat washers (22), screws (21), Iockwashers (20), and nuts (19).

(10) Position right relay table (18), to install flat washers (17), screws (16), Iockwashers (15) and nuts (14).

(11) Position top relay table (13), to install standoff (12), flat washers (11) Iockwashers (10), and screw (9).

(12) Install flat washers (8), Iockwashers (7), and screws (6).

(13) Position rear housing support (5), to install screws (4), fltat washers (3), Iockwashers (2), and nuts (1).

(14) Install main load contactor and special relay assembly (paragraphs 3-84 and 3-90).

(15) Install voltage reconnection board (See the Operator and Unit Maintenance Manual TM 9-6115-464-12, paragraph 4-71).

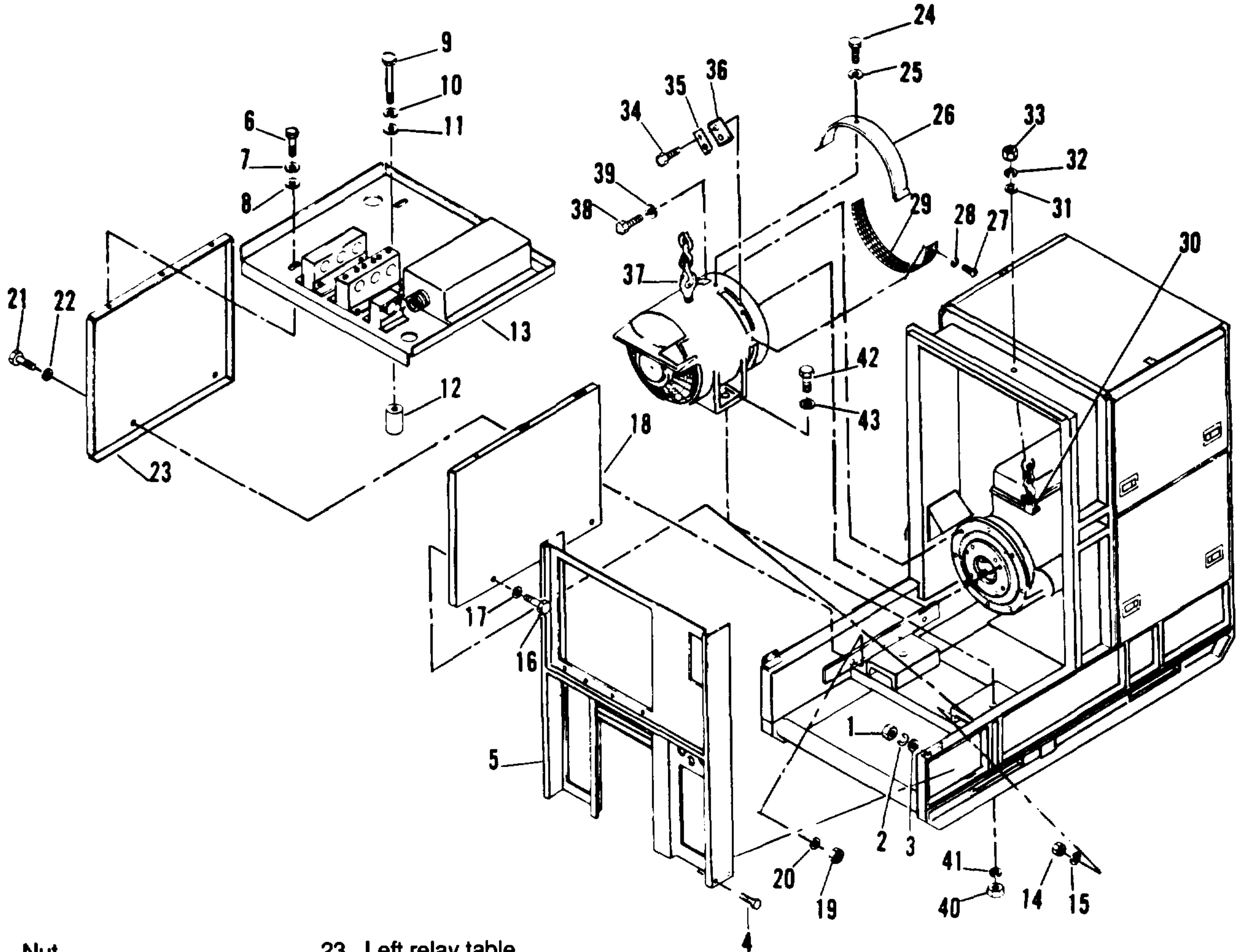
(16) Connect electrical leads between voltage reconnection board and terminal board. Remove tags.

(17) Connect generator leads to voltage reconnection board.

(18) Refer to the Operator and Unit Maintenance Manual and accomplish the following:

(a) Connect wiring harness to control cubicle and relay table components.

(b) Install rear housing assembly, doors, top panel, and grille



1. Nut
2. Lockwasher
3. Flat washer
4. Screw
5. Rear housing support
6. Screw
7. Lockwasher
8. Flat washer
9. Screw
10. Lockwasher
11. Flat washer
12. Standoff
13. Top relay table
14. Nut
15. Lockwasher
16. Screw
17. Flat washer
18. Right relay table
19. Nut
20. Lockwasher
21. Screw
22. Flat washer
23. Left relay table
24. Screw
25. Lockwasher
26. Access cover
27. Screw
28. Lockwasher
29. Air inlet screen
30. Engine support bracket
31. Flat washer
32. Lockwasher
33. Nut
34. Screw
35. Lockplate
36. Preasure plate
37. Eyebolt
38. Screw
39. Lockwasher
40. Nut
41. Lockwasher
42. Screw
43. Flat washer

Figure 2-2. Generator Assembly, Removal and Installation

CHAPTER 3
ENGINE AND GENERATOR REPAIR INSTRUCTIONS

Section I. MAINTENANCE OF ENGINE ELECTRICAL SYSTEM

3-1. GENERAL.

The engine electrical system consists of a starting circuit, a battery charging circuit, and protective and monitoring devices. Electrical power for cranking the 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 starter assembly is a 24 volt, heavy duty unit consisting of a starting motor, a solenoid, and a drive assembly. The battery charging alternator with integral voltage regulator and diode rectifier recharges and maintains the batteries in a fully charged condition after starting.

3-2. BATTERIES.

Refer to the Operator and Unit Maintenance Manual for battery maintenance procedures.

3-3. SLAVE RECEPTACLE.

Refer to the Operator and Unit Maintenance Manual for slave receptacle maintenance procedures.

3-4. STARTER ASSEMBLY.

a. Removal. Refer to the Operator and Unit Maintenance Manual for starter removal procedures.

b. Disassembly.

(1) Remove nut (1, figure 3-1), lockwasher (2) and terminal lead (3).

(2) Remove screws (4) to remove solenoid assembly (5) from starter assembly.

(3) Remove nut (6), flat washer (7), and insulating washer (8).

(4) Remove nut (9), lockwasher (10), nut (11), flat washer (12) and insulating washer (13).

(5) Remove screws (14) and flat washers (15) to remove cover (16) and gasket (17) from frame assembly (18). Discard gasket.

(6) Remove nuts (19), lockwashers (20), nuts (21), flat washers (22), and insulating washers (23) to remove terminal studs (24 and 25) and contact strip (26).

(7) Remove spring (27) and contact assembly (28).

(8) Remove plug (29), retaining ring (30), pin (31) and boot clamp (32) to remove plunger (33).

(9) Remove retaining ring (34) to remove spring retainer (35), spring (36), boot (37), spring retainer (38), washer (39), and retaining ring (40) from plunger (33).

(10) Remove bolts (41) to remove commutator end frame (42), packing (43) and spacer washer (44).

(11) Remove plug (45) and oil wick (46).

(12) Do not remove bushing (47) unless inspection reveals defective parts.

(13) Remove pin (48) to remove brush spring (49) and brushholders (50).

(14) Remove screws (51), electrical leads (52) and brushes (53) from brushholders (50).

CAUTION

Use care when removing armature to prevent damage to windings. Failure to observe this caution could result in equipment damage.

(15) Slide armature (54) from housing (55).

(16) Remove nut (56), flat washer (57), and insulating washer (58).

(17) Remove screws (59) to remove pole shoes (60), field coil assembly (61) and insulator (62).

(18) Remove and discard o-ring (63) and packing (64).

(19) Remove screws (65) and Iockwashers (66) to remove drive housing (67) and gasket (68). Discard gasket.

(20) Remove plug (69) and oil wick (70).

(21) Do not remove bushing (71) unless inspection reveals defects.

(22) Remove plug (72) to remove pivot pin (73).

(23) Remove retaining ring (74) and retainer (75).

(24) Rotate clutch assembly (76) counterclockwise to remove from shaft of armature (54).

(25) Remove shift lever (77), but do not remove bushings (78 and 79) or guide pin (80) from shifter housing (81) unless inspection reveals defects.

(26) Remove bushing (82) and o-ring (83).

c. Cleaning, Inspection, and Repair.

WARNING

Solvent, Dry Cleaning P-D-680, Type II is flammable and moderately toxic to skin, eyes and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate. Failure to observe this warning could result in servere personnel injury.

WARNING

Compressed air used for cleaning and drying purposes can create airborne particles that may enter the eyes. Pressure shall not exceed 30 psig and use only with adequate chip guards and chipping goggles. Failure to observe this warning could result in servere personnel injury.

CAUTION

Do not use dry cleaning solvent to clean electrical parts. Failure to observe this caution could result in equipment damage.

(1) Clean all metal non-electrical parts in solvent P-D-680 Type II and dry thoroughly with filtered compressed air.

CAUTION

When cleaning field coils, use extreme care to avoid damaging protective insulation. Failure to observe this caution could result in equipment damage.

(2) Clean field coils with a clean, lint-free cloth lightly moistened with solvent P-D-680 Type II and dry thoroughly with filtered compressed air.

(3) Remove loose particles from armature with filtered compressed air and wipe clean with a cloth lightly moistened with an approved solvent. Clean commutator lightly with No. 00 grit sand paper. Remove all traces of dust with low pressure compressed air.

(4) Clean non-metallic washers, insulators, and seals with a clean, lint-free cloth lightly moistened with solvent P-D-680 Type II.

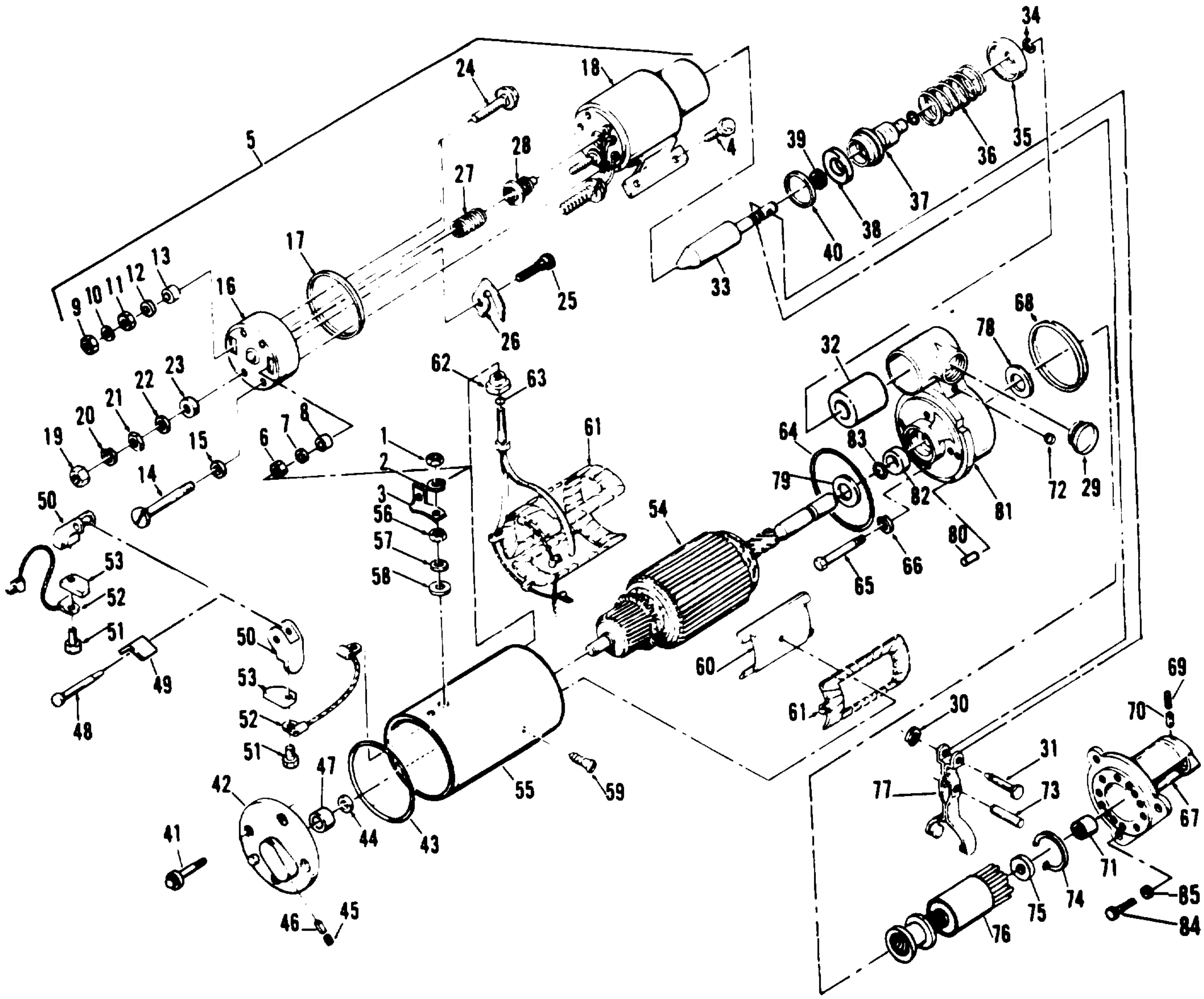


Figure 3–1. Starter Assembly, Exploded View (Sheet 1 of 2)

1 Nut
2 Lockwasher
3 Terminal lead
4 Screw
5 Solenoid assembly
6 Nut
7. Flat washer
8. Insulating washer
9. Nut
10. Lockwasher
11. Nut
12. Flat washer
13. Insulating washer
14. Screw
15. Flat washer
16. Cover
17. Gasket
18. Frame assembly
19. Nuts
20. Lockwasher
21. Nut
22. Flat washer
23. Insulating washer
24. Terminal stud
25. Terminal stud
26. Contact strip
27. Spring
28. Contact assembly
29. Plug
30. Retaining ring
31. Pin
32. Boot clamp
33. Plunger
34. Retaining ring
35. Spring retainer
36. Spring
37. Boot
38. Spring retainer
39. Washer
40. Retaining ring
41. Bolt
42. Commutator end frame
43. Packing
44. Spacer washer
45. Plug
46. Oil wick
47. Bushing
48. Pin
49. Brush spring
50. Brushholder
51. Screw
52. Electrical lead
53. Brush
54. Armature
55. Housing
56. Nut
57. Flat washer
58. Insulating washer
59. Screw
60. Pole shoe
61. Field coil assembly
62. Insulator
63. O-ring
64. Packing
65. Screw
66. Lockwasher
67. Drive housing
68. Gasket
69. Plug
70. Oil wick
71. Bushing
72. Plug
73. Pivot Pin
74. Retaining ring
75. Retainer
76. Clutch assembly
77. Shift lever
78. Bushing
79. Bushing
80. Guide pin
81. Shifter housing
82. Bushing
83. O-ring

Figure 3–1. Starter Assembly, Exploded View (Sheet 2 of 2)

CAUTION

Do not allow solvent to contact brushes. Failure to observe this caution could result in equipment damage.

(5) Clean brushes with a clean, lint-free cloth.

(6) Inspect housings and frames for cracks, corrosion, and distortion. Replace defective parts.

(7) Inspect bushings for wear, galling, and scores. Replace defective parts.

(8) Test armature for grounding as follows:

(a) Connect one lead of a test light to the armature core.

(b) Touch the other test lead to each commutator riser.

(c) If test light glows, armature is grounded and must be replaced.

(9) Test armature for short circuits as follows:

(a) Place armature on a growler fixture.

(b) Activate the fixture and slowly rotate armature while touching armature lightly with a steel strip.

(c) Strip will vibrate against armature over a shorted area.

(d) Replace armature if a short is indicated.

(10) Turn down armature if scored or out of round. Undercut mica to a depth of 0.025 to 0.032 inch below surface of commutator. Use care to avoid widening commutator slots.

NOTE

Check diameter of commutator after removing material. Diameter shall not be less than 1.6470 inches.

(11) Use an ohmmeter to check field coils for insulation breakdown as follows:

(a) Attach one lead to field housing and the other lead to field coil terminal.

(b) Replace field coil if a reading of less than 1 megohm is indicated.

(12) Inspect drive assembly for badly worn or broken teeth. Check internal spline for wear and damage. Check spring for cracks, breaks, and distortion. Replace drive assembly if defective.

(13) Inspect brushholders and support for cracks, corrosion, and other damage. Replace defective parts.

(14) Measure brush length. Replace brushes if length is 5/16 inch or less.

(15) Test brush spring tension with a spring tester. Tension shall be 36 ounces to 40 ounces. Replace brush springs if tension is less than specified.

(16) Inspect all threaded parts for crossed, stripped or peened threads. Replace damaged parts.

(17) Using an ohmmeter, test for continuity across terminals of solenoid frame assembly. There shall be no sign of open circuit.

(18) Check solenoid frame assembly for grounding by touching one lead of ohmmeter to either lead and the other to the frame casing. There shall be no sign of continuity.

(19) Smooth scratches, burrs, and nicks on any machined surfaces using a fine file. Remove all filings before reassembly.

(21) Remove minor rough spots, scores, and scratches from bushings using fine crows cloth or a fine stone dipped in cleaning solvent. Wash the bushings thoroughly in cleaning solvent to remove all grit and metal particles.

d. Assembly.

(1) Assemble starter assembly in reverse order of removal procedures using new gaskets.

(2) If brushes were replaced, run in new brushes as follows:

(a) Cover armature commutator with a piece of No. 00 grit sandpaper.

(b) Temporarily install brushes and commutator end frame and run in brushes.

(c) Disassemble, remove sandpaper, and clean armature commutator and brushholder assembly with filtered compressed air.

e. Testing.

(1) Test overrun clutch as follows:

(a) Rotate drive gear back and forth. Gear should turn freely in direction of motor rotation and rotate armature shaft in other direction.

(b) If gear turns armature shaft in both directions, the overrun clutch is binding and must be replaced.

(c) If gear does not rotate armature shaft in either direction, the overrun clutch is slipping and must be replaced.

(2) Test starter solenoid assembly as follows:

(a) Remove terminal lead (3, figure 3-1).

(b) Apply 24 Vdc between the negative terminal and the small terminal of the solenoid assembly.

(c) Solenoid actuation will be indicated by an audible “click” and rearward movement of the drive gear.

(d) Remove 24 Vdc from solenoid assembly terminals.

(e) The drive gear should move forward with an audible click.

(f) Replace solenoid assembly if it fails to function properly.

(9) Install terminal lead.

(3) Conduct starter assembly motoring test as follows:

(a) Remove terminal lead (3, figure 3-1).

(b) Install starter assembly into motoring test circuit shown in figure 3-2.

(c) Adjust rheostat until voltmeter indicates 22,5 volts.

(d) Check indications of ammeter and tachometer.

(e) Ammeter should indicate 56 amperes maximum with starter turning at 9300 rpm.

(f) If current and speed are low, disassemble starter and check for high resistance at internal connections.

(9) If current is high and rpm low, disassemble and inspect armature shaft and bushings for wear or misalignment.

(h) Do not install terminal lead (3, figure 3-1) until stalled torque testis completed.

(4) Conduct starter assembly stalled torque test as follows:

CAUTION

Rheostat must have a minimum capacity of 1000 amperes. Failure to observe this caution could result in equipment damage

(a) Install starter assembly in test setup shown in figure 3-3.

(b) Adjust rheostat until voltmeter indicates 14 Vdc.

(c) Ammeter should indicate 540 amperes maximum at a minimum torque of 26 ft-lb indicated on scale.

(d) If both current and torque are low, disassemble the starter and check for poor internal connections or improper brush contact. Both of these conditions would result in high internal resistance.

(e) High current and low torque may be caused by defective armature or field coil assembly.

(f) Remove starter assembly from test setup and install terminal lead (3, figure 3-1).

f. Installation. Refer to the Operator and Unit Maintenance Manual for starter assembly installation procedures.

3-5. STARTER ASSEMBLY. (Effective with serial numbers RZ60001 and up and KZ00001 thru KZ01226).

a. Removal. Refer to the Operator and Unit Maintenance Manual for starter removal procedures.

b.Disassembly.

(1) Remove nut (1, figure 3-4), lockwasher (2), nut (3) and lockwasher (4).

(2) Loosen clamp (5) and remove screws (6) to remove solenoid assembly (7) from starter assembly.

(3) Remove boot (8) and clamp (5).

c. Solenoid disassemble.

(1) Remove nuts (9), lockwashers (10), nuts (11), flat washers (12), insulating washers (13) and connector (14).

(2) Remove screws (15) and flat washers (16) to remove cover (17) and gasket (18) from solenoid frame assembly (19).

(3) Remove terminal studs (20 and 21) and terminal clip (22) from cover (17). Remove spring (23) and contact (24).

d. Starter Disassembly.

(1) Remove inspection plug (25) and gasket (26). Remove adjusting nut (27) to remove plunger.

(2) Remove snap ring (29), o-ring (30), spring retainer, spring (32), o-ring (33), spring retainer and washer (35) from plunger (28).

(3) Remove screws (36) and lockwashers (37) to remove commutator end frame (38), o-ring (39) and space washer (40).

(4) Do not remove bushing (41) unless inspection reveals damaged parts.

(5) Remove pins (42) to remove brush springs (43) and brushholders (44).

(6) Remove screws (45), electrical leads (46) and brushes (47) from brushholders (44).

(7) Remove screws (48), lockwashers (49), and nuts (50) to remove brush supports (51).

(8) Remove screws (52) to remove drive housing (53) and o-ring (54).

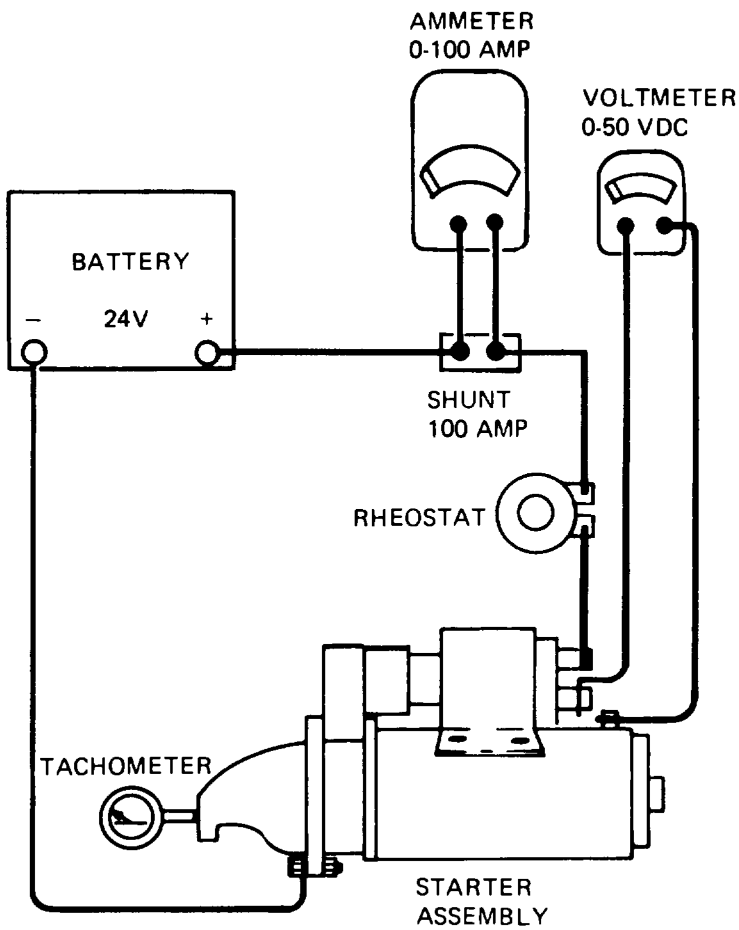


Figure 3-2. Starter Assembly Motoring Test Circuit

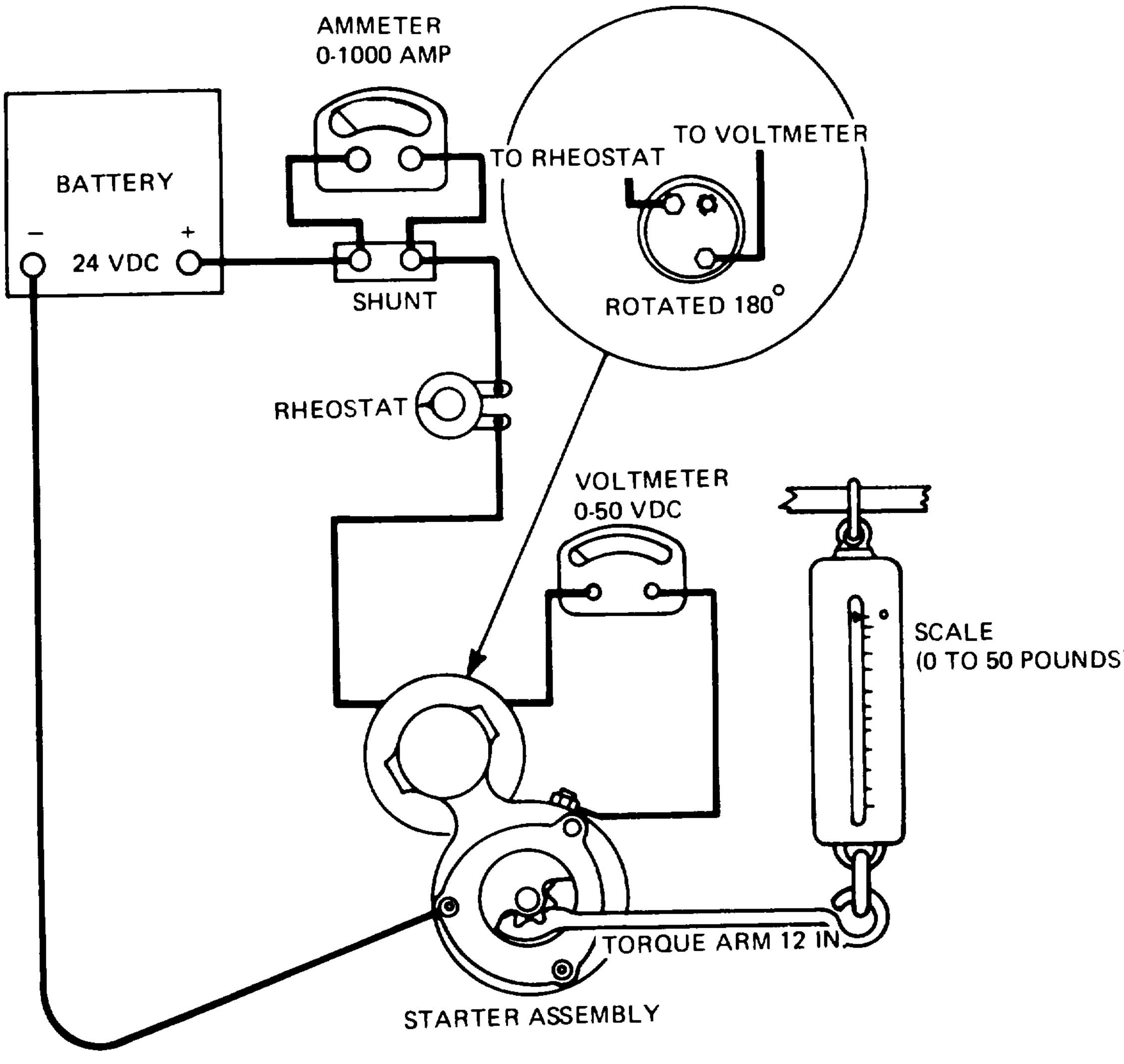


Figure 3–3. Starter Assembly Stalled Torque Setup

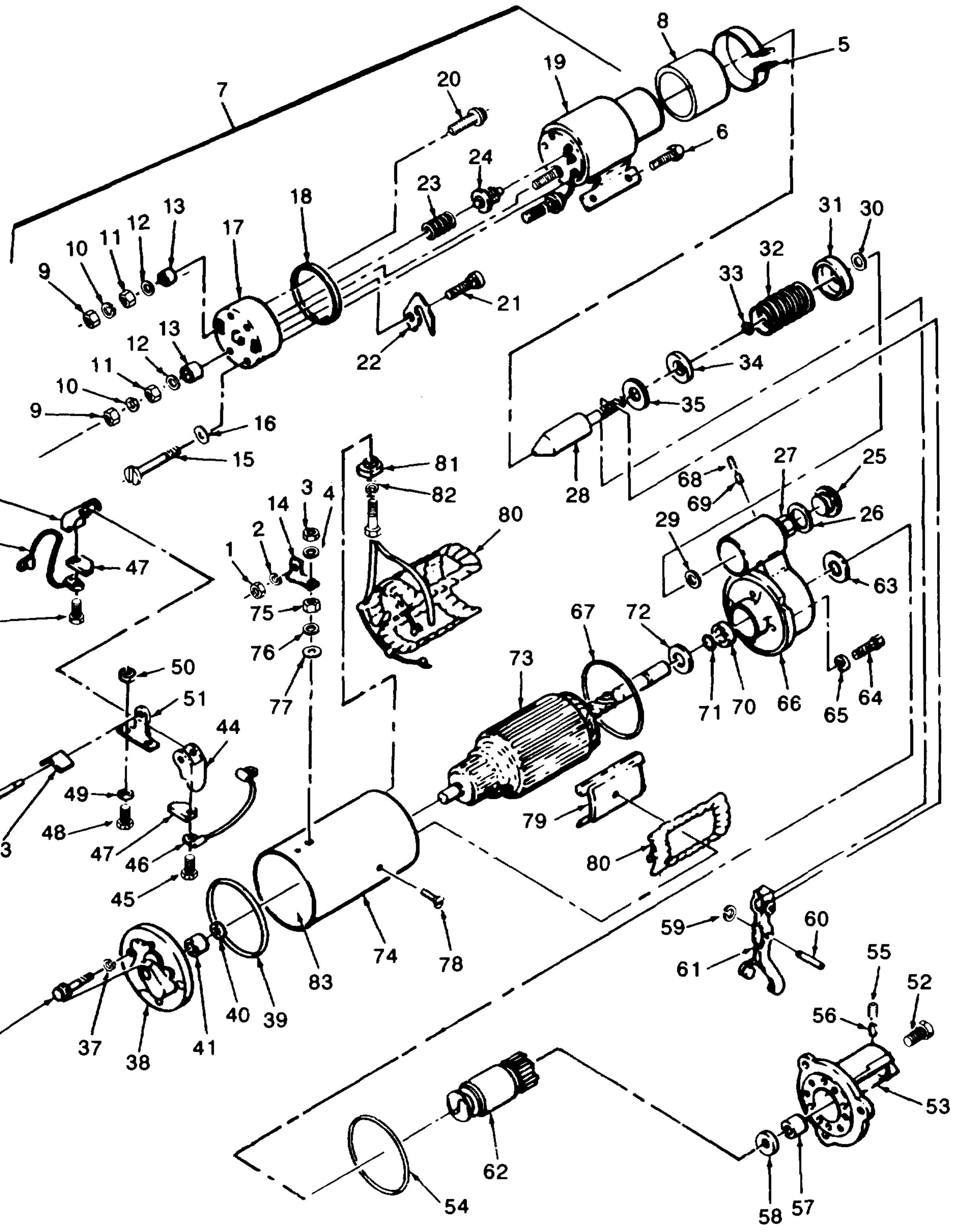


Figure 3-4. Starter Assembly, Exploded View (Effective with Serial No. RZ60001) (Sheet 1 of 2)

1. Nut
2. Lockwasher
3. Nut
4. Lockwasher
5. Clamp
6. Screw
7. Solenoid Assembly
8. Boot
9. Nut
10. Lockwasher
11. Nut
12. Flat washer
13. Insulating washer
14. Connector
15. Screw
16. Flat washer
17. Cover
18. Gasket
19. Solenoid frame assy
20. Terminal stud
21. Terminal stud
22. Terminal clip
23. Spring
24. Contact
25. Inspection plug
26. Gasket
27. Adjusting nut
28. Plunger
29. Snap ring
30. O-ring
31. Spring retainer
32. Spring
33. O-ring
34. Spring retainer
35. Washer
36. Screw
37. Lockwasher
38. Commutator end frame
39. O-ring
40. Space washer
41. Bushing
42. Pin
43. Brush spring
44. Brushholder
45. Screw
46. Electrical lead
47. Brush
48. Screw
49. Lockwasher
50. Nut
51. Brush support
52. Screw
53. Drive housing
54. O-ring
55. Plug
56. Wick
57. Bushing
58. Washer
59. Snap ring
60. Lever shaft
61. Lever
62. Motor drive
63. Brake washer
64. Screw
65. Lockwasher
66. Lever housing
67. O-ring
68. Plug
69. Wick
70. Bushing
71. O-ring
72. Space washer
73. Armature
74. Field frame
75. Nut
76. Washer
77. Insulating washer
78. Screw
79. Pole shoe
80. Field coil
81. Insulator
82. O-ring
83. Insulation

Figure 3-4. Starter Assembly, Exploded View (Effective with Serial No. RZ60001) (Sheet 2 of 2)

(9) Remove plug (55) and wick (56).

(10) Do not remove bushing (57) unless inspection reveals damage.

(11) Remove drive end washer (58).

(12) Remove snap ring (59), lever shaft (60), lever (61), motor drive (62), and brake washer (63).

(13) Remove screws (64) and lockwashers (65) to remove lever housing (66) and o-ring (67).

(14) Remove plug (68) and wick (69).

(15) Remove bushing (70) o-ring (71) and spacer washer (72).

CAUTION

Use care when removing armature to prevent damage to windings. Failure to observe this caution could result in equipment damage.

(16) Slide armature (73) from field frame (74).

(17) Remove nut (75), washer (76) and insulating washer (77).

(18) Remove screws (78) to remove pole shoes (79), field coil (80) and insulator (81). Remove o-ring (82).

(19) Inspect field coil insulation (83). Replace if damage is evident.

e. Cleaning, Inspection and Repair

WARNING

Solvent, Dry Cleaning P-D-680, Type II is flammable and moderately toxic to skin, eyes and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate. Failure to observe this warning could result in servere personnel injury.

WARNING

Compressed air used for cleaning and drying purposes can create airborne particles that may enter the eyes. Pressure shall not exceed 30 psig and use only with adequate chip guards and chipping goggles. Failure to observe this warning could result in servere personnel injury.

(1) Clean all metal non-electrical parts in solvent P-D-680 Type II and dry thoroughly with filtered compressed air.

CAUTION

Do not use dry cleaning solvent to clean electrical parts. Failure to observe this caution could result in equipment damage.

CAUTION

When cleaning field coils, use extreme care to avoid damaging protective insulation. Failure to observe this caution could result in equipment damage.

(2) Clean field coils with a clean, lint-free cloth lightly moistened with solvent P-D-680 Type II and dry thoroughly with filtered compressed air.

(3) Remove loose particles from armature with filtered compressed air and wipe clean with a cloth lightly moistened with solvent P-D-680 Type II. Clean commutator lightly with No. 00 grit sandpaper. Remove all traces of dust with low pressure compressed air.

(4) Clean non-metallic washers, insulators, and seals with a clean, Iint-free cloth lightly moistened with solvent P-D-680 Type Il.

CAUTION

Do not allow solvent to contact brushes. Failure to observe this caution could result in equipment damage.

(5) Clean brushes with a clean, Iint-free cloth.

(6) Inspect housing and frames for cracks, corrosion, and distortion. Replace defective parts.

(7) Inspect bushings for wear, galling, and scores. Replace defective parts.

(8) Test armature for grounding as follows:

(a) Connect one lead of a test light to the armature core.

(b) Touch the other test lead to each commutator riser.

(c) If test light glows, armature is grounded and must be replaced.

(9) Test armature for short circuits as follows:

(a) Place armature on a growler fixture.

(b) Activate the fixture and slowly rotate armature while touching armature lightly with a steel strip.

(c) Strip will vibrat agains armature over a shorted area.

(d) Replace armature if a short is indicated.

(10) Turn down armature if scored or out of round. Under cut mica to a depth of 0.025 to 0.032 inch below surface of commutator. Use care to avoid widening commutator slots.

NOTE

Check diameter of commutator after removing material. Diameter shall not be less than 1.6470 inches.

(11) Use an ohmmeter to check field coils for insulation breakdown as follows:

(a) Attach one lead to field housing and the other lead to field coil terminal.

(b) Replace field coil if a reading of less than 1 megohm is indicated.

(12) Inspect drive assembly for badly worn or broken teeth. Check internal spline for wear and damage. Replace drive assembly if defective.

(13) Inspect brushholders and support for cracks, corrosion. and other damage. Replace defective parts.

(14) Measure brush length. Replace brushes if length is 5/16 inch or less.

(15) Test brush spring tension with a spring tester. Tension shall be 36 ounces to 40 ounces. Replace brush springs if tension is less than specified.

(16) Inspect all threaded parts for crossed, stripped or penned threads. Replace damaged parts.

(17) Using an ohmmeter, test for continuity across terminals of solenoid frame assembly. There shall be no sign of open circuit.

(18) Check solenoid frame assembly for grounding by touching one lead of ohmmeter to either lead and the other to the frame casing. There shall be no sign of continuity.

(19) Smooth scratches, burrs, and nicks on any machined surfaces using a fine file. Remove all fillings before reassembly.

(20) Repair minor thread damage using thread chasers, taps and dies. Clean threads to remove metal particles.

(21) Remove minor rough spots, scores, and scratches from bushings using fine crocus cloth or a fine stone dipped in cleaning solvent. Wash the bushings thoroughly in cleaning solvent to remove all grit and metal particles.

f. Assembly.

(1) Assemble starter and solenoid in reverse order of disassembly procedures using new gaskets and o-rings. Inspect all insulating washers and bushings. Replace if defective.

(2) If brushes were replaced, run in new brushes as follows:

(a) Cover armature commutator with a piece of No. 00 grit sandpaper.

(b) Temporarily install brushes and commutator end frame and run in brushes.

(c) Disassemble, remove sandpaper, and clean armature commutator and brushholder assembly with filtered compressed air.

g. Testing.

(1) Test starter solenoid assembly as follows:

(a) Remove connector (14, Figure 3-4).

(b) Apply 24 Vdc between the negative terminal and the small terminal of the solenoid assembly.

(c) Solenoid actuation will be indicated by an audible “click” and rearward movement of the drive gear.

(d) Remove 24 Vdc from solenoid assembly terminals.

(e) The drive gear should move forward with an audible click.

(f) Replace solenoid assembly if it fails to function properly.

(g) Install connector.

(2) Conduct starter assembly motoring test as follows:

(a) Remove connector (14, Figure 3-4).

(b) Install starter assembly into motoring test circuit shown in figure 3-2.

(c) Adjust rheostat until voltmeter indicates 22.5 volts.

(d) Check indications of ammeter and tachometer.

(e) Ammeter should indicate 58 amperes maximum with starter turning at 9300 rpm.

(f) If current and speed are low, disassemble starter and check for high resistance at internal connection.

(g) If current is high and rpm low, disassemble and inspect armature shaft and bushings for wear or misalignment.

(h) Do not install connector (14, Figure 3-4) until stalled torque test is completed.

(3) Conduct starter assembly stalled torque, test as follows:

CAUTION

Rheostat must have a minimum capacity of 1000 amperes. Failure to observe this caution could result in equipment damage.

(a) Install starter assembly in test setup shown in figure 3-3.

(b) Adjust rheostat until voltmeter indicates 14 Vdc.

(c) Ammeter should indicate 540 amperes maximum at a minimum torque of 26 ft-lb indicated on scale.

(d) If both current and torque are low, disassemble the starter and check for poor internal connections or improper brush contact. Both of these conditions would result in high internal resistance.

(e) High current and low torque may be caused by defective armature or field coil assembly.

(f) Remove starter assembly from test setup and install connector (14, Figure 3-4).

h. Installation. Refer to the Operator and Unit Maintenance Manual for starter installation procedures.

3-6. BATTERY CHARGING ALTERNATOR.

a. Removal. Refer to the Operator and Unit Maintenance Manual for battery charging alternator removal procedures.

b. Disassembly.

(1) Remove screws (1, figure 3-5) and carefully pull regulator and cover assembly (2) away from alternator.

(2) Tag and disconnect electrical leads to completely separate regulator and cover assembly from alternator.

(3) Unsolder blue and brown leads from fuse holder (3). Remove nut (4), fuse holder (3) and washer (5) from cover assembly (2).

(4) Remove fuse holder cap (6) and fuse (7).

(5) Remove screws (8) and cover band (9).

(6) Remove thru bolts (10) and remove head assembly (11).

(7) Remove nuts (12 and 13), Iockwasher (14) and lead (15).

(8) Remove screws (16), Iockwashers (17), insulating plate (18), brushholder (19) and brush and spring assembly (20).

(9) Remove nuts (21, 22, and 23), Iockwasher (24), screw (25) and flat washers (26) to remove capacitor and clamp assembly (27).

NOTE

If capacitor and clamp assembly (28) was not removed and tagged when performing step 3-6b. (2) above, remove and tag at this time.

(10) Remove nuts (29 and 30), flat washers (31, 32,33 and 34). Remove rear part of insulating bushings (36, 37,38, and 39), and remove rectifier and stator assembly (40) from head assembly (11).

(11) Unsolder leads and remove negative plate and rectifier assembly (41) and positive plate and rectifier assembly (42) from stator (43). Remove front part of insulating bushings (36, 37, 38 and 39) and studs (35).

(12) Clamp pulley in a soft-jawed vise and remove nut (44).

(13) Remove assembly from vise and remove pulley (45) and fan (46).

NOTE

Use of a puller maybe necessary if pulley sticks to rotor shaft.

(14) Pry woodruff key (47) from keyway in rotor shaft and remove spacer (48).

(15) Support head assembly (49) and using a center punch in the indentation in the end of the rotor shaft, drive the rotor assembly (50) out of the head assembly (49).

(16) Remove snap ring (51) and bearing (52) and o-ring (55).

NOTE

It maybe necessary to press or drive the bearing (52) out of the head assembly (49).

(17) Use a bearing puller to remove rear bearing (53) from rotor assembly (50).

(18) Remove cover (54) and o-ring (55).

c.Cleaning Inspection. and Repair

WARNING

Solvent, Dry Cleaning P-D-680, Type II is flammable and moderately toxic to skin, eyes and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate. Failure to observe this warning could result in servere personnel injury

WARNING

Compressed air used for cleaning and drying purposes can create airborne particles that may enter the eyes. Pressure shall not exceed 30 psig and use only with adequate chip guards and chipping goggles. Failure to observe this warning could result in servere personnel injury

(1) Clean all non-electrical parts (housing fan, bearings, etc.) in solvent P-D-680 Type II and dry with filtered compressed air.

(2) Clean all electrical parts with a soft bristled brush and filtered compressed air.

(3) Inspect plate and rectifier assemblies for cracks, corrosion, and evidence of shorting or other damage.

(4) Using an ohmmeter or similar testing device, test positive diode rectifier assembly as follows:

(a) Connect positive lead of tester to heat sink and touch negative lead to lead of each diode. Tester should indicate open circuit at each diode.

(b) Connect negative lead to heat sink and touch positive lead to each diode lead. Tester should indicate continuity at each diode.

(c) Replace positive diode rectifier assembly if any of the diodes fail to test correctly.

(5) Test negative diode rectifier assembly as follows:

(a) Connect negative lead of tester to heat sink and touch positive lead to lead of each diode. Tester should indicate open circuit at each diode.

(b) Connect positive lead of tester to heat sink and touch negative lead to lead of each diode. Tester should indicate continuity at each diode.

(c) Replace negative diode rectifier assembly if any diode fails to test correctly.

(6) Visually inspect stator assembly for rub marks on the interior diameter, evidence of burned or shorted windings, and other damage.

INTERNAL WIRING CONNECTIONS		
COLOR	FROM	TO
BROWN	B (CONNECTOR)	FUSE
YELLOW	C (CONNECTOR)	NEGATIVE TERMINAL (OUTPUT)
WHITE	A (CONNECTOR)	VOLTAGE REGULATOR
BLUE	FUSE	POSITIVE TERMINAL (OUTPUT)
ORANGE	VOLTAGE REGULATOR	VOLTAGE ADJUST
BLACK 1	VOLTAGE ADJUST	NEG DIODE TERMINAL
BLACK 2	VOLTAGE REGULATOR	NEG DIODE TERMINAL
BLACK 3	BRUSHHOLDER	POSITIVE TERMINAL (OUTPUT)
GREEN	VOLTAGE REGULATOR	BRUSHHOLDER
CAPACITOR C1	POSITIVE TERMINAL (OUTPUT)	NEG DIODE TERMINAL
CAPACITOR C2	NEGATIVE TERMINAL (OUTPUT)	POSITIVE DIODE TERMINAL

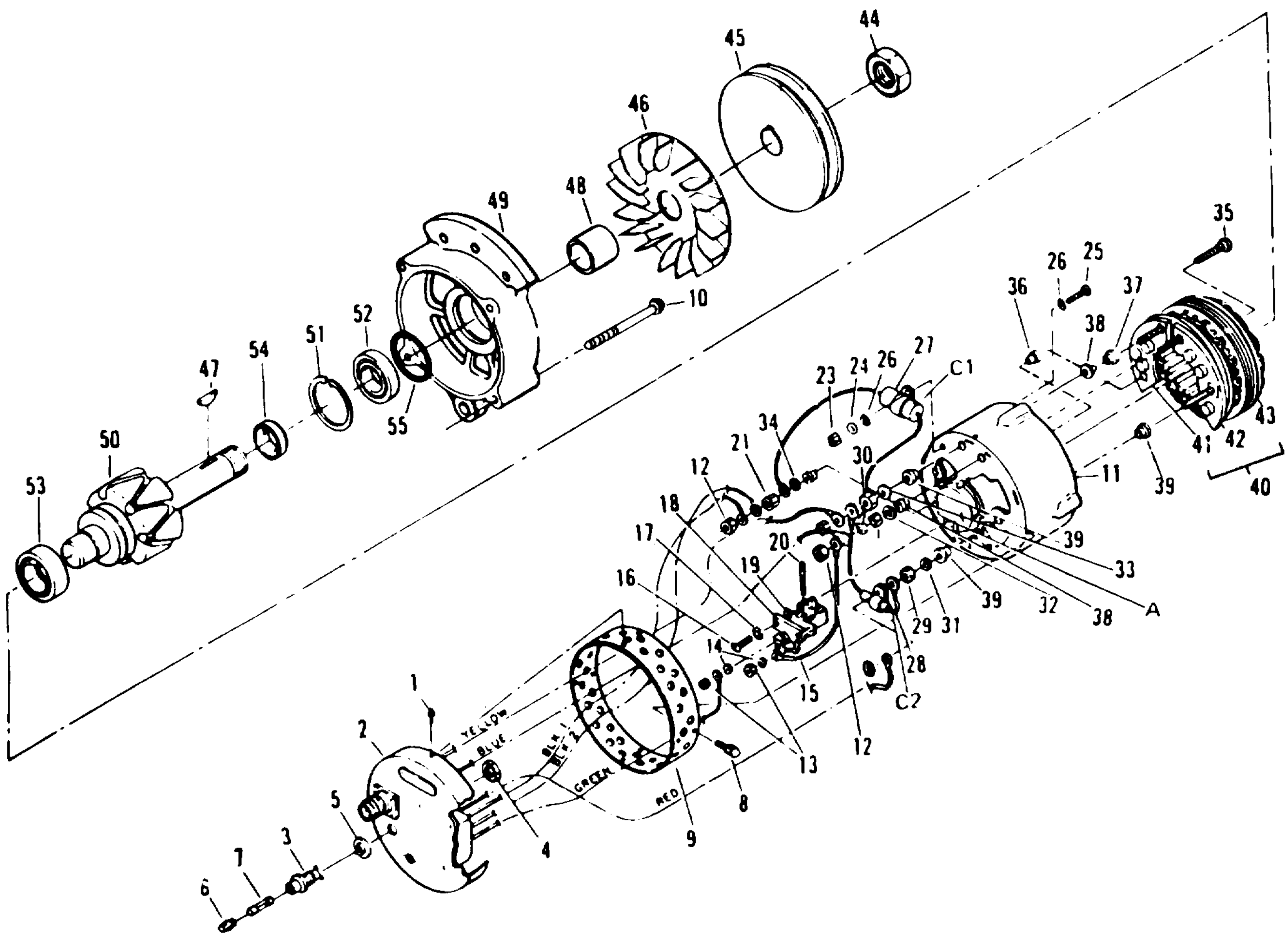


Figure 3-5. Alternator Assembly, Exploded View (Sheet 1 of 2)

1. Screw
2. Regulator and cover assembly
3. Fuse holder
4. Nut
5. Washer
6. Cap
7. Fuse
8. Screw
9. Cover band
10. Thru bolts
11. Head assembly (slip ring end)
12. Nut
13. Nut
14. Lockwasher
15. Brush lead
16. Screw
17. Lockwasher
18. Insulating plate
19. Brushholder
20. Brush and spring assembly
21. Nut
22. Nut
23. Nut
24. Lockwasher
25. Screw
26. Flat washer
27. Capacitor and clamp assembly
28. Capacitor and clamp assembly
29. Nut
30. Nut
31. Flat washer
32. Flat washer
33. Flat washer
34. Flat washer
35. Stud
36. Insulating bushing
37. Insulating bushing
38. Insulating bushing
39. Insulating bushing
40. Rectifier and stator assembly
41. Negative plate and rectifier assembly
42. Positive plate and rectifier assembly
43. Stator assembly
44. Nut
45. Pulley
46. Fan
47. Woodruff key
48. Spacer
49. Head assembly (drive end)
50. Rotor assembly
51. Snap ring
52. Bearing (front)
53. Bearing (rear)
54. Cover
55. O-ring

Figure 3-5. Alternator Assembly, Exploded View (Sheet 2 of 2)

(7) Using an ohmmeter, check continuity of each phase of stator assembly. Replace stator assembly if ohmmeter indicates open circuit of one or more phase.

(8) Visually inspect rotor assembly for rub marks and burns or other evidence of shorting. Inspect shaft for worn key slot and bearing surfaces.

(9) Test rotor assembly as follows:

(a) Install rotor assembly in test setup shown in figure 3-6.

(b) Adjust rheostat until voltmeter indicates 20 Vdc.

(c) Ammeter should indicate 2.8 to 3.0 amperes at 70° to 80°F (21.1 ° to 26.7°C).

(d) High current reading on ammeter indicates low resistance, or a shorted rotor warning.

(e) Using an ohmmeter, check resistance across slip rings. Resistance should be 7.5 to 8.0 ohms at an ambient temperature of 70° to 80‘F (21.10 to 26.7°C).

(10) Replace rotor assembly if inspection and test requirements are not met.

(11) Inspect voltage regulator connector, cover assembly, and voltage adjust for cracks, corrosion, and evidence of shorting or other damage.

(12) Inspect fuse holder for cracks, corrosion, and other damage. Check fuse for burned out condition. Check fuse for continuity if in doubt.

(13) Inspect brush assembly for corrosion and excessive wear.

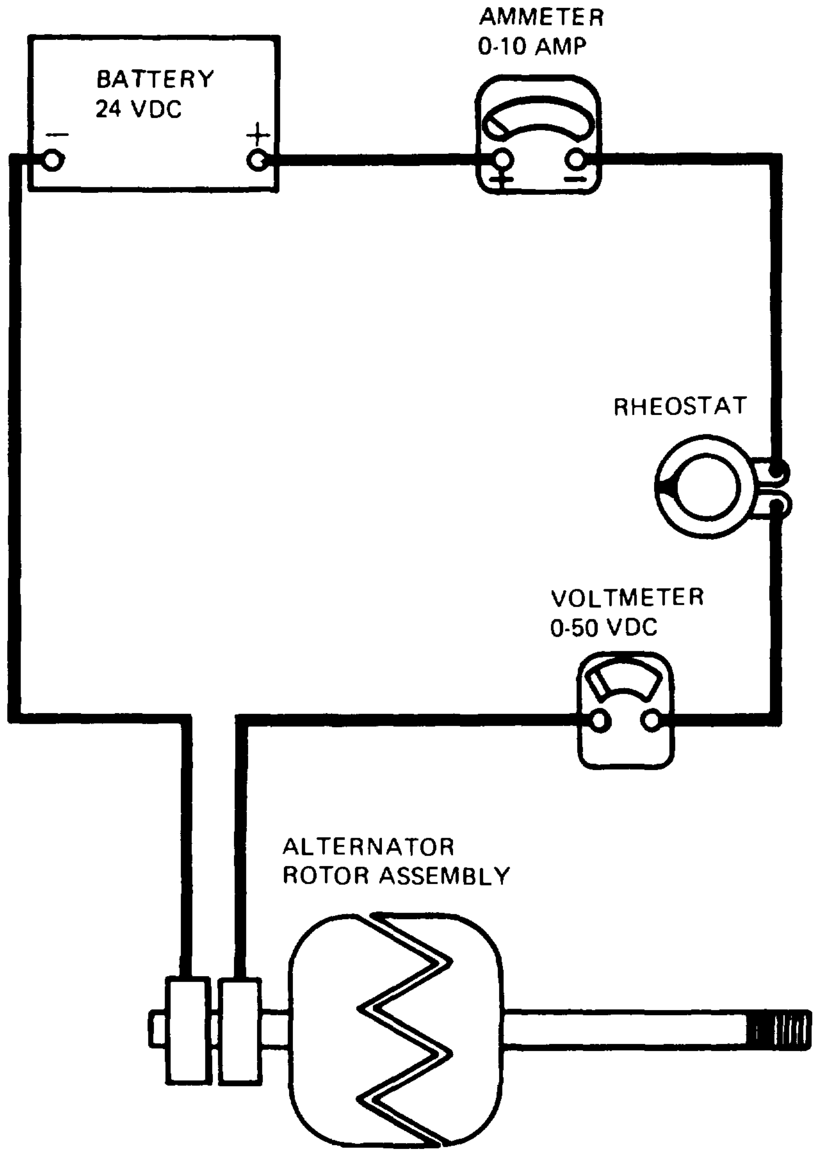


Figure 3-6. Rotor Assembly Current Draw Test Circuit

NOTE

The brushes are excessively worn if 3/16 inch or less extends beyond the bottom of the holder.

(14) Check brush spring tension. A force of 4 to 6 ounces should move brush against spring.

(15) Using an ohmmeter, test brushholder assembly as follows:

(a) Attach one test lead to brushholder and touch other lead to each terminal and each brush. There should be no indication of continuity between brushholder and any terminal or brush.

(b) Check for continuity between each terminal and its respective brush.

(16) Replace brushholder assembly if inspection and test requirements are not met.

(17) Inspect pulley for excessive wear at pulley groove, cracks, corrosion. and other damage.

(18) Inspect fan for cracks, corrosion, bent blades and other damage.

(19) Inspect bearings for pitting, excessive wear, and other damage.

(20) Inspect head assemblies (11 and 49) for cracks, breaks, and corrosion.

(21) Inspect all threads for crossing, stripping, and peening.

d. Assembly.

(1) Install positive diode rectifier assembly (42, figure3-5) and negative diode rectifier assembly (41) onto stator assembly (43) and solder diode leads.

(2) Using a driver which exerts pressure on the outer race only, install front bearing (52) into front head (49) and secure with snap ring (51).

(3) Install cover (54) and support rear bearing area of rotor assembly (50) on a suitable press and fit assembled front head and bearing over rotor shaft. Using a driver which exerts pressure on the inner race only, press front head down until front bearing contacts cover (54) on rotor shaft.

(4) Support front of rotor assembly shaft on a suitable press. Using a driver which contacts the inner race only, press rear bearing (53) onto rotor shaft until it contacts shoulder on shaft. Remove rotor assembly from press.

(5) Install spacer (48), woodruff key (47), fan (46), pulley (45), and nut (44). Torque nut to 35 to 50 ft-lbs.

(6) Fit front part of insulating bushings (36, 37,38, and 39) over rectifier studs.

(7) Position stator and rectifier assembly (40) into rear head assembly (11).

(8) Install rear part of insulating bushings (36, 37,38 and 39) and washers (31, 32,33, and 34).

(9) Install brushholder (19), insulating plate (18), Iockwashers (17) and screws (16).

NOTE

Insure that the contour of the brushes correspond to the contour of the commutator when installing brushes in the brushholder.

(10) Install brush and spring assemblies (20) in brushholder (19).

(11) Insert a wire of sufficient stiffness in the access hole provided (point A, figure 3-5), to hold the brushes (20) depressed into the brushholder (19).

(12) Install the rotor (50) with assembled front head (49) into rear head (11), assembled together with rectifier and stator assembly (40).

(13) Install thru bolts (10).

(14) Remove wire, inserted in step 3-6d. (11).

NOTE

Perform steps in paragraph 3-6e(1) before proceeding with assembly.

(15) Install capacitor and clamp assembly (27), screw (25), washers (26), Iockwasher (24) and nut (23). Install nuts (22 and 21).

(16) Install capacitor and clamp assembly (28) and brush lead (15).

(17) Install ventilated cover band (9) with screws (8).

(18) Install all electrical Ieads that were tagged and disconnected during disassembly in step 3-6b. (2). (See figure 3-5.)

(19) Install washer (5), fuse holder (3), and nut (4). Resolder leads to fuse holder.

(20) Install fuse (7) and cap (6).

NOTE

Install test leads as indicated in e. (2) below.

NOTE

Complete testing of alternator sub-paragraph e. (2) below prior to completing assembly.

e. Testing.

(1) Manufacture test leads as follows:

(a) From No. 8 or No. 10 insulated wire, cut three lengths, one 10 inches long and two 5 inches long.

(b) Strip both ends of all three leads and tin with solder.

(c) Attach a 1/4 inch ring terminal to one end of the 10 inch lead.

(d) Attach a No. 10 ring terminal to one end of each 5 inch lead.

(2) Install test leads as follows:

(a) Attach test leads as shown in figure 3-7. Pass the free end of each lead through the ventilated band cover (9, figure 3-5).

(b) Install regulator and cover assembly (2) and secure with screws (1).

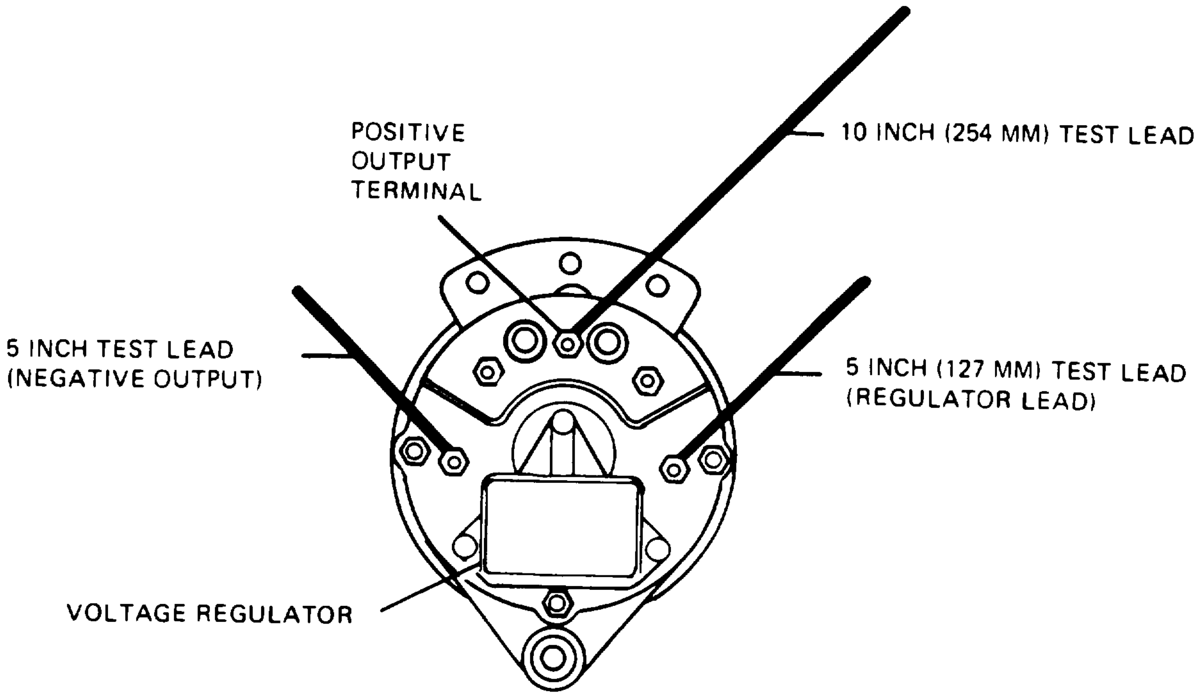


Figure 3-7. Alternator Test Leads Installation

(3) Check alternator total circuit voltage as follows:

(a) Install alternator in test circuit as shown in figure 3-6.

NOTE

The test circuit is identical to the alternator installation circuit. If an operational generator set is available, the alternator maybe installed on it for testing. (Refer to the Operator and Unit Maintenance Manual for installation instructions.

(b) With switch open, compare voltage readings at V1 and V2. The readings should be identical.

NOTE

While checking voltage at V2, check to see if the reading varies when the cable or the connector plug on the alternator cover assembly is disturbed. This could indicate inadequate test connections which must be corrected before proceeding with the tests,

(c) If voltage at V2 is low or zero, the alternator positive and negative output circuits must be tested as indicated in steps (4) and (5) below.

(d) If voltage readings at V1 and V2 are identical, proceed with alternator output and voltage protector test in step (10) below.

(4) Test alternator positive output circuit as follows:

(a) Check voltage at V3 as shown in figure 3-9.

(b) If voltage is zero, check fuse (11, figure 3-5).

(c) If voltage is greater than zero, but below voltage VI in figure 3-8, check for poor circuit conditions between battery positive terminal and alternator positive output terminal.

(d) Correct any discrepancies before proceeding with operational tests.

(e) If voltage indicated is equal to voltage V1, test alternator negative output circuit as directed in step (5) below.

(5) Test alternator output circuit as follows:

(a) Check voltage V4 as indicated in figure 3-10.

(b) If voltage is below voltage at V1 (figure 3-8), check for inadequate circuit conditions between battery negative terminal and alternator negative output terminal.

(c) Correct any discrepancies before conducting operational tests.

(6) Conduct excitation voltage test as follows:

(a) With voltmeter connected as in figure 3-11, close switch.

(b) Voltmeter should indicate 3.5 ± 0.2 Vdc.

(c) If voltmeter indicates zero volts, test voltage regulator as directed instep (8) below.

(d) If voltmeter indication is greater than 3.7 Vdc, test for open circuit of alternator field (rotor) as directed in step (9) below.

(e) If voltmeter indication is as specified, proceed with voltage regulator, alternator output, and voltage protector test as outlined in step (10) below.

(7) Test for faulty alternator voltage regulator as follows:

(a) Remove screws (1, figure 3–5) and cover assembly (2).

(b) Disconnect voltage regulator by disconnecting and tagging the red, green and black leads.

(c) Disconnect and tag the blue and yellow output leads.

(d) Install a jumper from the GND terminal to brush terminal as shown in figure 3-12.

(e) Install alternator in test circuit as shown in figure 3-12.

NOTE

A means of rotating the alternator at 2000 to 3000 RPM must be provided. This test can be performed with the alternator installed on an operational generator set, and operating the set at rated frequency.

(f) With the alternator rotating at 2500 RPM the voltmeter should indicate 24 to 28 volts and the ammeter should indicate 32 to 35 amperes.

(g) If the alternator tests satisfactorily, this indicates that the voltage regulator was faulty.

(h) If the alternator does not test satisfactorily, this indicates that the voltage regulator is good and the trouble is in the alternator.

(i) If the regulator is faulty, remove the jumper (figure 3-12) and install a new regulator and cover assembly using the tagged leads on the old cover assembly as a guide when making connections.

(8) Conduct field current test as follows:

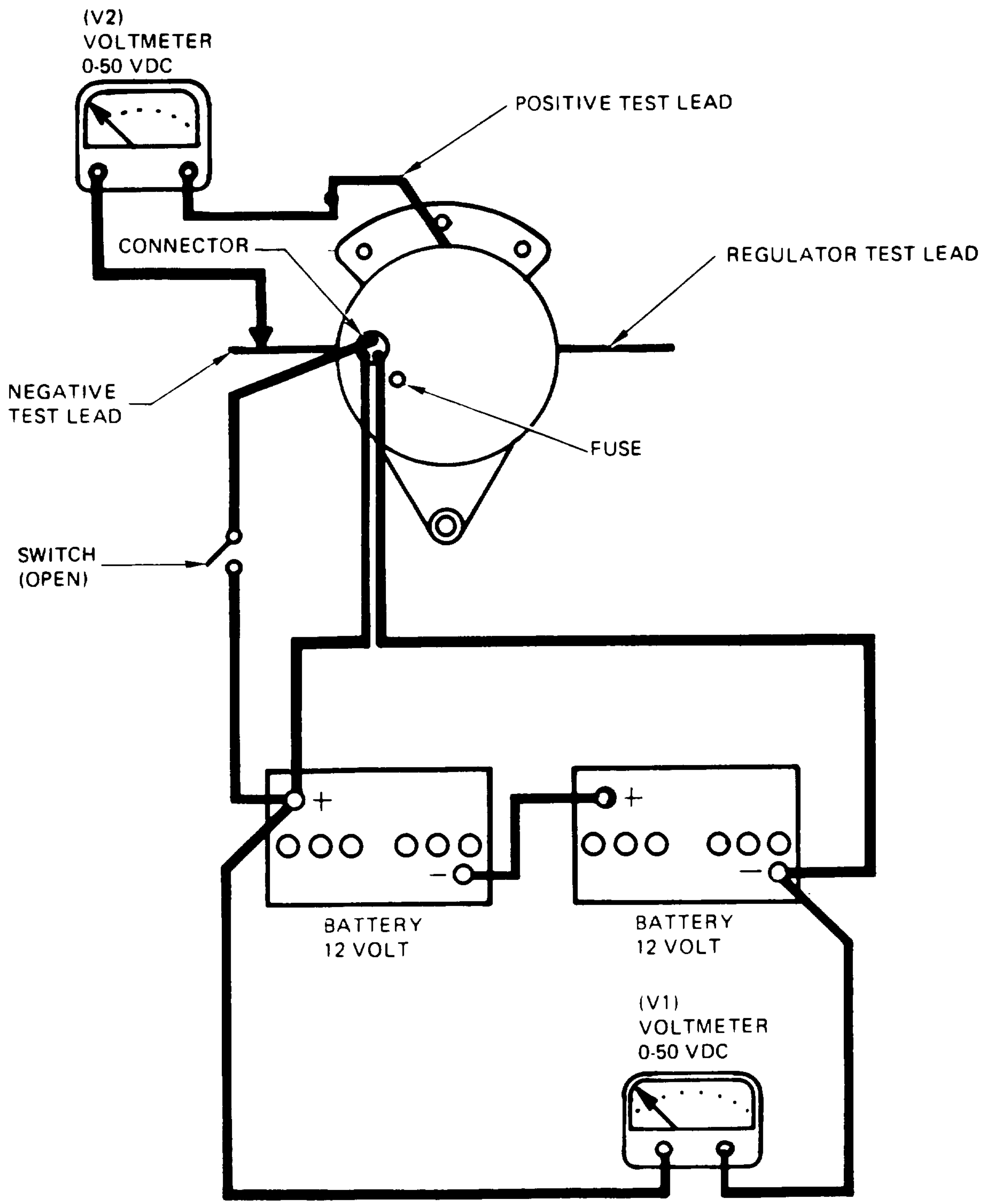


Figure 3-8. Total Circuit Voltage Test

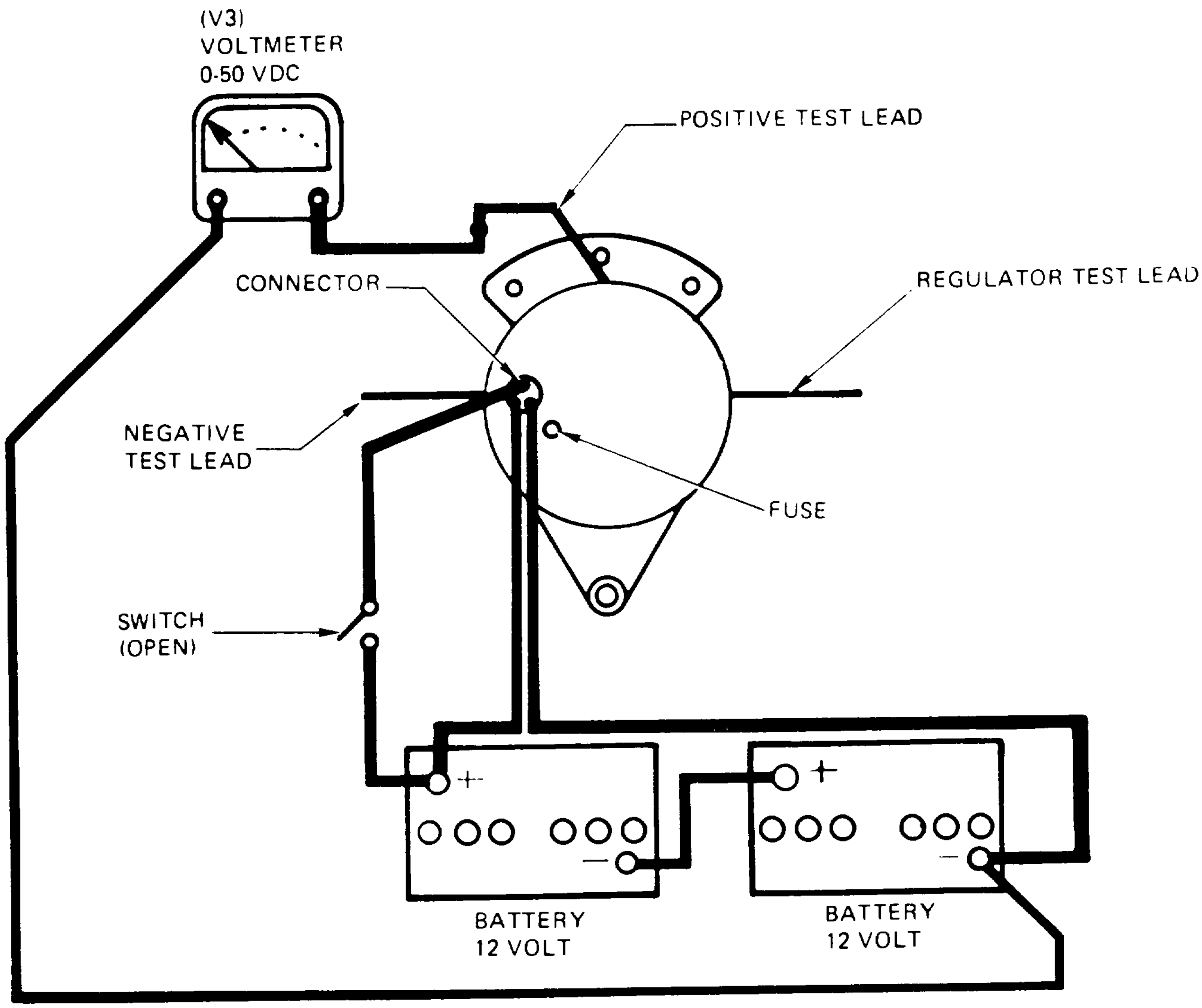


Figure 3-9. Alternator Positive Output Circuit Test

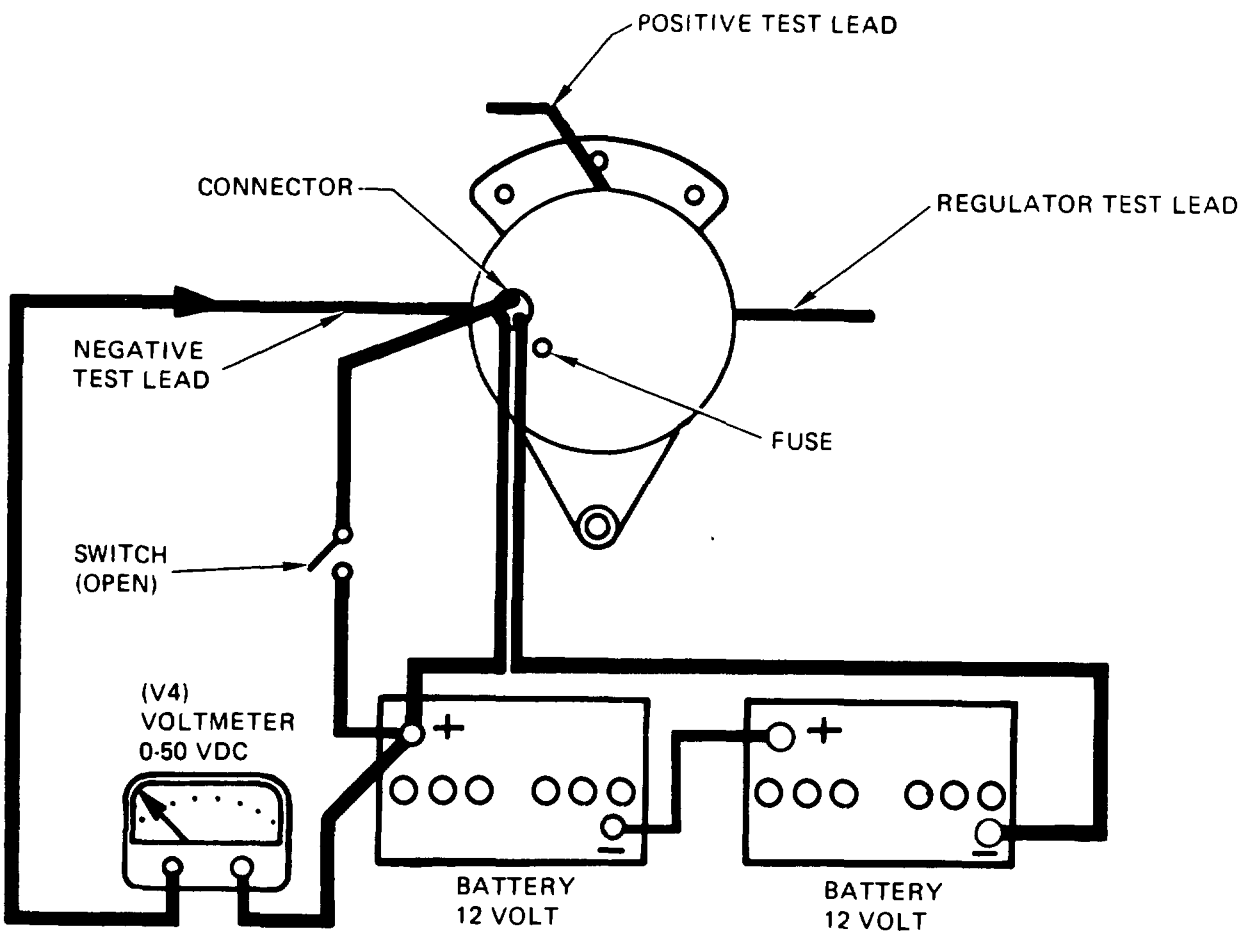


Figure 3-10. Alternator Negative Output Circuit Test

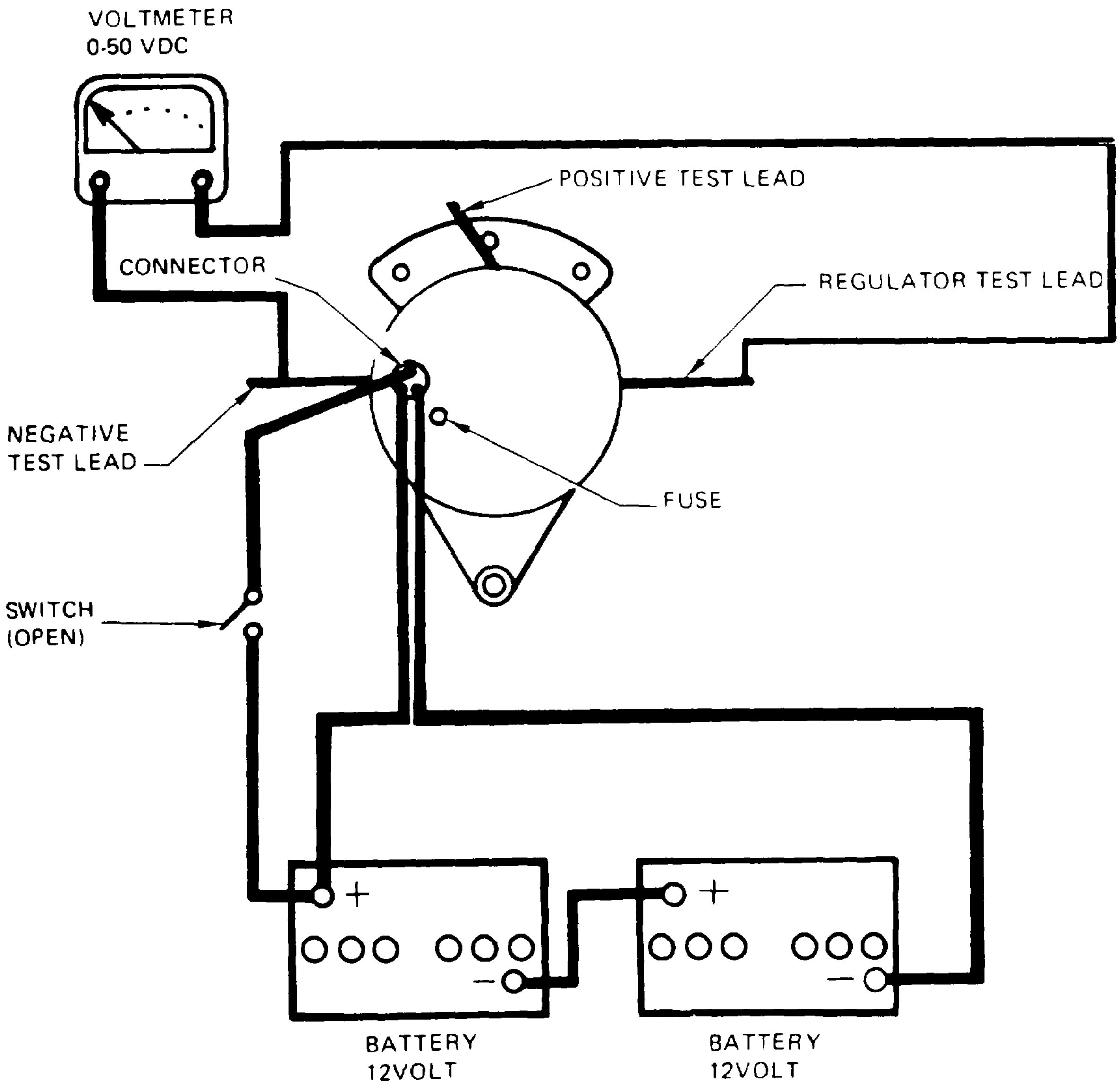


Figure 3–11. Excitation Voltage Test

CAUTION

Rheostat must be set in maximum resistance position to protect the ammeter in the event the field circuit is short circuited. Failure to observe this caution could result in equipment damage.

(a) Install alternator in test circuit as shown in figure 3-13.

(b) Slowly reduce field rheostat resistance while observing ammeter and voltmeter.

(c) When field rheostat reaches zero ohms, ammeter should indicate 3.0 to 3.5 amperes with voltmeter indicating 24 Vdc.

(d) If current is not as specified, check for poor connections and inadequate brush contact.

(9) Conduct alternator output and voltage protector test as follows:

(a) Install alternator in test circuit shown in figure 3-14.

NOTE

If alternator is not installed on generator set for this test, a means of rotating the alternator at 2,000 to 3,000 RPM must be provided.

(b) Adjust the drive device to provide 2500 RPM.

(c) Note the voltmeter indication. Nominal voltage should be 28 Vdc ± 0.3 Vdc.

(d) If voltage is not as specified, adjust the voltage regulator rheostat on the alternator rear cover.

(e) Close switch (S2) to put carbon pile load on the batteries.

(f) Check ammeter and voltmeter indications. Nominal current output should be 20-25 amperes with charging voltage exceeding 25.0 Vdc.

CAUTION

Open switch (S2) immediately after current test to avoid discharging the batteries.

(g) If nominal voltage cannot be obtained, disassemble alternator and correct difficulty.

(h) Remove alternator from test circuit, remove rear cover assembly and disconnect test leads.

(i) Reinstall rear cover assembly and fuse.

f. Installation. Refer to Operator and Unit Maintenance Manual for battery charging alternator installation instructions.

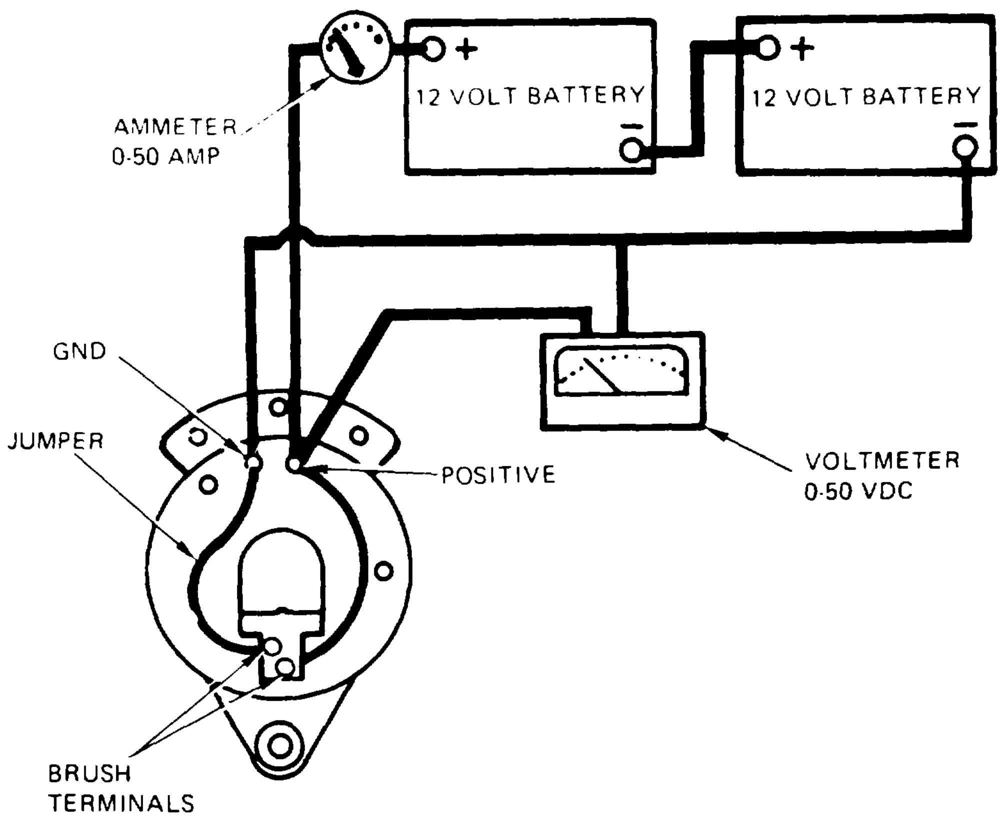


Figure 3-12. Faulty Voltage Regulator Circuit Test

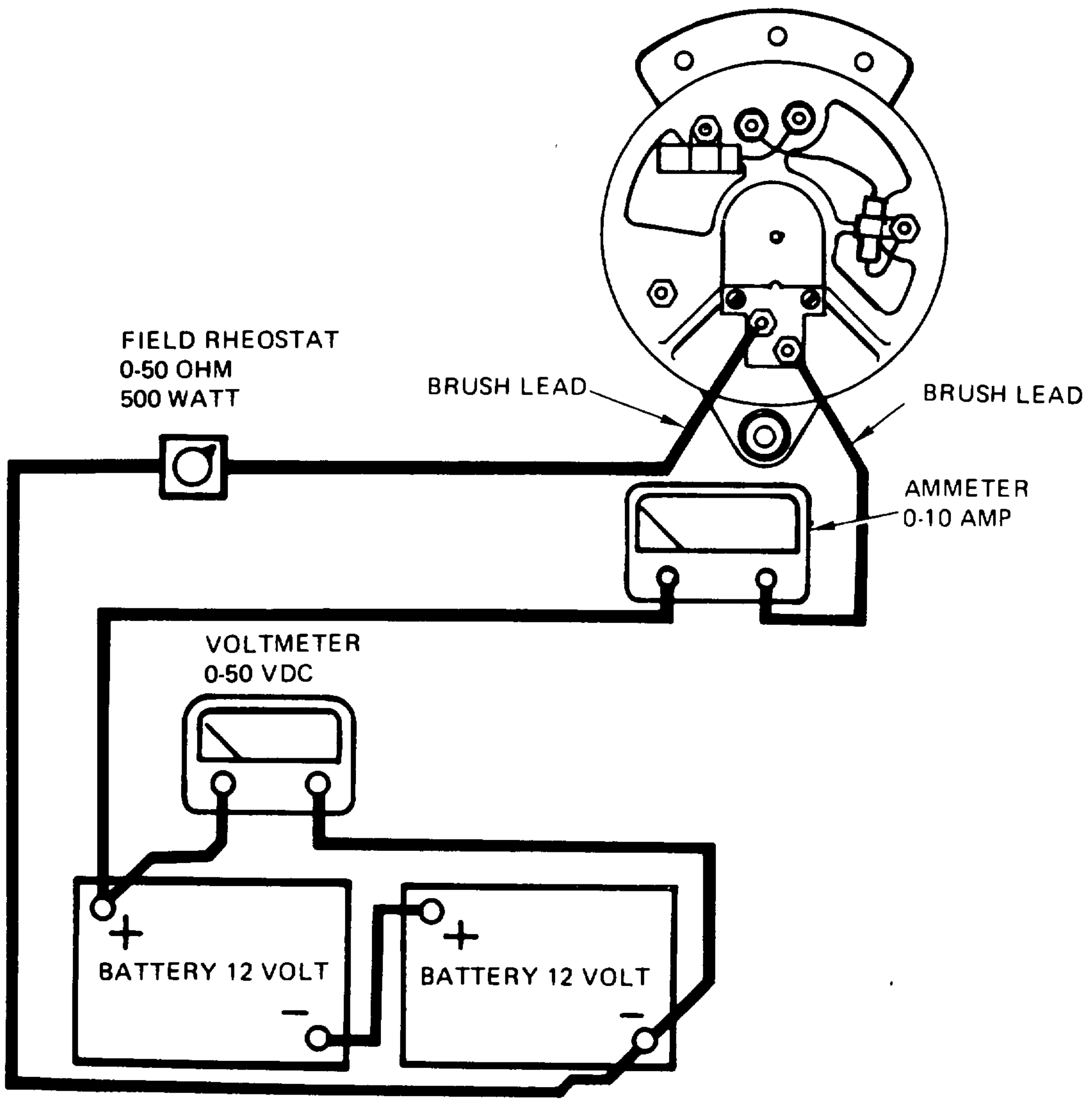


Figure 3-13. Field Current Test

3-7. SPEED SWITCH.

a. General.

(1) The speed switch provides sequenced control of circuits during engine startup, and protection against engine overspeed during operation. Three sets of contact elements, S9-1, S9-2, and S9-3, contained in the speed switch, are set to open, close, or transfer at certain engine speeds. The speed switch drive gear is designed to drive the speed switch at one-half engine speed.

(2) At an engine speed of 580 to 620 rpm (accelerating) element S9-1 transfers two sets of contacts, energizing the field flash circuit and de-energizing the crank relay to stop the starting motor.

(3) On tactical precise sets, when the engine reaches the speed range of 1180 to 1220 rpm (50/60 Hz), 1650 to 1700 rpm (400 Hz), element S9-2 closes, energizing the electro–hydraulic governor which takes over control of engine speed.

(4) Speed switch element S9-3 consists of two sets of contacts which are set to transfer at an engine speed of 2425 ± 25 rpm to shut down the engine and prevent damage to the equipment. Shutdown is achieved by de-energizing the stop-run relay and the fuel solenoid, cutting off fuel to the engine.

(5) Elements S9-1 and S9-2 reset at 100 rpm (decreasing) below actuation speed. Element S9-3 is manually reset by a pushbutton on the speed switch housing.

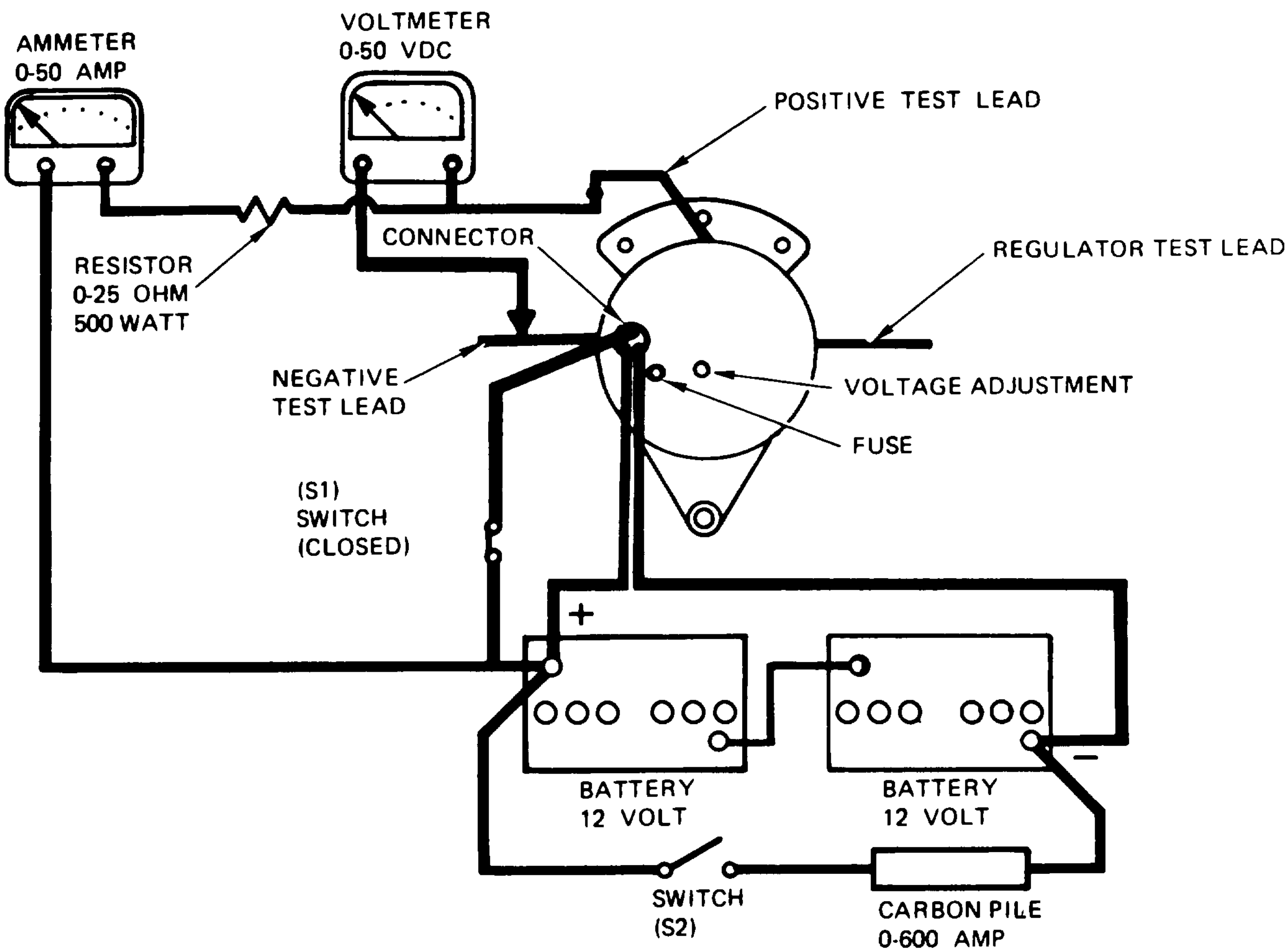


Figure 3-14. Output and Voltage Protector Test.

b. Removal. Refer to Operator and Unit Maintenance Manual for speed switch removal instructions.

NOTE

Two different types of switch, one electronic, the other mechanical, are used interchangeably in the sets. Determine which type you are removing by referring to figure 3-15 sheets 1 and 2 and proceed accordingly.

c. Disassembly (Electronic Type).

(1) Remove screws (1, figure 3-15, sheet 1) to remove rotor assembly (2) from electronics assembly (12).

(2) Remove rotor cap (3), cotter pin (4), and rotor (5).

(3) Remove retaining rings (6 and 7), bearing (8), shaft (9) and base (10).

d. Disassembly (Mechanical Type)

(1) Cut lockwire on speed switch.

(2) Remove screw (1, figure 3-15, sheet 2), Lockwire (2), washer(3), to remove rotor assembly (4) from cap and cover assembly (10).

(3) Remove counterweight (5), spacer (6), packing (7), and retaining ring (9) from body assembly (8).

e. Cleaning, Inspection, Repair and Assembly (Electronic Type). Refer to figure 3-15, sheet 1.

CAUTION

Do not submerge the electronics assembly (12) and base assembly (11) in cleaning solvent. Failure to observe this caution could result in equipment damage.

WARNING

Solvent, Dry Cleaning P-D-680, Type II is flammable and moderately toxic to skin, eyes and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate. Failure to observe this warning could result in servere personel injury.

(1) Wipe the exterior of the electronics assembly (12) and base assembly (11) with a clean rag, lightly moistened with solvent P-D-680 Type II.

(2) Clean all other parts with P-D-680 Type II and dry thoroughly.

(3) Inspect base, rotor cap, electronics and base assemblies for cracks, corrosion, or other damage.

(4) Check rotor and shaft for cracks, corrosion, or other damage.

(5) Check the bearing (8) for excessive wear.

(6) Replace any worn or defective parts.

f. Assembly (Electronic Type)

(1) Position base (10, figure 3-15 sheet 1) to install shaft (9), bearing (8), retaining rings (7 and 6).

(2) Install rotor (5), cotter pin (4), and rotor cap (3).

(3) Install rotor assembly (2), and screws (1) onto electronics assembly (12).

g. Cleaning, Inspection, Repair and Assembly (Mechanical Type). Refer to figure 3-15, sheet 2.

(1) If either the rotor assembly, the body assembly or the spacer are damaged or defective, replace defective part.

(2) Refasten with lockwire after readjustment.

(h). Assembly (Mechancial Type

(1) Position body assembly (8, figure 3-15 sheet 2), to install retaining ring (9), packing (7), spacer (6), and counterweight (5).

(2) Position cap and cover assembly (10), to install rotor assembly (4), washer (3), and Iockwire (2), and screw (1).

(3) Install lockwire on to speed switch.

i. Test Equipment (Electronical Type).The following test equipment will be required to properly test the speed switch.

(1) Tachometer test stand or speed switch tester with 0.187 tach takeoff fitting, capable of operation up to 1225 rpm.

(2) 24 Vdc power supply.

(3) VOM suitable for measuring continuity and 24 volts dc.

(4) Mating connector and cable for MS3102R-18-1P connector.

j. Testing (Electronic Type). Refer to figure 3-16, sheet 1 for schematic diagram of pins to be used during test, and perform the following procedures.

(1) Screw the tachometer fitting onto the test stand.

(2) Attach the connector and cable to J37 of the speed switch.

(3) Connect 24 volts dc to pins E, G and I with the polarity indicated in the test circuit.

(4) Using the VOM, test for the conditions listed below:

Element No. 1:
Pins A & B . . . . continuity
Pins A & C. . . . . open circuit

Element No. 2:
Pin D . . . . 0 volts dc to ground

Element No. 3:
Pins F & J . . . . open circuit
Pin H . . . . 24 volts dc to ground

(5) Connect the VOM to read continuity between pins A and B.

(6) Slowly bring up shaft speed of the tester. At 290 to 310 rpm Element No. 1 should trip causing an open circuit to appear between pins A and B.

(7) After Element 1 has tripped, check with the VOM for continuity between pins A and C.

(8) Proper tripping of Element No. 1 is indicated by meeting the conditions of steps (4), (6) and (7).

(9) Connect the VOM to read voltage on pin D with respect to ground.

(10) Slowly increase the tester shaft speed while monitoring the VOM. When Element No. 2 trips, the reading will go from 0 volts to 24 volts. Trip speed for Element No. 2 (50/60 Hz) is 590 to 610 rpm. Trip speed for Element No. 2 (400 Hz) is 825 to 850 rpm.

(11) Continue increasing shaft speed while monitoring pin H for voltage. It should be at 24 volts, dropping to 0 volts when the third element trips. Trip speed for Element No. 3 is 1200 to 1225 rpm.

(12) After Element No. 3 has tripped, connect the VOM between pins F and J to check for continuity. Continuity should exist after Element No. 3 has tripped.

(13) Slowly decrease shaft speed while monitoring pin D with the VOM for voltage. There should be 24 volts present, dropping to 0 volts when Element No. 2 resets. “Reset speed” for Element No. 2 should be no more than 100 RPM below the trip speed noted in step (10).

(14) Continue decreasing shaft speed while measuring for continuity between pins A and C with the VOM. Continuity should exist between these two pins until Element No. 1 resets, then an open circuit should exist. Reset speed for Element No. 1 should be no more than 100 rpm below the trip speed noted in step (6).

(15) Decrease shaft speed to 0 rpm. Monitor pin H for voltage with the VOM. Element No. 3 should still remain in the tripped condition, resulting in 0 volts on pin H, and continuity between pins F and J.

(16) Depress and release the reset switch, S1, on the speed switch. Pin H should now read 24 volts on the VOM, and an open circuit should exist between pins F and J.

NOTE

There are no repair or adjustment procedures for the electronics and base assemblies. If this portion of the speed switch is malfunctioning, replace both assemblies as a unit.

k. Testing (Mechanical Type).

(1) Connect a variable speed drive device to the speed switch drive. The drive device must have a tachometer in order to determine the speed of the device in rpm’s.

(2) With an ohmmeter on the R1 scale, reading from the speed switch connector, check for the contact conditions of elements S9-1, S9-2, and S9-3 illustrated in figure 3-16, sheet 2.

(3) When contact conditions are verified, as shown in figure 3-16 sheet 2, start variable drive and gradually increase speed, with ohmmeter connected to pins B and A. At a speed of 290 rpm the ohmmeter should indicate that contact A-B opens. Hold the variable speed drive at that speed and transfer the ohmmeter leads to pins A and C. The ohmmeter should indicate a closed contact.

(4) Leave the ohmmeter leads connected to pins A and C and gradually reduce speed. In the range of 190 to 210 rpm, the contacts of element S9-1 should reset to the condition illustrated in figure 3-16, sheet 2. To verify operation of element S9-1 contacts A and C, increase drive speed gradually and observe that the contacts close in the 290 to 310 rpm range.

(5) Connect ohmmeter leads across pins D and E and verify an open circuit. Increase drive speed and observe that element S9-2 (contacts D and E) closes in the speed range of 590 to 610 rpm (Mode I), 825 to 850 rpm (Mode II). Gradually reduce speed to 490 minimum rpm (Mode I), 725 minimum rpm (Mode II). Observe that element S9-2 resets to the condition shown in figure 3-16, sheet 2.

(6) Connect ohmmeter across pins H and G and verify a closed circuit. Increase drive speed gradually. The contacts should open at a speed of 1200 to 1225 rpm. Hold drive speed and read contacts F and J. Meter should indicate a closed circuit. Reduce drive speed to less than 1000 rpm, press the manual reset switch and observe with the meter that element S9-3 contacts reset to the condition shown in figure 3-16, sheet 2.

1. Screw
2. Rotor assembly
3. Rotor cap
4. Cotter pin
5. Rotor
6. Retaining ring (bearing)
7. Retaining ring (shaft)
8. Bearing
9. Shaft
10. Base
11. Base assembly
12. Electronics assembly
13. Connector (J37)

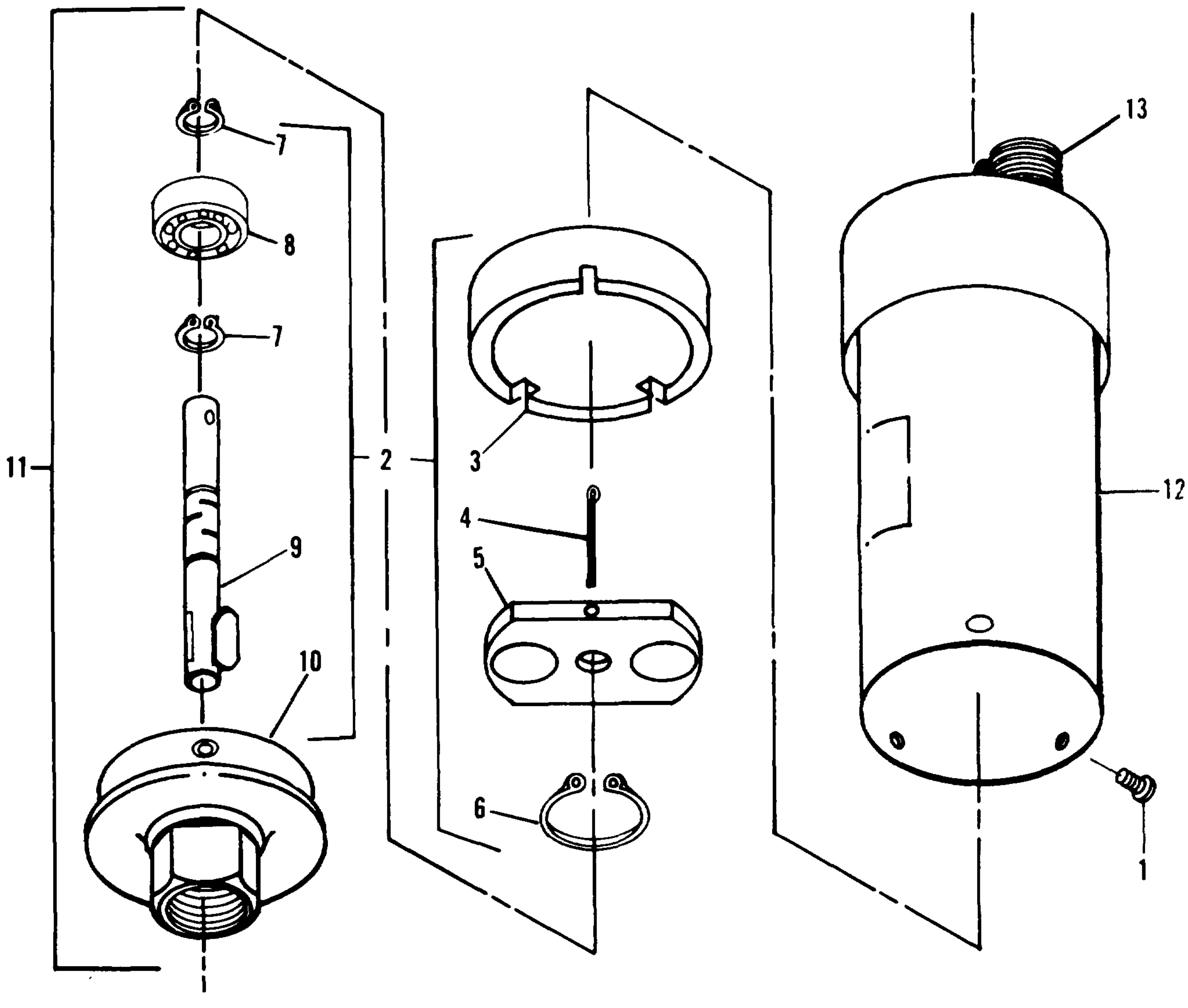


Figure 3-15. Speed Switch, Exploded View (Electronic Switch) (Sheet 1 of 2)

1. Screw
2. Lockwire
3. Washer
4. Rotor assembly
5. Counterweight
6. Spacer
7. Packing
8. Body assembly
9. Retaining ring
10. Cap and cover assembly
11. Screw
12. Plate
13. Connector

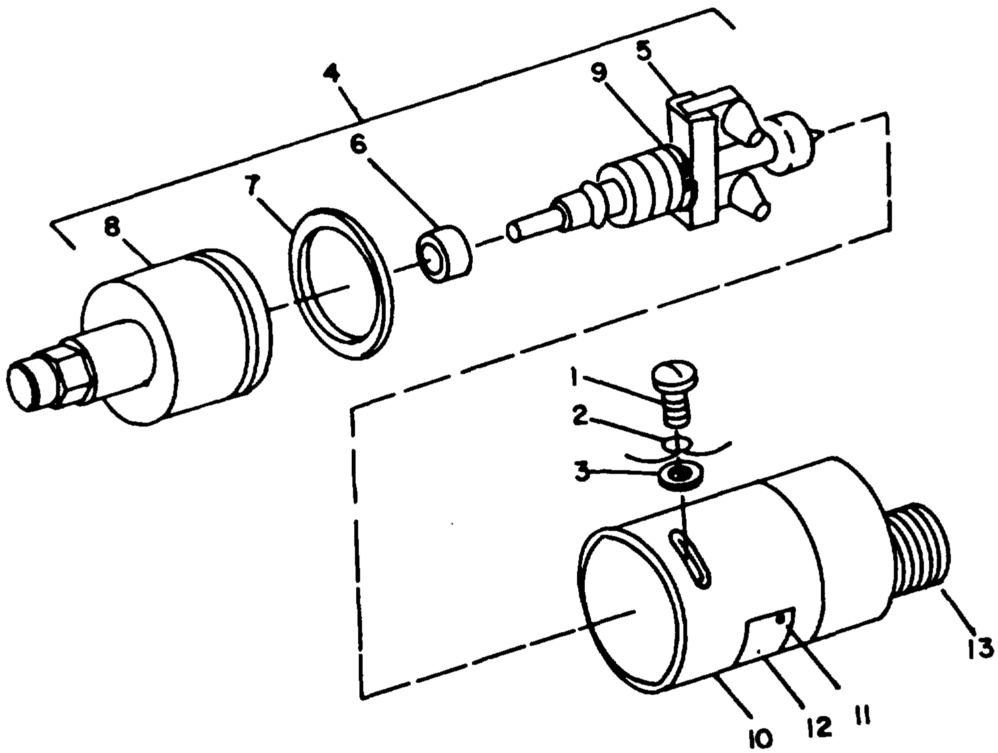


Figure 3-15. Speed Switch, Exploded View (Mechanical Switch) (Sheet 2 of 2)

NOTE

To obtain the required performance characteristics during tests (3) through (6), adjustments can be made. By loosening screws (1, figure 3-15, sheet 2) and rotating the cap and cover assembly relative to the body assembly, the trip points of all those elements can be raised or lowered. In addition, the trip speed of each individual element can be raised or lowered by removing access screws as shown in figure 3-16 sheet 2 and turning appropriate set screw located beneath cover screws with a 1/16 inch allen wrench.

l. Installation. Refer to Operator and Unit Maintenance Manual and install speed switch in reverse order of removal.

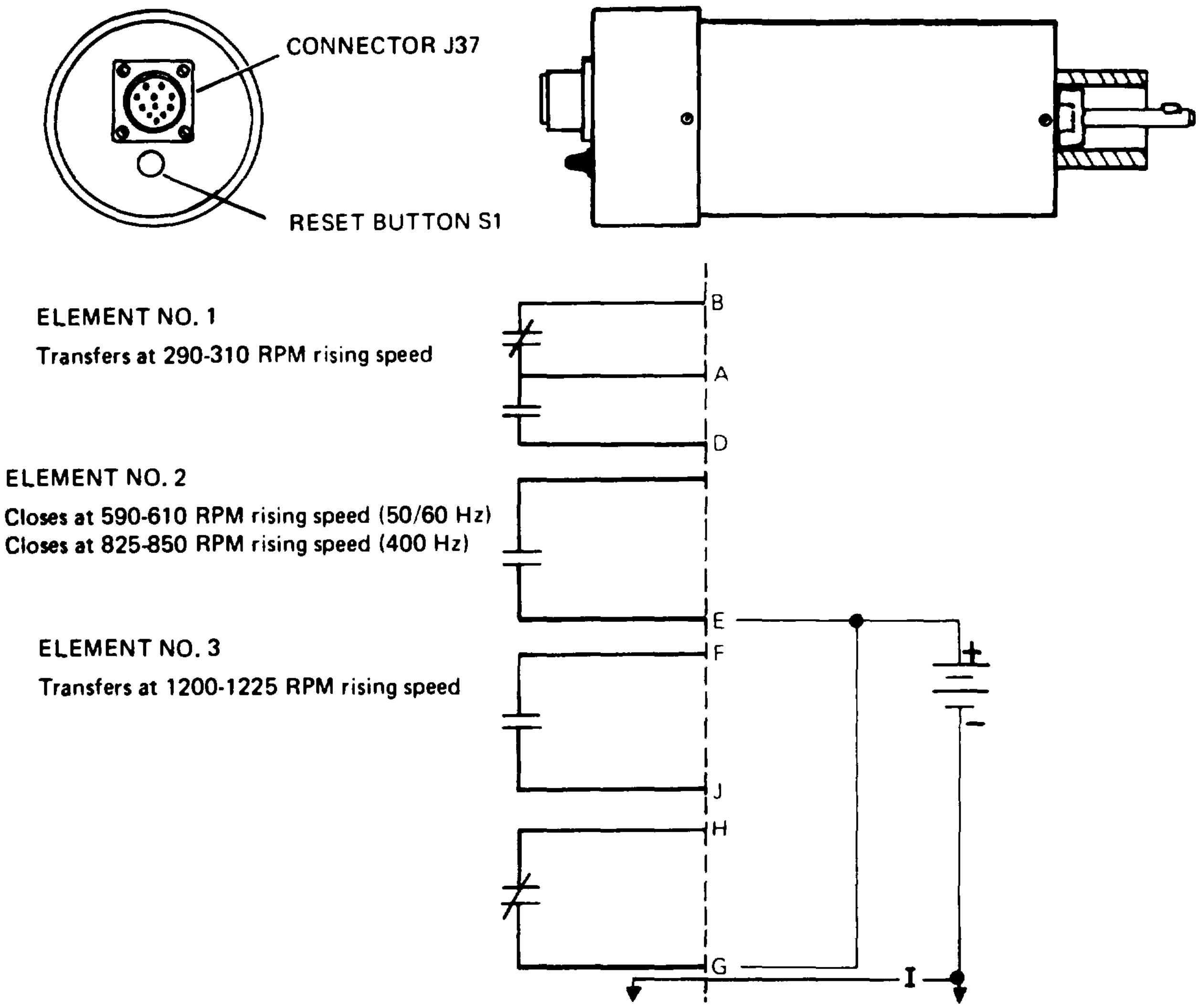


Figure 3-16. Speed Switch Test Points (Electronic Switch) (Sheet 1 of 2)

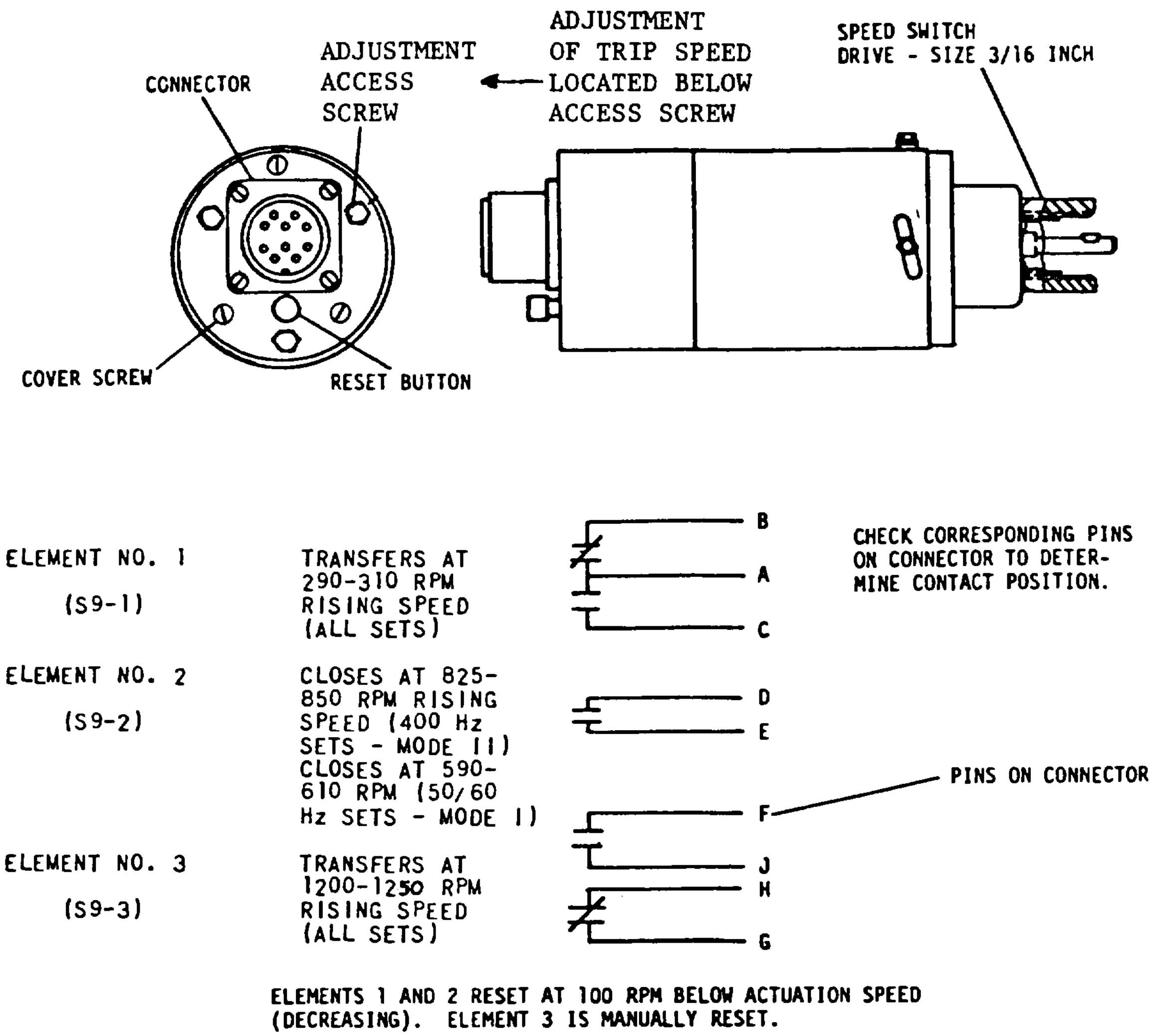


Figure 3-16. Speed Switch Test Points (Mechanical Switch) (Sheet 2 of 2)

3-8. COOLANT TEMPERATURE TRANSMITTER.

Refer to the Operator and Unit Maintenance Manual for coolant temperature transmitter maintenance procedures.

3-9. OVERTEMPERATURE SWITCH.

Refer to the Operator and Unit Maintenance Manual for overtemperature switch maintenance procedures.

3-10. OIL PRESSURE TRANSMITTER.

Refer to the Operator and Unit Maintenance Manual for oil pressure transmitter maintenance procedures.

3-11. LOW OIL PRESSURE SWITCH.

Refer to the Operator and Unit Maintenance Manual for low oil pressure switch maintenance procedures.

3-12. DAY TANK FUEL LEVEL AND LOW FUEL CUTOFF SWITCH.

Refer to the Operator and Unit Maintenance Manual for day tank fuel level and low fuel cut off switch maintenance procedures.

3-13. FUEL SOLENOID VALVE.

Refer to the Operator and Unit Maintenance Manual for fuel solenoid valve maintenance procedures.

3-14. ENGINE WIRING HARNESS ASSEMBLY.

a. Removal. Refer to the Operator and Unit Maintenance Manual for engine wiring harness removal instructions.

b. Cleaning Inspection and Repair. Refer to the Operator and Unit Maintenance Manual for engine wiring harness cleaning, inspection, and repair procedures.

c. Rebuild. If the wiring harness has sustained damage and requires repair or rebuild, refer to figure 3-17 for layout, identification, and material requirements and Appendix A for detailed soldering and replacement procedures.

Refer to the Operator and Unit Maintenance Manual for engine wiring harness installation procedures.

Section II. MAINTENANCE OF ENGINE FUEL SYSTEM

3-15. GENERAL.

Fuel for generator set operation is supplied from either the integral main fuel tank or an auxiliary source as determined by the fuel selector valve. Fuel is pumped through the strainer and filter assembly and fuel solenoid valve into the day tank by two electrically driven fuel transfer pumps. The day tank fuel level and low fuel cutoff switch controls the operation of the fuel transfer pumps and the fuel solenoid valve. Fuel from the day tank is drawn through the secondary fuel filter assembly by the fuel injection pump. This single cylinder, opposed plunger, inlet metering type pump forces a metered amount of fuel under high pressure and in timed sequence to the fuel injection nozzle holders in the engine cylinder head. The nozzle holders spray a metered amount of fuel into each combustion chamber. Unused fuel is returned to the day tank through the fuel return line.

WIRE MARKING	FROM	TERMINATION FIND NO REF.	TO	FIND NO REF.	WIRE FIND NO	WIRE LENGTH REF.	WIRE MARKING COLOR
P207C16	PS–A	1	P14–B	5	7	18.50	RED
P200G16	P5–A	1	P14–C	5	7	18.50	RED
P52A16	P5–Y	1	P14–D	5	7	18.50	RED
P201C16	P5–C	1	P42–C	5	7	42.00	RED
P200CC16	P5–m	1	P42–B	5	7	42.00	RED
P58E16	P5–E	1	P42–A	5	7	42.00	RED
P200H18	P5–W	1	P37–F	4	7	49.00	RED
P202C16	P5–B	1	P37–J	4	7	49.00	RED
P81D16	P5–F	1	P37–D	4	7	49.00	RED
P48C16	P5–U	1	P37–B	4	7	49.00	RED
P54A16	P5–V	1	P37–C	4	7	49.00	RED
P44H16	P5–D	1	P37–A	4	7	49.00	RED
P47J16	P5–n	1	P37–G	4	7	49.00	RED
P80R16	P5–p	1	P37–H	4	7	49.00	RED
P50HH16	P5–k	1	P35–A	6	7	16.00	RED
P198D16	P5–G	1	P35–B	6	7	16.00	RED
P46D16	P5–H	1	P38–A	6	7	35.50	RED
P550016	P5–o	1	P38–B	6	7	35.50	RED
E39D16	P5–1	1	MT1	9	7	36.50	RED
E38D16	P5–J	1	MT2	9	7	48.00	RED
E37D16	P5–K	1	MT3	22	7	54.00	RED
P50DD16	P5–c	1	P33–A	3	7	22.00	RED
P50EE16	P5–e	1	P33–C	3	7	22.00	RED
P68816	P5–b	1	P33–D	3	7	22.00	RED
P55XX16	P5–S	1	L1(–)	10	7	45.00	RED
P80N16	P5–P	1	L1 (+)	10	7	45.00	RED
P55EF16	P5–h	1	CR27–Y1	23	7	21.50	RED
P141C12	P5–z	1	CB1–1	11	8	45.00	RED
P40NA16	P5–M	1	CB–2	10	7	45.00	RED
P51F16	P5–f	1	B2	12	7	25.00	RED
P51R16	P5–r	1	B3	12	7	33.00	RED
V65F12	P5–x	1	TM1–1	11	8	46.00	RED
V64F12	P5–y	1	TM1–2	11	8	46.00	RED
P142B12	P5–v	1	4+(COIL)	13	8	44.50	RED
P140A14	P5–w	1	L4–1	14	8	44.50	RED
P55N12	P5–t	1	E1	20	8	34.00	RED
P80P16	P5–R	1	P43–A	2	7	77.50	RED
PS5SS12	P43–C	2	E1	20	8	36.00	RED
P53A16	P42–D	5	P14–A	5	7	43.50	RED
P69A16	P33–B	3	CR27–Y	23	7	23.50	RED
P140C16	P37–E	4	L4–1	15	7	87.00	RED
P77A16	CP27–R	23	P36–A	6	7	12.00	RED
P55EY16	CR27–Y1	23	P36–B	6	7	12.00	RED

FIND NO.	SYM	CODE IDENT	DWG SIZE	PART OR IDENTIFYING NO.	QTY REQD	NOMENCLATURE OR DESCRIPTION	SPEC	MATERIAL
1				MS3106R36–7S	1	CONNECTOR PLUG, ELECTRICAL P5		
2				MS3106R18–5P	1	CONNECTOR PLUG, ELECTRICAL P43		
3				MS3108814S–25	1	CONNECTOR PLUG 90° P33		
4				MS3106P18–15	1	CONNECTOR PLUG ELECTRICAL P37		
5				MS3106E145–25	1	CONNECTOR PLUG ELECTRICAL P14, P42		
6				MS3106R10SL–45	3	CONNECTOR PLUG, ELECT. P38, P35, P36		
7				M5086/2–16–9	AR	WIRE ELECTRICAL 16 AWG	MIL–W–5086/2	
8				M5086/2–12–9	AR	WIRE ELECTRICAL 12 AWG	MIL–W–5086/2	
9				MS25–36–108	2	TERMINAL LUG NO. 10 STUD 18 AWG WIRE		
10				MS25036–153	3	TERMINAL LUG NO. 8 STUD 16 AWG WIRE		
11				MS25–36–156	4	TERMINAL LUG NO. 8 STUD 12 AWG WIRE		
12				MS27144–1	2	CONNECTOR		
13				MS25036–112	1	TERMINAL LUG NO. 10 STUD 12 AWG		
14				MS25036–114	1	TERMINAL LUG 3/8 STUD 12 AWG		
15				MS25036–110	1	TERMINAL LUG 3/8 STUD 16 AWG		
16				MS3367–1–9	AR	STRAP, CABLE ADJUSTABLE		
17				MS3367–5–9	AR	STRAP, CABLE ADJUSTABLE		
18				MS25251–16	7	PLUG, END SEAL, ELECT, CONN.		
19				MS25251–12	2	PLUG, END SEAL, ELECT, CONN.		
20				72–2133	2	TERMINAL LUG KO 12 AWG 5/8 STUD T&B		
21				M23053/S–106–0	4"	INSULATION SLEEVING	MIL–I– 23053/5	
22			C	70–1484	1	CONNECTOR, ELECT FEMALE		

NOTES:

1. ALL SOLDERED CONNECTIONS SHALL BE IN ACCORDANCE WITH MIL–STD–454, REQUIREMENT 5.
2. INSTALL STRAPS, FIND NO. 18 OR 17, AT 3.0 MAX INTERVALS AND AT EACH CABLE BREAK–OUT.
3. WIRE MARKINGS TO BE IN ACCORDANCE WITH MIL–W– 5088 EXCEPT THAT LENGTH BETWEEN GROUPS OF NUMBERS SHALL NOT EXCEED 6 INCHES.
4. CRIMPED TERMINALS SHALL MEET THE PERFORMANCE REQUIREMENTS OF MIL–T–7928.
5. INSTALL END SEAL PLUGS, FIND NO. 18 AND 19 IN UNUSED HOLES OF CONNECTOR FIND NO. 1.
6. CUT INSULATION SLEEVING (FIND # 21) INTO 2 PIECES 2.0 INCHES LONG AND INSTALL OVER FIND NO. 20. THEN APPLY HEAT OF 400° F for 3–5 SEC. FOR PROPER SHRINKAGE.
7. REFERENCES
   a) FOR WIRING DIAGRAM. SEE DRAWING 72–2205.
   b) FOR SCHEMATIC DIAGRAM, SEE DRAWING 72–2200, AND 72–2269.
8. INTERPRET DRAWING PER MIL–STD–100.

Figure 3-17. Engine Wiring Harness Assembly, Drawing No. 72-2267 (Sheet 1 of 2).

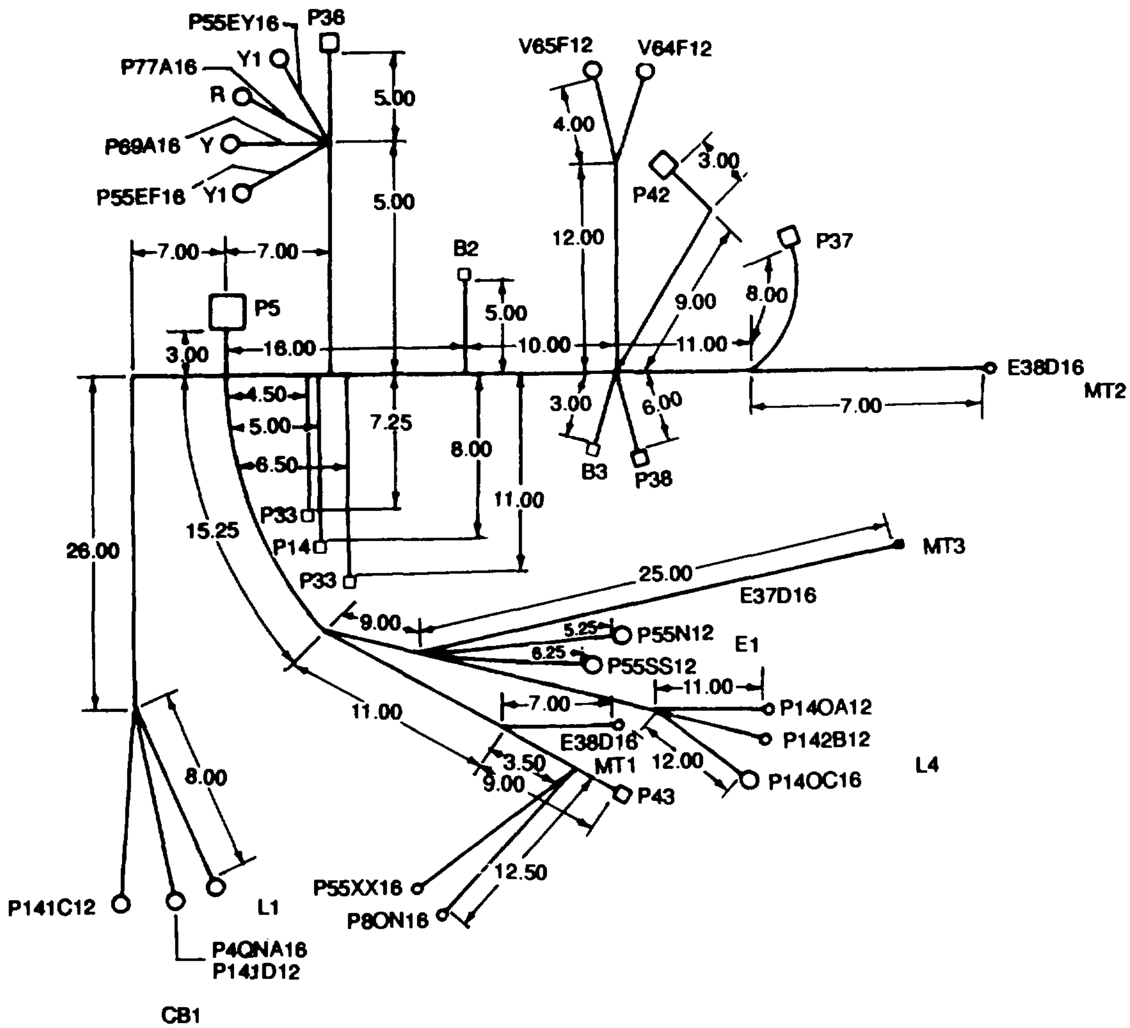


Figure 3-17. Engine Wiring Harness Assembly, Drawing No. 72-2267 (Sheet 2 of 2)

3-16. MAIN FUEL TANK (METAL).

a. Removal.

(1) Refer to the Operator and Unit Manual and accomplish the following:

(a) Drain the main fuel tank assembly.

(b) Disconnect fuel lines and fittings from main fuel tank.

(c) Disconnect fuel vent system from main fuel tank.

(d) Disconnect engine wiring harness from fuel level gauge.

(e) Remove left and right ventilation doors, ventilation louver panel, and lower cover panels from rear of generator set housing.

(2) .Remove nut (1, figure 3-18), lockwasher (2), screw (3), clamps (4), filler neck (5), and hose (6).

(3) Remove screws (7), lockwasher (8), adapter (9), and gasket (10).

(4) Remove locknut (11), and flatwasher (12), from strap (13).

(5) Remove screws (14), lockwasher (15), fuel level switch (16), and fuel level switch gasket (17). Replace gasket if damaged.

(6) Remove cap (18) and drain valve (19) from metal fuel tank (20).

b. Cleaning, Inspection, and Repair.

WARNING

Solvent, Dry Cleaning P-D-680, Type II is flammable and moderately toxic to skin, eyes and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate. Failure to observe this warning could result in servere personel injury.

(1) Clean exterior surfaces of fuel tank and other non-electrical parts with dry cleaning solvent (Federal Specification P-D-680).

(2) Flush interior of fuel tank with an approved solvent.

(3) Inspect fuel tank assembly for cracked or broken welds, dents, leaks, and other damage.

(4) Test fuel level sensor in accordance with instructions provided in Operator and Unit Maintenance Manual.

(5) Check filler hose for damage or deterioration.

(6) Check all threads for crossing, stripping, and peening.

WARNING

Steam clean interior of fuel tank for a minimum of 2 hours to remove residual vapors before attempting to repair welds. Serious injury or death may result from failure to observe this warning. Failure to observe this warning could result in servere personel injury.

(7) Repair cracked or broken welds and leaks by welding. Refer to Appendix A for detailed instructions.

(8) Repair damaged threads with a thread chaser.

(9) Replace any parts which are extensively damaged.

c. Installation.

NOTE

Install filler neck hose with vent holes to top and outboard.

(1) Position metal fuel tank (20, figure 3-18) to install drain valve (19) and cap (18).

(2) Install new fuel level switch gasket (17), fuel level switch (16), lockwasher (15), and screws (14).

(3) Position strap (13), to install flatwasher (12), and locknut (11).

(4) Install gasket (10), adapter (9), Iockwasher (8) and screws (7).

(5) Install hose (6), filler neck (5), clamps (4), screws (3), Iockwasher (2) and nut (1).

(6) Refer to the Operator and Unit Maintenance Manual and accomplish the following:

(a) Install Iower cover panels, ventilation louver panel, and right and left ventilation doors to generator set housing.

(b) Connect engine wiring harness to fuel level gauge.

(c) Connect fuel vent system to main fuel tank.

(d) Connect fuel lines and fittings to main fuel tank:

(e) Fill the main fuel tank assembly.

3-17. MAIN FUEL TANK (PLASTIC).

a. Removal.

(1) Refer to the Operator and Unit Manual and accomplish the following:

(a) Drain the main fuel tank assembly.

(b) Disconnect fuel lines and fittings from main fuel tank.

(c) Disconnect fuel vent system from main fuel tank.

(d) Disconnect engine wiring harness from fuel level gauge.

(e) Remove left and right ventilation doors, ventilation louver panel, and lower cover panels from rear of generator set housing.

(2) Remove nut (1, figure 3-19), lockwasher (2), screw (3), clamps (4), filler neck (5), and hose (6).

(3) Remove locknut (7), flat washer (8), from strap (9).

(4) Remove screws (10), Iockwasher (11), ground wire assembly (12), fuel level switch (13), and fuel level switch gasket (14). Replace gasket if damaged.

(5) Remove cap (15) and drain valve (16) from plastic fuel tank (17).

b. Cleaning, Inspection, and Repair.

WARNING

Solvent, Dry Cleaning P-D-880, Type II is flammable and moderately toxic to skin, eyes and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate. Failure to observe this warning could result in servere personel injury.

1. Nut
2. Lockwasher
3. Screw
4. Clamp
5. Filler neck
6. Hose
7. Screw
8. Lockwasher
9. Adapter
10. Gasket
11. Locknut
12. Flat washer
13. Strap
14. Screw
15. Lockwasher
16. Fuel level switch
17. Fuel level switch gasket
18. Cap
19. Drain valve
20. Fuel tank

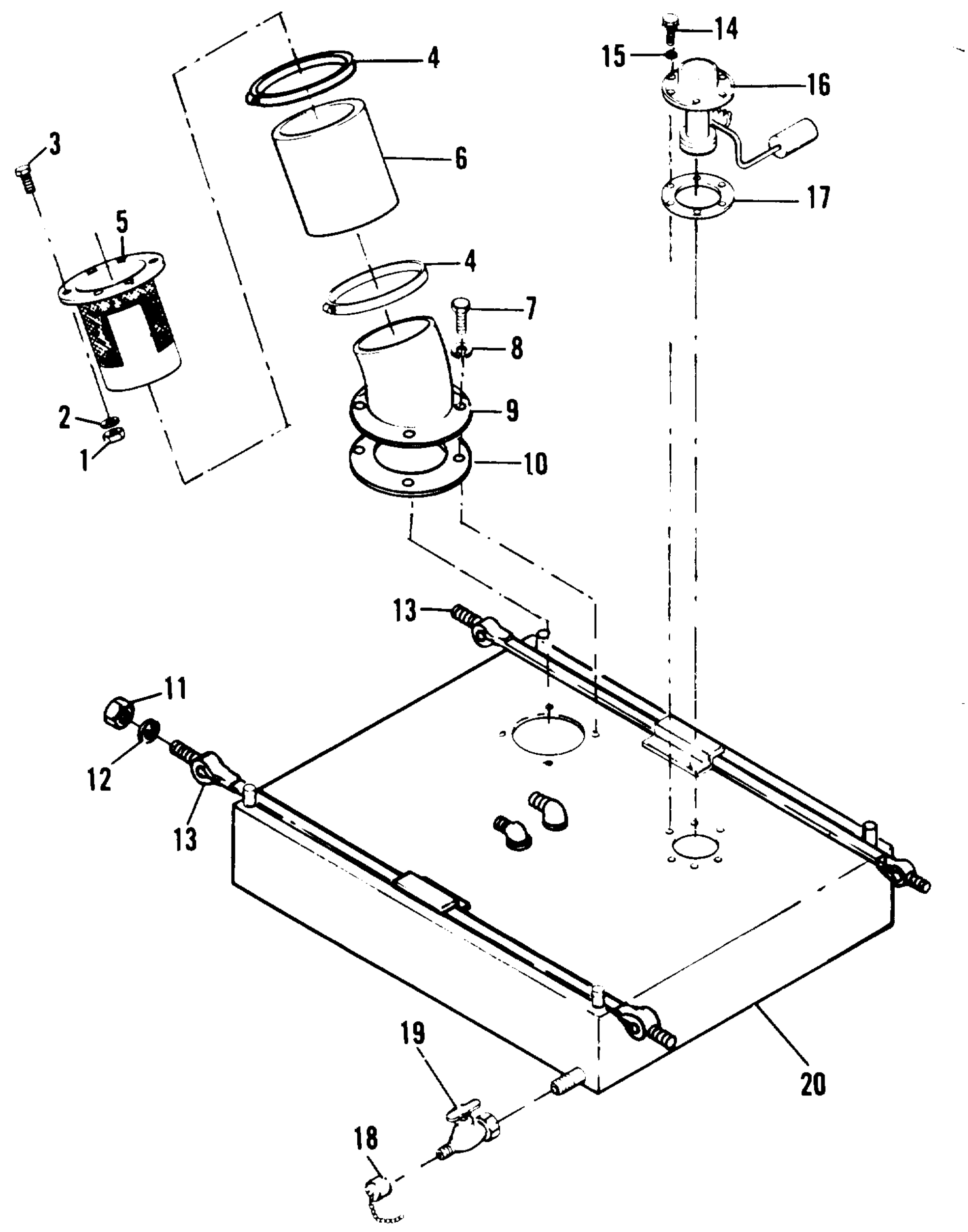


Figure 3-18. Main Fuel Tank (Metal), Removal and Installation

(1) Clean exterior surfaces of fuel tank and other nonelectrical parts with dry cleaning solvent (Federal Specification P-D-680).

(2) Flush interior of fuel tank with an approved solvent.

(3) Inspect fuel tank assembly for cracked or broken welds, dents, leaks, and other damage.

(4) Test fuel level sensor in accordance with instructions provided in Operator and Unit Maintenance Manual.

(5) Check filler hose for damage or deterioration.

(6) Check all threads for crossing, stripping, and peening.

WARNING

Steam clean interior of fuel tank for a minimum of 2 hours to remove residual vapors before attempting to repair welds. Serious injury *or* death may result from failure to observe this warning. Failure to observe this warning could result in servere personel injury.

(7) Repair cracks or leaks by using Epoxy. Refer to appendix Din TM 9-6115-464-12 for detailed instructions.

(8) Repair damaged threads with a thread chaser.

(9) Replace any parts which are extensively damaged.

c. Installion.

(1) Position plastic fuel tank (17, figure 3-19) to install drain valve (16) and cap (15).

(2) Install new fuel level switch gasket (14), fuel level switch (13), ground wire assembly (12), lockwasher (11) and screws (10).

(3) Position strap (9), to install flat washer (8), and locknut (7).

(4) Install hose (6), filler neck (5), clamps (4), screws (3), lockwasher (2), and nut (1).

(5) Refer to the Operator and Unit Maintenance Manual and accomplish the following:

(a) Install lower cover panels, ventilation louver panel, and right and left ventilation doors to generator set housing.

(b) Connect enging wiring harness to fuel level gauge.

(c) Connect fuel vent system to main fuel tank.

(d) Connect fuel lines and fittings to main fuel tank.

(e) Fill the main fuel tank assembly.

NOTE

Install filler neck hose with vent holes to top and outboard.

3-18. FUEL TRANSFER PUMPS.

Refer to the Operator and Unit Maintenance Manual for fuel transfer pumps maintenance procedures.

3-19. FUEL STRAINER AND FILTER ASSEMBLY.

Refer to the Operator and Unit Maintenance Manual for fuel strainer and filter assembly maintenance procedures.

1. Nut
2. Lockwasher
3. Screw
4. Clamp
5. Filler neck
6. Hose
7. Locknut
8. Flat washer
9. Strap
10. Screw
11. Lockwasher
12. Ground Wire Assembly
13. Fuel level switch
14. Fuel level switch gasket
15. Cap
16. Drain valve
17. Fuel tank

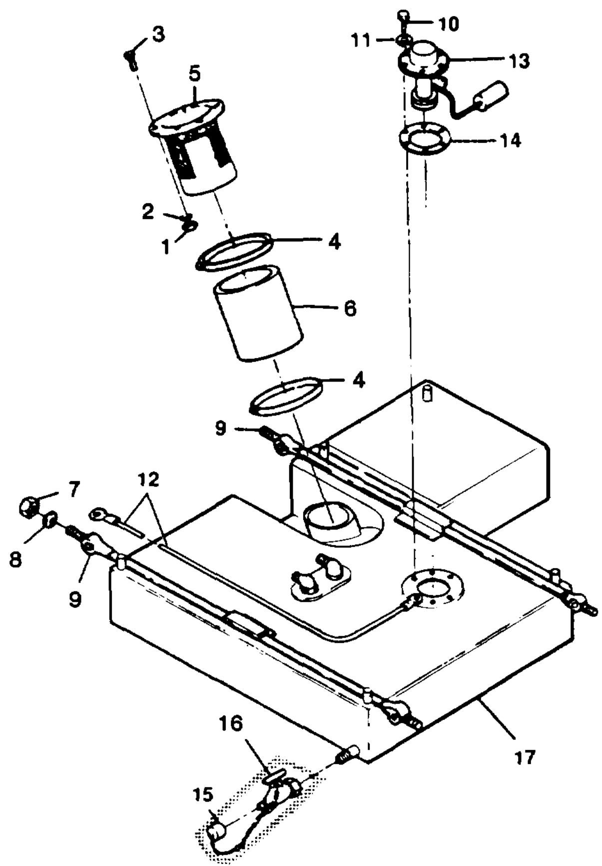


Figure 3-19. Main Fuel Tank (Plastic), Removal and Installation

3-20. DAY TANK ASSEMBLY.

a. Removal. Refer to the Operator and Unit Maintenance Manual for day tank assembly removal instructions.

b. Cleaning, Inspection, and Repair.

WARNING

Solvent, Dry Cleaning P-D-880, Type II is flammable and moderately toxic to skin, eyes and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate. Failure to observe this warning could result in servere personel injury.

WARNING

Compressed air used for cleaning and drying purposes can create airborne particles that may enter the eyes. Pressure shall not exceed 30 psig and use only with adequate chip guards and chipping goggles. Failure to observe this warning could result in servere personel injury.

(1) Clean exterior surfaces with dry cleaning solvent (Federal Specification P-D-680) and dry with filtered compressed air.

(2) Flush interior of day tank with an approved solvent.

(3) Inspect day tank assembly for cracked or broken welds, dents, and damaged threads.

(4) Check interior of tank for scale formation and hardened sediment deposits.

(5) Test for leaks as follows:

(a) Plug all openings except one.

(b) Install a fitting and attach a compressed air line to the unplugged opening.

(c) Submerge day tank in a container of water and apply 5 psig air pressure.

(d) Check for bubble formations which will indicate leakage.

WARNING

Steam clean interior of day tank a minimum of two hours to dissipate residual fuel vapors before attempting to repair welds. Serious injury or death may result from failure to observe this warning. Failure to observe this warning could result in servere personel injury.

(6) Repair cracked or broken welds and leaks by welding.

(7) Repair damaged threads with a thread chaser.

c. Installation. Refer to the Operator and Unit Maintenance Manual for day tank installation instructions.

3-21. SECONDARY FUEL FILTER ASSEMBLY.

Refer to the Operator and Unit Maintenance Manual for secondary fuel filter assembly maintenance procedures.

3-22. FUEL INJECTION PUMP ASSEMBLY.

a. General. The Roosa Master Fuel Injection Pump is mounted on the timing gear case and is gear driven through an idler gear arrangement by the crankcase gear. The end thrust of the fuel injection pump gear and shaft is controlled by a spring loaded thrust button located in the inspection cover on the timing gear housing cover. It is advisable when removing or installing the fuel injection pump that the gear housing inspection cover be removed from the timing gear cover to relieve the spring tension of the thrust button. The fuel injection pump attaching flange holes are elongated to permit accurate adjustment of the fuel pump timing.

b. Removal.

CAUTION

Thoroughly clean the fuel injection pump prior to removal. Cap or plug all fittings and lines to prevent dirt from entering the pump and fuel system. Failure to observe this caution could result in equipment damage.

1. Injector return line
2. Injector return line
3. Tee
4. Self–locking nut
5. Screw
6. Linkage
7. Inlet fuel line
8. Elbow
9. Screw
10. Timing line cover
11. Gasket
12. Nut
13. Lockwasher
14. Fuel injection pump

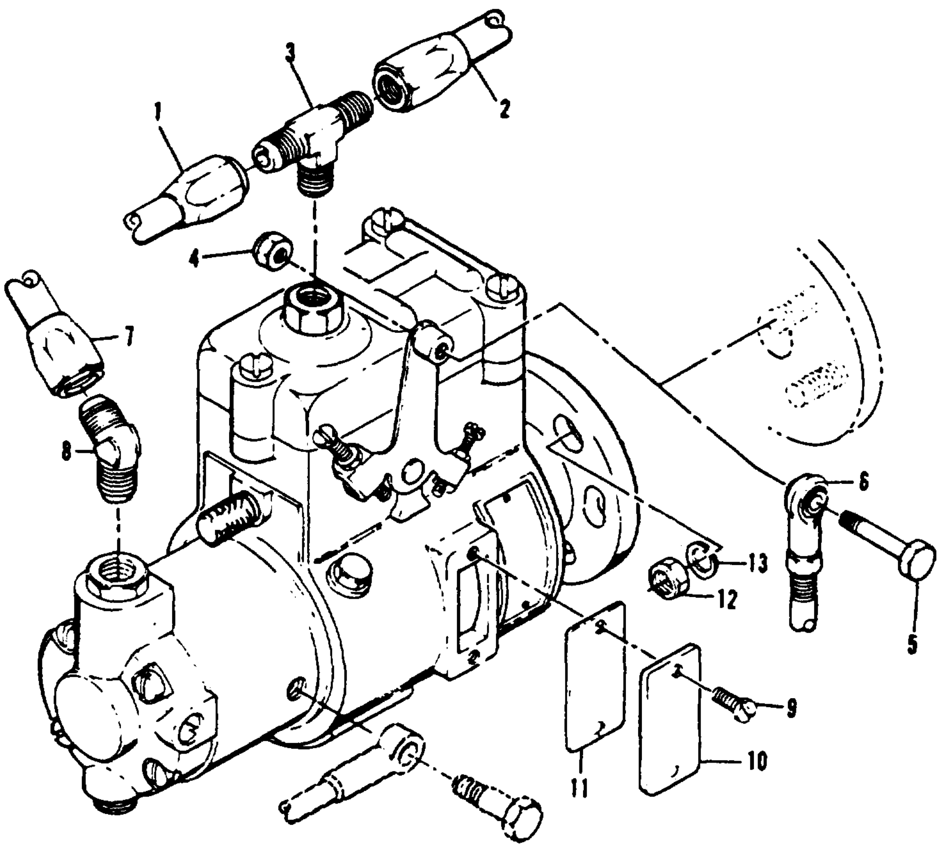


Figure 3-20. Fuel Injection Pump Assembly, Removal and Installation

(1) Refer to the Operator and Unit Maintenance Manual and drain the day tank assembly.

(2) Disconnect injector return lines (1 and 2, figure 3-20) and remove tee (3).

(3) On precise sets, remove self-locking nut (4) and screw (5) to disconnect hydraulic actuator linkage (6). On utility sets disconnect the manual speed control.

NOTE

When fuel pump is removed from the engine for repair, the throttle lever should be tied in the wide open position while it is in transit or storage. This prevents the governor weights from dislodging inside the pump housing.

(4) Disconnect inlet fuel line (7) and remove elbow (8).

(5) Refer to the Operator and Unit Maintenance Manual and disconnect fuel injector lines.

(6) Remove screws (9), timing Iine cover (10), and gasket (11).

(7) Using a suitable wrench on the crankshaft pulley, bar the engine over in the direction of rotation until the timing line on the governor retainer hub aligns with the timing line on the pump cam.

(8) Remove nuts (12) and Iockwashers (13).

CAUTION

Do not allow the pump to “cock” as it is removed, as damage to the pilot tube will result.

(9) Carefully slide fuel injection pump (14) from the timing gear housing.

c. Disassembly. Disassemble the fuel injection pump in the ascending sequence of item numbers assigned to figure 3–21 while observing the following:

NOTE

Place all parts in a pan containing clean oil. Discard all o-rings and gaskets.

CAUTION

Never clamp the pump in a vice without using the fixture. Failure to observe this caution could result in equipment damage.

(1) Mount the pump in holding fixture and secure.

(2) Remove three screws (1) and remove cover containing solenoid.

(3) Rotate shut-off lever (21) to full shutoff position; place a screwdriver between housing and linkage hook (50) and pry off shutoff cam (25). Discard shutoff cam.

(4) Partially withdraw throttle shaft assembly (26) and lift out throttle shaft lever (45), spacers and damper barrel assembly (88).

(5) Remove throttle shaft assembly and shutoff shaft assembly (24).

(6) Loosen end plate sleeve.

(7) Remove screws (63), Iockwashers (64), flat washers (65), and transfer pump and plate (66).

(8) Remove thrust plate (67).

(9) Remove the pressure regulating sleeve (55) from end plate (66). Slide off filter element (57). Remove adjusting plug (54). Shake out the regulating spring (60) and piston (61). Reverse the assembly and remove the regulating piston seal (62).

1. Screw cover
2. Washer, lock
3. Washer, flat
4. Cover, mechanical governor
5. Connector, return line
6. Gasket
7. Nut
8. Nut, lock
9. Washer, contact
10. Washer, insulating
11. Tube, insulating
12. Tube, insulating
13. Spring, shutdown area
14 Sleeve, spring
15. Arm assembly, shutdown
16. Frame assembly, solenoid

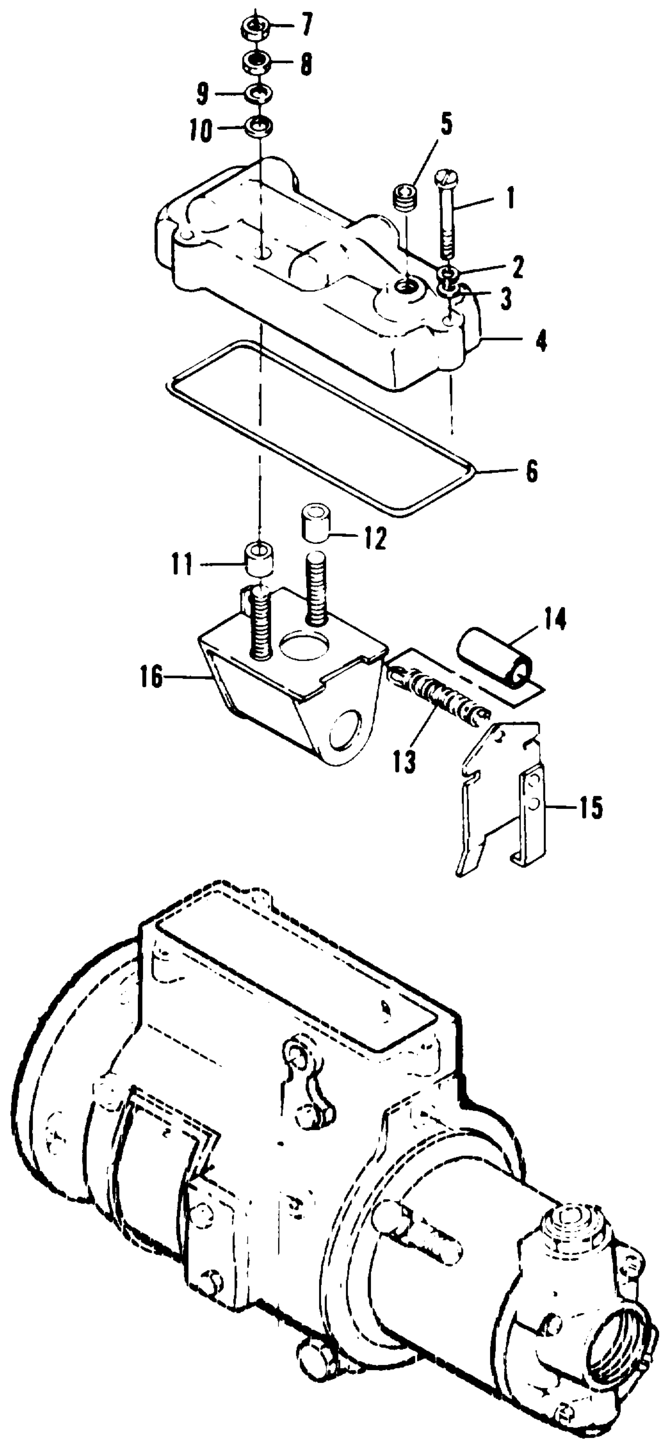
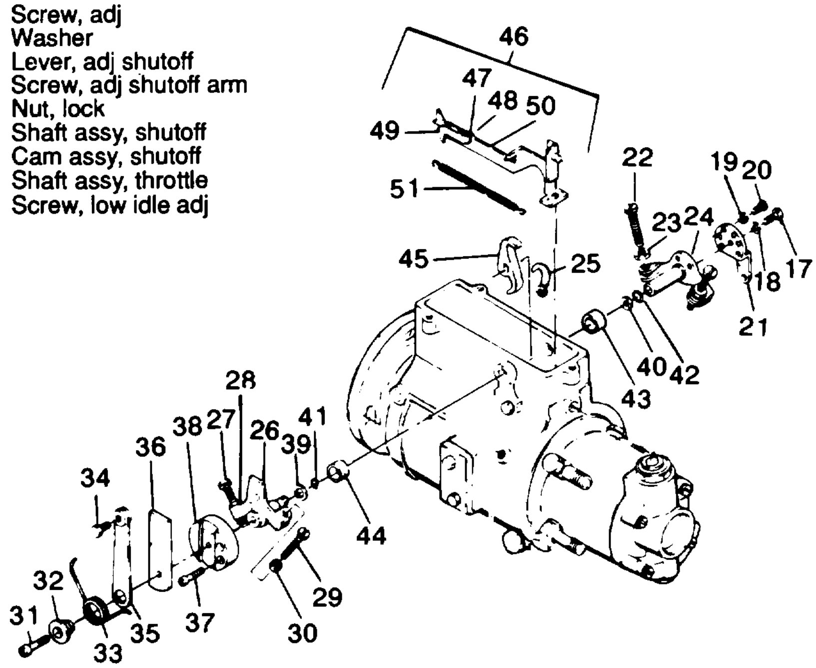


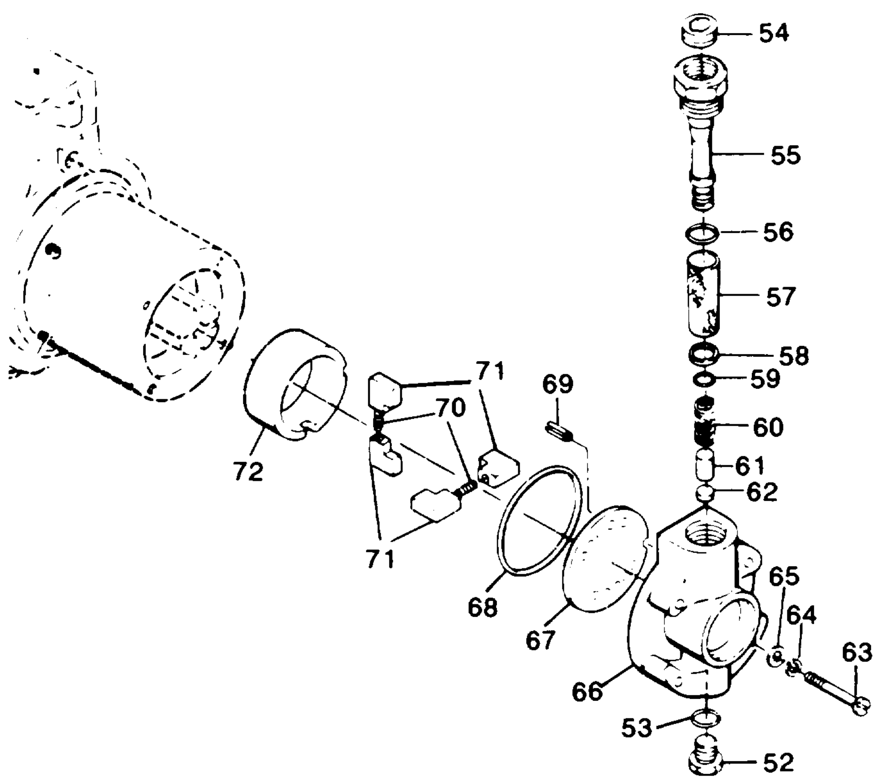
Figure 3-21. Fuel Injection Pump, Exploded View (Sheet 1 of 7)

17. Screw, adj
18. Washer
19. Screw, adj
20. Washer
21. Lever, adj shutoff
22. Screw, adj shutoff arm
23. Nut, lock
24. Shaft assy, shutoff
25. Cam assy, shutoff
26. Shaft assy, throttle
27. Screw, low idle adj



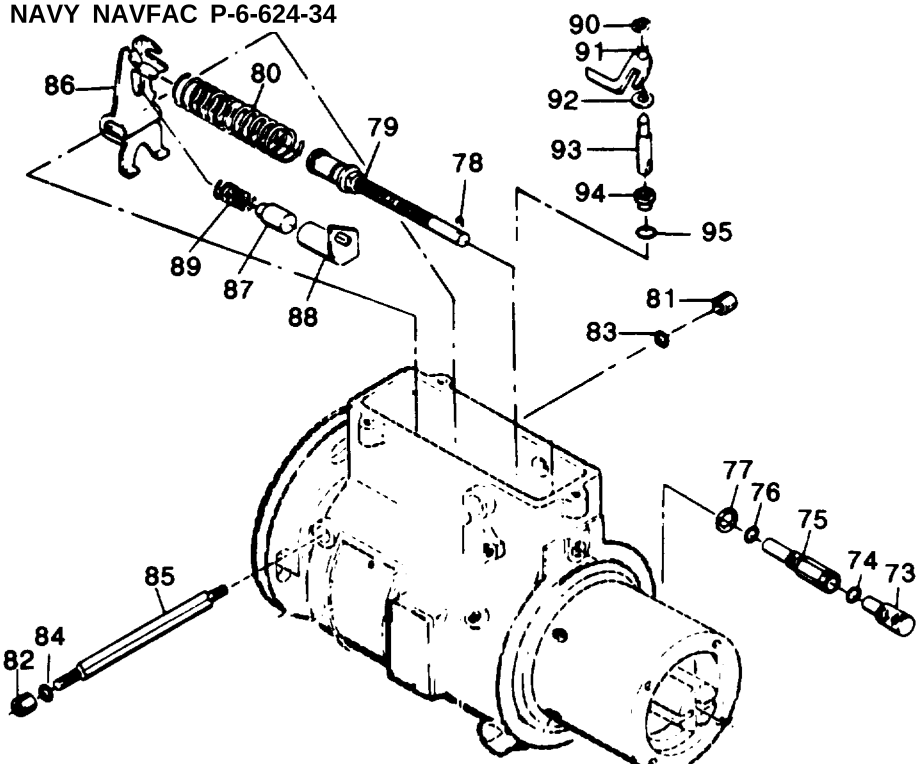
28. Nut, lock
29. Screw, high idle adj
30. Nut, lock
31. Screw, throttle lever spring
32. Retainer, throttle lever spring
33. Spring, throttle lever
34. Screw, throttle lever
35. Lever, throttle
36. Arm, adjusting spacer
37. Screw, positioning
38. Spacer, adj
39. Washer, seal
40. Washer, seal
41. Seal, throttle shaft
42. Seal, shutoff shaft
43. Spacer
44. Spacer
45. Lever, throttle
46. Hook assy, linkage
47. Screw hook adj
48. Washer
49. Link assy, adj
50. Hook, governor linkage
51. Spring, governor linkage

Figure 3-21. Fuel Injection Pump, Exploded View (Sheet 2 of 7)



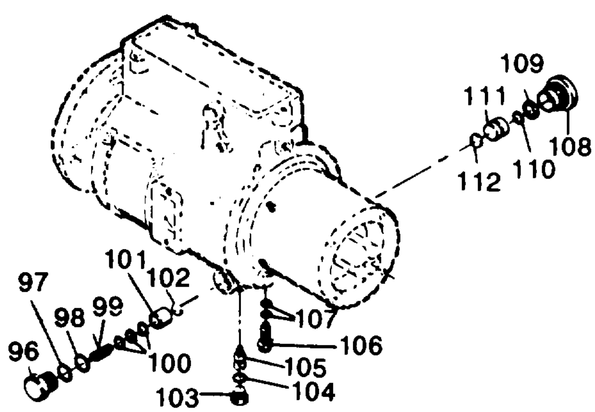
52. Plug, end plate
53. Seal, plug
54. Plug assy, adj
55. Sleeve, end plate
56. Seal, sleeve
57. Element, filter
58. Seal, element
59. Ring, sleeve seal
60. Spring, regulating
61. Piston, regulating
62. Seal, regulating piston
63. Screw
64. Lockwasher
65. Washer
66. Plate, end
67. Plate, thrust
68. Seal, transfer pump
69. Roll pin, locating
70. Spring, blade
71. Blade, transfer pump
72. Liner, transfer pump

Figure 3–21. Fuel Injection Pump, Exploded View (Sheet 3 of 7)



73. Cap assy, adj
74. Seal, cap assy
75. Guide, control rod
76. Washer, guide
77. Seal, guide
78. Pin, control spring
79. Rod assy, control
80. Spring, control
81. Nut, retainer
82. Nut, retainer
83. Seal, pivot shaft
84. Seal, pivot shaft
85. Shaft, governor arm pivot
86. Arm assy, governor
87. Piston assy, governor
88. Barrel assy, damper
89. Spring, damper
90. Washer
91. Arm assy, metering valve
92. Shim
93. Valve, metering
94. Spacer,valve
95. Shim, metering valve

Figure 3–21. Fuel Injection Pump, Exploded View (Sheet 4 of 7)



96. Plug, piston hole (spring)
97. Seal, plug
98. Seal, plug
99. Spring, outer advance
100. Shim, advance spring
101. Piston, spring
102. Washer, slide
103. Plug, adv screw hole
104. Seal, plug
105. Screw, cam advance
106. Screw assy, head locating
107. Seal, screw
108. Plug, piston hole
109. Ring, piston
110. Seal, piston ring
111. Piston, power
112. Washer, slide

Figure 3-21. Fuel Injection Pump, Exploded View (Sheet 5 of 7)

113. Weight, governor
114. Sleeve, thrust
115. Washer, thrust sleeve
116. Ring, rotor retainer
117. Retainer, rotor
118. Ring, cage retainer
119. Cage, governor weight
120. Ring, flexible retaining
121. Cam ring
122. Screw, adj
123. Spring, leaf
125. Roller,cam
126. Shoe, cam
127. Plunger, rotor
128. Screw, fuel line connector
129. Washer, fuel line connector
130. Screw, valve retainer
131. Stop, delivery valve
132. Spring, delivery valve
133. Valve, delivery
134. Hydraulic head
135. Rotor

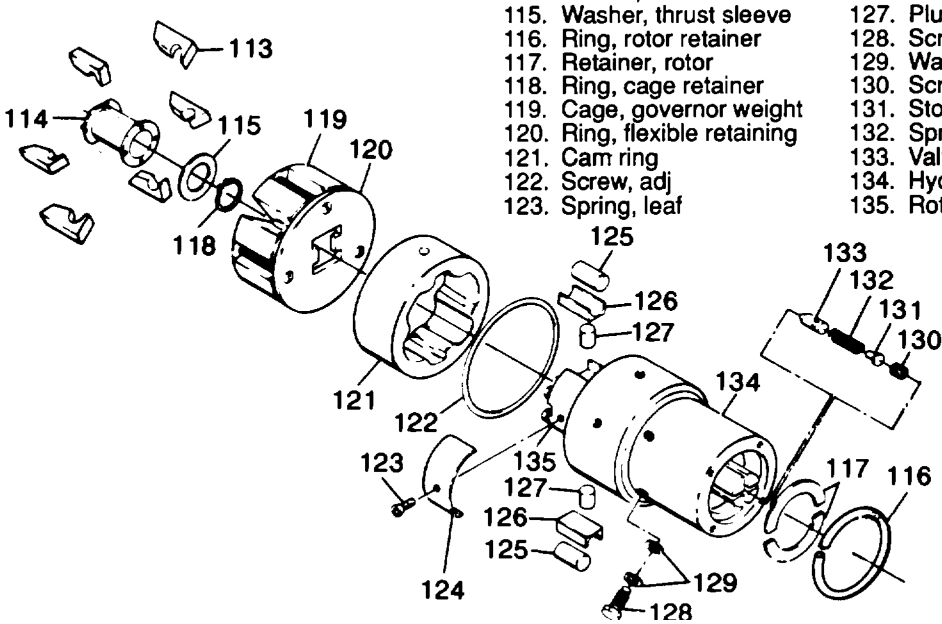


Figure 3–21. Fuel Injection Pump, Exploded View (Sheet 6 of 7)

136. Screw, head locking
137. Screw, head locking
138. Screw, plug
139. Washer,
140. Stop, high idle screw
141. Screw, cover
142. Cover, timing line
143. Gasket, cover
144. Screw, plug
145. Washer,
146. Screw, nameplate
147. Plate, name
148. Shaft, drive
149. Seal, drive shaft
150. Seal, drive shaft
151. Seal, pilot tube
152. Housing assembly

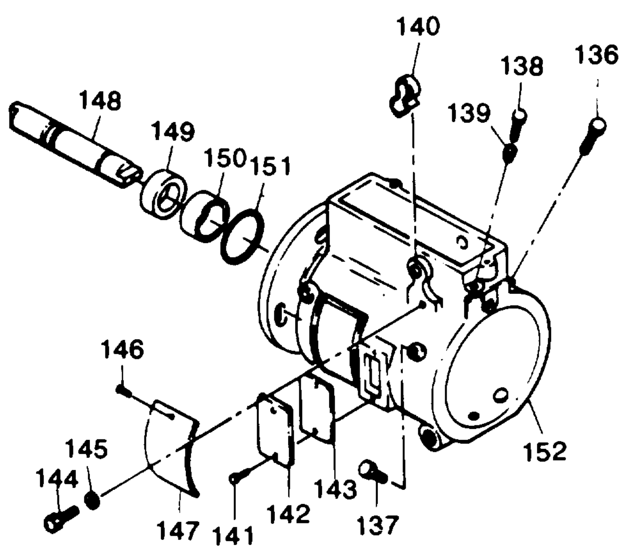


Figure 3-21. Fuel Injection Pump, Exploded View (Sheet 7 of 7)

(10) To disassemble transfer pump, lift out transfer pump seal (68), liner (72), blades (71), and springs (70).

(11) Remove the speed droop adjusting cap assembly (73) by pulling it from control rod guide (75).

(12) Remove and discard control spring pin (78).

(13) Discard seals (74 and 77), control rod guide (75) and washer (76).

CAUTION

Use care not to bend control rod. Failure to observe this caution could result in equipment damage.

(14) Disengage governor spring (80) from the governor arm (86), then remove the governor spring and control rod assembly (79).

(15) Remove the metering valve (93) and arm assembly (91) from the hydraulic head.

(16) Remove head locking screws (136 and 137) from the pump housing (152).

(17) Invert pump and holding fixture as a unit and remove head locating screw (1 06), advance screw hole plug (103). Remove the advance spring and power piston plugs (96 and 108). Using the cam advance screw removal bushing, part number 15500, and the Bristol socket cam advance screw wrench, part number 15499, remove the cam advance screw (105).

NOTE

The sides of the housing just above the advance bears a “C” denoting clockwise pump rotation as viewed from the drive end. The power side of the piston is located on the ‘C” side of a clockwise rotation pump.

(18) Invert the holding fixture in the vise. Grasp the hydraulic head firmly in both hands and withdraw with a slight rotary motion. Use caution not to drop the governor weights (113).

(19) To disassemble the governor, invert the hydraulic head and rotor assembly and let the governor weights (113), governor thrust sleeve (114) and governor thrust sleeve washer (115) fall into your hand.

(20) Place the hydraulic head assembly on pump holding fixture so that the governor weight retainer (1 19) engages the bar on the fixture.

(21) Remove pivot shaft nut (81) and seal (83) from one side of pivot shaft (85). Slide pivot shaft out one side of the housing and lift out governor arm (86).

(22) Using a 5/32 inch Allen wrench, loosen the delivery valve retainer screw (130) and remove it.

(23) Lift head and rotor assembly and shake delivery valve stop (131), spring (132), and delivery valve (133) into the hand. If delivery valve sticks, remove using extractor. Discard delivery stop.

(24) Using a small–bladed screwdriver or a dull scribe, disengage and remove the rotor retainer snap ring (116). This releases the rotor retainers which should now be moved outward as far as possible to clear the rotor.

CAUTION

When the rotor retainers are removed, the rotor is no longer retained in the head. Failure to observe this caution could result in equipment damage.

(25) Gently lift the hydraulic head off the distributor rotor (135). Invert the hydraulic head and shake out the rotor retainers (117).

(26) Lift off the cam ring (121). Check and record the roller-to-roller dimension as instructed in the assembly procedures. This dimension should be 1.9640 ± 0.0005 inches. Remove rollers (125), shoes (126), plungers (127), and leaf springs (124). Discard spring screws (123).

CAUTION

Do not handle rotor shank. Failure to observe this caution could result in equipment damage.

(27) Remove governor weight retainer snap ring (118) with snap ring pliers.

(28) The flexible retaining ring (120) should be replaced whenever the pump is disassembled. Insert the snap ring plier, in the closed position, under the edge of the retaining ring between only two of the rivets. Spread the pliers while applying pressure in an upward direction. A slight twisting motion will snap the ring off the rivet. Repeat the process until the retaining ring is free from all rivets. Discard the retaining ring.

d. Cleaning. Inspection. and Repair.

(1) Inspect all springs, bores, grooves, and seal seats for wear, breakage, or damage. Repair or replace as necessary.

(2) Carefully inspect transfer pump blades for chipping on any edges, pitting, imbedded foreign particles, or wear on the rounded ends. Visually check flat surfaces for scores. Determine blade wear by measuring the length (0.538 inches minimum).

CAUTION

Do not handle the rotor shank. Do not force the plungers into their bore. Failure to observe this caution could result in equipment damage.

(3) While holding the rotor under fuel, insert the plungers into their bore. With thumb and forefinger over the guide slots, tilt the rotor from side to side several times to insure complete freedom of movement of the plungers. Interchanging or reversing their individual positions may be necessary, as these are mated parts. Replace defective parts. If plungers are not visibly damaged, clean them with a soft brush and a lacquer removing solvent such as lacquer thinner or acetone.

(4) Examine the radii of the rotor which is contacted by the leaf springs, and the weight retainer for wear. Check all slots, charging and discharge parts of the hydraulic head for chipping or erosion of edges. Check the rotor shank for scratches.

NOTE

The rotor and hydraulic head are matched parts and shall be replaced as a unit.

(5) Check the vent wire in the hydraulic head air bleed passage for freedom of movement. If the wire is free, flush the head and blow out all passages with clean, dry compressed air. If the wire is stuck, replace it after thoroughly cleaning the passages.

(6) Check each cam roller for freedom of rotation in its shoe. Check each shoe for chipping or wear on the surface contacted by the leaf spring.

(7) Check the leaf springs for cracks, nicks, chipping, or distortion. Check for damage and wear along rotor radii contact points and steps which retain roller shoes.

(8) Examine the retainer sockets of governor weight retainer and the pivot point of each governor weight for evidence of wear or damage. Replace the flexible snap ring (120) of the weight retainer.

(9) Inspect the pivot points of the governor arm (86) pivot shaft for wear. Check the governor arm tabs at the point which contacts the thrust sleeve. If either tab is worn flat, replace the governor arm.

(10) Examine the junction points of the metering valve pin hole in the linkage hook, throttle lever, shutoff cam, and shutoff lever for looseness and burrs.

(11) Check the metering valve body for wear. Ascertain that the metering valve arm is well seated and there is no radial movement of the arm on the valve. Check the metering valve arm pin for wear or looseness.

(12) Carefully inspect the bore and edges of all flat surfaces of the cam. If evidence of spatting or flaking out exists, replace the cam.

NOTE

Since only the working portions of the cam lobes on the bore are ground, the tool marks between lobes should not be considered as damage. The cam finish is mottled from heat treatment rather than operation.

(13) Visually inspect the drive shaft for undue wear or cracking. Check the diameter where the thrust sleeve slides for scores. Check for smoothness of seal grooves. They must be absolutely smooth.

(14) Check the regulating piston for freedom of movement in the end plate sleeve. Check all threads for damage. The filter element should bear no evidence of damage. Clean all dirt or rust from the element.

CAUTION

Check for tightness of the orifice plate. Replace adjusting plug if plate is loose. Failure to observe this caution could result in equipment damage.

(15) Check that the damper piston (87) moves freely in the damper barrel (88). Inspect for chipping of piston or scratches to the piston and damper barrel bore. The bleed orifice should allow free flow when the piston is inserted. Replace components as necessary.

e. Assembly.

NOTE

All parts should be flushed in clean oil as they are assembled. Replace all seals and gaskets.

CAUTION

Install piston seal dry. Do not use grease. Failure to observe this caution could result in equipment damage.

(1) Insert regulating piston seal (62) into the lower end of the regulating sleeve assembly (55) far enough to expose retaining ring groove. Install retaining ring (59).

(2) Install regulating piston (61) and spring (60) into the sleeve making sure that the piston slides to the bottom of the sleeve bore without binding.

(3) Install end plate adjusting plug (54) into the sleeve until all threads are just below port “A”.

CAUTION

Do not exceed this position as excessive transfer pump pressure could occur. Failure to observe this caution could result in equipment damage.

(4) Insert regulating sleeve assembly into the bore in end plate (66).

(5) Fit the transfer pump thrust plate (67) on the end plate (66).

NOTE

The thrust plate may be reversed if one side appears worn or scratched. A small amount of grease may be used to hold the thrust plate in place,

CAUTION

Do not use force when inserting rotor. Binding may be caused by the presence of foreign particles. If rotor binds, withdraw it, rinse the rotor and hydraulic head in clean fuel and attempt to assemble again. Failure to observe this caution could result in equipment damage.

(6) Immerse rotor (135) and hydraulic head (134) in clean oil and assemble with a slight rotary motion.

(7) Install delivery valve (133) making sure that it moves freely in its bore. Install spring (132) and stop (131). Install screw (130) and torque to 85-90 inch-pounds.

NOTE

The screw (130) has one end which is relieved to clear the delivery stop. Be sure that this end faces the stop.

(8) Place the hydraulic head and rotor in the holding fixture. Insert plungers (127) into the rotor bores. Install shoes (126), rollers (125) and leaf springs (124).

(9) Adjust roller-to-roller dimension as follows: (See figure 3-22.)

(a) Apply clean, dry air at 30 to 100 pounds per square inch by means of a suitable fitting to any one of the head outlets.

(b) Rotate the rotor until the rollers are pushed to their extreme outward position.

(c) Using a 1 inch to 2 inch micrometer, measure the roller-to-roller dimension. If roller-to-roller dimension is not 1.964 ± 0.0005 inch, adjust screw (123, figure 3–21).

NOTE

Turning screw clockwise increases the roller–to–roller dimension. Turning screw counterclockwise reduces roller-to-roller dimension.

(10) Place the cam ring (121, figure 3-21) atop the hydraulic head, making sure that the rotation arrow points clockwise.

(11) Place the governor weight retainer (119) over the drive of the distributor rotor. Make sure that the assembly marks on the weight retainer and the rotor align with each other. Install retaining ring (118).

CAUTION

Use care when inverting the hydraulic head, as the rotor is not retained and could easily fall out. Failure to observe this caution could result in equipment damage.

(12) Invert the hydraulic head in the holding fixture so that the governor weight retainer engages the bar.

(13) Lift the hydraulic head slightly so that its inside face aligns with the rotor end and install retainers (117). Install retaining ring (116).

(14) Insert the transfer pump liner (72) into the hydraulic head so that the large slot is in line with the head locating screw hole and the letter “C”, which signifies pump rotation, is up. This will correctly position the liner locating slot to accept the end plate locating pin.

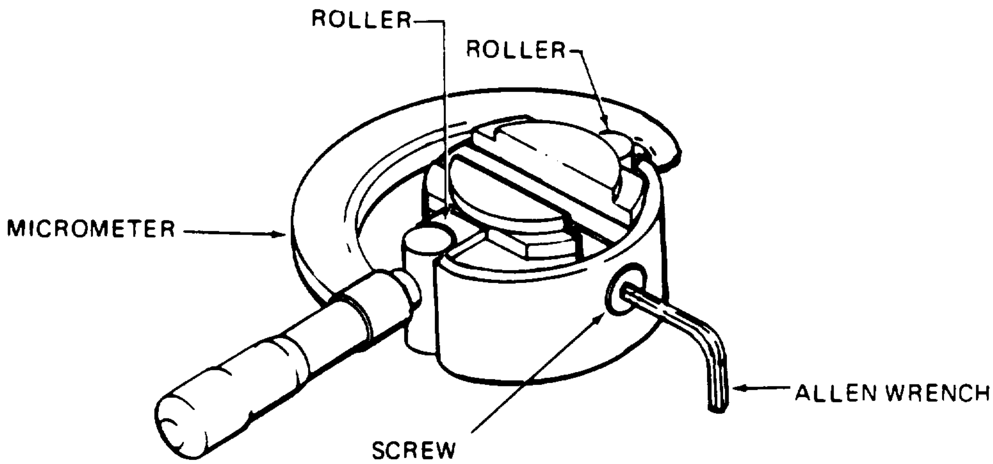


Figure 3-22. Adjusting Fuel Injection Pump Roller-to-Roller Dimension

(15) Carefully insert the transfer pump blades (71) and springs (70) taking care not to cock them. Rotate the liner several times to check for freedom of movement. Return the liner to the correct position.

(16) Install transfer pump seal (68).

(17) Slip the head and rotor assembly, drive end up, into the holding fixture. Place the six governor weights (113) in their sockets with the slots facing the bore of the assembly. Place the thrust sleeve washer (115) against the thrust sleeve (114) so that the camfered edge faces the sleeve. Insert the forefinger into the bore of the sleeve and washer, holding them together, and insert them into the slots of the governor weights by tilting the weights slightly back. The two slots on the thrust sleeve flange should face up. Sight across the tops of the assembled weights to ascertain correct positioning. One weight higher than others indicates incorrect assembly of the thrust washer.

(18) Place the governor arm (86) in position with the fork for the governor linkage hook facing the end plate. Insert pivot shaft (85) with the knife edge facing the end plate and assemble the two seals (83 and 84) and nuts (81 and 82). Tighten the nuts simultaneously to a torque of 20 to 25 inch-pounds.

(19) install a new seal (122) on the hydraulic head. Rotate the cam ring so that the unthreaded hole is in line with the metering valve bore to insure proper positioning of the cam. Apply a light film of clean grease around the inside edge of the housing (152).

CAUTION

Do not use force. If the hydraulic head should cock during insertion, withdraw and start over. Failure to observe this caution could result in equipment damage.

(20) Grasp the hydraulic head firmly in both hands and insert it into the housing with a slight rotary motion.

NOTE

Make sure that the assembly is wrung into position past the hydraulic head seal (122). Failure to do this may result in leakage.

(21) Rotate the hydraulic head until the head locking screw holes are aligned. Install head locking screws (136 and 137) finger tight.
(22) Invert the pump and holding fixture in the vise so that the bottom faces up.
(23) Install seals (107) and head locating screw (106).
(24) Install seals on piston plugs (96 and 108).
(25) Install piston ring seal (110) and piston ring (109).
(26) Install cam advance screw (105) using tool number 15500 and 15499 and torque to 400 inch- pounds. Install seal (104) and plug (103).
(27) Using the piston ring installing tool (part number 16199), slide power piston plug (108) over piston (111).
(28) Install spring (99), shim (100), piston (101), and slide washer (102) into plug (96). Install seal (98) onto plug (96).
(29) Install plugs (96 and 108) with their assembled parts into the housing and torque to 215 to 265 inch-pounds.

NOTE

Make sure that the power piston plug is on the right side of the pump as viewed from the transfer pump end.

(30) Torque plug (103) to 75-100 inch-pounds

(31) Torque head locating screw (106) to 300 inch-pounds

(32) Torque head locking screws (136 and 137) to 180-220 inch-pounds

(33) Invert the pump and holding fixture in the vise

<u>CAUTION</u>

Never sand or polish off the special treatment on the valve. Failure to observe this caution could result in equipment damage.

(34) Install the metering valve (93) and shims (95) into its bore. Depress and rotate the valve several times to insure freedom of movement. If valve sticks, lap it carefully in dean oil.

(35) Metering Valve Setup:

(a) Install No.shim and No.16575 spacer on metering valve.

(b) Thread control rod guide No. 20223 into pump (finger tight).

(c) Check clearance between valve and control rod guide. Add shim No. 16576 through 16583 (as required) to control clearance between 0.002 in. and 0.005 in. maximum.

(36) Pull back on the governor linkage hook (50) stretching the spring just enough to Connect the hook correctly to the fork on the governor arm (86). Position the other end over the pin on the metering valve arm (91). Check all governor parts again for freedom of movement

(37) With the end plate (66) removed, install the speed droop control rod though threaded hole from inside of pump housing.

(38) Slide speed droop guide (75) with seal (77), assembled over end of rod (79) and thread into the housing. Tighten securely.

(39) Insert control spring pin (78) into hole at end of rod (79).

(40) Assemble seal (74) to groove at end of guide (75) and install speed droop cap assembly (73) over seal.

(41) Install end plate (66), making sure that guide pin (69) enters the slot in the transfer pump liner (72). Install flat washers (65), lockwashers (64), and screws (63) and torque to 25 to 30 inch-pounds.

(42) Thread five full turns of spring (80) onto speed droop control rod (79). Slide the free end of the spring over the formed ends of the governor arm (86) with the bent-in ends of the spring between the two tabs.

NOTE

The apparent looseness in the governor parts is normal. Lost motion is immediately taken up as soon as the pump actuates.

(43) Assemble the throttle shaft assembly (26) with lever (35) installed partially into position through the housing. Slide the spacer bushing (44) and the throttle shaft lever (45) over the throttle shaft so that the projection on the throttle shaft lever bore engages the keyway on the shaft. Position the throttle lever so that its forward tab straddles the linkage hook tab. Apply a light coat of grease to the throttle and shut off seals (41 and 42). Assemble the shutoff shaft assembly (24) from the opposite side of the housing with a slight rotary motion. Locate and secure shutoff cam (25).

(44) Rotate the shaft until a click is heard. This is the governor arm (86) engaging the governor thrust sleeve.

(45) With the throttle shaft in the wide open position, check the clearance between the rear of the throttle shaft (B) and the vertical tab (A) on the linkage hook. This clearance should be 0.210 to 0.225 inch. (See figure 3-23.)

NOTE

Adjustment of this clearance is made by changing the effective length of the linkage hook.

(46) With adjusting screw (C) tight, apply pressure to tab (A). At the same time, rotate one or two complete revolutions to assure that the linkage is in the full forward position. Loosen adjusting screw (C) and slide the linkage to the full forward position. Insert linkage gauge No. 18914 between the vertical tab (A) and the shutoff shaft (B). Slide the linkage hook until the face of the tab is flush against the gauge. Tighten adjusting screw (C) and remove gauge. Check the adjustment and reset if necessary.

(47) Check all governor parts for freedom of movement.

(48) Assemble frame assembly (16, figure 3-21), spring sleeve (14), spring (13) and arm assembly (15).

(49) Adjust armature as illustrated in figure 3-24.

(50) Install new insulating tubes (11 and 12, figure 3-21) and secure frame to cover (4) with insulating washers (10), contact washers (9), and lock-nuts (8).

(51) Install new gasket (6) to cover (4) and secure cover to pump with flat washers (3), lock-washers (2) and screws (1).

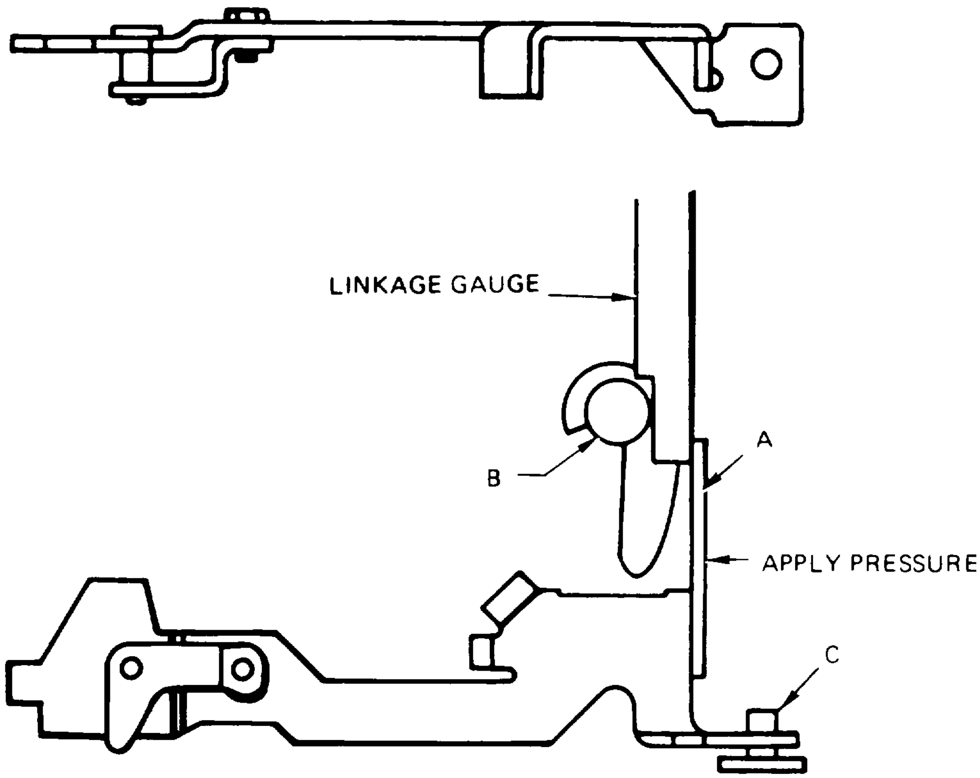


Figure 3-23. Throttle Linkage Adjustment

f. Fuel Inject Pump Bench Test.

(1) General. The bench test procedure is based on the following renditions:

(a) Injection lines are 3/32 inch ID by 30 inches long.

(b) Fuel readings are based on fuel with a viscosity of 34-36 SSU at 100°F.

(c) Fuel temperature at 110° to 115°F.

(d) Nozzles, part number 12SD12, adjusted to opening pressure of 2500 psi (170 ATS).

(2) Test procedure.

(a) Mount pump securely in diesel injector test stand using a suitable adapter. The drive adapter, usually with a ball bearing, supports the shaft. This pump must be tested with an intermediate support bearing. Install high pressure injection lines using new gaskets. Leave fuel line connector screws at pump and injection line nuts at the nozzles loose. Install fuel inlet and return lines. Install transfer pump pressure gauge with a shutoff valve as close to the transfer pump as possible.

NOTE

Transfer pump pressure gauge must be isolated by shutoff valve at the fuel injection pump when checking fuel delivery and advance movement.

(b) Set counter and tachometer switches to clockwise position.

NOTE

Pump runs at half the engine speed.

(c) Start the test stand at lowest speed and check for clockwise rotation. Move throttle to full-load position. When transfer pump picks up suction, allow fuel to bleed for several seconds from loosened connector screws and injection line nuts, then tighten securely.

WARNING

Compressed air used for cleaning and drying purposes can create airborne particles that may enter the eyes. Pressure shall not exceed 30 psig and use only with adequate chip guards and chipping goggles. Failure to observe this warning could result in servere personal injury.

(d) Operate pump at 500 rpm for 10 minutes. Dry off completely with compressed air.

Observe for leaks and correct as necessary. Back out high idle stop screw.

NOTE

The inlet to the fuel transfer pump should never be pressurized during bench testing.

(e) Close valve in supply Iinetransfer pump must pull at least 18 inches of mercury at 200 rpm. If it does not, check for air leaks on suction side or malfunction of end plate and transfer pump parts.

(f) Fill graduates to bleed air from test stand and to wet glass.

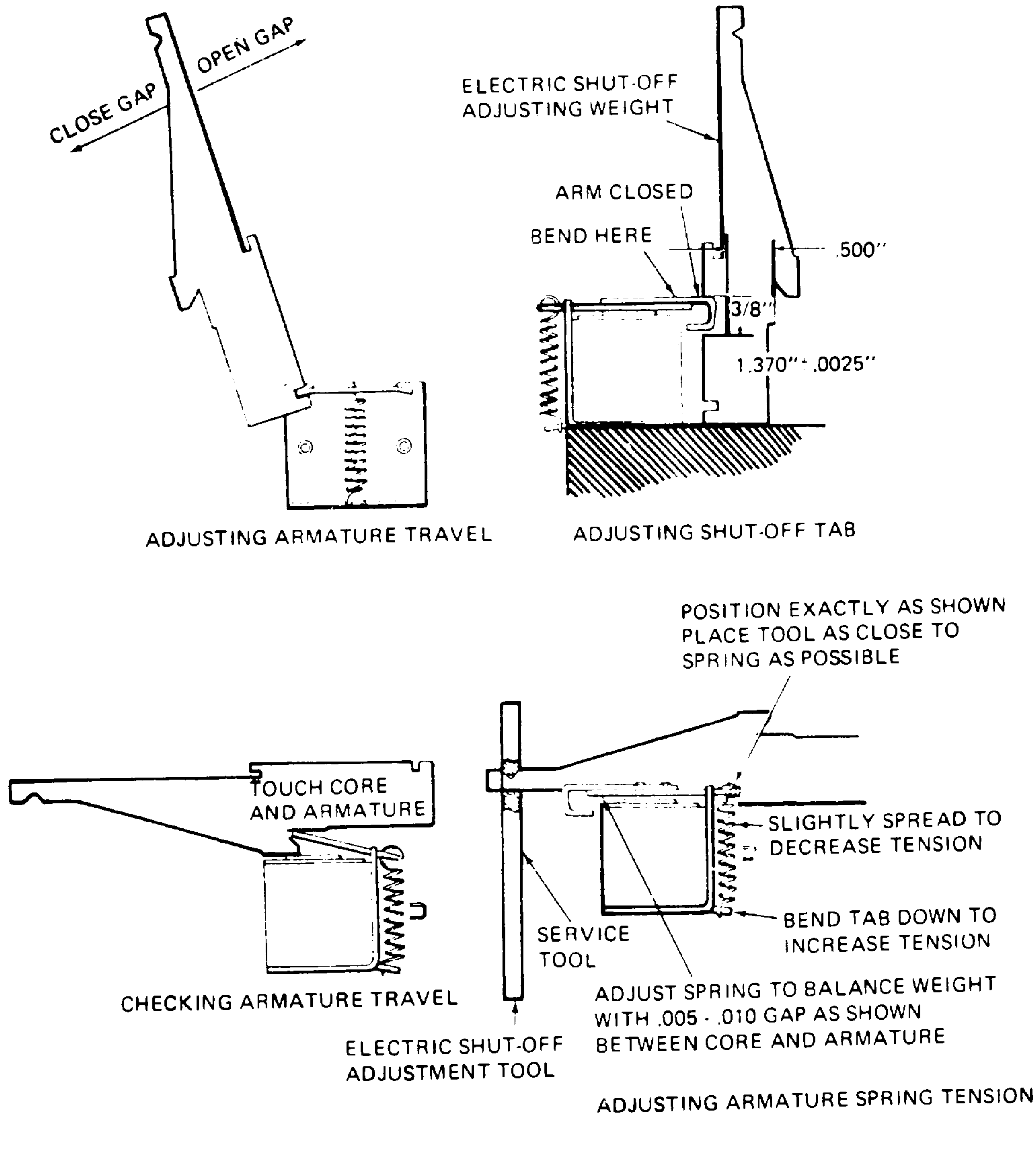


Figure 3–24. Solenoid Armature Adjustments

Table 3-1. FUEL DELIVERY

PUMP RPM	DELIVERY (mm3/stroke)	PRESSURE PSIG	MAX VAR BETWEEN CYLINDERS
900	58-59	70-75	3
750	55-58		4
927 (high idle)	15-20		

(g) Observe return oil. Return should be at rate of 100-450 cc/minute at 35 psi transfer pump pressure.

CAUTION

Under no circumstances should 130 psi be exceeded, as the pump will be damaged. Failure to observe this caution could result in equipment damage.

(h) Operate pump at 900 rpm, with wide open throttle and observe transfer pump pressure. Pressure should be 70 to 75 psig. If it is not, use a hex key wrench and adjust pressure regulating spring by 1/4 turns, clockwise to raise pressure – counterclockwise to lower pressure.

(i) Perform automatic advance check as follows:

NOTE

Each mark on the timing window is 2 pump degrees.

1. Check at 250 to 400 rpm for one degree cam movement.
2. Drain burettes for 30 seconds minimum.
3. Check at 450 to 550 rpm for 3-1/2 degree cam movement.

(j) Perform speed droop adjustment as follows: (See table 3-1.)

1. At 900 rpm and wide open throttle, adjust high idle screw temporarily for 15-20 mm3 delivery per stroke.
2. Raise pump speed to 927 rpm and turn the droop adjustment cap assembly clockwise as viewed from the transfer pump end of injection pump to obtain a delivery of 15-20 mm3 per stroke.
3. Lower pump speed to 900 rpm and check full load delivery rate. If 58-59 mm3 delivery rate is not realized, repeat steps 1. and 2. above until 58-59 mm3 is obtained.
4. When step 3. requirements are met, lock the high idle adjusting screw.
5. If fuel pump is to be used for 400 HZ application, reset high idle speed screw to 1,125 rpm.

(k) Check delivery at 750 rpm. If delivery is not 55-58 mm3 per stroke, repeat step (j) above until it is.

(1) Raise pump speed to 950 rpm and check for a delivery rate of 5 mm3 maximum.

(m) Lower pump speed to 900 rpm and reenergize the solenoid. Check for 5 mm3 maximum delivery rate.

(n) At the same speed, energize the solenoid and check the manual shutoff for the same delivery rate of 5 mm3 maximum.

(o) At a pump speed of 200 rpm, repeat steps (n) and (o). Delivery shall be 2 mm3 maximum.

(p) Check minimum cranking speed delivery as follows:

1. Check transfer pump for 8 psig minimum and close the shutoff valve to gauge.

2. Check for 35 mm3 per stroke, minimum, at 75 rpm.

(q) Remove pump from test stand.

g. Installation.

(1) Remove fuel injector nozzle from No. 1 cylinder.

(2) Turn the engine over until the 20 degree before top dead center (BTDC) mark on the flywheel is lined up with the timing mark on the flywheel housing, and No. 1 cylinder is on compression stroke.

(3) Remove the timing hole cover on the injection pump and rotate the pump shaft until the timing marks line up.

NOTE

The pump shaft should never be turned backwards to align internal timing marks.

(4) Install pump on engine and install attaching hardware.

(5) Recheck flywheel timing marks then rotate the fuel pump body until the pump timing marks are exactly in line. Tighten pump attaching nuts to 35 to 40 ft-lb.

NOTE

After fuel injection pump is installed, rotate engine 180 degrees backwards. Then rotate engine in correct rotation until 20° BTD timing marks on the flywheel appears in flywheel timing hole and recheck pump timing marks.

(6) Install pump timing hole cover.

(7) Install fuel Injection lines.

NOTE

New injection pumps received from supply have a high idle adjustment of 1,860 rpm for 60 HZ applications. Installation on 400 HZ generator sets requires resetting the high idle adjustment screw (29, figure 3-21) to 2,250 rpm Adjustment is accomplished using an engine speed tachometer, with actuator linkage (6, figure 3-20) disconnected, the shutoff lever (21, figure 3-21) in the on-fuel condition, then manually operating the throttle lever (35, figure 3-21) against high idle stop.

NOTE

When replacing the fuel lines, always use new gaskets.

(8) Connect throttle linkage and stop control.

(9) Connect fuel supply and return lines.

(10) Replace No. 1 fuel injection nozzle in No. 1 cylinder.

(11) Bleed the air from the fuel system.

3-23. FUEL INJECTION NOZZLE HOLDERS AND LINES.

a. Removal. Refer to the Operator and Unit Maintenance Manual for fuel injection nozzle holders and lines removal instructions.

b. Disassembly.

(1) Unscrew spray cap (1, figure 3-25) and remove pintle holder (2) and pintle (3).

(2) Remove cap (4) and washer (5).

(3) Remove lock nut (6), adjusting screw (7), and washer (8) to remove spring (9) and spindle (10) from body (11).

c. Cleaning and Inspection.

WARNING

Solvent, MIL-C-38736 is flammable and highly toxic to skin, eyes and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate. Failure to observe this warning could result in servere personal injury.

(1) Soak nozzle holder parts in solvent, Methy Ethyl Ketone (MEK), and dry with a clean, lint-free cloth.

(2) Soak nozzle holder parts in a container of clean fuel and dry with a clean, lint-free cloth.

(3) Inspect pintle, pintle holder and spray cap for cracks, corrosion, erosion from fuel flow and other damage.

(4) Check body, spindle, and cap for cracks, corrosion, breaks, and other damage.

(5) Check spring for fretting, cracks, breaks, corrosion, and distortion.

(6) Check all threaded parts for cross, stripped, or otherwise damaged threads.

d. Repair. Repair nozzle holder by replacing defective parts.

e. Assembly.

(1) Install spindle (10, figure 3-25) and spring (9) into body (11).

(2) Install washer (8), adjusting screw (7) and locknut (6).

(3) Insert pintle (3) into pintle holder (2).

(4) Position pintle holder in body and secure with spray cap (1).

(5) Do not install washer (5) and cap (4) until after adjustment.

f. Testing and Adjustment.

(1) Install repaired nozzle holder on a standard static fuel nozzle testing fixture.

(2) Tighten adjusting screw all the way down.

(3) Apply fuel at 2500-2950 psig and slowly loosen adjusting screw until nozzle begins to open.

(4) Tighten locknut while holding adjusting screw with screwdriver.

(5) Lower fuel pressure. Nozzle holder assembly shall close.

(6) Slowly increase fuel pressure. Nozzle holder shall open at 2500-2950 psig.

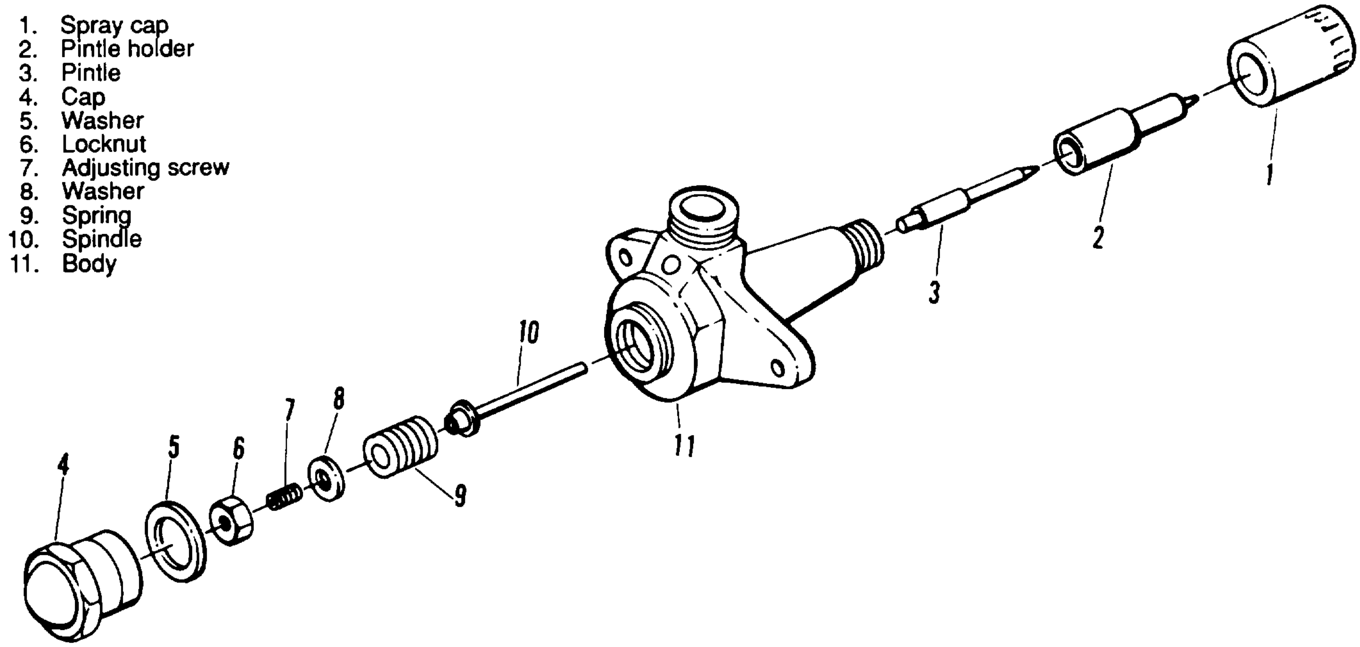


Figure 3-25. Fuel Injection Nozzle Holder, Exploded View

(7) Observe fuel spray. Fuel spray shall be even and smooth. Spray cone shall be same thickness at a distance of 5 inches. There shall be no signs of leakage.

(8) Remove fuel pressure and remove nozzle holder from testing fixture.

(9) Install washer (5, figure 3-25) and cap (4).

g. Installation. Refer to the Operator and Unit Maintenance Manual for fuel injection nozzle holder and lines installation procedures.

3-24. FUEL LINES.

Refer to the Operator and Unit Maintenance Manual for fuel lines maintenance instructions.

3-25. START AID ASSEMBLY.

Refer to the Operator and Unit Maintenance Manual for start aid assembly maintenance instructions.

Section III. MAINTENANCE OF ENGINE COOLING SYSTEM

3-26. GENERAL.

The engine cooling system is a circulating pressure type system. It consists of a radiator, a belt driven cooling fan and centrifugal water pump, a coolant control thermostat, a thermostatically controlled shutter assembly, and a protective grille. The water pump receives coolant from the lower radiator hose and circulates it through the engine cylinder block and cylinder head. As it circulates through the engine, the coolant absorbs heat generated by engine operation. When the engine reaches normal operating temperature, the coolant control thermostat opens and the coolant returns to the radiator through the upper radiator hose. As the heated coolant circulates through the radiator, the cooling fan blows air through the radiator air passages which dissipates the heat. The shutter assembly blocks the flow of cooling air until the coolant in the radiator reaches normal engine operating temperature.

3-27. GRILLE.

Refer to the Operator and Unit Maintenance Manual for grille maintenance instructions.

3-28. SHUTTER CONTROL ASSEMBLY.

a. Removal. Refer to the Operator and Unit Maintenance Manual for shutter control assembly removal instructions.

b. Disassembly.

(1) Remove screws (1, figure 3-26) and lockwashers (2) to remove housing (3), gasket (4), thermostat (5), nut (6) and piston (7). Discard gasket.

(2) Remove and discard packing (8).

(3) Remove retaining rings (9) and loosen setscrews (10) to remove shaft assembly (11). Do not disassemble setscrews (12), cam (13) and shaft (14) unless inspection reveals damage.

(4) Remove bushings (15).

(5) Remove retaining rings (16) to remove shaft (17), lever (18) and bushings (19).

(6) Remove retaining ring (20) to remove actuator pin (21) with assembled parts.

(7) Remove retainer (22), spring (23) and washers (24, 25, and 26) from actuator pin.

(8) Remove nut (27), spring (28), screw (29), and flat washer (30) to remove manual control arm (31) from flange (32).

c. Cleaning,. Inspect, and Repair.

WARNING

Solvent, Dry Cleaning P-D-680, Type II is flammable and moderately toxic to skin, eyes and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate. Failure to observe this warning could result in severe personal injury.

(1) Clean all parts with dry cleaning solvent (Federal Specification P-D-680) and dry thoroughly.

(2) Visually inspect housing and flange for cracks, breaks, corrosion, and other damage.

(3) Inspect shafts and pin for scores, deep water patterns and other damage.

(4) Inspect manual control arm for cracks, corrosion and excessive wear.

(5) Check springs for cracks, corrosion, breaks, chaffing and distortion.

(6) Inspect lever for cracks, corrosion, and excessive wear.

1. Screw
2. Lockwasher
3. Housing
4. Gasket
5. Thermostat
6. Nut
7. Piston
8. Packing
9. Retaining ring
10. Setscrew
11. Shaft assembly
12. Setscrw
13. Cam
14. Shaft
15. Bushing
16. Retaining ring
17. Shaft
18. Lever
19. Bushing
20. Retaining ring
21. Actuator pin
22. Retainer
23. Spring
24. Washer
25. Washer
26. Washer
27. Nut
28. Spring
29. Screw
30. Flat washer
31. Manual control arm
32. Flange

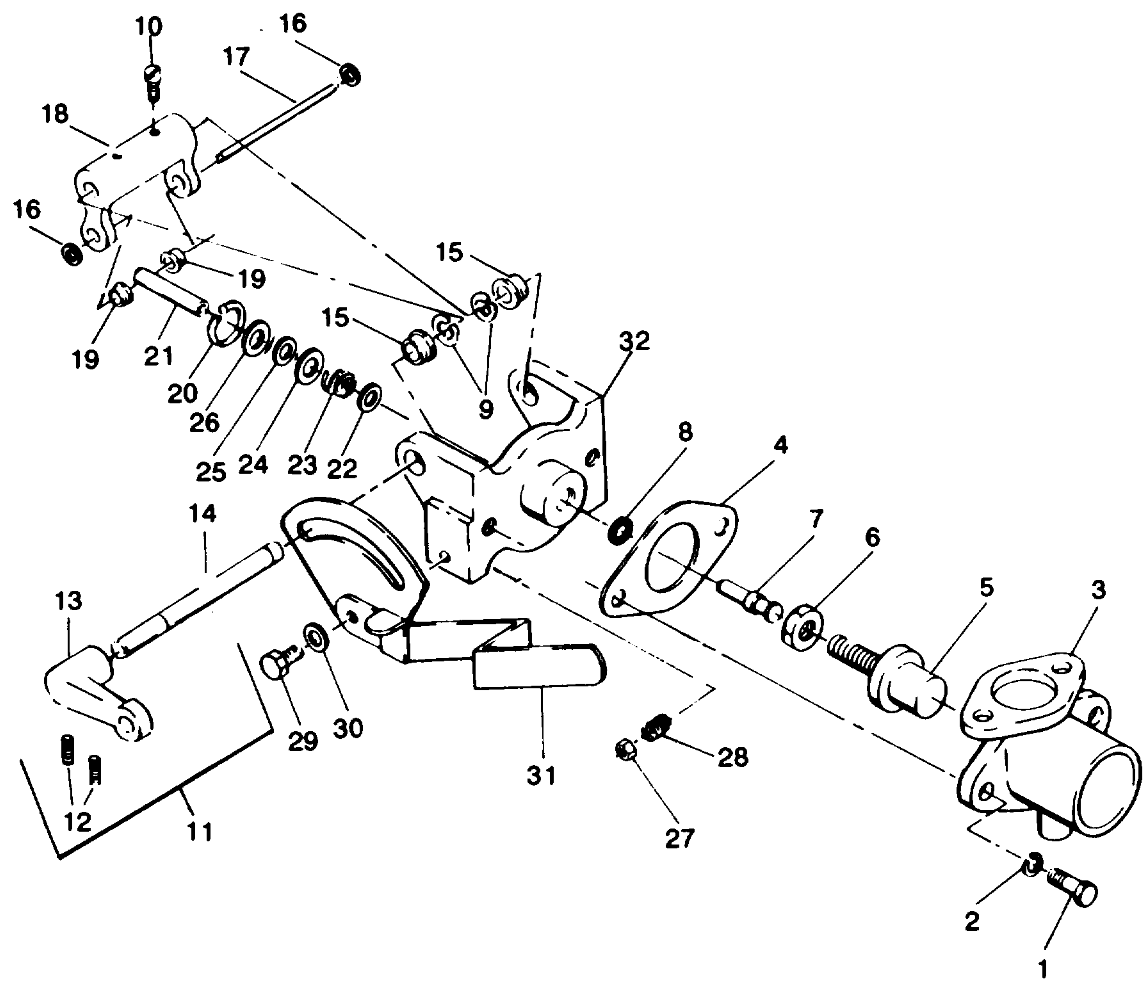


Figure 3-26. Shutter Control Assembly, Exploded View

(7) Inspect bushings for scores and excessive wear.

(8) Refer to the Operator and Unit Maintenance Manual and test thermostat.

(9) Replace any damaged or defective parts.

d. Assembly.

(1) Position flange (32, figure 3-26) to install manual control are (31), flat washer (30), screw (29), spring (28) and nut (27).

(2) Install washers (26, 25, and 24) onto actuator pin, spring (23), and retainer (22).

(3) Install actuator pin (21), with assembled parts, and retaining ring (20).

(4) Install bushings (19), lever (18), shaft (17), and retaining rings (16)

(5) Install bushings (15).

(6) If removed, install shaft (14), cam (13), setscrews (12). Position shaft assembly (11) and tighten setscrews (10), and install retaining rings (9).

(7) Install new packing (8)

(8) Install piston (7), nut (6), thermostat (5), new gasket (4), onto housing (3), with Iockwashers (2) and screws (1).

e. Installation. Refer to the Operator and Unit Maintenance Manual for shutter control installation procedures.

3-29. RADIATOR.

a. Removal. Refer to the Operator and Unit Maintenance Manual for radiator removal procedures.

b. Cleaning, lnspection, and Repair.

WARNING

Always wear protective glasses when using compressed air to clean radiator air passages. Injury to the eyes may result from failure to observe this warning. Failure to observe this warning could result in servere personal injury.

(1) Clean foreign particles from radiator core air passages with filtered compressed air.

(2) Clean exterior surface of radiator with dry cleaning solvent (Federal Specification P-D-680).

(3) Visually inspect radiator for excessive corrosion, cracked or broken brazing, and bent cooling fan.

(4) Check interior of radiator for rust and scale deposits.

(5) Test radiator for leaks as follows:

(a) Provide an air line fitting at one of the radiator openings. Seal all other openings.

(b) Attach an air line to the fitting and submerge the radiator in a container of water.

(c) Pressurize the radiator to 10 to 15 psig and check for air bubbles which will indicate leakage.

(6) Repair radiator as follows:

(a) Straighten bent cooling fins.

(b) Remove light corrosion with number 00 grit abrasive paper.

(c) Repair leaks and cracked or broken brazing by brazing or soldering.

(7) Replace radiator if damaged beyond repair.

3-30. SHUTTER ASSEMBLY.

a. Removal. Refer to the Operator and Unit Maintenance Manual for shutter removal instructions.

b. Disassembly.

(1) Remove spring (1, figure 3-27).

(2) Remove cotter pin (2) to remove retainer (3) and spring (4).

(3) Remove retainer (5) to remove control lever(6).

(4) Remove any damaged or deteriorated seals (7) from vanes of shutter (8).

1. Spring
2. Cotter pin
3. Retainer
4. Spring
5. Retainer ring
6. Control lever
7. Seal
8. Shuter

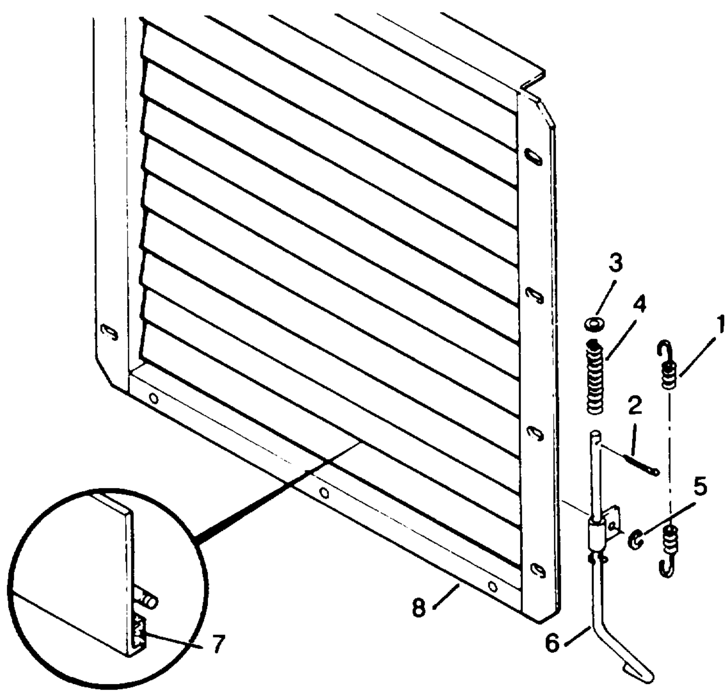


Figure 3-27. Shutter Assembly, Exploded View

c. Cleaning, Inspection, and Repair.

WARNING

Solvent, Dry Cleaning P-D-680, Type II is flammable and moderately toxic to skin, eyes and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate. Failure to observe this warning could cause servere personal injury.

(1) Clean all parts in dry cleaning solvent (Federal Specification P-D-680) and dry thoroughly.

(2) Visually inspect springs for cracks, breaks, and distortion.

(3) Inspect control lever for cracks, bends, and excessive wear.

(4) Inspect seals for damage and deterioration.

(5) Inspect shutter for bent or damaged vanes and support brackets, defective paint and other damage.

(6) Straighten bent control rod.

(7) Remove defective paint, treat, and repaint.

(8) Replace any parts damaged beyond repair.

d. Assmbly.

(1) Position Shutter (8, figure 3-27) to install new seal (7).

(2) Install control lever (6) and retainer(5).

(3) Install spring (4), retainer (3) and cotter pin (2).

(4 Install spring (1).

e. Installation Refer to the Operator and Unit Manual for shutter assembly installation procedures.

3-31. COOLING FAN.

Refer to the Operator and Unit Maintenance Manual for cooling fan maintenance procedures.

3-32. WATER PUMP.

a. Refer to the Operator and Unit Maintenance Manual for cooling fan maintenance procedures.

b. Disassembly.

(1) Using a suitable puller, remove pulley hub (1, figure 3-28).

(2) Remove retaining ring (2).

(3) Remove screws (3 and 4), Iockwasher (5) and bracket (6) to remove cover plate (7) and gasket (8).

(4) Support front end of pump in bed of arbor press and press shaft bearing and flinger assembly (9) from impeller (1 0), seal assembly (11), and pump body (1 2).

NOTE

Shaft, bearing and flinger assembly (9) is a unit. Do not attempt to disassemble.

(5) Press seal assembly (11) from pump body. Discard seal.

(6) Disconnect water inlet housing (15) by removing screw (13) and Iockwasher (14). Discard gasket (16).

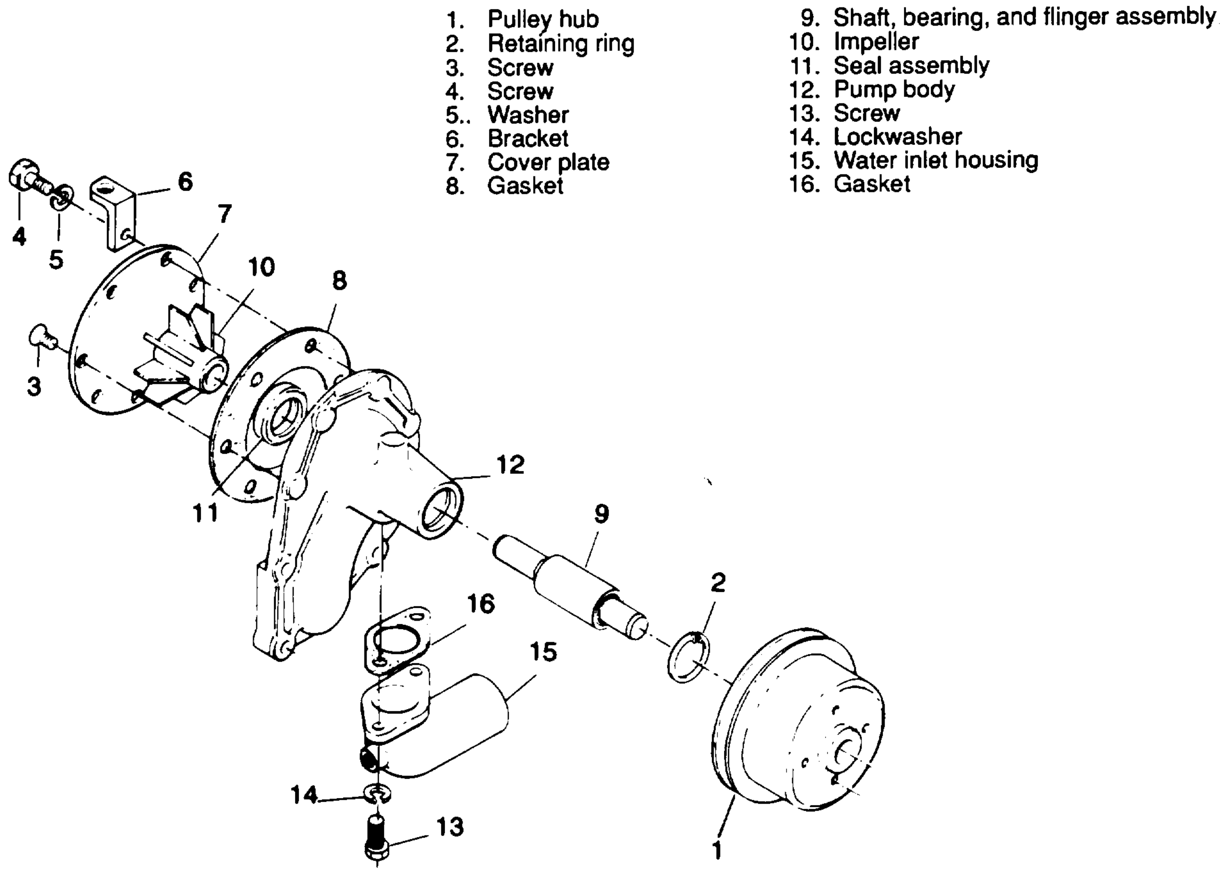


Figure 3-28. Water Pump Assembly, Exploded View

c. Cleaning, Inspection and Repair

WARNING

Solvent, Dry Cleaning P-D-880, Type II is flammable and moderately toxic to skin, eyes and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate. Failure to observe this warning could cause servere personal injury.

(1) Clean all parts in dry cleaning solvent (Federal Specification P-D-680) and dry thoroughly.

(2) Visually inspect cooling fan pulley for cracks, corrosion, and excessive wear.

(3) Check pulley hub for cracks, corrosion, and other damage.

(4) Inspect cover plate for cracks, corrosion, and rub marks on inner face.

(5) Inspect pump body for cracks, breaks, and excessive wear.

(6) Inspect shaft and bearing assembly for deep wear patterns, scores, pitting and other damage. Rotate bearing on shaft. If bearing is binding or feels rough, the shaft and bearing assembly must be replaced.

(7) Check impeller for erosion, cracking, and other damage.

(8) Replace any damaged or defective parts.

d. Asssembly.

CAUTION

When installing seal, press on outer flange to avoid damaging the seal. Failure to observe this caution could result in equipment damage.

(1) Press replacement seal (11) into pump body (12).

CAUTION

When installing shaft and bearing assembly, press on outer bearing face and not on end of shaft. Failure to observe this caution could result in equipment damage.

(2) Press shaft, bearing and flinger assembly (9) into pump body and install retaining ring (2).

(3) Support pump on outer end of shaft and press impeller (10) onto shaft, bearing and flinger assembly to obtain 0.010 inch clearance between impeller and cover plate (figure 3-29).

(4) Install gasket (8) and cover plate (7) and secure with screws (3). Install bracket (6) with screw (4) and washer (5).

(5) Press pulley hub (1) onto shaft (9) until shaft is flush with front of pulley.

(6) Install water inlet housing (15) and new gasket (16) with screws (13) and Iockwasher (14).

e. Installation. Refer to the Operator and Unit Maintenance Manual for water pump installation procedures.

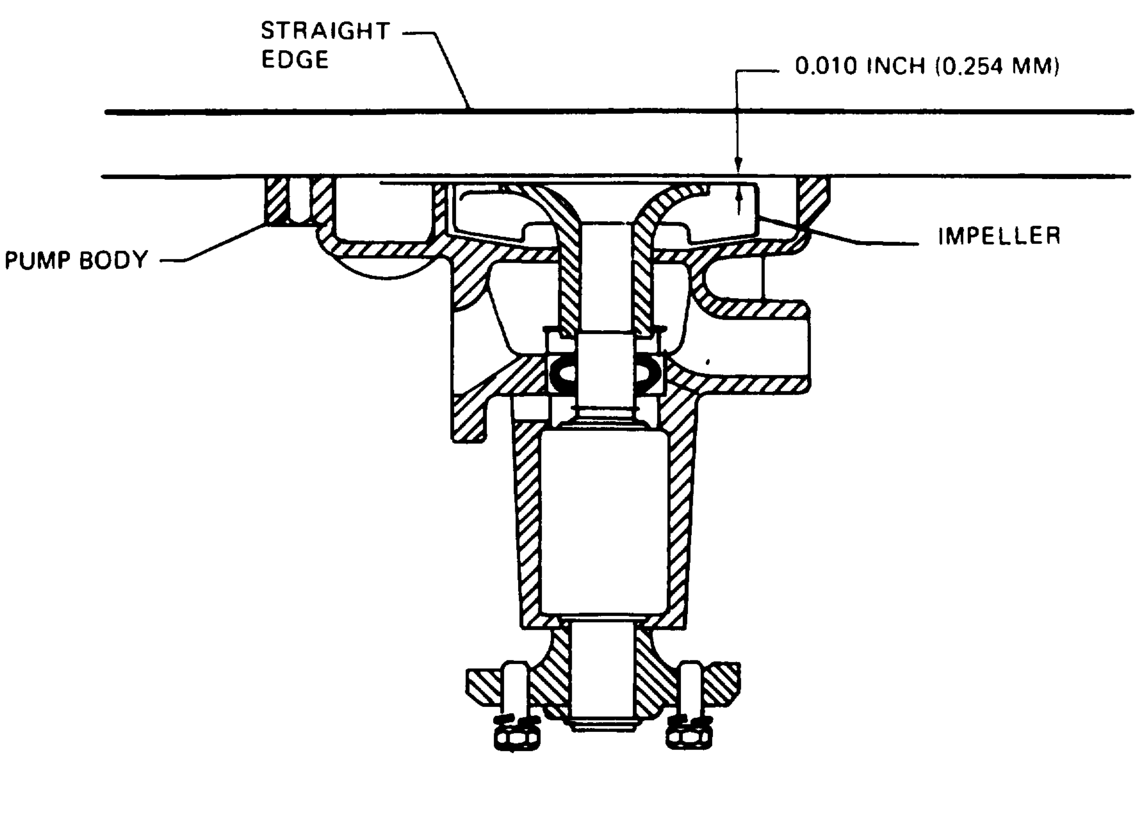


Figure 3-29. Checking Impeller to Cover Plate Clearance

3-33. COOLANT THERMOSTAT AND HOUSING.

Refer to the Operator and Unit Maintenance Manual for coolant thermostat and housing maintenance procedures.

Section IV. MAINTENANCE OF ENGINE LUBRICATION SYSTEM

3-34. GENERAL.

The engine oil pan serves as a reservoir for lubricating oil. It is equipped with a bayonet type gauge for checking the oil level in the pan. Oil is drawn into a gear type, positive displacement pump through a screen which prevents the entry of coarse abrasives. The oil pump forces the oil through a full flow type oil filter, which removes minute abrasives. From the oil filter the oil flows into the header, a drilled passage in the cylinder block, from which it is distributed to the internal engine components. A pressure transmitter measures oil pressure in the header and transmits it electrically to the oil pressure gauge. Header oil pressure is also measured by a low oil pressure switch which shuts down the engine if oil pressure falls to a dangerously low level.

3-35. LUBRICATION OIL FILTER.

Refer to the Operator and Unit Maintenance Manual for lubrication oil filter maintenance procedures.

3-36. OIL LEVEL GAUGE.

Refer to the Operator and Unit Maintenance Manual for oil level gauge maintenance procedures.

3-37. OIL PAN ASSEMBLY.

a. Removal.

(1) If generator set has winterization kits installed, refer to Operator and Unit Maintenance Manual and remove kits.

(2) Remove oil level gauge (1, figure 3-30).

(3) Remove elbow (7) from oil pan.

(4) Remove screws (2) and lockwashers (3) to lower oil pan (4) and remove gaskets (5), and seals (6). Discard seals and gaskets. Refer to paragraph 3-38 and remove oil pump assembly. Remove oil pan.

b. Cleaning. Inspection, and Repair.

WARNING

Solvent, Dry Cleaning P–D-880, Type II is flammable and moderately toxic to skin, eyes and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate. Failure to observe this warning could cause servere personal injury.

(1) Scrape gasket remains from oil pan and cylinder block mating surfaces.

WARNING

Compressed air used for cleaning and drying purposes can create airborne particles that may enter the eyes. Pressure shall not exceed 30 psig and use only with adequate chip guards and chipping goggles. Failure to observe this warning could cause servere personal injury.

(2) Clean all parts with dry cleaning solvent (Federal Specification P-D-680) and a stiff bristle brush. Dry thoroughly with filtered, compressed air.

(3) Scrape gasket remains from oil pan and cylinder block mating surfaces.

(4) Inspect and replace oil level gauge in accordance with instructions provided in the Operator and Unit Maintenance Manual.

(5) Inspect oil pan for cracks, dents, broken welds and leaks.

(6) Check all threads for crossing, stripping and peening.

(7) Repair cracks and broken welds in oil pan by welding.

(8) Repair minor thread damage with a thread chaser.

(9) Replace any parts damaged beyond repair.

c. Installation. Using new gaskets and seals, apply sealant (such as MILSpecA46102A) to dry gasket.

(1) Refer to paragraph 3-38 and install oil pump assembly. Install new seals (6, figure 3-30) new gaskets (5), oil pan (4), lockwashers (3) and screws (2).

(2) Install elbow (7) onto oil pan.

(3) Install oil level gauge (1).

(4) If winterization kits were removed, refer to Operator and Unit Maintenance Manual for installation procedures.

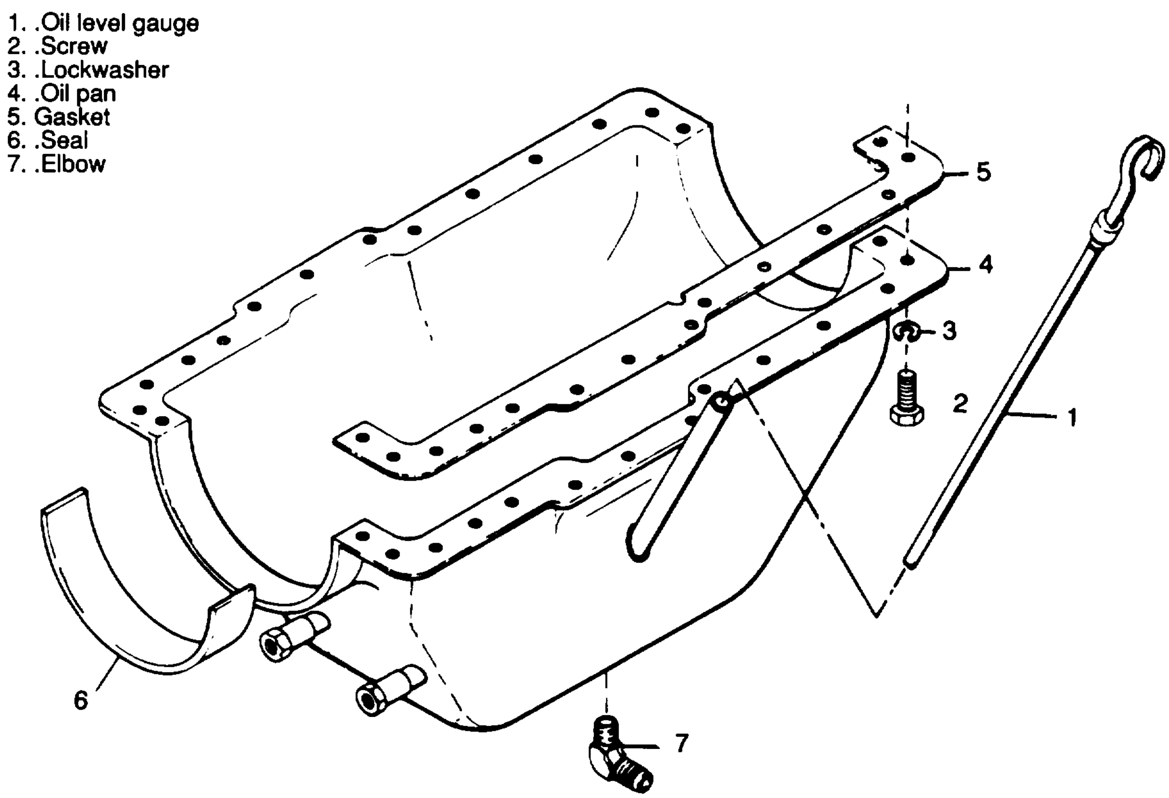


Figure 3-30. Oil Pan Assembly

3-38. OIL PUMP ASSEMBLY.

a. Removal.

(1) Lower oil pan assembly (paragraph 3-37).

(2) Remove screws (1, figure 3-31) and Iockwashers (2) to remove oil pump.

b. Disassembly.

(1) Remove oil pickup screen (3).

(2) Remove pressure relief valve (4), Iockwasher (55) and seal (6). Discard seal.

CAUTION

Spring is under tension. Use care when removing roll pin. Failure to observe this caution could cause damage to the equipment.

(3) Remove roll pin (7) and withdraw retainer (8), spring (9) and plunger (10) from valve body (11).

(4) Using a suitable puller, remove gear (12).

(5) Remove screws (13 and 15) and Iockwashers (14 and 16) to remove cover plate (17).

(6) Remove driven gear (18).

(7) Withdraw drive gear (19) and drive shaft (20) as a unit. Press gear from shaft.

(8) Press shaft (21) from pump body (22).

c. Cleaning, Inspection, and Repair.

(1) Clean all parts in dry cleaning solvent (Federal Specification P-D-680) and dry thoroughly.

(2) Inspect spring (9, figure3-31) for cracks, breaks and distortion.

(3) Inspect plunger (10) and bore of valve body (11) for scores, scratches, and deep wear patterns. Check that plunger moves freely in valve body.

(4) Check gear (12) for chipped or broken teeth, excessive wear, or other damage.

(5) Inspect cover plate for cracks and warpage. Check inner face for deep wear marks or scores from contact with gears.

(6) Inspect gears (18 and 19) for chipped or broken teeth, excessive wear or other damage.

(7) Inspect shafts (20 and 21) for cracks, scores and deep wear patterns. Check that shaft (20) rotates freely in pump body. Check that gear (18) rotates freely on shaft (21).

(8) Inspect pump body (22) for cracks, breaks and other damage.

(9) Check all threads for crossing, stripping or peening.

(10) Inspect screen (3) for rips, tears, breaks and clogging.

(11) Repair minor thread damage with a thread chaser.

(12) Remove minor nicks and burrs with crocus cloth and oil. Clean the part in dry cleaning solvent and dry thoroughly with filtered compressed air.

(13) Replace any parts worn or damaged beyond repair.

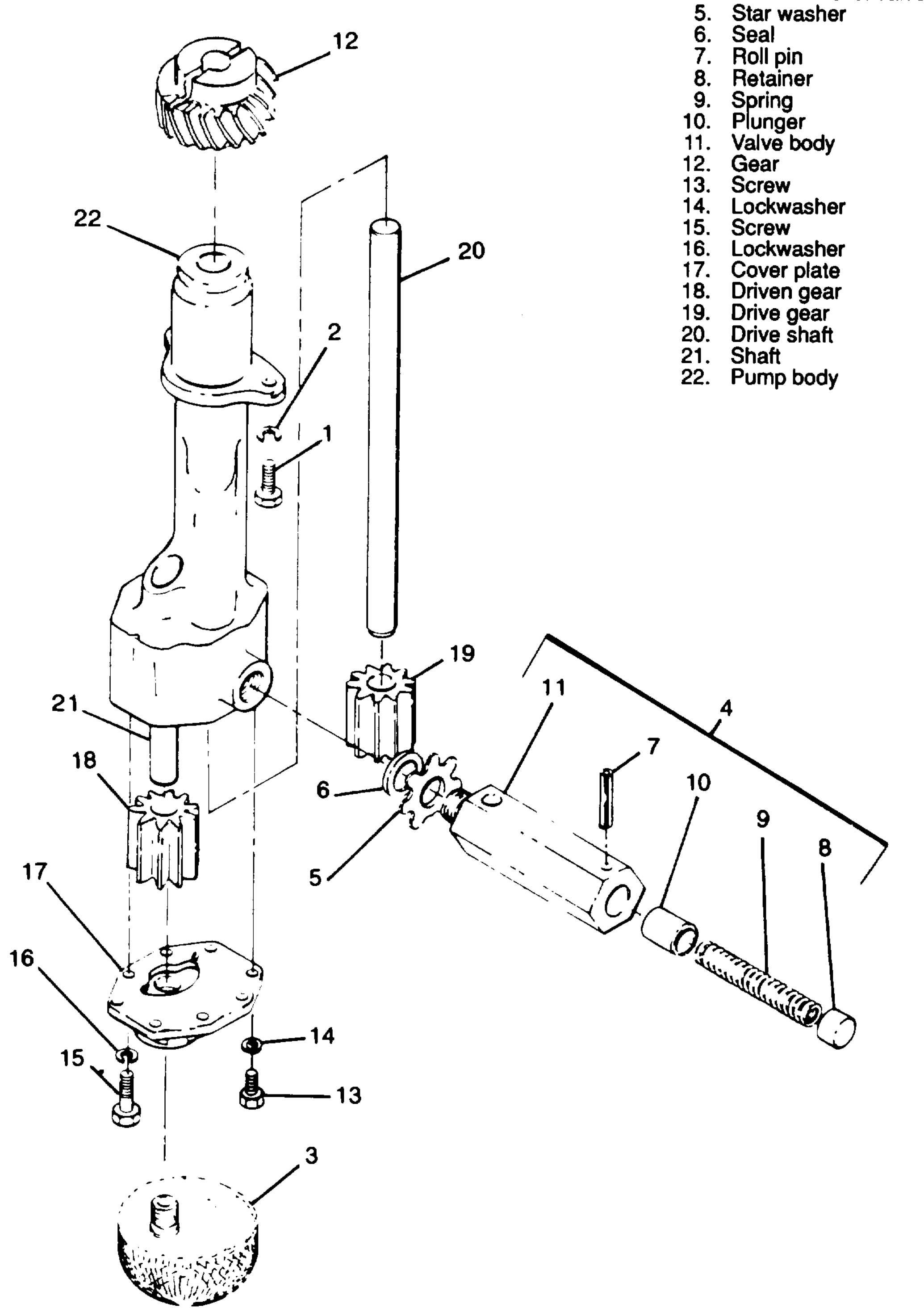


Figure 3–31. Oil Pump Assembly, Exploded View

d. Assembly.

(1) Press drive gear (19, figure 3-31) onto shaft (20).

(2) Insert shaft into pump body (22) and press gear (12) onto shaft until a dimension of 4.84375 ± 0.010 inches is obtained between the mounting flange and the top of the drive flange (figure 3-32). For type 1 dimensions use 4.220 +/– .010M

(3) Press shaft (21, figure 3-31) into pump body and install driven gear (18).

(4) Install cover plate (17) and secure with lockwashers (16 and 14) and screws (15 and 13).

(5) Insert plunger (10) into valve body (11). Install spring (9) and retainer(8) and secure with roll pin (7).

(6) Install new seal (6), lockwasher (5) and pressure relief valve (4).

(7) Check that drive shaft rotates freely. If shaft binds, disassemble pump and ascertain cause before installing.

(8) Install pickup screen (3) and tighten.

NOTE

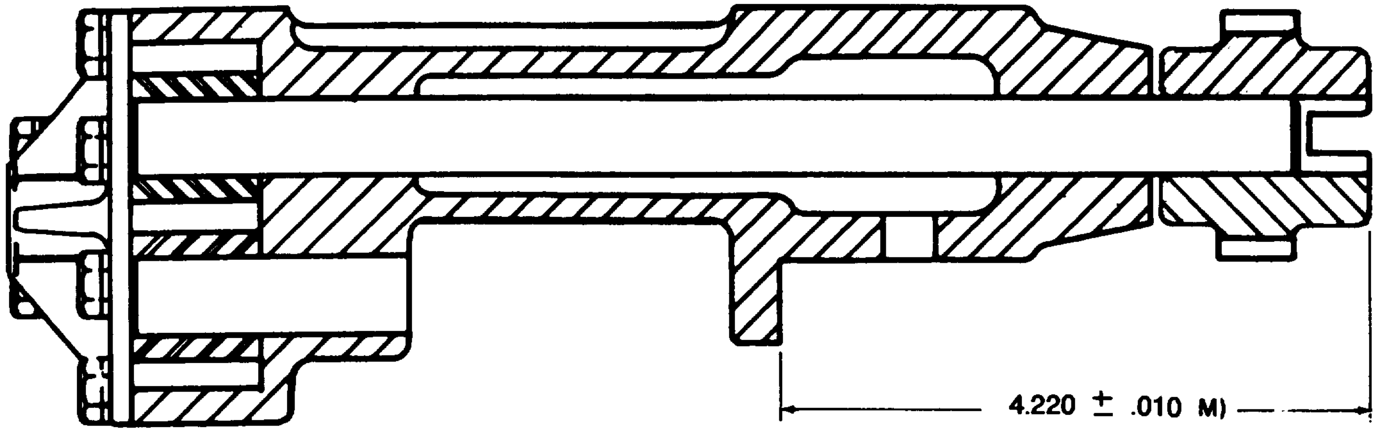
Pickup screen must be in the horizontal position when the pump is installed in the engine.

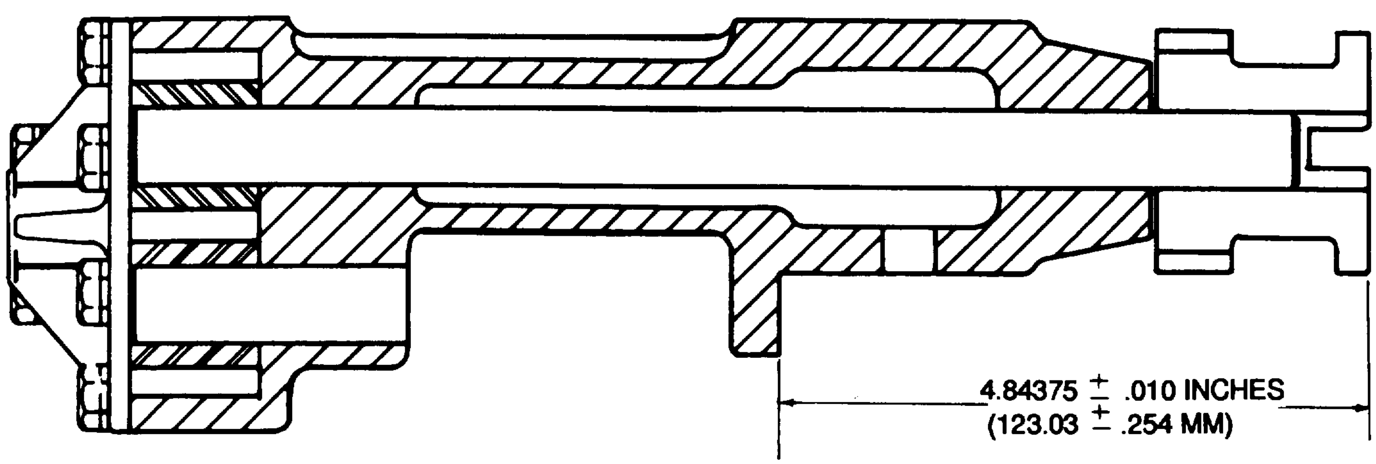
e. Installation.

(1) Install oil pump, making sure that drive gear mates correctly with speed switch drive assembly.

(2) Install oil pan (paragraph 3-37).

TYPE I





TYPE 2

Figure 3-32. Oil Pump Assembly Dimensions

Section V. MAINTENANCE OF HYDRAULIC SYSTEM (ELECTRO-HYDRAULIC GOVERNOR EQUIPPED PRECISE SETS ONLY)

3-39. GENERAL.

The hydraulic system provides a means of precise frequency control on all MEP-103A and some MEP-113A precise generator sets. The system consists of a sump, a replaceable element type filter, a gear type positive displacement pump and a hydraulic actuator unit. The hydraulic pump draws oil from the sump and forces it through the filter. From the filter, the oil flows to the hydraulic actuator unit. An electrically controlled set of valves alters the path of the oil which determines the positioning of the governor control linkage. The position of the governor control linkage determines the fuel pump governor setting, which sets engine speed. Changes in engine speed causes a corresponding increase or decrease in generator output frequency.

3-40. HYDRAULIC SUMP.

a. Removal.

(1) Refer to the Operator and Unit Maintenance Manual and drain the hydraulic sump.

(2) Disconnect hydraulic lines (1, figure 3-33).

(3) Remove nuts (2), lockwashers (3) and screws (4) to remove hydraulic sump (5).

(4) Remove cap and dipstick assembly (6) and elbows (7) from sump.

Cleaning, Inspection, and Repair

WARNING

Solvent, Dry Cleaning P–D-680, Type II is flammable and moderately toxic to skin, eyes and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate. Failure to observe this warning could cause servere personal injury.

WARNING

Compressed air used for cleaning and drying purposes can create airborne particles that may enter the eyes. Pressure shall not exceed 30 psig and use only with adequate chip guards and chipping goggles. Failure to observe this warning could cause servere personal injury.

(1) Clean all parts in solvent P-D-680 Type II and dry thoroughly with filtered compressed air.

(2) Flush interior of sump with an approved solvent and dry thoroughly.

(3) Visually inspect hydraulic sump for cracked or broken welds, defective paint, illegible markings, and dents.

(4) Inspect cap and dipstick assembly for corrosion, bent dipstick, and other damage.

(5) Check all threads for crossing, stripping, and peening.

1. Hydraulic line
2. Nut
3. Lockwasher
4. Screw
5. Hydraulic sump
6. Cap and dipstick assy
7. Elbow

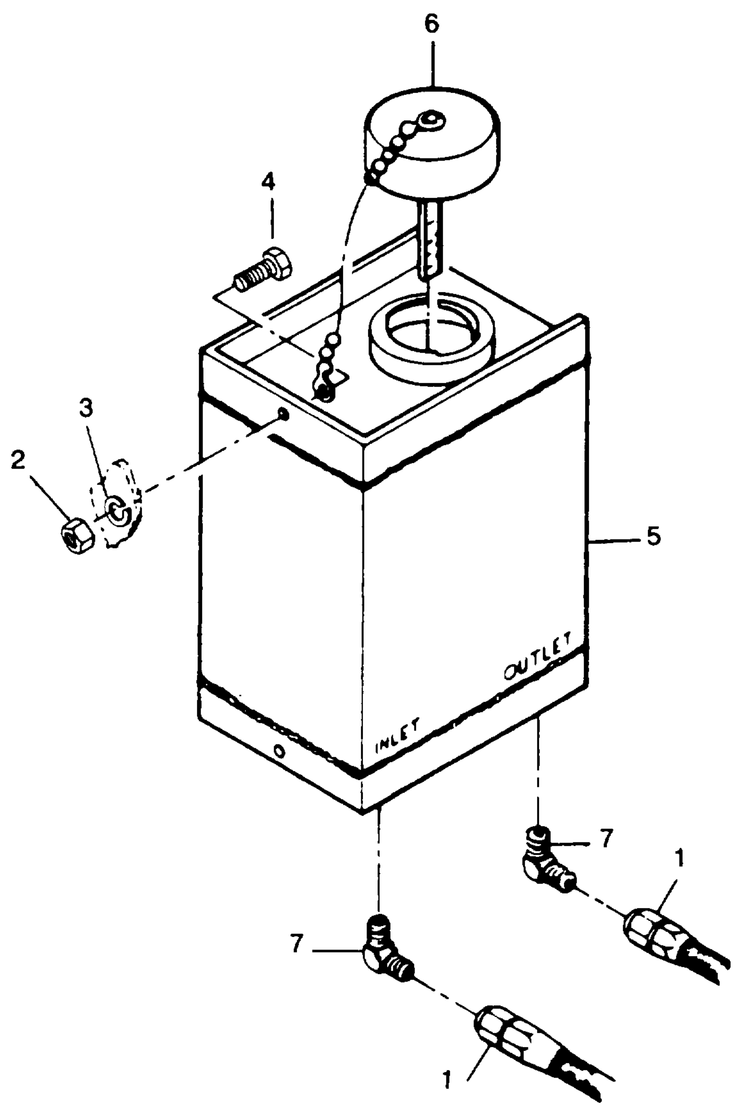


Figure 3-33. Hydraulic Sump, Removal and Installation (Electro-Hydraulic Governor Equipped Precise Sets Only)

(6) Test hydraulic sump for leaks as follows:

(a) Securely install cap and dipstick assembly.

(b) Install a plug in outlet connection.

(c) install a fitting in inlet opening and connect an air line.

(d) Submerge hydraulic sump in a container of water and pressurize at 10 to 15 psig air pressure.

(e) Check for air bubble formations which will indicate leaks.

(f) Remove hydraulic sump from container. Release air pressure. Thoroughly dry exterior prior to removing cap and dipstick assembly, plug, or fitting to prevent entry of water into hydraulic sump.

CAUTION

Steam clean the interior of the sump for a period of 2 hours to remove residual vapors prior to welding. Failure to observe this caution could result in equipment damage.

(7) Repair leaks and cracked or broken welds by welding.

(8) Test repairs as outlined in step (6) above.

(9) Remove defective paint, treat, and repaint.

(10) Markings shall be in accordance with using service requirements.

(11) Repair minor thread damage with a thread chaser.

(12) Replace any excessively damaged parts.

c. Installation.

(1) Install elbows (7, figure 3-33).

(2) Install cap and dipstick assembly (6) in hydraulic sump (5) and secure with screws (4), Iockwashers (3) and nuts (2).

(3) Connect hydraulic lines (1).

3-41. HYDRAULIC PUMP ASSEMBLY.

a. Removal.

(1) Refer to the Operator and Unit Maintenance Manual and drain the hydraulic sump.

(2) Remove hydraulic lines and fittings from hydraulic pump assembly.

(3) Remove Iockwires (1, figure 3-34), screws (2) and flat washers (3) to remove hydraulic pump assembly and gasket (4). Discard gasket.

b. Disassembly.

(1) Remove cotter pin (5), castellated nut (6), driver gear (7), woodruff key (8) and adapter (9).

(2) Remove locknut (10), pressure setscrew (11), flat washer (12), sealing washer (13), pressure valve block (14), o-ring (15), valve plug (16), spring (17) and flange eyelet (18).

(3) Remove screws (19) and seal plate (20).

(4) Remove screws (21), dowel pin (22), cover (23), needle bearing (24), o-ring (25) and idler gear (26).

(5) Remove drive shaft and gear assembly (27), plate and seal assembly (28), check valve (29), needle bearing (30) from body (31).

c. Cleaning, Inspection, and Repair.

WARNING

Solvent, Dry Cleaning P-D-680, Type II is flammable and moderately toxic to skin, eyes and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate. Failure to observe this warning could result in servere personal injury or death.

(1) Clean all parts in dry cleaning solvent (Federal Specification P-D-680) and dry thoroughly.

(2) Inspect drive gear for cracks and worn, chipped, or broken teeth.

(3) Inspect adapter for deep wear marks, cracks, and galling.

(4) Inspect pressure valve block and valve plug for corrosion, wear and galling.

(5) Check spring for chaffing, cracks, and distortion.

(6) Inspect flange eyelet and valve seat for wear, cracks, and galling.

(7) Inspect drive shaft and gear assembly and idler gear for cracks, deep wear patterns, and other damage.

(8) Inspect body and cover for cracks, corrosion, deep wear patterns in gear bores.

(9) Replace all bearings, seals, gaskets, and o-rings at each overhaul.

(10) Replace any damaged parts.

d. Assembly.

(1) Position body (31), and install needle bearing (30), check valve (29), plate and seal assembly (28) and drive shaft and gear assembly (27).

(2) Install idler gear (26), new O-ring (25), needle bearing (24), cover (23), dowel pin (22) and screws (21).

(3) Install seal plate (20) and screws (19).

(4) Install flange eyelet (18), spring (17), valve plug (16), new o-ring (15), pressure valve block (14), sealing washer (13), flat washer (12), pressure setscrew (11) and locknut (1 O).

(5) Install adapter (9), woodruff key (8), drive gear (7), castellated nut (6) and cotter pin (5).

e. Testing.

(1) Install hydraulic pump assembly on a suitable test stand and provide a means of rotating at approximately 600 RPM.

(2) Connect a hydraulic line to pump assembly inlet.

(3) Connect a hydraulic line equipped with a pressure gauge, and a restriction valve to the pump assembly outlet.

(4) Operate pump at approximately 600 RPM.

(5) Close restriction valve until pressure gauge reads 320 +10 PSI. If 320 ± 10 PSI is not obtainable, loosen locknut and adjust pressure relief valve screw until 320 ± 10 PSI is reached.

(6) Slowly close the restriction valve while observing the pressure gauge. The pressure should drop. If not, continue to adjust pressure relief valve screw until pressure does drop.

(7) Loosen locknut and adjust pressure setscrew (11, figure 3-34) until pressure gauge indicates 320 ± 10 psig.

(8) Tighten locknut and remove hydraulic pump assembly from test hookup.

f. Installation.

(1) Install hydraulic pump assembly with gasket (4), flat washers (3), screws (2) and Iockwires (1).

(2) Install hydraulic lines and fittings onto hydraulic pump assembly.

(3) Refer to Operator and Unit Maintenance Manual to fill the hydraulic sump

1. Lockwire
2. Screw
3. Flat washer
4. Gasket
5. Cotter pin
6. Castellated nut
7. Drive gear
8. Woodruff key
9. Adapter
10. Locknut
11. Pressure setscrew
12. Flat washer
13. Sealing washer
14. Pressure valve block
15. O–ring
16. Valve plug
17. Spring
18. Flange eyelet
19. Screw
20. Seal plate
21. Screw
22. Dowel pin
23. Cover
24. Needle bearing
25. O–ring
26. Idler gear
27. Drive shaft and gear assy
28. Plate and seal assy
29. Check valve
30. Needle bearing
31. Body

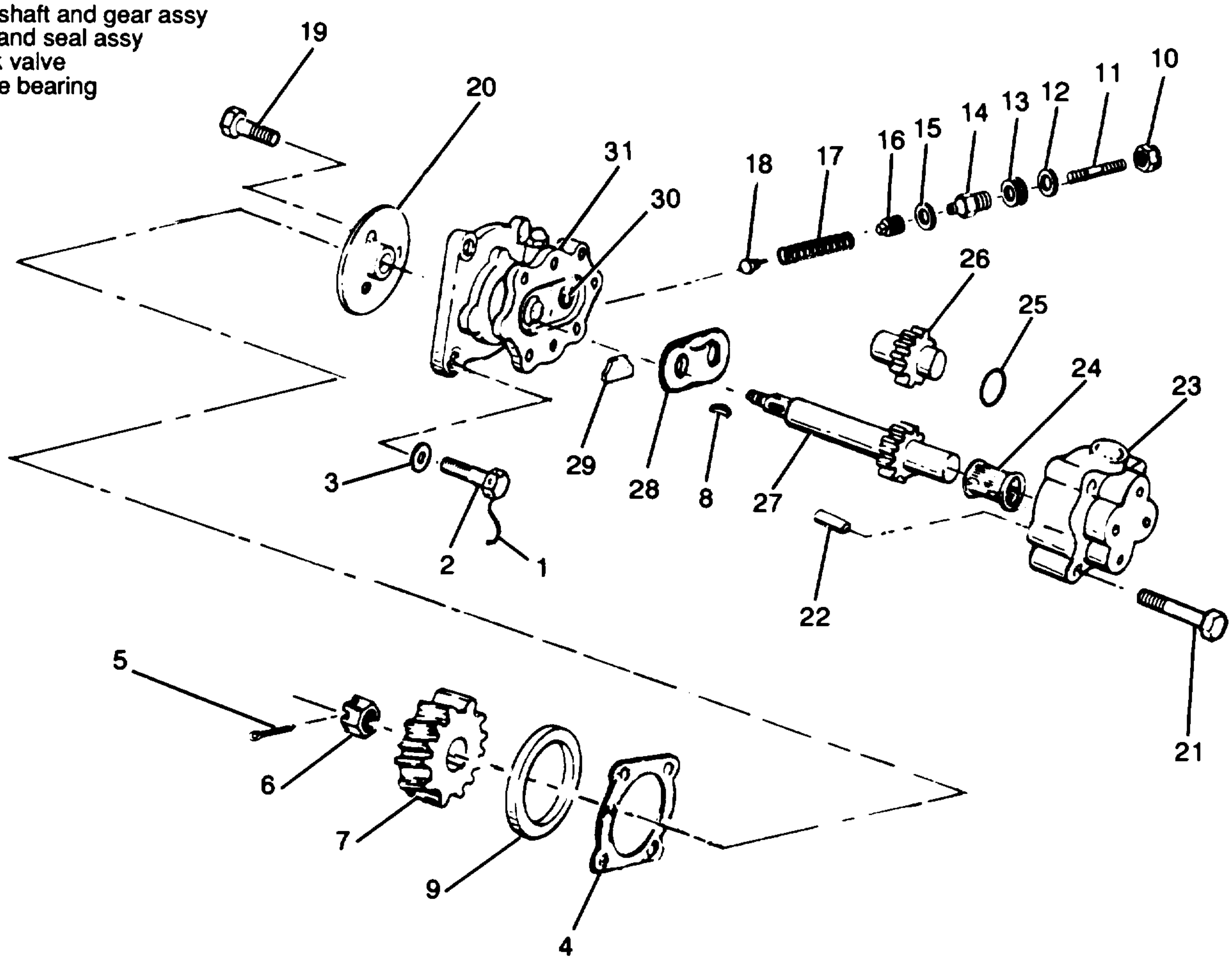


Figure 3-34. Hydraulic Pump Assembly, Exploded View (Electro-Hydraulic Governor Equipped Precise Sets Only)

3-42. HYDRAULIC SYSTEM FILTER ASSEMBLY.

a. Removal.

(1) Disconnect hydraulic lines (1, figure 3-35), and drain hydraulic fluid into a suitable container.

(2) Remove nuts (2), Iockwashers (3) and screws (4) to remove filter assembly.

(3) Do not remove screws (5), Iockwashers (6), nuts (7) and mounting bracket (8) unless inspection reveals damage.

b. Disassembly.

(1) Remove Iockwire (9) and unscrew housing (10).

(2) Remove and discard filter element (11), backup ring (12), packing (13) and backup ring (14).

(3) Remove elbows (15), o-rings (16), washers (17) and nuts (18) from head assembly (19). Discard o-rings.

(4) Do not remove pressure relief valve (20).

c. Cleaning, Inspection, and Repair.

(1) Clean all parts in dry cleaning solvent (Federal Specification P-D-680) and dry thoroughly with filtered compressed air.

(2) Visually inspect mounting bracket for cracks, breaks and corrosion.

(3) Inspect housing for cracks, corrosion, and other damage.

(4) Inspect head assembly for cracks, breaks, and corrosion. Check parts for deposits of foreign material. Remove any deposits found.

(5) Check all threads for crossing, stripping, and peening. Repair minor thread damage with a thread chaser.

(6) Replace any damaged or defective parts.

d. Assembly.

NOTE

Soak replacement filter element in oil conforming to Military Specification MIL-H-5606 to remove trapped air before installing.

(1) If removed, install pressure relief valve (20).

(2) Position head assembly (19), to install nuts (18), washers (17), new o-rings (16), and elbows (15).

(3) Install backup ring (14), packing (13), backup ring (12) and new filter element (11).

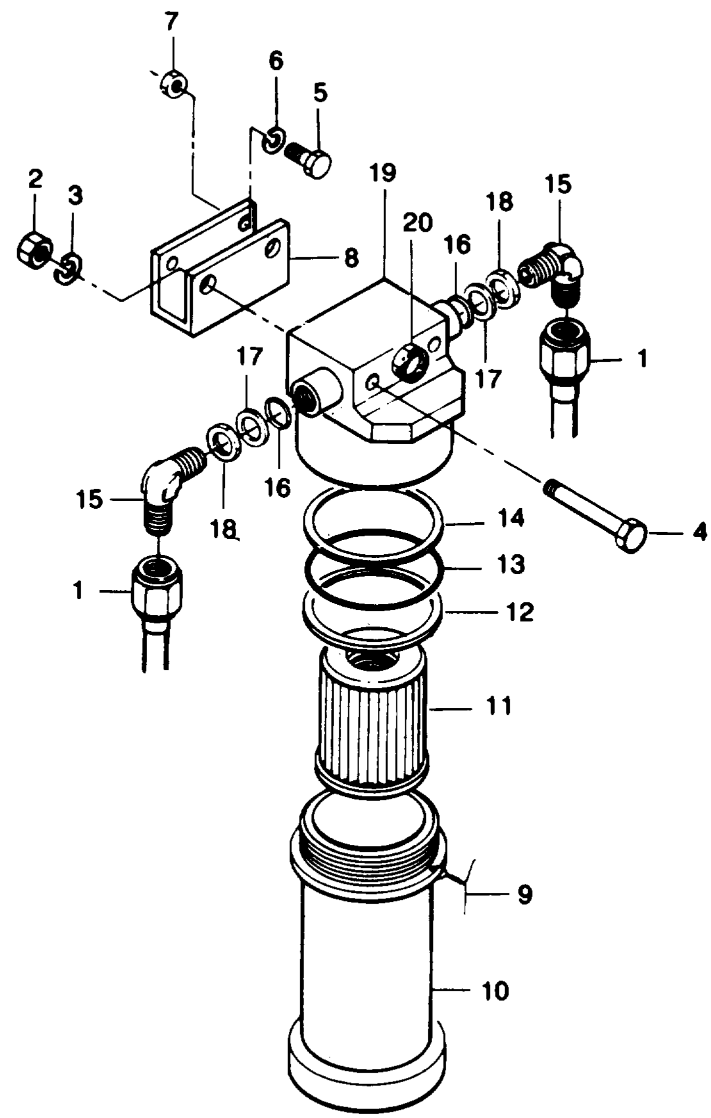
(4) Install housing (10) and Iock wire (9).

e. Installation.

(1) If removed, install mounting bracket (8, figure 3-35), nuts (7), Iockwashers (6) and screws (5).

(2) Position filter assembly to install screws (4), Iockwashers (3), and nuts (2).

(3) Connect hydraulic lines (1), and fill with hydraulic fluid.



1. Hydraulic line
2. Nut
3. Lockwasher
4. Screw
5. Screw
6. Lockwasher
7. Nut
8. Mounting bracket
9. Lockwire
10. Housing
11. Filter element
12. Backup ring
13. Packing
14. Back ring
15. Elbow
16. O–ring
17. Washer
18. Nut
19. Head assembly
20. Pressure relief valve

Figure 3-35. Hydraulic System Filter Assembly, Exploded View (Electro-Hydraulic Governor Equipped Precise Sets Only)

3-43 HYDRAULIC ACTUATOR UNIT.

a. Removal.

(1) Refer to the Operator and Unit Maintenance Manual and drain the hydraulic tank.

(2) Disconnect electrical connectors (1 and 2, figure 3-36) and hydraulic lines (3 and 4).

(3) Remove nut (5) and bolt (6).

(4) Do not remove nut (7), screw (8), rod ends (9), Iocknut (10), and threaded rod (11) unless inspection reveals damage.

(5) Remove bolts (12) and Iockwashers (13) to remove actuator unit (14).

b. Disassemblv.

NOTE

Test hydraulic actuator unit in accordance with subparagraph f. below prior to disassembly.

(1) Remove elbow (1, figure 3-37), adapter (2), and o-ring (3).

(2) Remove elbow (4), adapter (5), filter assembly (6), and o-ring (7).

(3) Remove screw (8) and Iockwasher (9).

(4) Loosen setscrew (1 O) and remove link(11).

(5) Remove transducer slug (12).

(6) Remove retaining ring (13), washer (14), o-ring (15), collar (16), and quad-ring collar (17). Discard o-rings.

(7) Remove clevis (18), retaining ring (19), washer (20), o-ring (21), collar (22) and quad-ring collar (23). Discard o-ring.

(8) Remove piston (24).

(9) Remove setscrew (25), screw (26), and Iockwasher (27) to remove electrical connector (28) and split spacer (29).

(10) Remove transducer (30).

(11) Do not remove roll pin (31) unless damage is present.

(12) Remove plugs (32) and o-rings (33). Discard o-rings.

(13) Remove screws (34) and Iockwashers (35) to remove electrical connector (36) and gasket (37). Discard gasket.

(14) Remove screws (38) and Iockwashers (39) to remove cover (40) and gasket (41). Discard gasket.

(15) Remove screws (42) and Iockwashers (43) to remove armature core (44) from valve block (45).

(16) Remove valve needles (46), top orifices (47), o-rings (48), valves (49), spacers (50), bottom orifices (51) and o-rings (52). Discard o-rings.

(17) Remove screws (53) and Iockwashers (54) to remove adapters (55) with attached parts and pin springs (56).

1. Electrical connector
2. Electrical connector
3. Hydraulic line
4. Hydraulic line
5. Nut
6. Bolt
7. Nut
8. Screw
9. Rod end
10. Locknut
11. Threaded rod
12. Bolt
13. Lockwasher
14. Hydraulic actuator unit

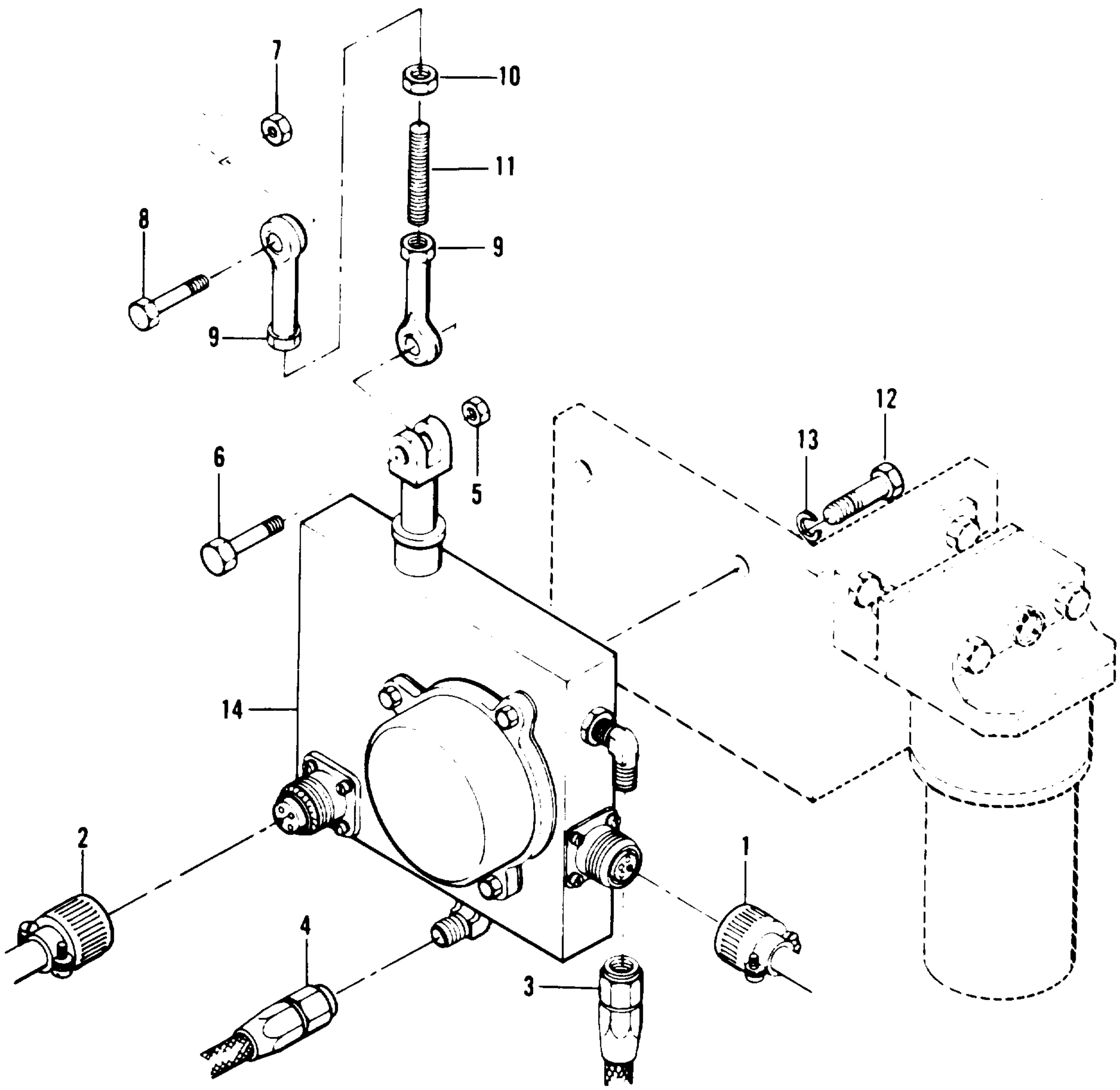


Figure 3-36. Hydraulic Actuator Unit, Removal and Installation (Electro-Hydraulic Governor Equipped Precise Sets Only)

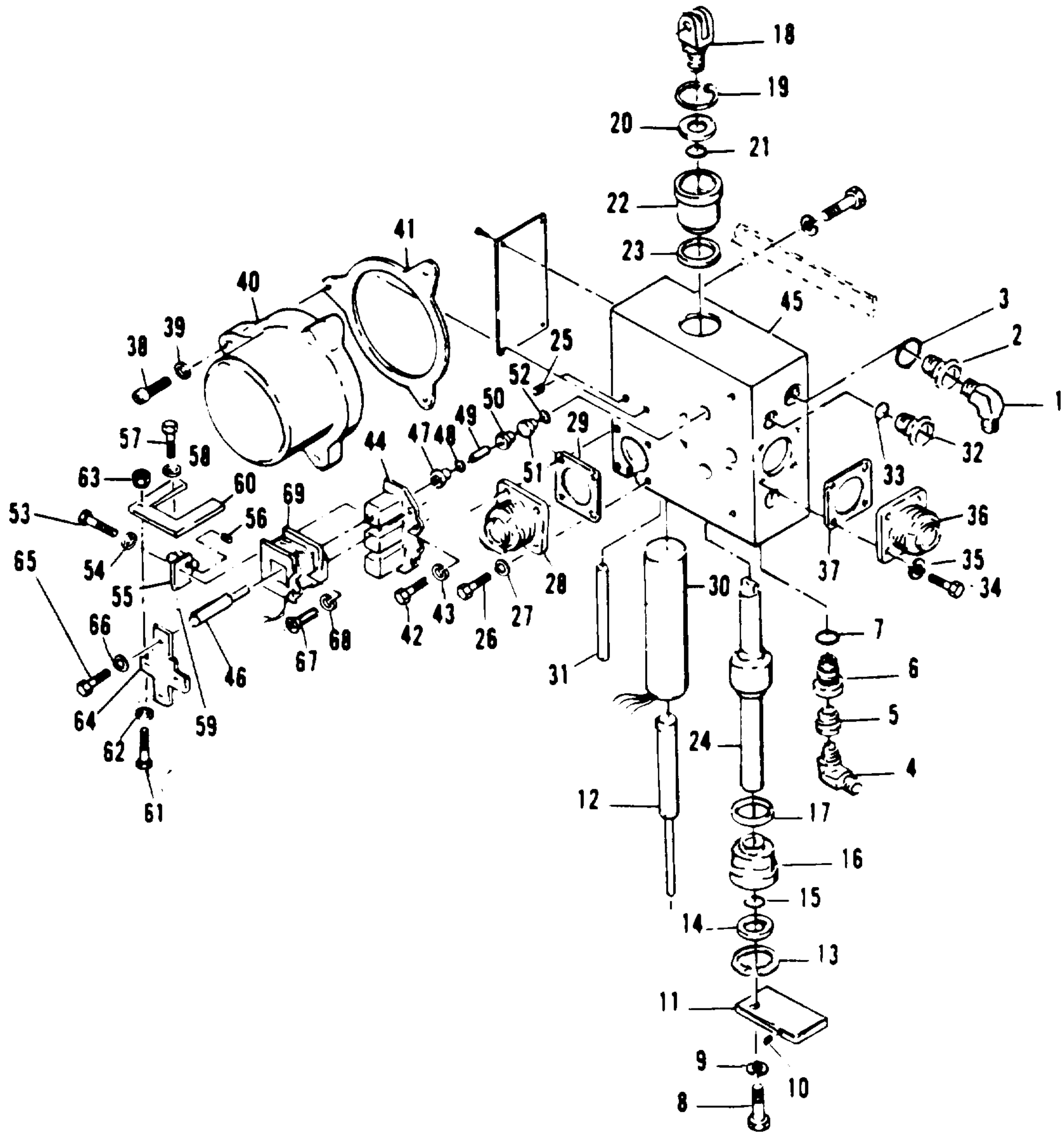


Figure 3-37. Hydraulic Actuator Unit, Exploded View (Sheet 1 of 2)
(Electro-Hydraulic Governor Equipped Precise Sets Only)

1. Elbow
2. Adapter
3. O-ring
4. Elbow
5. Adapter
6. Filter assembly
7. O-ring
8. Screw
9. Lockwasher
10. Setscrew
11. Link
12. Transducer slug
13. Retaining ring
14. Washer
15. O-ring
16. Collar
17. Quad ring collar
18. Clevis
19. Retaining ring
20. Washer
21. O-ring
22. Collar
23. Quad ring collar
24. Piston
25. Setscrew
26. Screw
27. Lockwasher
28. Electrical connector
29. Split spacer
30. Transducer
31. Roll pin
32. Plug
33. O-ring
34. Screw
35. Lockwasher
36. Electrical connector
37. Gasket
38. Screw
39. Lockwasher
40. Cover
41. Gasket
42. Screws
43. Lockwasher
44. Armature mounting (core)
45. Valve block
46. Valve needle
47. Top orifice
48. O-ring
49. Valve
50. Spacer
51. Bottom orifice
52. O-ring
53. Screw
54. Lockwasher
55. Adapter
56. Pin spring
57. Screw
58. Lockwasher
59. Nut
60. Mounting plate
61. Screw
62. Lockwasher
63. Nut
64. Armature
65. Lock nut
66. Setscrew
67. Screw
68. Lockwasher
69. Coil

Figure 3-37. Hydraulic Actuator Unit, Exploded View (Sheet 2 of 2) (Electro-Hydraulic Governor Equipped Precise Sets Only)

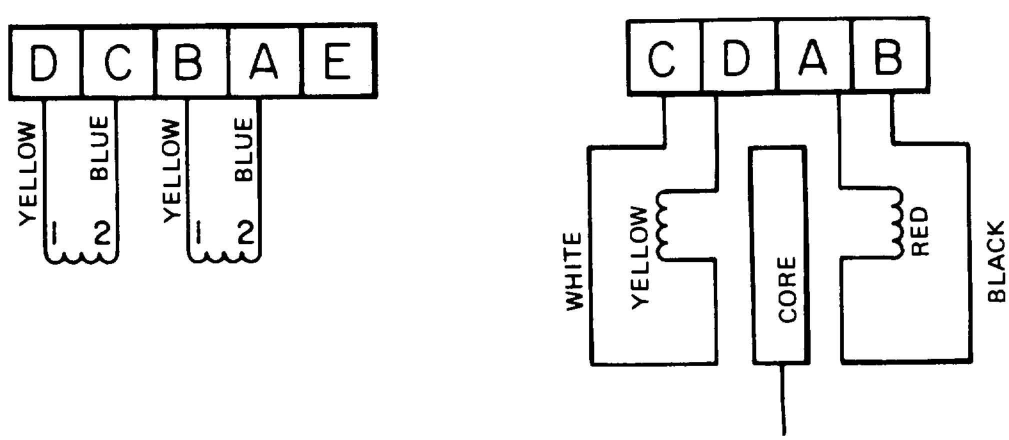


Figure 3–38. Transducer and Armature Coil Schematic Diagram

(18) Remove screws (57), lockwashers (58), and nuts (59) to remove mounting plates (60).

(19) Remove screws (61), Iockwashers (62), and nuts (63) to remove armature (64). Remove locknuts (65) and setscrews (66) from armature.

(20) Remove screws (67) and Iockwashers (68) to remove coils (69).

c. Cleaning, Inspection, and Repair.

WARNING

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WARNING

Compressed air used for cleaning and drying purposes can create airborne particles that may enter the eyes. Pressure shall not exceed 30 psig and use only with adequate chip guards and chipping goggles. Failure to observe this warning could cause servere personal injury or death.

(1) Clean all non-electrical parts in dry cleaning solvent (Federal Specification P-D-880) and dry thoroughly with filtered compressed air.

(2) Clean all electrical parts with a clean, lint-free cloth lightly moistened with an approved solvent.

(3) Visually inspect collars, piston, and bore in valve block for nicks, burrs, scores, and other damage.

(4) Insert piston into valve block bore to ascertain that it moves freely.

(5) Inspect transducer slug and bore of transducer for nicks, burrs, scratches, and other damage. Remove minor nicks and burrs from transducer slug with crocus cloth.

(6) Inspect transducer for burns, discoloration, and other indications of electrical malfunction. Check continuity of transducer using figure 3-38 as a guide.

(7) Inspect electrical connectors for cracks, bent or broken pins, and other damage.

(8) Inspect armature cores for cracks, corrosion, and burns or other indications of electrical malfunction. Check continuity of cores using figure 3-38 as a guide.

(9) Inspect cover and valve block for cracks, corrosion, and other damage.

(10) Check all threads for crossing, stripping, and peening. Repair minor thread damage with a thread chaser.

(11) Inspect top and bottom orifices, spacer for nicks and burrs. Inspect three cornered valve for nicks and burrs on vertical edges that could cause binding; depth of needle hole should be at least 0.125 inch. Inspect bottom face of valve (opposite needle hole) for grooving. The valve may be polished to remove grooves. After polishing the bottom face, the overall length of the valve must be at least 0.240 inch, if not, replace the valve.

(12) Inspect needles for burrs and any wear indications. Check for straightness by rolling large diameter end with finger slowly on a known flat surface; observe small diameter end while rolling, it must not move up and down which indicates a bent needle. A bent needle, new or used, must be replaced as the pressures at Al and A2 ports will vary and be difficult to adjust for correct values.

(13) Replace any damaged or defective parts.

d. Assembly.

(1) Install coils (69, figure 3-37), lockwashers (68), and screws (67).

(2) Position armature (64), to install setscrews (66), and locknuts (65). Install armature (64), nuts (63), lockwashers (62) and screws (61).

(3) Install mounting plates (60), nuts (59), lockwashers (58), and screws (57).

(4) Install pin springs (56), with attaching parts, position adapters (55), to install lockwashers (54) and screws (53).

(5) Install new o-rings (52), bottom orifices (51), spacers (50), valves (49) with the holes in the up position to accept needles, new o-rings (48), top orifices (47) and valve needles (46).

(6) Position valve blick (45), to install armature core (44), lockwashers (43) and screws (42).

(7) Install new gasket (41), cover (40), lockwashers (39) and screws (38).

(8) Install new gasket (37), electrical connector, with lockwashers (35) and screws (34)

(9) Install new o-rings (33) and plugs (32).

(10) If removed, install roll pin (31).

(11) install transducer (30) to 0.125 inches below outside edge of valve block, and secure with setscrew (25).

(12) Install split spacer (29), electrical connector (28), lockwasher (27) and screw (26).

(13) Install piston (24).

(14) install quad-ring collar (23), collar (22), new o-ring (21), washer (20), retaining ring (19) and clevis (18).

(15) Install quad-ring collar (17), collar (16), new o-ring (15), washer (14) and retaining ring (13).

(16) Install transduce slug (12).

(17) Install link (11), and tighten setscrew (10).

(18) Install lockwasher (9) and screw (8).

(19) Install new o-ring (7), filter assembly (6), adapter (5) and elbow (4).

(20) Install new o-ring (3), adapter (2) and elbow (1)

e. Testing with test stand.

(1) Install hydraulic actuator unit in test stand as follows: (See figure 3-39.)

(a) Connect hydraulic fluid supply from test stand gauge (G3) to actuator inlet port (P).

(b) Connect hydraulic fluid return line to actuator port (R).

(c) Connect test stand gauge (G1) to actuator unit test point (A1).

(d) Connect test stand gauge (G2) to actuator test point (A2).

(e) Connect connectors (P3) and (P4) of test stand electrical cable assemblies to actuator unit connectors (J6 and J4) respectively.

(2) Start the test stand.

(3) Beginning at position 1, rotate switch (S3) to each position and compare the readings with those of table 3-2.

(4) Place test stand switch (S2) in the off position to turn off hydraulic fluid pump.

(5) Place the actuator unit piston in the full fuel position and check indication on test stand meter (M1). Indication should be less than 3 volts.

(6) Place the actuator unit piston in the no fuel position and check indication on test stand meter (M1). Indication should be approximately 48-55 volts.

(7) Slowly, at an even rate, move the hydraulic actuator unit piston from the no fuel to the full fuel position while observing test stand meter (M1). The indication on meter should decrease, at an even rate, from approximately 50 volts to less than 3 volts. The indication should not change directions.

(8) Shut off test stand and remove the hydraulic actuator unit.

(9) If unit failed to meet test requirements, disassemble and ascertain cause. Retest prior to installation.

f. Test without test stand.

(1) Actuator Valve and Piston Test.

(a) See figure 3-40 to perform the valve and piston test.

(b) Connect dc power supply (ps) and switch (S1) to J6 as illustrated. Connect voltmeter (Ml) with resistor (R1) to pins A and B of J4.

(c) Attach gage G1 and G2 as shown. Connect hydraulic power source (310-320 psi, 2 gpm) and gage G3 and provide a return line from port R to the hydraulic sump.

(d) To adjust the valves, remove the large round cover and replace it with a similar diameter collar which will allow access to the adjustment screws and jam nuts. This is necessary to contain the hydraulic fluid which is ported within this cover.

(e) With hydraulic power but no electric power applied, adjust the valve with Allen set screw to yield 200 psi ± 10 psi at A1 port (gage G1) and 150 psi ± 10 psi at A2 port (gage G2). (See figure 3-40).

CAUTION

Avoid overadjusting to prevent pressures or forces which could bend valve push rods. Failure to observe this caution could result in equipment damage.

(f) After adjusting, lock Allen adjusting screws with jam nuts, and install cover.

(9) Set S1 to the center position (solenoid coils in series). Apply 350 ± 20 ma through the coils. Pressures at A1 and A2 ports shall remain the same (step e above).

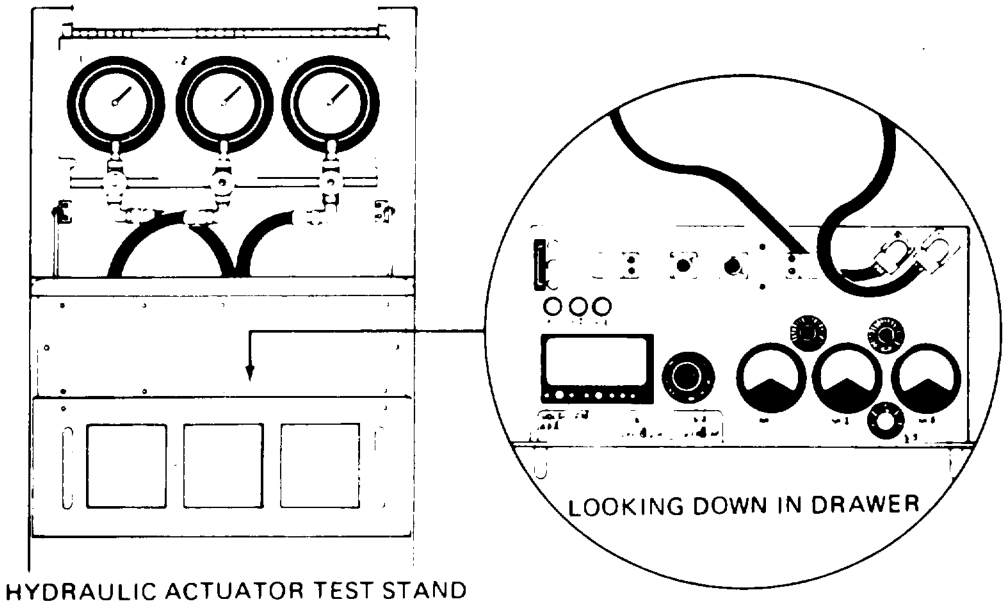
(h) Set switch S1 to connect power (PS) to coil L2 and apply 700 ma ± 40 ma. Pressure at A1 port (gage G1) shall be 310 to 400 psi. pressure at A2 port (gage G2) shall be O to 20 psi.

(i) Set switch S1 to connect power (PS) to coil L1 and apply 700 ma ± 40 ma. Pressure at A1 port (gage G1) shall be 0 to 40 psi and pressure at A2 port (gage G2) shall be 310 to 400 psi.

(2) Throttle Position Transducer Test.

(a) With voltmeter (M1), resistor (R1) and 120 ± 1%, 60 Hz) power source connected as shown in figure 3-40, move piston to fully open throttle position.

(b) With the transducer body locked in place by its set screw, loosen the transducer core set screw and move the core relative to the body until a minimum voltage (0.5 to 2.5 volts) is obtained on the transducer secondary, as indicated on M1.



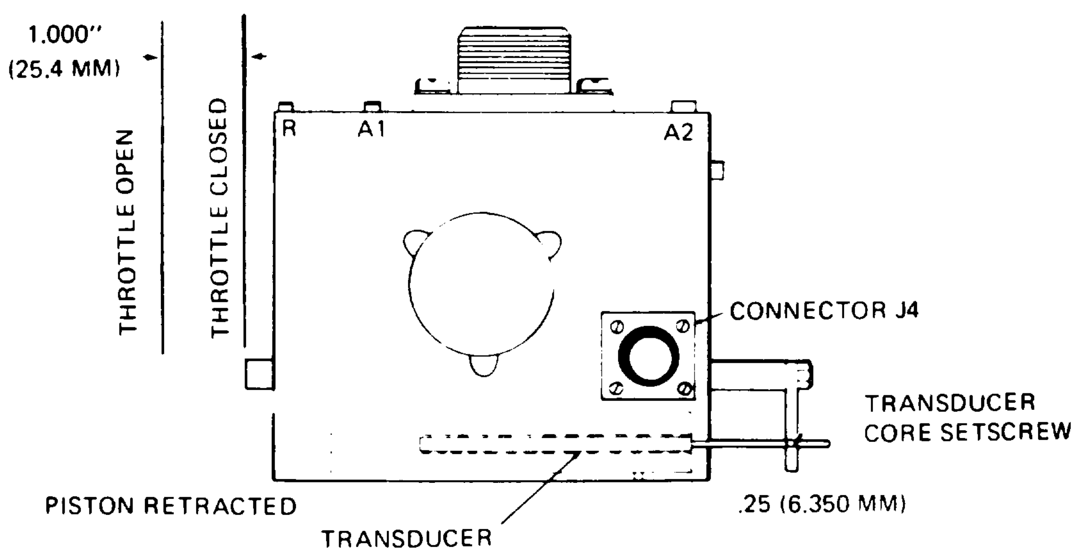


Figure 3-39. Hydraulic Actuator Unit Test
(Electro-Hydraulic Governor Equipped Precise Sets Only)

(c) Move the piston gradually towards the fully closed throttle position. The transducer secondary voltage, indicated by meter M1 shall increase in a linear manner to a maximum of 48 to 55 volts.

(d) Repeat these adjustments until the transducer secondary voltage increases linearly from the lowest possible value to a maximum value over the entire 1.0 inch displacement of the piston.

(e) When final adjustment is made lock the transducer core in place with the transducer core set screw.

(f) Remove the gages, meter, and power supplies.

9. Installation and Final Adjustment.

(1) Position actuator unit (14, figure 3-36) to install Iockwashers (13), and bolts (12).

(2) If removed, install threaded rod (11), locknut (10), rod ends (9), screws (8) and nut (7)

(3) Install bolt (6) and nut (5).

(4) Connect hydraulic lines (4 and 3) and electrical connectors (2 and 1).

(5) Refer to the Operator and Unit Maintenance Manual and fill the hydraulic tank.

NOTE

Leave governor linkage loose to accommodate adjustments.

(6) Place the generator set START-RUN- STOP switch in the RUN position.

CAUTION

Do not attempt to start the generator set. Failure to observe this caution could result in equipment damage.

(7) Place the generator set BATTLE SHORT switch in the override (ON) position.

(8) Beginning at the full counterclockwise position, rotate the fuel injection pump shutoff lever in the clockwise direction until a slight resistance is felt. Hold the shutoff lever in this position.

NOTE

This resistance is the fuel injection pump governor linkage hook engaging the metering valve arm.

(9) Move the hydraulic actuator unit piston to the extended position for 69-600-3, retracted position for 69-600-2 (refer to table 3-2).

(10) Adjust the hydraulic actuator governor linkage until it fits between the actuator unit piston clevis and the fuel injection pump shutoff lever.

(11) Return the generator set START-RUN-STOP switch to the STOP position and the BATTLE SHORT switch to the OFF position.

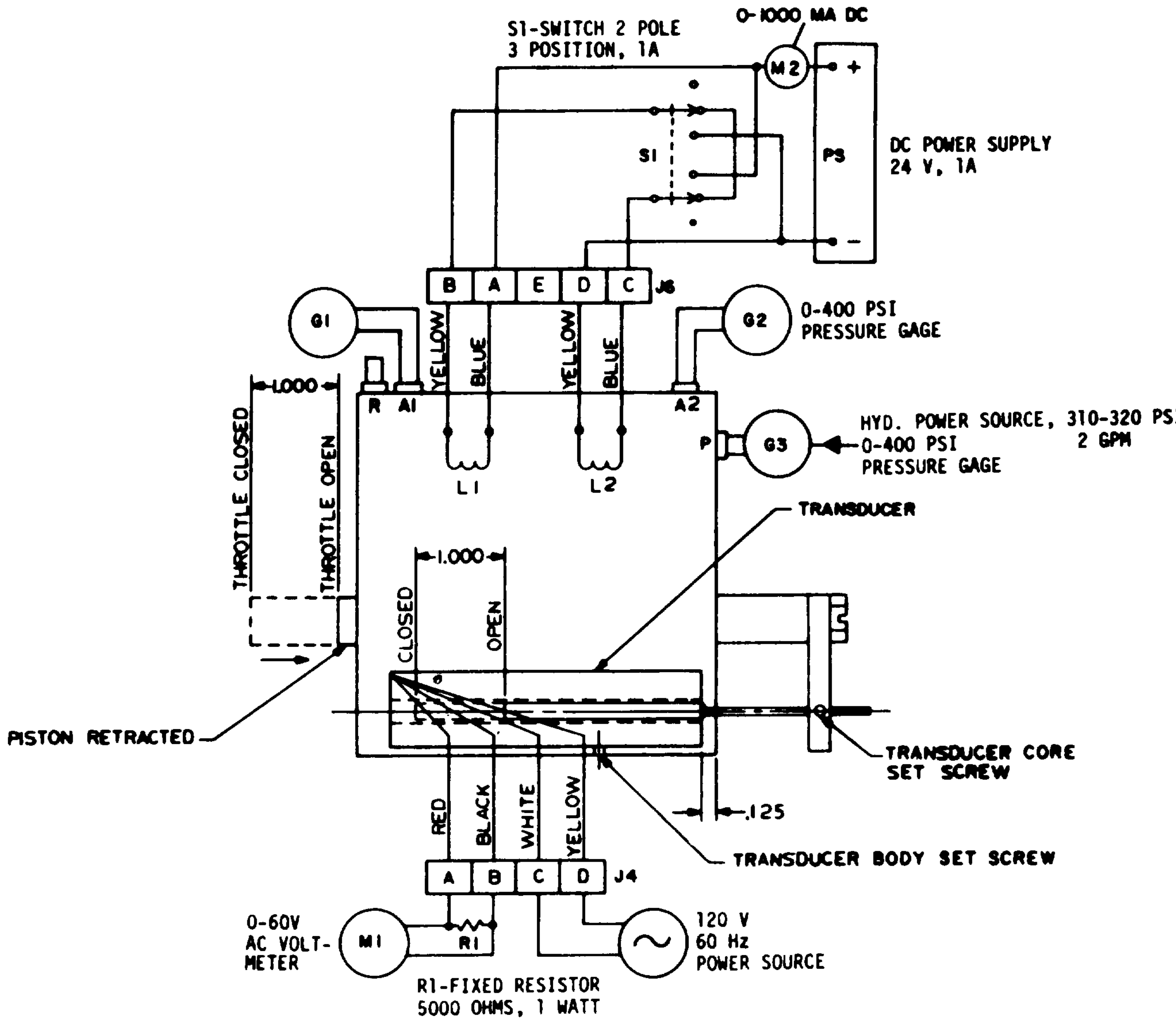


Figure 3-40. Hydraulic Actuator Tests, Schematic Diagram
(Electro-Hydraulic Governor Equipped Precise Sets Only)

Table 3-2. HYDRAULIC ACTUATOR TEST VALUES

ACTUATOR STYLES						
69–600–2						
13217E5390–2, 32D1560G13, 1261A05G02, 1289A86G02						
S3 SWITCH POSITION	COIL CURRENT		GAUGE PRESSURE			FLOW METER
	M2 (L1)	M3 (L2)	G1	G2	G3	
1 MECH BIAS	0	0	200±20	150±20	320±20	GREEN AREA
2 BAL COIL	.35±.02	.35±.02	200±20	150±20	320±20	GREEN AREA
3 RET PISTON	.70±04	0	310 MIN	40 MAX	380 MAX	0
4 EXT. PISTON	0	.70±.04	40 MAX	310 MIN	380 MAX	0
FULL FUEL POSITION – PISTON RETRACTED						
ACTUATOR STYLES						
69–600–3						
13217E5390–3,32D1560G31, 32D1560G32, 1261A05G03, 1289A86G03						
S3 SWITCH POSITION	COIL CURRENT		GAUGE PRESSURE			FLOW METER
	M2 (L2)	M3 (L1)	G1	G2	G3	
1 MECH BIAS	0	0	150±20	200±20	320±20	GREEN AREA
2 BAL COIL	.35±.02	.35±.02	150±20	200±20	320±20	GREEN AREA
3 EXT PISTON	.70±.04	0	40 MAX	310 MIN	380 MAX	0
4 RET. PISTON	0	.70±.04	310 MIN	40 MAX	380 MAX	0
FULL FUEL POSITION – PISTON EXTENDED						

Section VI MAINTENANCE OF INTAKE AND EXHAUST SYSTEMS AND BREATHER

344. GENERAL.

a. The intake system consists of a dry type air cleaner assembly with a reusable type filter element. The assembly removes dust and dirt from the engine combustion air. It is equipped with a restriction transducer. The restriction transducer measures vacuum in the air cleaner housing. When the filter element becomes sufficiently clogged that the vacuum begins to impair engine performance, the restriction transducer transmits an electrical impulse to the air cleaner condition indicator on the engine control panel.

b. The exhaust system consists of a muffler assembly. The system muffles the noise of engine operation and provides a means of expelling exhaust fumes from the generator set. The exhaust pipe end of the muffler assembly is fitted with a rain cap which prevents the entry of foreign material when the engine is not operating.

c. The breather system provides an escape for gases which accumulate in the engine crankcase during engine operation. The gases pass through the breather which traps oil vapors, and is drawn into the engine air cleaner housing through the breather tube.

3-45. AIR CLEANER ASSEMBLY.

Refer to the Operator and Unit Maintenance Manual for air cleaner assembly maintenance procedures.

3-46. EXHAUST PIPE AND MUFFLER.

Refer to the Operator and Unit Maintenance Manual for exhaust pipe and muffler maintenance procedures.

3-47. BREATHER AND BREATHER TUBE.

Refer to the Operator and Unit Maintenance Manual for breather and breather tube removal procedure.

Section VII. MAINTENANCE OF ENGINE ASSEMBLY

3-48. GENERAL.

a. The engine assembly is a four cylinder, four cycle, fuel injected, compression ignition, liquid cooled diesel engine. The assembly consists of the cylinder head, rocker arm assembly, timing gears and housing, camshaft, flywheel and flywheel housing, main bearings and crankshaft, piston and connecting rod assembly, and cylinder block.

b. The cylinder head is a one piece casting and is detachable. Valve seats are part of the casting, but valve guides are removable.

c. The rocker arm assembly is mounted on the cylinder head. It functions to open and close the valves.

d. The timing gears determine the sequence of valve opening and fuel injection. The gears are enclosed in a housing, the cover of which contains the front crankcase oil seal.

e. The cam shaft actuates the rocker arm assembly which operates the valves. It is driven by a gear which meshes with the crankshaft gear.

f. The flywheel is made of cast iron. It is machined to accommodate the coupling disc of the generator assembly. The flywheel is attached to the crankshaft by six bolts, one of which is off center. This permits the flywheel to be installed in only one position for timing purposes. The flywheel housing serves as a cover for the rear of the cylinder block and oil pan and as a partial enclosure for the flywheel. It provides the mounting for the starter assembly and also contains the rear crankshaft seal.

g. The crankshaft has five main bearing journals and four connecting rod bearing journals. This arrangement places each connecting rod journal between two main bearing journals. All bearing journals are surface hardened and are drilled for oil passages.

h. The connecting rods are heavy alloy steel forgings with precision type bearings for the crankshaft and bronze bushings for the full floating piston pin. The pistons are made of aluminum and are the solid type (no saw slots or splits in the skirt). Each piston is fitted with five rings. The top three rings are compression type and the fourth ring from the top is an oil control ring. The fifth ring is an oil scrapper ring.

i. The cylinder block and crankcase are cast as a single unit giving ridged support for the crankshaft. Cooling is obtained by water jacketing the entire length of the block. When installed in the generator set, the block is supported by the front engine support with rear support supplied through ridged coupling to the generator assembly housing.

3-49. ENGINE FRONT SUPPORT.

a. Removal.

NOTE

If engine is not removed from the generator set, block the front of the engine prior to removing the front engine support.

(1) Remove nut (1, figure 3-41), Iockwasher (2), ring (3), and crankshaft (4).

(2) Remove front engine support from crankshaft by removing bolt and Iockwasher.

b. Cleaning, Inspection, and Repair.

WARNING

Solvent, Dry Cleaning P-D-880, Type H is flammable and moderately toxic to skin, eyes and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate. Failure to observe this warning could result in servere personal injury or death.

WARNING

Compressed air used for cleaning and drying purposes can create airborne particles that may enter the eyes. Pressure shall not exceed 30 psig and use only with adequate chip guards and chipping goggles. Failure to observe this warning could result in servere personal injury or death.

(1) Clean all parts in a dry cleaning solvent (Federal Specification P-D-880) and dry thoroughly with filtered compressed air. Remove caked grease deposits with a stiff bristle brush.

(2) Inspect engine front support for cracks, corrosion, and excessive wear. Check inner surfaces for scores, ridging, and other damage.

(3) Check crankshaft pulley for corrosion, cracks, and step wear in v-belt groove.

(4) Check all threads for crossing, stripping, and peening.

(5) Repair minor thread damage with a thread chaser.

(6) Replace any parts damaged beyond repair.

c. Installation.

(1) Install lockwasher (7, figure 3-41), bolt (6), to crankshaft to install engine front support (5)

(2) Install crankshaft (4), ring (3), Iockwaser (2) and nut (1).

1. Nut
2. Lockwasher
3. Ring
4. Crankshaft
5. Engine Front Support
6 Bolt
7 Lockwasher

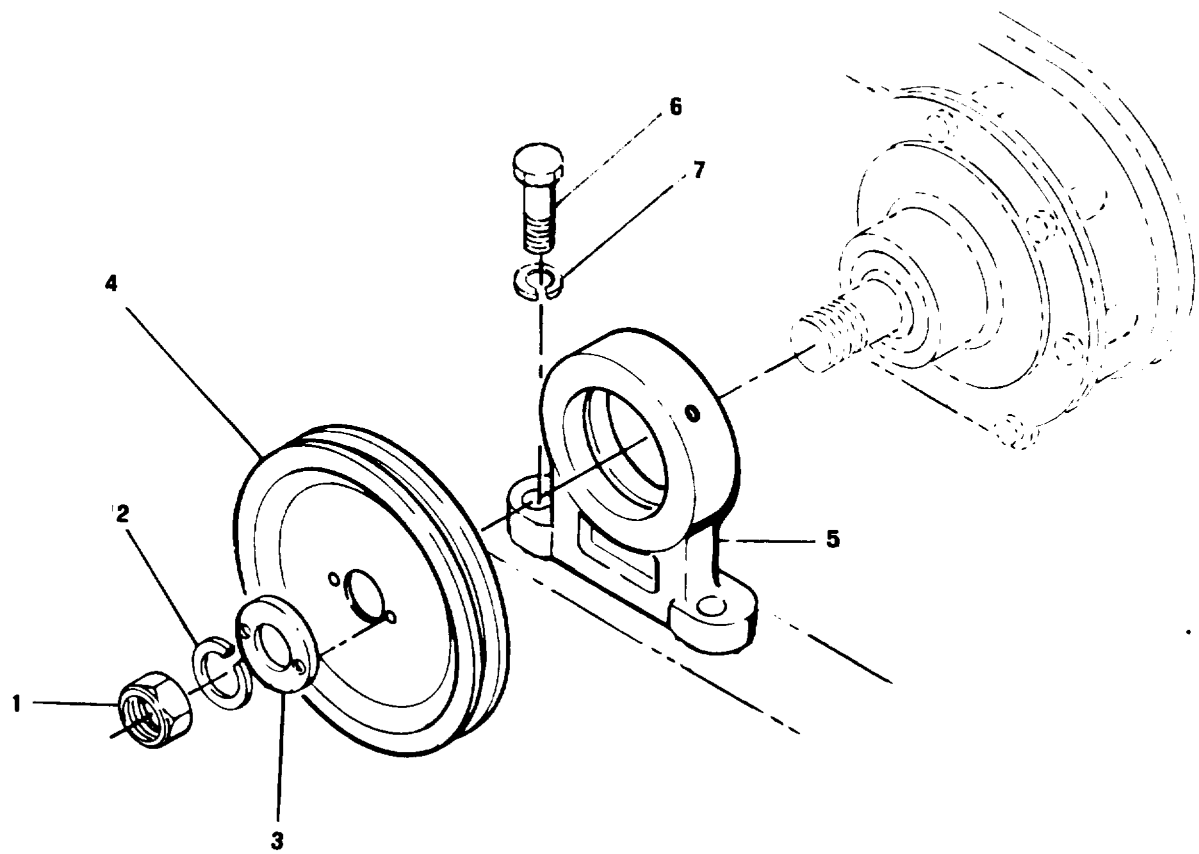


Figure 3-41. Engine Front Support, Removal and Installation

3-50. FLYWHEEL AND FLYWHEEL HOUSING.

a. Removal.

(1) Remove oil pan assembly (paragraph 3-37).

(2) Remove screws (1, figure 3-42) to remove flywheel (2) and ring gear (3) as an assembly. Do not remove ring gear unless it is badly damaged and replacement is necessary.

(3) Remove nuts (4), lockwashers (5), screws (6), lockwasher (7), screw (8) and lockwasher (9) to remove flywheel housing (10) and gasket (11). Discard gasket.

(4) Using a suitable press, remove oil seal (12) from flywheel housing and discard.

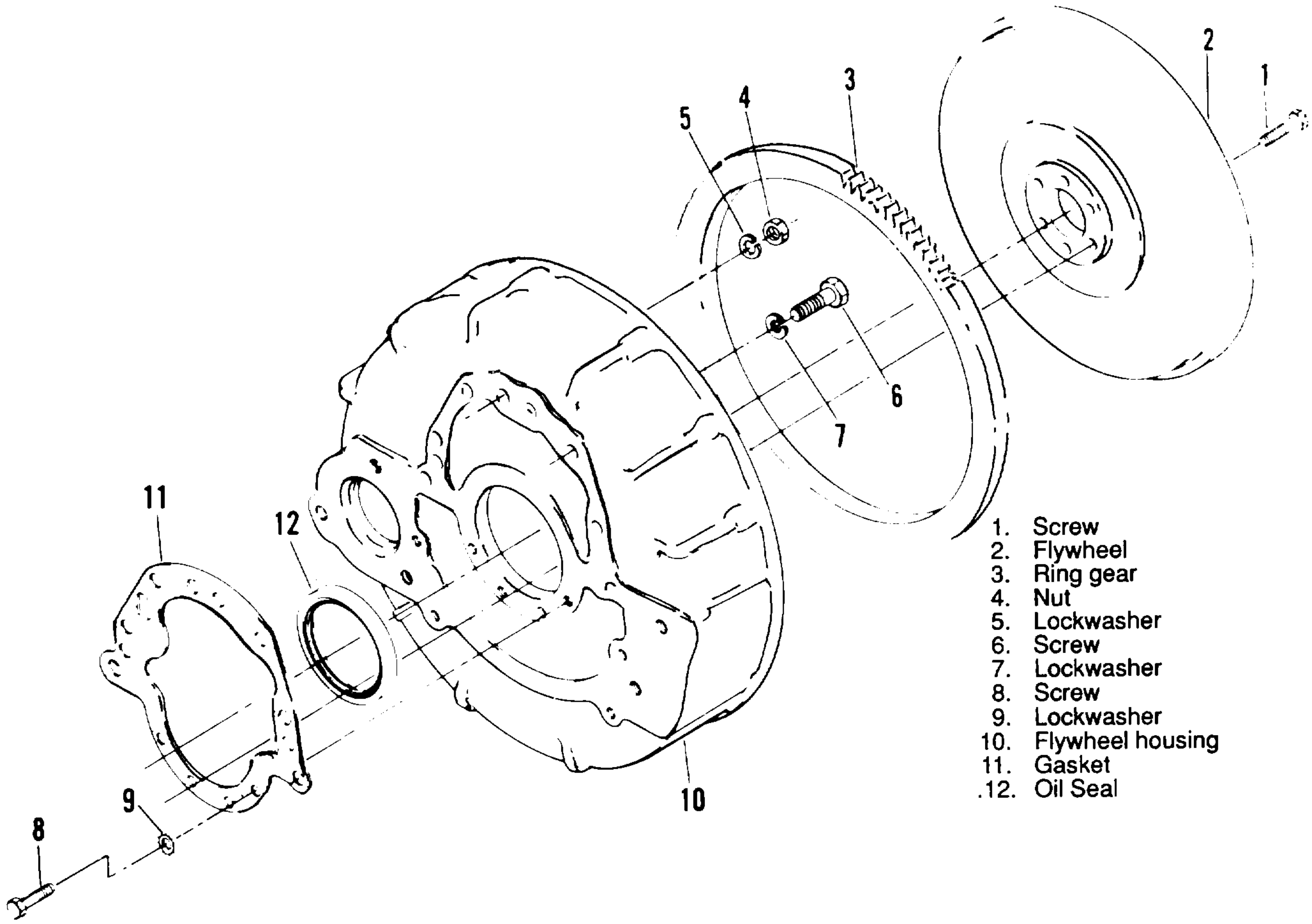


Figure 3-42. Flywheel and Flywheel Housing, Exploded View

b. Cleaning, Inspection. and Repair.

WARNING

Solvent, Dry Cleaning P–D–680, Type II is flammable and moderately toxic to skin, eyes and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate. Failure to observe this warning could result in servere personal injury or death.

(1) Clean all parts in dry cleaning solvent (Federal Specification P-D-680) and dry thoroughly. Remove caked grease deposits with a stiff bristle brush.

(2) Inspect flywheel for cracks, nicks, and burrs. Remove minor nicks and burrs with crocus cloth.

NOTE

Rinse flywheel in dry cleaning fluid after dressing with crocus cloth. Crocus cloth contains ferrous oxide which will accelerate rusting of cast iron parts.

(3) Inspect ring gear for cracks, chipped or broken teeth and other damage. If ring gear is badly damaged, replace as follows:

(a) Heat flywheel and ring gear in an oven at 450°F (232.2 °C) for two hours.

WARNING

Wear heat resistant gloves when handling heated flywheel to avoid serious burns. Failure to observe this warning could result in servere personal injury or death.

(b) Remove flywheel and ring gear and lightly tap ring gear to separate.

(c) Heat replacement ring gear as in step (3) (a) above while freezing flywheel.

CAUTION

Wear heat resistant gloves when handling frozen flywheel and heated ring gear. Failure to observe this caution could result in equipment damage.

(d) Quickly install heated ring gear onto frozen flywheel.

(4) Inspect flywheel housing for cracks, excessive corrosion, and defective paint.

(5) Repair cracks in flywheel housing by welding.

(6) Remove corrosion from flywheel housing with No. 00 grit abrasive paper soaked in oil. Clean flywheel housing with dry cleaning solvent after removing corrosion.

(7) Repair defective paint by removing. Treat and paint.

(8) Replace oil seal each time flywheel housing is removed.

c. Installation.

NOTE

One flywheel bolt is off center to insure proper alignment.

(1) Using a suitable press, install new oil seal (12, figure 3-42) to flywheel housing.

(2) Install gasket (11), flywheel housing (10), with lockwashers (9), screw (8), lockwasher (7), screws (6), lockwashers (5) and nut (4).

(3) Install ring gear(3), as an assembly onto flywheel (2) with screws (l).

(4) Install oil pan assembly (paragraph 3-37).

d. Testing.

(1) Turn crankshaft to dead center (DC) position.

(2) Attach a dial indicator to flywheel housing and position so that foot rides on inner face of pilot bore (see figure 3-43).

(3) Set dial indicator pointer to zero position.

(4) Slowly rotate crankshaft one complete revolution.

(5) Concentricity of pilot bore shall not vary 0.005 inch total reading.

(6) Position dial indicators that foot rides on outer face of flywheel (see figure 3-43).

(7) Set dial indicator pointer to the “zero” position.

(8) Slowly rotate crankshaft one complete revolution.

(9) Alignment of flywheel shall not vary more than 0.005 inch total reading.

(10) Replace flywheel if the above test requirements cannot be met.

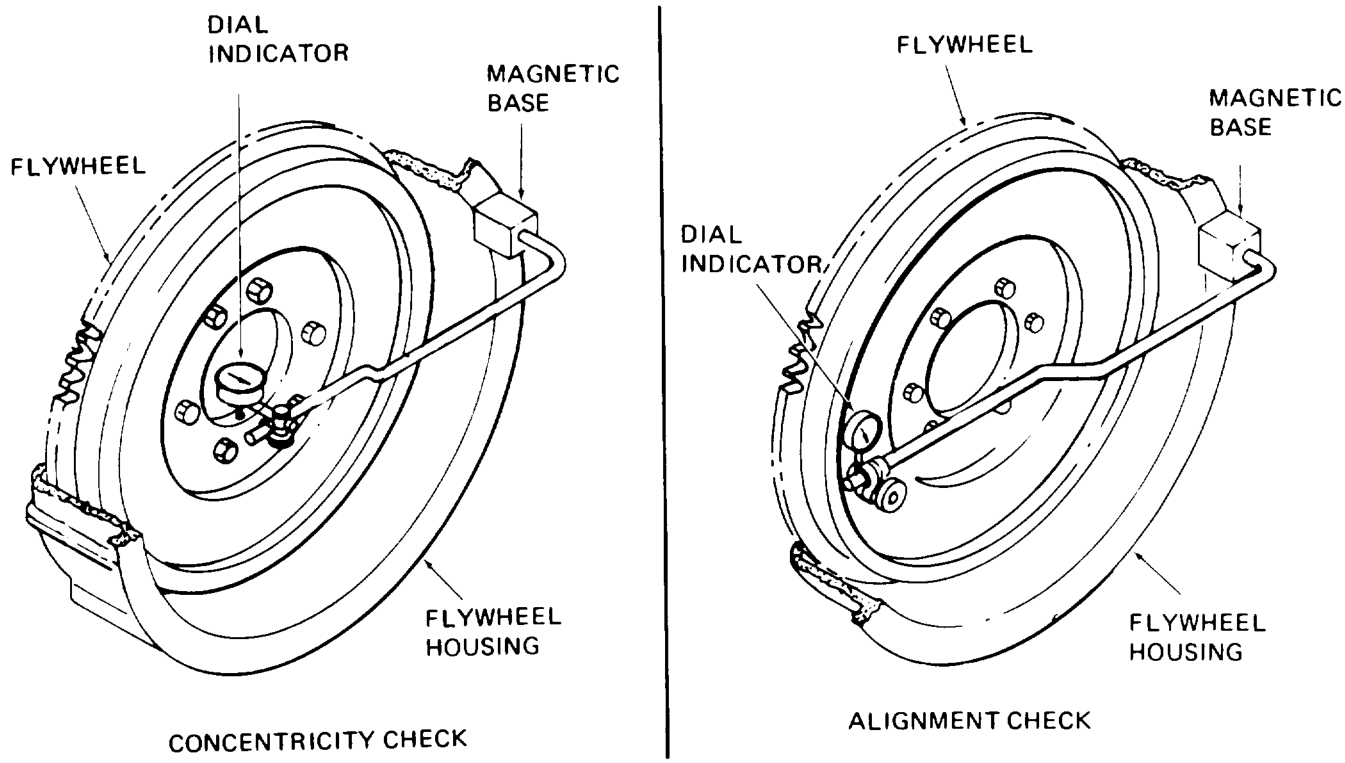


Figure 3-43. Checking Flywheel Concentricity and Alignment

3-51. TIMING GEARS AND COVER.

a. Removal and Disassembly.

(1) Remove the hydraulic pump assembly (paragraph 3-41).

(2) Remove the fuel injector nozzle from No. 1 cylinder.

(3) Turn the engine over until the 20 degree before top dead center (BDC) mark on the engine flywheel is aligned with the timing mark on the flywheel housing and No. 1 cylinder is on compression stroke.

(4) Remove the front engine support (paragraph 3-49).

(5) Remove screws (1, figure 3-44) and Iockwashers (2) to remove fuel pump thrust plate (3), gasket (4), thrust button (5) and spring (6). Discard gasket.

(6) Remove screws (7, 9, 11, and 13), screws (15), and Iockwashers (8, 10, 12, 14, and 16) to remove timing gear cover (17) and gasket (18). Discard gasket.

(7) Press seal (19) from cover and discard.

(8) Remove nut (20) and Iockwasher (21) to remove fuel pump drive gear (22).

(9) Remove screw (23) and washer (34) to remove idler assembly (25).

(10) If inspection indicates that idler bearings must be replaced, disassemble idler as follows:

(a) Remove bearings (26) and press races (27) from gear (29).

NOTE

Each bearing and race is a matched set and must be replaced as such.

(b) Remove ring (28) from gear.

(11) Do not remove idler shaft (30) from cylinder block unless inspection reveals damage.

(12) Remove screws (31) and lockwashers (32) to remove housing (33) and gasket (34). Discard gasket.

b. Cleaning, Inspection, and Repair.

WARNING

Solvent, DryCleaning P-D-680, Type II is flammable and moderately toxic to skin, eyes and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate. Failure to observe this warning could cause servere personal injury or death.

(1) Clean all parts with dry cleaning solvent (Federal Specification P-D-680) and dry thoroughly.

(2) Visually inspect timing gear cover for cracks, corrosion, and other damage,

(3) Inspect gears for cracked, chipped or broken teeth and excessive wear.

(4) Inspect bearings for pitting and excessive wear.

(5) Inspect thrust plate for cracks and deep wear patterns.

(6) Inspect idler shaft for cracks, wear, and other damage.

(7) Inspect threads for crossing, stripping, and peening.

(8) Replace seal at each overhaul.

(9) Replace any damaged or worn parts.

c. Assembly and Installation.

(1) Using new gasket, install housing (33) and secure with lockwashers (32) and screws (31).

(2) If shaft (30) was removed, press replacement into timing gear housing.

(3) If bearings were replaced, assemble idler assembly as follows:

(a) Install ring (28) into gear (29).

(b) Press races (27) into gear until they seat against ring.

(c) Install bearings (26).

(4) Check that 20 degree (BDC) mark on flywheel is still aligned with timing mark on flywheel housing.

(5) Install idler assembly and secure with washer (24) and screw (23). Torque idler shaft screw to 24-27 ft-lb.

(6) Install fuel pump drive gear (22) insuring that the proper timing has been maintained (see paragraph 3-22). Secure gear with lockwasher (21) and nut (20). Torque drive gear nut to 35-40 ft-lb.

(7) Press replacement seal (19, figure 3-44) into cover.

NOTE:
Spacers (35) located top and bottom holes of cover (17).

1. Screw
2. Lockwasher
3. Thrust plates
4. Gasket
5. Thrust button
6. Spring
7. Screw
8. Lockwasher
9. Screw
10. Lockwasher
11. Screw
12. Lockwasher
13. Screw
14. Lockwasher
15. Screw
16. Lockwasher
17. Timing gear cover
18. Gasket
19. Seal
20. Nut
21. Lockwasher
22. Fuel pump drive gear
23. Screw
24. Washer
25. Idler assembly
26. Bearing
27. Race
28. Ring
29. Gear
30. Idler shaft
31. Screw
32. Lockwasher
33. Housing
34. Gasket
35. Spacer

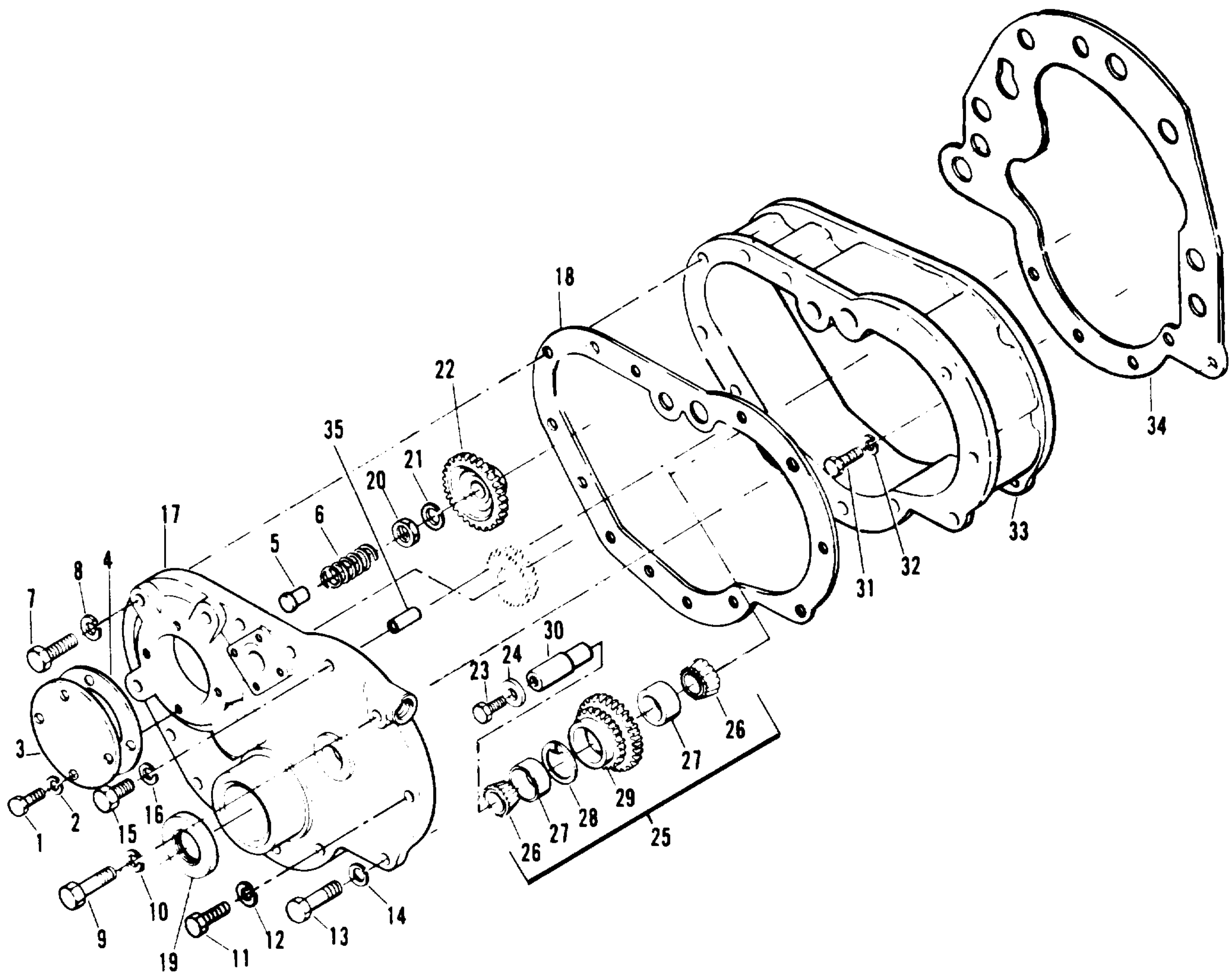


Figure 3-44. Timing Gears and Cover, Exploded View

(8) Install gasket (18) and cover (17) and secure with Iockwashers (8, 10,12,14, and 16), screw (15) and screws (7, 9, 11, and 13).

(9) Install spring (6), thrust button (5), gasket (4), and thrust plate (3) and secure with Iockwashers (2) and screws (1).

(10) Install hydraulic pump assembly (paragraph 3-41).

(11) Install front engine support (paragraph 3-41).

(12) Install injector in No. 1 cylinder and tighten sufficiently to stop all leakage.

1. Crankshaft gear
2. Idler assembly
3. Camshaft gear
4. Fuel pump drive gear
5. Timing gear housing
6. Timing marks

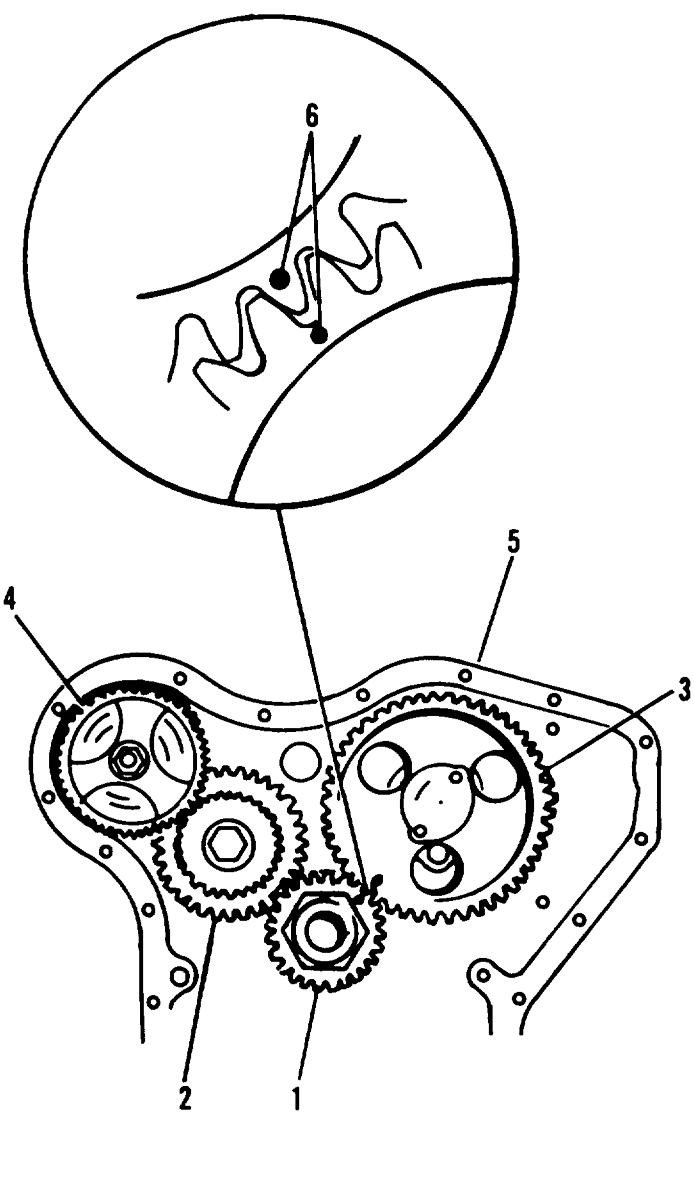


Figure 3-45. liming Gear Relationships

3-52. INTAKE MANIFOLD.

Refer to the Operator and Unit Maintenance Manual for intake manifold maintenance procedure.

3-53. EXHAUST MANIFOLD.

Refer to the Operator and Unit Maintenance Manual for exhaust manifold maintenance procedure.

3-54. CYLINDER HEAD AND ROCKER ARM ASSEMBLY.

a. Removal.

(1) Refer to the Operator and Unit Maintenance Manual and remove the air cleaner assembly, muffler and exhaust pipe assembly, intake manifold, exhaust manifold, coolant control thermostat, and injector nozzle holder assemblies.

(2) Remove nuts (1, figure 3-46) and Iockwashers (2) to remove lifting eyes (3).

(3) Remove nuts (4) and washers (5) to remove rocker arm assembly (6) and push rods (7).

(4) Remove nuts (8) and washers (9).

CAUTION

Tap cylinder head lightly with a soft hammer to loosen it. Do not pry on contact surfaces. Failure to observe this caution could result in equipment damage. Failure to observe this caution could cause damage to the equipment.

(5) Lift cylinder head (10) from engine.

(6) Remove and discard gasket (11).

b. Disassembly.

(1) Remove retaining rings (12) to remove mounting blocks (13, 14, and 15), spacers (16), rocker arm (17) and springs (18) from shaft (20).

NOTE

Record position and quantity of spacers (16) to facilitate assembly.

(2) Remove adjustment screws (19).

(3) Do not remove plugs (21).

(4) Using a valve spring depressor, depress valve springs and remove locks (22 and 23).

(5) Release valve springs and remove spring seats (24 and 25), valve springs (26 and 27), exhaust valves (28) and intake valves (29).

(6) Remove and discard bonnets (30).

(7) Do not remove valve guides (31 and 32) plugs (33), studs (34), seal (35) fuel injector sleeves (36), and valve tappet (37) unless inspection reveals damage.

(8) Remove side plates (18, figure 3-53) from cylinder block (16).

1. Nut
2. Lockwasher
3. Lifting eye
4. Nut
5. Washer
6. Rocker arm assembly
7. Push rod
8. Nut
9. Washer
10. Cylinder head
11. Gasket
12. Retaining ring
13. Mounting block
14. Mounting block
15. Mounting block
16. Spacer
17. Rocker arm
18. Spring
19. Adjustment screw
20. Rocker arm shaft
21. Plug
22. Locks
23. Locks
24. Spring seat
25. Spring seat
26. Valve spring
27. Valve spring
28. Exhaust valve
29. Intake valve
30. Bonnet
31. Valve guide
32. Valve guide
33. Plug
34. Stud
35. Seal
36. Fuel injector sleeve
37. Valve tappet

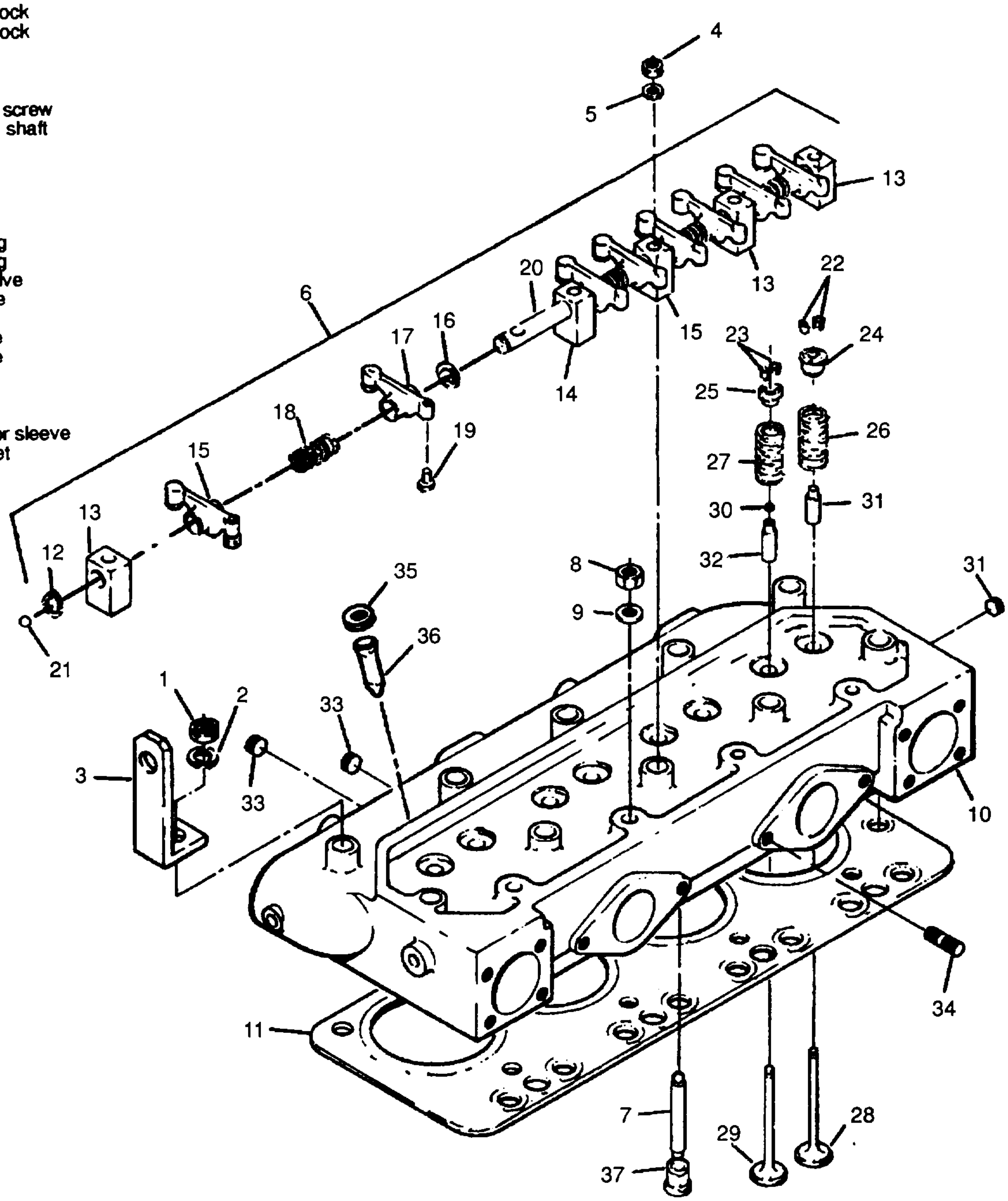


Figure 3-46. Cylinder Head and Rocker Assembly, Exploded View

c. Cleaning, Inspection, and Repair.

WARNING

Solvent, Dry Cleaning P-D-680, Type II is flammable and moderately toxic to skin, eyes and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate. Failure to obsever this warning could cause servere personal injury or death.

WARNING

Compressed air used for cleaning and drying purposes can create airborne particles that may enter the eyes. Pressure shall not exceed 30 psig and use only with adequate chip guards and chipping goggles. Failure to obsever this warning could cause servere personal injury or death.

(1) Clean all parts in dry cleaning solvent (Federal Specification P-D-680) and dry thoroughly with filtered compressed air.

(2) Scrape carbon deposits from valves and cylinder head.

(3) Visually inspect rocker arms for cracks, corrosion, and excessive wear. Check that oil holes are open.

(4) Inspect rocker arm shafts for cracks, deep wear patterns, nicks, and burrs. Remove minor nicks and burrs with oil soaked crocus cloth. Clean polished shaft in dry cleaning solvent to remove abrasive particles.

(5) Inspect blocks for cracks, nicks, burrs, and excessive wear. Remove nicks and burrs from outer surfaces with fine abrasive paper or stone.

(6) Inspect springs for cracks, breaks, chaffing and distortion.

(7) Inspect push rods for cracks, bends, excessive wear, nicks and scratches. Polish push rods with crocus cloth to remove minor defects.

(8) Inspect valve guides for excessive wear. Bore diameter of exhaust valve guide shall be 0.3750 to 0.3790 inch. Bore diameter of intake valve guide shall be 0.3740 to O. 3780 inch.

(9) Replace worn valve guides as follows:

(a) Use a 5/8 inch drift with a 3/8 inch pilot and drive out valve guides.

(b) Drive replacement valve guides to a depth of 1.3700 to 1.3800 inches blow cylinder head deck.

(c) Ream bore diameter of intake valve guides to 0.3740 to 0.3750 inch.

(d) Ream bore diameter of exhaust valve guides to 0.3750 to 0.3760 inch.

(10) Inspect valve springs for cracks, breaks, and distortion. Using a spring tester, compress valve spring to a length of 1.4920 inches. Test load shall be 72 to 82 pounds. Compress spring to a length of 1.0820 inches. Test load shall be 80 to 86 pounds.

(11) Inspect cylinder head for cracks, breaks, and broken studs. Remove broken studs by center punching, drilling, and using an easy out.

(12) Check cylinder head for warping using a straightedge and feeler gauge. Check lengthwise and between each cylinder crosswise. Warpage shall not exceed 0.003 inch laterally and 0.005 inch longitudinally. Cylinder head may be milled to remove minor warpage.

(13) Perform magnetic particle inspection in accordance with established procedures.

(14) Inspect valve seats of cylinder head. If they are pitted or if new valve guides were installed, the valve seats must be refinished, using a tool with a 3/8 inch pilot. Both intake and exhaust valve seats should be refinished on an angle of 30 degrees for intake valves and 45 degrees for exhaust valves.

NOTE

Use a vibrating angle grinder type tool. The large diameter and surface area of the valve seats makes obtaining a proper finish with a reamer type tool extremely difficult.

(15) Inspect valves for bent or broken stems, cracks, and pitting of sealing surface. Using a micrometer, check valve stem diameter to determine wear. Stem diameter of intake valves shall be 0.3725 to 0.3735 inch. Stem diameter of exhaust valves shall be 0.3740 to 0.3750 inch.

(16) Check all threads for crossing, stripping, and peening. Repair minor thread damage with a thread chaser.

(17) Repair slightly damaged valves as follows:

(a) Polish stems with crocus cloth to remove minor nicks and scratches.

(b) Reface slightly pitted valves on a valve grinding machine. See table 1-1 for valve seat width.

(18) If valves and valve seats have been refinished or if contact surfaces are only slightly pitted, lap each valve into its seat as follows:

(a) Install a light coil spring with enough tension to hold valve off its seat.

(b) Lubricate valve stem and guide.

(c) Apply a thin coating of coarse grinding compound to the valve face.

(d) Insert valve into valve guide and attach a hand grinding tool.

CAUTION

Avoid continuous round and round motion which could cut grooves in valve face and seat. Failure to observe this caution could result in equipment damage.

(e) Rotate valve back and forth while applying firm pressure on the grinding tool.

(f) Release pressure on grinding tool, allowing coil spring to lift valve from its seat.

(9) Rotate valve 15° to 20° and repeat the grinding process,

(h) Periodically clean valve and seat to check progress.

(i) Replenish grinding compound and continue grinding until the valve seat and valve surfaces are in contact.

(j) Remove valve. Clean valve and valve seat to remove all traces of coarse grinding compound.

(k) Apply a thin coating of fine grinding compound to face of valve.

(1) Install valve into cylinder head and repeat grinding process until a bright, silver-like band of uniform width appears on both valve and seat.

(m) Remove valve. Clean valve and valve seat to remove all traces of grinding compound. Dry valve and valve seat thoroughly.

(n) Make ten or twelve pencil marks, equally spaced, across valve seat.

(o) Install valve, press firmly, and rotate approximately one quarter of a turn.

(P) Remove valve and observe pencil marks. If marks are rubbed out, valve is seating properly. If all pencil marks are not rubbed out, repeat grinding process.

CAUTION

Mark each valve to insure that it will be installed in the seat into which it was ground. Failure to observe this caution could result in equipment damage.

(q) Repeat grinding process for each valve.

d. Assembly.

(1) Lubricate stem of intake valves (29) and exhaust valves (28) and insert into valve guides (31 and 32).

(2) Install bonnets (30), valve springs (26 and 27), spring seats (24 and 25) and locks (22 and 23).

NOTE

Bonnets are installed on intake valves only.

(3) Assemble rocker arm assembly as follows:

(a) Install adjusting screws (19) into rocker arms (17).

(b) Assemble springs (18), rocker arms (17), spacers (16) and mounting blocks (13,14, 15, and 22) onto rocker arm shaft (20). Make sure that mounting blocks and spacers are correctly installed (figure 3-47) and that oil holes in rocker arm shaft are correctly positioned (figure 3-48).

(c) Install retaining rings (12).

e. Installation.

(1) Install cylinder head and rocker arm assembly in reverse order of removal procedures.

(2) Tighten nuts to 75 Ibs.-ft. torque following the sequence of figure 3-49.

(3) Repeat the sequence, tightening each nut to 125 Ibs.–ft. torque.

(4) Again repeat the sequence, tightening each nut to a final torque of 160 Ibs.-ft. for 9/16 in. DIA stubs and 175 Ibs.-ft. for 5/8 in. DIA studs, as specifies in paragraph 1-6v.

NOTE

Nuts must be retorqued after 1 hour operation.

(5) Refer to the Operator and Unit Maintenance Manual and adjust the valve tappet clearance to a “HOT” setting of 0.015 inch.

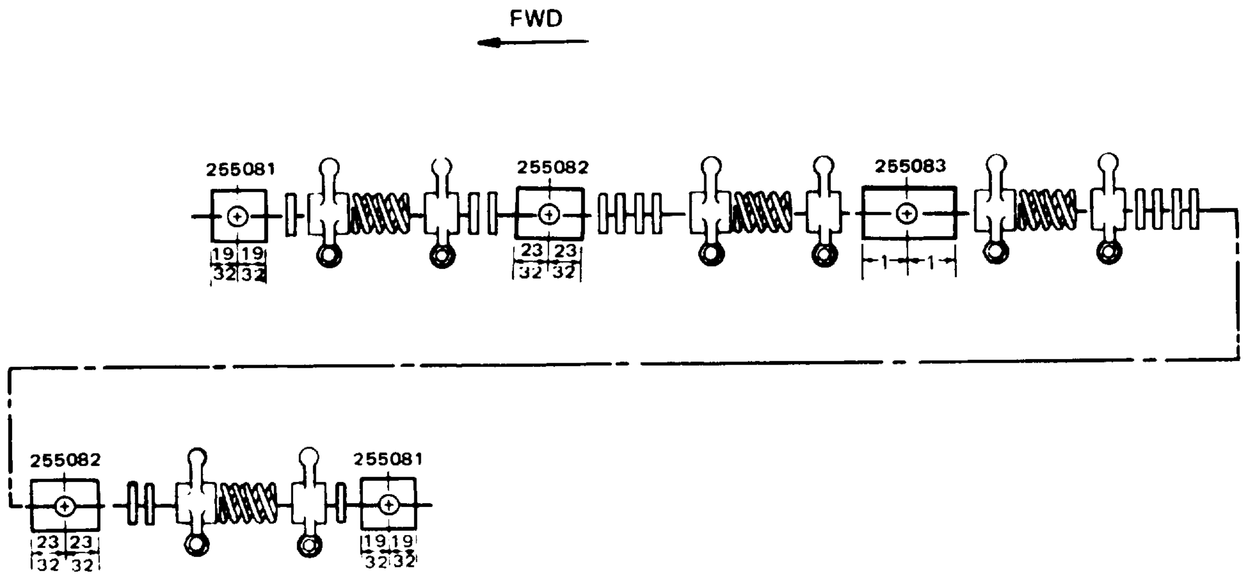


Figure 3-47. Rocker Arm Mounting Blocks Installation

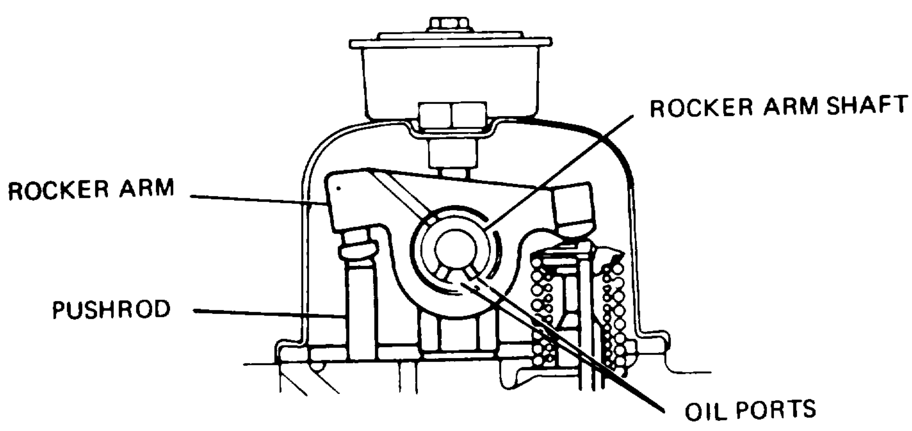


Figure 3-48. Rocker Arm Shaft Positioning

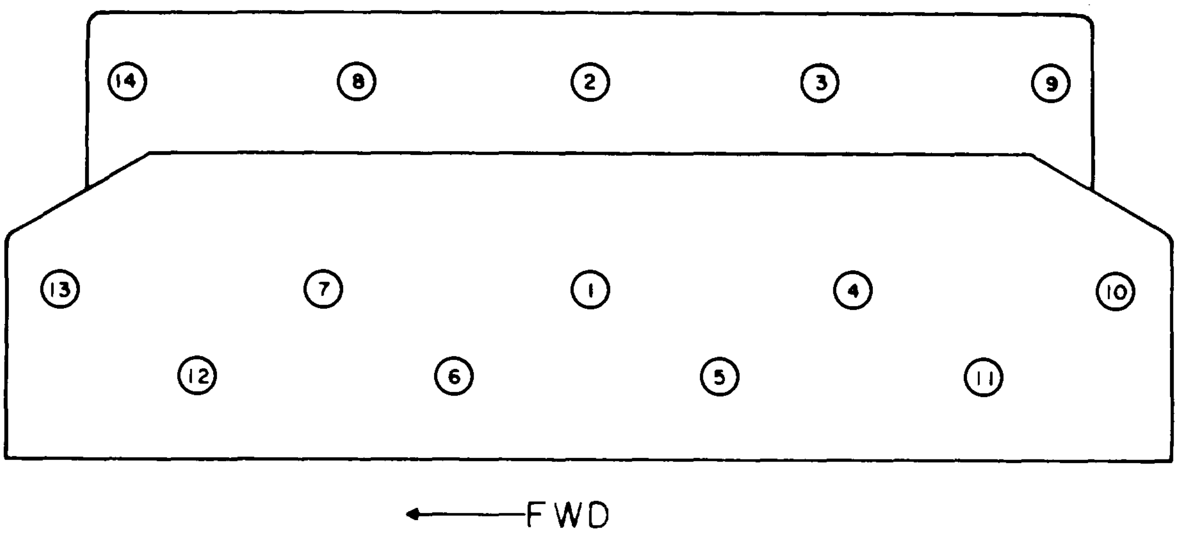


Figure 3-49. Cylinder Head Nut Tightening Sequence

3-55. CAMSHAFT

a. Removal.

(1) Remove oil pan (paragraph 3-37).

(2) Remove oil pump assembly (paragraph 3-38).

(3) Remove timing gear cover (paragraph 3-51).

(4) Remove rocker arm assembly and push rods (paragraph 3-54).

(5) Rotate engine crankshaft until screws (1, figure 3-50) are visible through holes in camshaft drive gear.

(6) Refer to the Operator and Unit Maintenance Manual and remove the fuel filter assemblies.

NOTE

Rotate crankshaft as necessary to lift valve tappets. Use tapered wooden dowels or magnets to hold tappets in topmost position.

(7) Remove screws (1) and lockwashers (2) to remove camshaft (5).

(8) Remove valve tappets (35, figure 3-46).

b. Disassembly.

(1) Remove nut (3, figure 3–50) and support drive gear (4) on arbor press.

(2) Press shaft (5) out of gear and remove key (6) and thrust plate (7).

c. Cleaning, Inspection, and Repair.

WARNING

Solvent, Dry Cleaning P-D-680, Type II is flammable and moderately toxic to skin, eyes and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate. Failure to observe this warning could result in personal injury or death.

WARNING

Compressed air used for cleaning and drying purposes can create airborne particles that may enter the eyes. Pressure shall not exceed 30 psig and use only with adequate chip guards and chipping goggles. Failure to observe this warning could result in personal injury or death.

(1) Clean all parts in dry cleaning solvent (Federal Specification P-D-680) and dry thoroughly with filtered compressed air.

(2) Visually inspect drive gear for cracks and chipped, broken, or worn teeth.

(3) Check thrust plate for cracks, breaks, and excessive wear.

(4) Using a micrometer, dimensionally inspect camshaft in accordance with figure 3-51.

(5) Inspect camshaft lobes and bearing journals for wear, scoring, and scratching. Polish minor nicks, scores, and scratches with crocus cloth. Clean to remove abrasive residue.

(6) Check camshaft bearing runout as follows:

(a) Place camshaft in a set of vee blocks.

(b) Position a dial indicator so that the foot rides on one of the bearing journals.

(c) Set indicator pointer to the “zero” position.

(d) Slowly rotate camshaft one complete revolution while observing dial indicator.

(e) Runout shall not exceed 0.0040 inch total indicator reading.

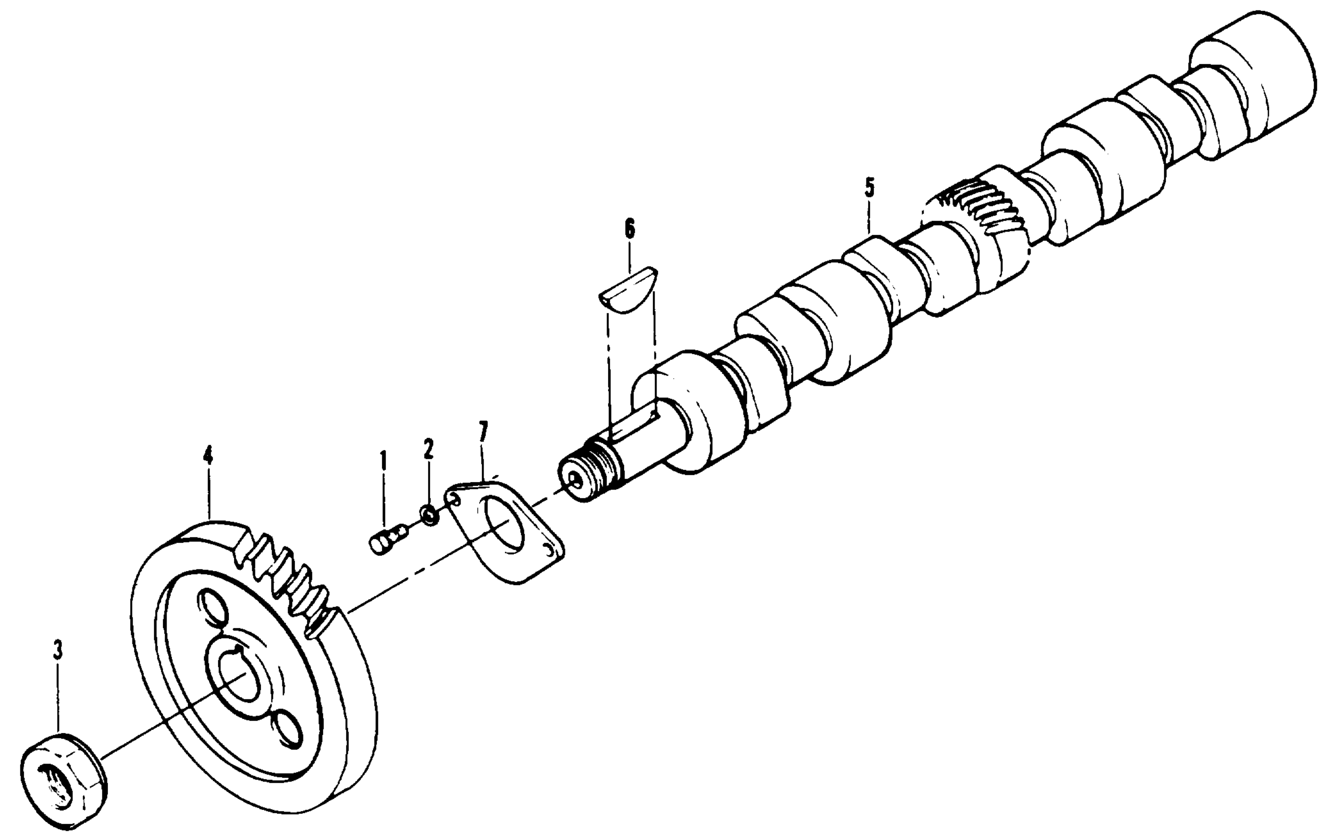
(f) Repeat the check for each bearing journal.

(7) If runout of any bearing exceeds limit specified total (step 6(e) above), replace camshaft and bearings.

(8) Perform magnetic particle inspection on camshaft and drive gear in accordance with established procedures.

(9) Check all threads for crossing, stripping, and peening. Repair minor thread damage using a thread chaser.

(10) Measure and record diameter of camshaft bearings in cylinder block. Subtract camshaft bearing journals dimensions from the corresponding bearing inner diameter. The difference shall not be less than 0.0015 inch or greater than 0.0035 inch.



1. Screw
2. Lockwasher
3. Nut
4. Drive gear
5. Camshaft
6. Woodruff key
7. Thrust plate

Figure 3-50. Camshaft, Exploded View

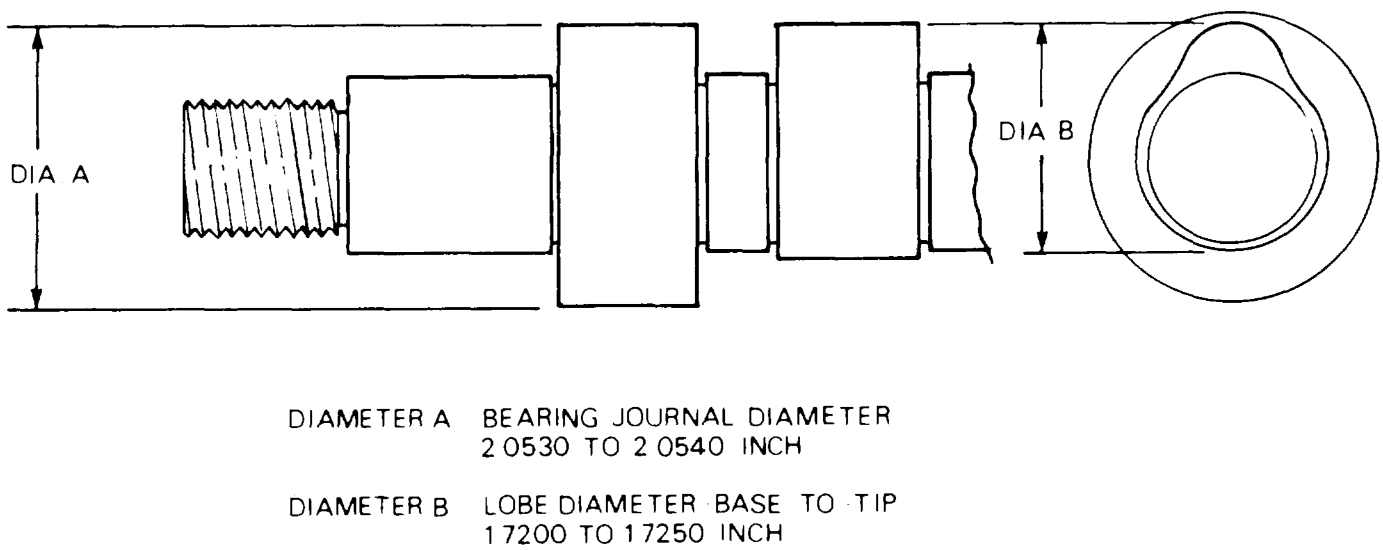


Figure 3-51 .Dimensional Inspection of Camshaft

(11) If dimension obtained in step (8) indicates excessive wear, replace camshaft bearings as follows:

(a) Using a suitable press, remove camshaft bearings from cylinder block.

CAUTION

Make sure that the replacement bearings are installed so that oil holes match with oil ports in cylinder block. Failure to observe this caution could result in equipment damage.

(b) Press replacement bearings into cylinder block.

d. Assembly.

(1) Install thrust plate (7, figure 3–50), key (6) and press shaft (5) into gear.

(2) Install support drive gear (4) onto arbor press with nut (3).

(3) Torque nut (3) to 130 ft-lbs.

e. Installation.

CAUTION

Make sure that timing mark on camshaft drive gear mates with timing mark on crankshaft gear. Failure to observe this caution could result in equipment damage.

NOTE

Valve tappets must be in the UP position to install camshaft.

(1) Refer to figure 3-45 to insure proper timing of camshaft gear to crankshaft gear is obtained.

(2) Install valve tappets (35, figure 3-46).

(3) Install camshaft (5, figure 3-50) with Iockwashers (2) and screws (1).

(4) Refer to the Operator and Unit Maintenance Manual to install fuel filter assemblies,

(5) Install rocker arm assembly and push rods (paragraph 3-54).

(6) Install timing gear cover (paragraph 3-51).

(7) Install oil pump assembly (paragraph 3-38).

(8) Install oil pan (paragraph 3-37).

(9) Check camshaft end thrust as follows:

(a) Attach a dial indicator to the cylinder block and position so that the foot contacts the end of the camshaft.

(b) Press camshaft as far into the cylinder block as it will go.

(c) Se tdial indicator to ''zero" position.

(d) Move camshaft as far forward as it will go.

(e) Check indicator reading. Reading shall not exceed 0.0120.

(f) If reading exceeds specified limit, remove camshaft and replace thrust plate.

(10) Check backlash between camshaft drive gear and crankshaft gear. Backlash shall be 0.0010 to 0.0030. If backlash is not within specified limits, both camshaft drive gear and crankshaft gear must be replaced.

3-56. CRANKSHAFT, CONNECTING RODS, AND PISTONS.

a. Removal.

(1) Remove oil pump assembly (paragraph 3-38).

(2) Remove flywheel and flywheel housing (paragraph 3-50).

(3) Remove cylinder head and rocker arm assembly (paragraph 3-54).

(4) Using a ridge cutter, remove the ridge from the top of each cylinder.

(5) Remove screws (1, figure 3-52) and connecting rod bearing caps (2) and lower half of connecting rod bearing insert (3).

(6) Using a wooden dowel, push pistons and connecting rods out top of cylinder block.

NOTE

Rotate crankshaft to simplify removal if necessary.

(7) Remove upper half of connecting rod bearing insert.

CAUTION

Keep connecting rod bearing caps with the connecting rod from which they were removed. Failure to observe this caution could result in equipment damage.

(8) Remove screws (4) and Iockwashers (5) to remove main bearing caps (6) and lower half of main bearing inserts (7).

(9) Remove screws (8) and Iockwashers (9) to remove main bearing cap (10) and lower half of center main bearing insert (11).

(10) Lift crankshaft (12) from cylinder block and remove upper half of main bearing inserts.

CAUTION

Conspicuously mark each main bearing cap as to position to aid at assembly. Failure to observe this caution could result in equipment damage.

b. Disassembly.

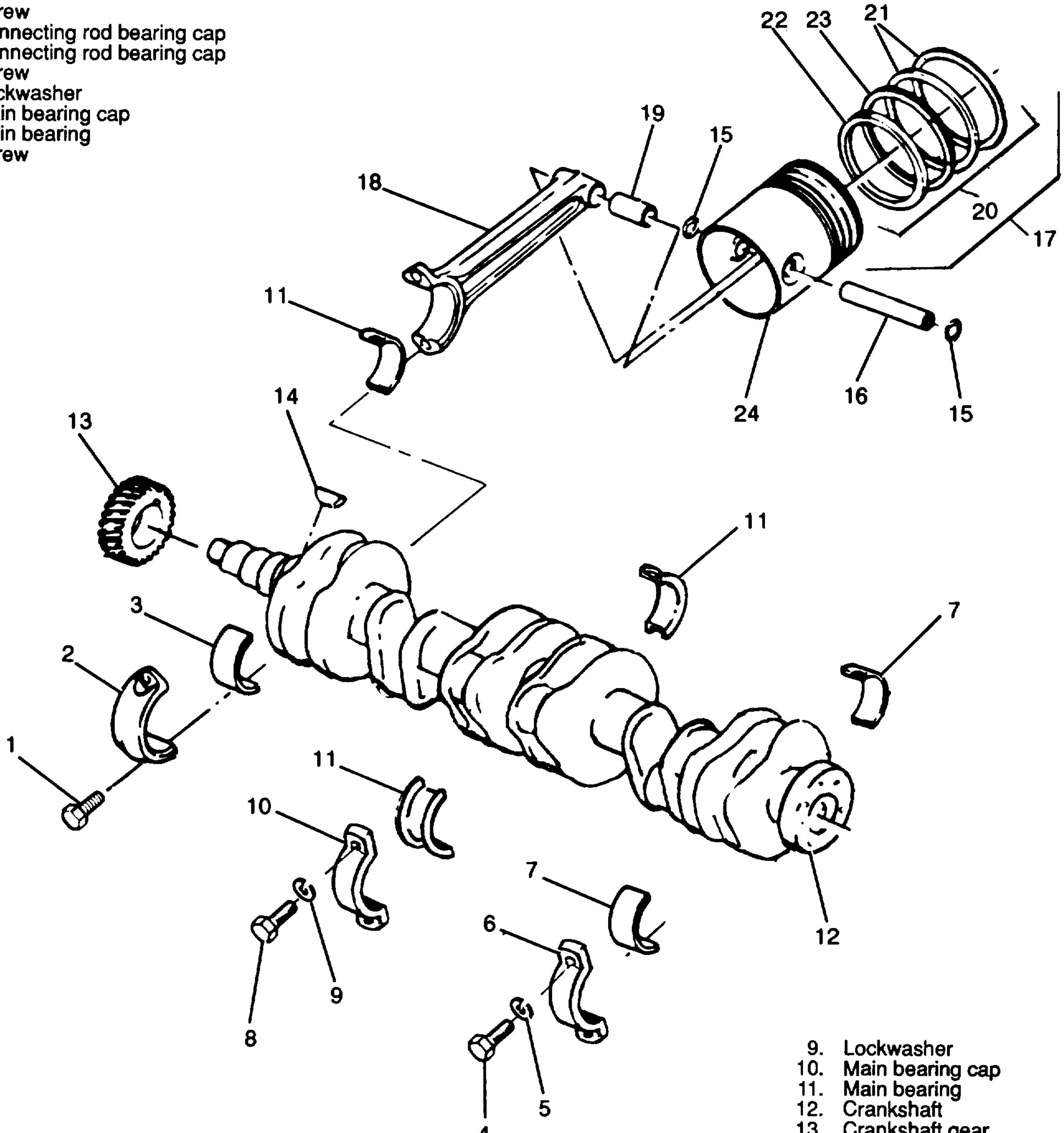
(1) Do not remove crankshaft gear (13) and woodruff key (14) unless inspection reveals damage and replacement is necessary.

(2) Remove retaining ring (15) and piston pin (16) to remove piston assembly (17) from connecting rod (18).

(3) Do not remove bushing (19) unless inspection reveals damage and replacement is necessary.

(4) Remove compression rings (21), scraper rings (22) and oil control ring (23) from piston (24). Discard piston rings.

1. Screw
2. Connecting rod bearing cap
3. Connecting rod bearing cap
4. Screw
5. Lockwasher
6. Main bearing cap
7. Main bearing
8. Screw



9. Lockwasher
10. Main bearing cap
11. Main bearing
12. Crankshaft
13. Crankshaft gear
14. Woodruff key
15. Retaining ring
16. Piston ring
17. Piston assembly
18. Connecting rod
19. Bushing
20. Ring set
21. Compression rings
22. Scraper ring
23. Oil control ring
24. Piston

Figure 3-52. Crankshaft, Connecting Rods and Pistons, Exploded View

c. Cleaning, Inspection, and Repair.

WARNING

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WARNING

Compressed air used for cleaning and drying purposes can create airborne particles that may enter the eyes. Pressure shall not exceed 30 psig and use only with adequate chip guards and chipping goggles. Failure to observe this warning could result in personal injury or death.

(1) Clean all parts in dry cleaning solvent (Federal Specification P–D-880) and dry with filtered compressed air.

(2) Clean all oil passages in crankshaft and connecting rods with a wire brush.

CAUTION

Use care to avoid damaging ring groove in pistons. Failure to observe this caution could result in equipment damage.

(3) Scrape carbon deposit from top and ring groove of piston.

(4) Inspect crankshaft for cracks, nicks and scratches on bearing journals or other damage. Remove minor nicks and scratches from bearing journals with crocus cloth. Clean to remove abrasive residue.

(5) Perform magnetic particle inspection of crankshaft in accordance with established procedures.

(6) Remove minor nicks, burrs, and scratches from crankshaft bearing journals by polishing with crocus cloth.

CAUTION

When regrinding crankshaft, it is imperative that the 5/32 inch radius from journal to cheek be maintained. Crankshaft breakage may result from improper grinding of this fillet. Failure to observe this caution could result in equipment damage.

Table 3-3. (UNDERSIZED BEARING JOURNALS)

	Crankshaft journal diameter (In.)	
Bearing Size	Main Bearing	Connecting rod
Standard	2.8734/2.8744	2.3730/2.3740
0.020 inch	2.8534/2.8544	2.3530/2.3540
0.040 inch	2.8334/2.8344	2.3330/2.3340
0.060 inch	2.8134/2.8144	2.3130/2.3140

(7) If necessary, regrind crankshaft bearing journals to accept undersized bearings in accordance with Table 3–3.

(8) inspect crankshaft gear for cracks and chipped, broken or excessive worn teeth.

(9) lf replacement of crankshaft gear is necessary, proceed as follows:

(a) Support crankshaft gear in arbor press and press crankshaft and woodruff key from gear.

(b) Heat replacement gear in an oven at 450°F. (232.2 °C.) for approximately one hour.

(c) Install woodruff key into crankshaft.

CAUTION

Wear heavy heat resistive asbestos gloves to avoid serious burns when handling heated gear. Failure to observe this caution could result in equipment damage.

(d) Remove gear from oven and assemble onto crankshaft.

(e) Using a driver with an inside diameter of 2 inches, quickly drive gear into position,

(f) Allow crankshaft and gear to cool.

(10) Inspect connecting rod for cracks, breaks and excessively worn or damaged bushing.

(11) Check piston pin for nicks, burrs, cracks, and excessive wear.

(12) Remove minor nicks and burrs from piston by polishing with crocus cloth. Clean to remove abrasive residue.

(13) If necessary, replace both piston pin and bushing.

NOTE

If new piston pin and bushing are used, check connecting rod alignment on a standard aligning fixture.

(14) Inspect piston for deep scores and scratches and other damage.

(15) Insert each piston into its cylinder bore with a piece of 1/2 x 0.0050 feeler ribbon. A force of 5 to 8 pounds should be required to remove each ribbon. Replace all pistons if any are not within the required limits.

NOTE

Cylinder bores may be rebored to accept oversized pistons (paragraph 3-55).

(16) Fit each piston ring into place into its cylinder bore and using a feeler gauge, measure gap dimension. Gap shall be 0.0100 to 0.0200 inch. If gap is under 0.0100 inch, file as follows:

(a) Hold a file in a vise.

(b) Grasp piston ring in both hands.

(c) Insert file into ring gap and move ring down the entire length of the file. Be sure to apply equal pressure on the ring.

(17) Roll each ring all the way around its piston groove to check clearance. If clearance is insufficient, lap the sides of the ring on a piece of No. 000 grit emery cloth laid on a flat surface.

d. Assembly.

(1) Using a piston ring expander install oil control ring (23, figure 3-52), scraper ring (22) and compression rings (21) onto pistons (24).

NOTE

If replacement piston rings have dots on the rings, the rings should be installed with the dots toward the piston head.

(2) Apply a light coat of engine oil to the bushing (19) and connecting rod (18) and press the bushing into the connecting rod.

(3) Fit piston assemblies (17) onto connecting rods (18) and insert piston pins (16). Install retaining rings (15).

e. Installation.

NOTE

Prior to installation of piston assemblies inspect cylinder block (paragraph 3-57), camshaft (paragraph 3–55) and cylinder head (paragraph 3-54) prior to installation of the piston, connecting rods and crankshaft.

(1) Install upper half of main bearings (7 and 11, figure 3-52) into cylinder block.

NOTE

Some of the bearings partially cover oil holes.

(2) Carefully place crankshaft (12) into position.

(3) Place a short strip of plastic gauge on each main bearing journal.

(4) Install lower half of main bearings, main bearing caps (6 and 10), Iockwashers (5 and 9) and screws (4 and 8).

(5) lighten screws (4) to 100 ft.-lbs. torque. Tighten screws (8) to 130 ft.-lbs. torque.

(6) Remove main bearing cap and lower half of main bearings. Check plastic gauge against standard to determine main bearing clearance. Clearance shall be 0.0009 to 0.0034 inch.

(7) If clearance is not within specified limits, grind crankshaft and install with undersized bearings (paragraph c (7) above).

(8) When bearing clearances have been established, install lower half of main bearings and main bearing caps ((5) above).

NOTE

Apply a liberal coating of engine lubricating oil to inner surface of main bearings prior to installation.

(9) Use a feeler gauge to check crankshaft end thrust clearance on center main bearing. End thrust clearance shall be 0.0050 to 0.0100 inch.

(10) If end thrust clearance is not as specified, remove center main bearing and polish sides on a piece of crocus cloth. Clean to remove abrasive residue and apply a liberal coating of engine lubricating oil before installation.

(11) Apply a liberal coating of engine lubricating oil to cylinder bores, pistons, piston rings and piston pins.

NOTE

Proper position of the oil ring gap is with the gap aligned with either piston pin hole.

(12) Position piston rings so that no two gaps are aligned.

CAUTION

Use care to insure that connecting rod is properly aligned with crankshaft connecting rod bearing journal and that the precombustion chamber is away from the camshaft side of the engine. Failure to observe this caution could result in equipment damage.

(13) With piston rings compressed, use a hammer handle or wooden dowel to force piston down into cylinder bore.

(14) When entire piston is in cylinder bore, insert upper half of connecting rod bearing (3, figure 3-52) and pull connecting rod down to crankshaft.

(15) Place a short strip of plastic gauge on crankshaft and install lower half of connecting rod bearing, connecting rod bearing cap (2) and screws (1). Tighten screws to 70 lb-ft torque.

(16) Remove screws and connecting rod bearing cap to remove plastic gauge.

(17) Check plastic gauge against standard to determine bearing clearance. Clearance shall be 0.0010 to 0.0030 inch.

(18) When clearance is established, install lower bearing half, bearing cap and screws (step 16, above).

(19) Install timing gear housing and assembly.

(20) Install cylinder head and rocker arm assembly (paragraph 3-54).

(21) Install flywheel and flywheel housing (paragraph 3-50).

(22) Install oil pump assembly (paragraph 3-38).

3-57. CYLINDER BLOCK ASSEMBLY.

a. Removal and Disassembly.

(1) Remove engine assembly (paragraph 2-6).

(2) Remove timing gears and cover (paragraph 3-51).

(3) Remove flywheel and flywheel housing (paragraph 3-50).

(4) Remove cylinder head and rocker arm assembly (paragraph 3-54).

(5) Remove camshaft and bearings (paragraph 3-55).

(6) Remove timing gear housing (paragraph 3-51).

(7) Remove crankshaft, connecting rods, and pistons (paragraph 3-56).

(8) Remove plugs (1 and 2, figure 3-53).

(9) Do not remove oil filler neck and captive cap assembly (3) or stud (4) unless inspection reveals damage.

(10) Do not remove studs (5 and 6) or guide pin (7) unless inspection reveals damage.

(11) Do not remove studs (8) and guide pin (9) unless inspection reveals damage.

(12) Do not remove studs (10, 11, 12 and 13) or guide pin (14) unless inspection reveals damage.

(13) Do not remove plug (15) from cylinder block (16) unless replacement is necessary.

b. Cleaning, Inspection, and Repair.

(1) Clean sludge and dirt deposits from cylinder block with dry cleaning solvent. If necessary, block should be steam cleaned.

(2) Clean all oil and water passages.

(3) Scrape carbon deposits from top of block.

(4) Remove gasket remains from all mating surfaces.

(5) Perform magnetic particle inspection of cylinder block in accordance with MIL-I-6868.

(6) Inspect cylinder bores for scores and scratches. Minor scratches and scores may be removed by honing. If necessary, cylinder bores maybe rebored to accept up to 0.060 inch oversized pistons.

(7) Check cylinder bores for excessive wear. Diameter shall be 3.7490 to 3.7510 inches.

(8) Inspect cylinder bores for out-of-roundness. Each cylinder shall not be out-of-round by more than 0.0005 inch.

(9) Check cylinder bore taper. Taper shall be 0.0005 inch maximum.

(Io) Non conformity to dimension specified in steps (7) through (9) above requires that cylinders be bored to accept oversized pistons.

(11) Temporarily install main bearing caps and check main bearing bore diameter. Diameter shall be 3.0665 to 3.0670 inches.

(12) Check camshaft bearing bore diameter. Diameter shall be 2.1870 to 2.1880 inches.

(13) Visually inspect main bearing and camshaft bearing bore diameters for nicks and scratches. Remove nicks and scratches with oil-soaked abrasive paper.

(14) Check oil pump bore diameter. Diameter shall be 2.0000 to 2.0005 inches.

(15) Inspect oil pump bore for nicks and scratches. Remove minor nicks and scratches by polishing with crocus cloth.

(16) Inspect for broken or damaged studs. If any studs are broken too short to allow removal, center punch, drill, and use an easy out.

(17) Inspect all gasket surfaces for nicks, burrs, and scratches. Remove nicks, burrs, and scratches with oil-soaked abrasive paper.

(18) Use a straight edge and check the block lengthwise, across each end and between cylinder bores for warping. Warpage shall not exceed 0.0003 inch. Remove studs and guide pins and mill to a maximum of 0.0005 inch top of block to correct a slight warpage. If cylinder block is warped sufficiently that milling would radically affect engine performance, replace block.

(19) Check all internal threads for crossing, stripping, and peening. Clean or repair minor thread damage. Repair extensively damaged threads by reaming, tapping and installing inserts.

c. Assembly and Installation.

(1) Prior to installation, mask all openings. Treat and paint.

(2) If removed, position cylinder block (16), and install plug (15).

(3) If removed, install guide pin (14), and studs (13, 12,11, 10).

(4) If removed, install guide pin (9) and studs(8).

(5) If removed, install guide pin (7) and studs (6 and 5).

(6) If removed, install stud (4) and oil filler neck and cap assembly (3).

(7) Install plugs (2 and 1, figure 3-53).

(8) Install crankshaft, connecting rods and pistons (paragraph 3-56).

(9) Install timing gear housing (paragraph 3-51).

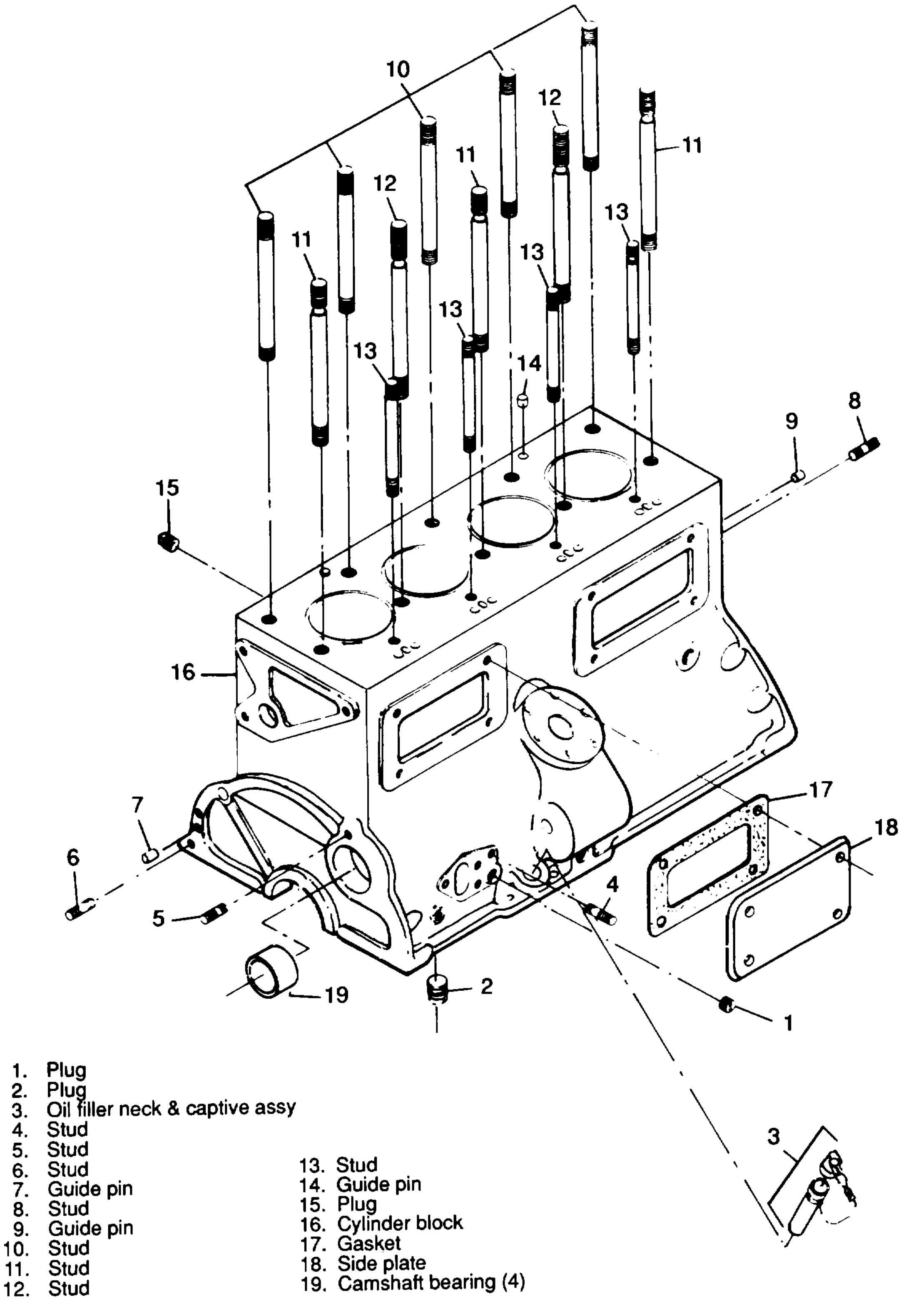
(lo) Install camshaft and bearings (paragraph 3-55).

(11) Install cylinder head and rocker arm assembly (paragraph 3-54).

(12) Install flywheel and flywheel housing (paragraph 3-50).

(13) Install timing gears and cover (paragrahp 3-51).

(14) Install engine assembly (paragraph 2-6.



1. Plug
2. Plug
3. Oil filler neck & captive assy
4. Stud
5. Stud
6. Stud
7. Guide pin
8. Stud
9. Guide pin
10. Stud
11. Stud
12. Stud
13. Stud
14. Guide pin
15. Plug
16. Cylinder block
17. Gasket
18. Side plate
19. Camshaft bearing (4)

Figure 3-53. Cylinder Block Assembly, Exploded View

Section VIII. MAINTENANCE OF GENERATOR SET CONTROLS

3-58. GENERAL.

This section contains maintenance instructions for the generator set controls. The control cubicle assembly and sensing monitors contain the controls, instruments and indicators for controlling and monitoring the operation of the generator set. Precise models of the generator set incorporate a governor control unit which signals the actuator unit to change the fuel injection pump governor setting which controls engine speed and, thus, generator frequency. This function is assumed by the manual speed control on utility models. The interconnecting wiring harnesses provide electrical connection between major assemblies and the control cubicle and fault locating indicator.

3-59. CONTROL CUBICLE ASSEMBLY.

a. Frequency Meter and Transducer.

(1) Refer to the Operator and Unit Maintenance Manual and remove, clean, and inspect frequency meter and transducer.

(2) Install frequency meter and transducer in a test setup as shown in figure 3-54.

NOTE

Test frequency meter must have an accuracy of 0.05 percent.

(3) Activate sinusoidal source and adjust its output as indicated by the test frequency meter to the lowest frequency indication on the frequency meter being tested (388 Hz for a 400 Hz frequency meter and 48 Hz for a 50/60 Hz frequency meter).

(4) Rotate adjusting screw of frequency meter being tested until its indication exactly matches that of the test frequency meter.

(5) If the frequency meter being tested cannot be properly adjusted, replace it and the frequency transducer.

(6) When frequency meter being tested has been properly adjusted, slowly increase the sinusoidal source frequency to the highest value of the frequency meter being tested (412 Hz for a 400 Hz frequency meter and 62 Hz for a 50/60 Hz frequency meter).

(7) If at any point the indication of the frequency meter being tested varies more than 0.25 percent from that of the test frequency meter, replace both transducer and frequency meter being tested.

(8) Refer to the Operator and Unit Maintenance Manual and install frequency meter and transducer.

b. Kilowatt Meter and Thermal Converter.

(1) Refer to the Operator and Unit Maintenance Manual and remove, clean, and inspect kilowatt meter and thermal converter.

(2) Test ac kilowatt meter and converter as follows:

(a) Connect a calibrated kilowatt meter and a suitable variable load to the generator set load terminal board.

(b) Refer to the Operator and Unit Maintenance Manual and start the generator set.

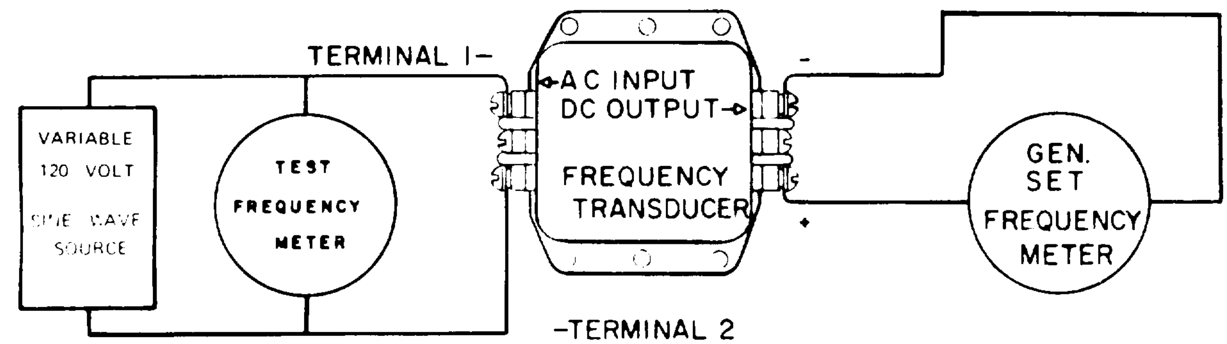
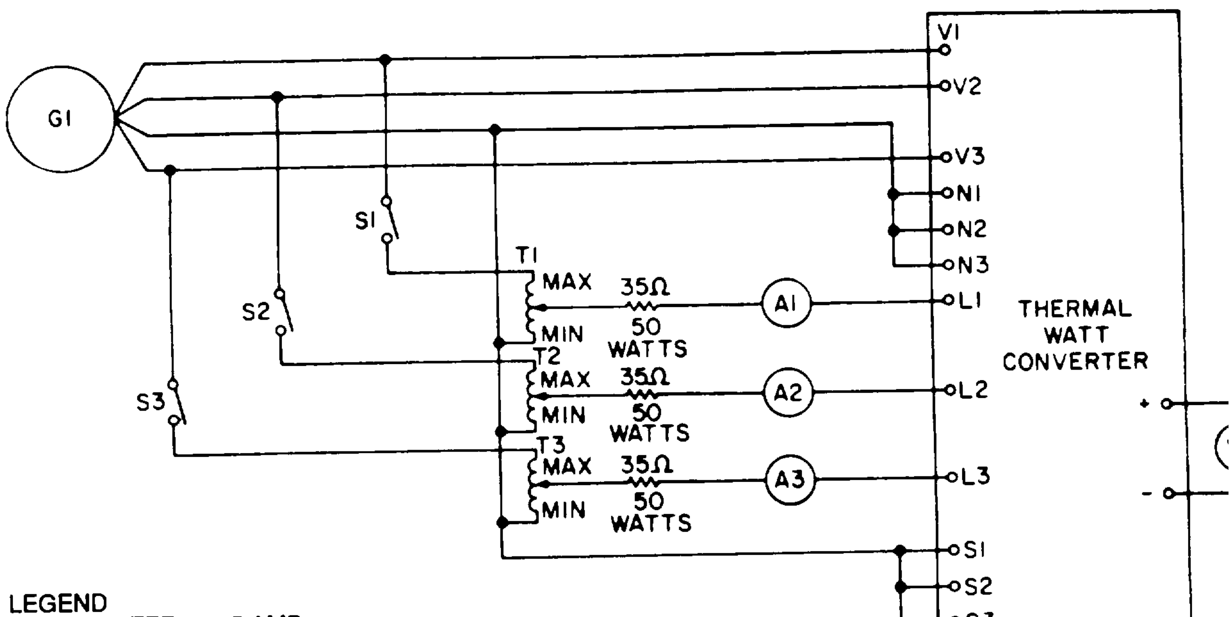


Figure 3-54. Frequency Meter and Transducer Test Setup



LEGEND
A1 AMMETER 0–1.5 AMP
A2 AMMETER 0–1.5 AMP
A3 AMMETER 0–1.5 AMP
G1 GENERATOR, 120/208 VAC,
3 PHASE, 4 WIRE, 60 HZ (OR 400 HZ AS APPLICABLE)
T1 AUTOTRANSFORMER
T2 AUTOTRANSFORMER
T3 AUTOTRANSFORMER
V1 VOLTMETER, DC, VACUUM
TUBE, 0–50 MV

S1 SWITCH
S2 SWITCH
S3 SWITCH

Figure 3-55. Thermal Watt Converter Circuit Schematic

(c) Vary the load while comparing the generator set kilowatt meter reading to that of the calibrated kilowatt meter.

(d) If readings vary more than 1.33 percent, install thermal watt converter in a test setup using figure 3-55 as a guide.

(e) Adjust all auto transformers to the minimum position.

(f) Close switch S-1 and open switches S-2 and S-3.

(9) Energize Power source G-1 and adjust autotransformer T1 until 1 ampere is indicated on ammeter

(h) Check indication of voltmeter V-1. Indication shall be 6.66 ± 0.04 millivolts.

(i) Close switch S2 and adjust auto transformer T2 until 1 ampere is indicated on ammeter A2.

(j) Check indication of voltmeter. Indication shall be 13.33 ±0.07 millivolts.

(k) Close switch S3 and adjust auto transformer T3 until 1 ampere is indicated on ammeter A3.

(l) Again check voltmeter indication. indication shall be 20.00+ 0.1 millivolts.

(m) Replace thermal watt converter if it fails to perform as indicated.

(n) If thermal watt converter performs as indicated, replace meter.

(o) Refer to the Operator and Unit Maintenance Manual and install thermal watt converter.

c. AC Current Meter.

(1) Refer to the Operator and Unit Maintenance Manual for AC current meter adjustment, removal, cleaning, inspection, and installation procedures.

(2) Test AC ammeter as follows:

(a) Connect a calibrated test ammeter in series with the generator set current meter.

(b) Connect a variable load to the generator set load terminal board.

(c) Refer to the Operator and Unit Maintenance Manual and start the generator set.

(d) Vary the load while comparing the indication of the generator set current meter to that of the calibrated test ammeter.

(e) Replace generator set current meter if its indication varies more than 2 percent of full scale value from the indication of the test ammeter.

d. Control Cubicle Relay Assembly.

(1) Removal.

(a) Tag and disconnect electrical leads to relay assembly.

(b) Remove nut and captive washer assemblies (1, figure 3-56) to remove relay assembly (2).

(2) Disassembly.

NOTE

Test relay assembly as outlined in subparagraph d. (5) below prior to disassembly.

(a) Identify any parts removed to facilitate assembly.

(b) Disassemble relay assembly only as is necessary to replace damaged or defective parts.

(c) Remove nut and captive washer assembly (1 and 2, figure 3-57), screw (3) and terminal board (4).

(d) Remove nut (5), lockwasher (6), flatwasher (7), screw (8), relay (9) k6, and spacer.

(e) Remove relay (11) k1.

(f) Remove rectifier (CR1).

(g) Remove resistor (R10).

(h) Remove printed circuit board (14).

(3) Cleaning, Inspection, and Repair.

(a) Clean relay assembly with filtered compressed air and a soft bristled brush.

(b) Visually inspect terminal boards for cracks, burns, and corroded or damaged terminals.

(c) Inspect relays (K1 and K6) for cracks, corrosion, and evidence of shorting.

(d) Inspect resistor (R10) for burns, damaged leads and insecure mounting.

(e) Inspect silicone rectifier (CR1) for cracks, burns, and evidence of shorting.

(f) Inspect printed circuit for cold solder joints, evidence of component overheating, and damage to the polyurethane coating.

NOTE

Prior to coating, deaerate resin by evacuating at room temperature to 5 to 10 Hg absolute to remove air bubbles.

(g) Check all components for illegible markings.

(h) If any circuit board component must be replaced or encapsulating coating repaired or replaced, refer to Appendix A references for detailed procedures. Repair/replace encapsulation by applying a 0.007 inch (minimum) coating of polyurethane resin (Scotchcoat 221, Minnesota Mining and Mfg. Co. or equal).

CAUTION

Solder joints and components leads shall not protrude more than 0.094 inch beyond surface of printed circuit board. Failure to observe this caution could result in damage to the equipment.

WARNING

Avoid breathing fumes generated by soldering. Eye protection is required. Failure to observe this warning could result in servere personal injury or death.

(i) Solder in accordance with requirement 5, MIL-STD-454.

(4) Assembly.

(a) Install printed circuit board (14).

(b) Install resistor (13) (CR1).

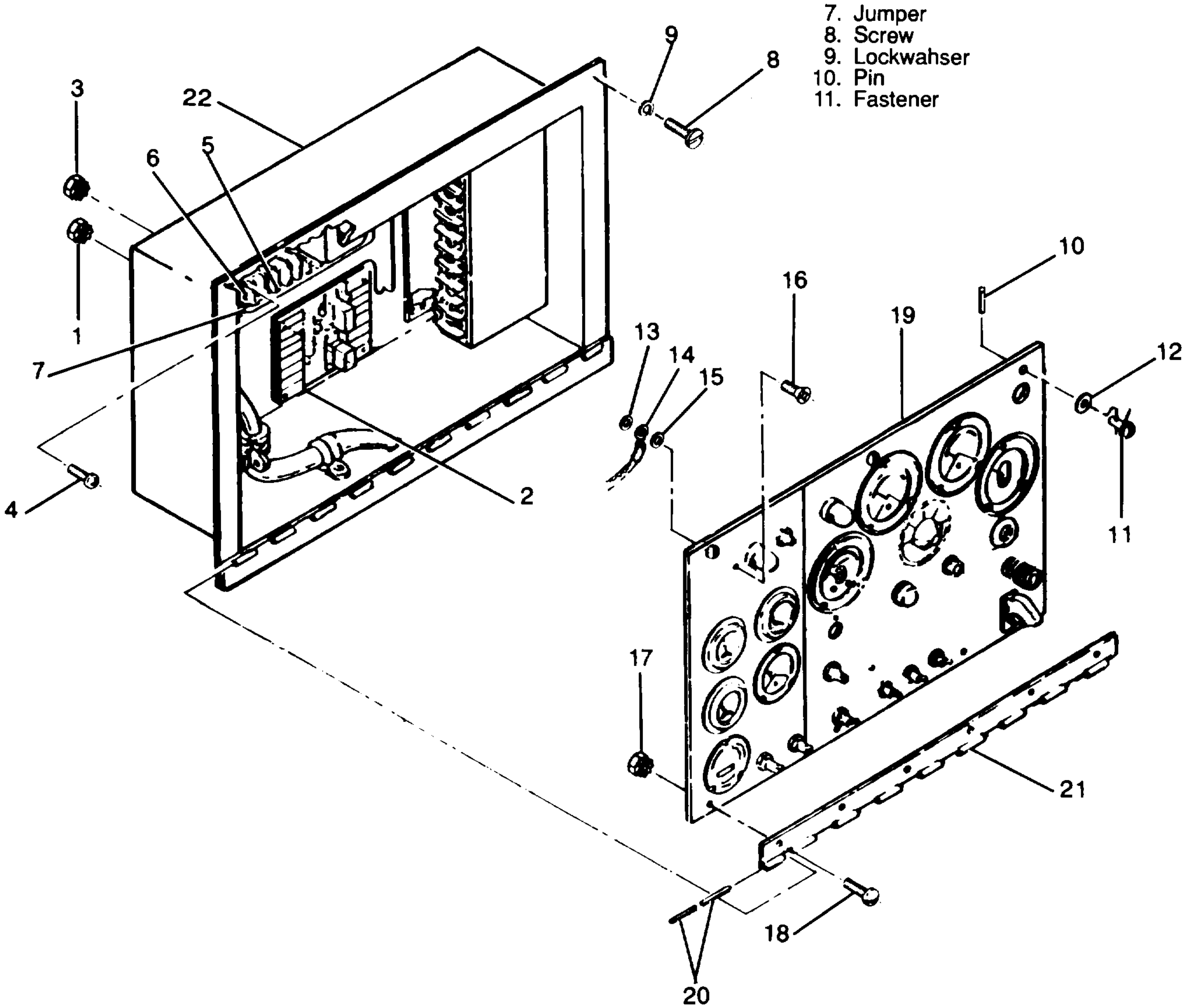
(c) Install rectifier (12) (CR1).

(d) Install relay (11) K1.

(e) Install spacte (10), relaly (9) K6, screw (8), flatwasher (7), lockwasher (6) and nut(5).

(f) Install terminal board (4), screw (3), nut and captive washer assembly (2 and 1).

1. Nut & captive washer assembly
2. Relay assembly
3. Nut & captive washer assembly
4. Screw
5. Terminal board
6. Screw
7. Jumper
8. Screw
9. Lockwahser
10. Pin
11. Fastener



12. Seal
13. Nut
14. Door holder
15. Flat washer
16. Screw
17. Nut & captive washer assy
18. Screw
19. Panel
20. Pivot pin
21. Hinge
22. Housing

Figure 3-56. Control Cubicle Housing Assembly, Exploded View

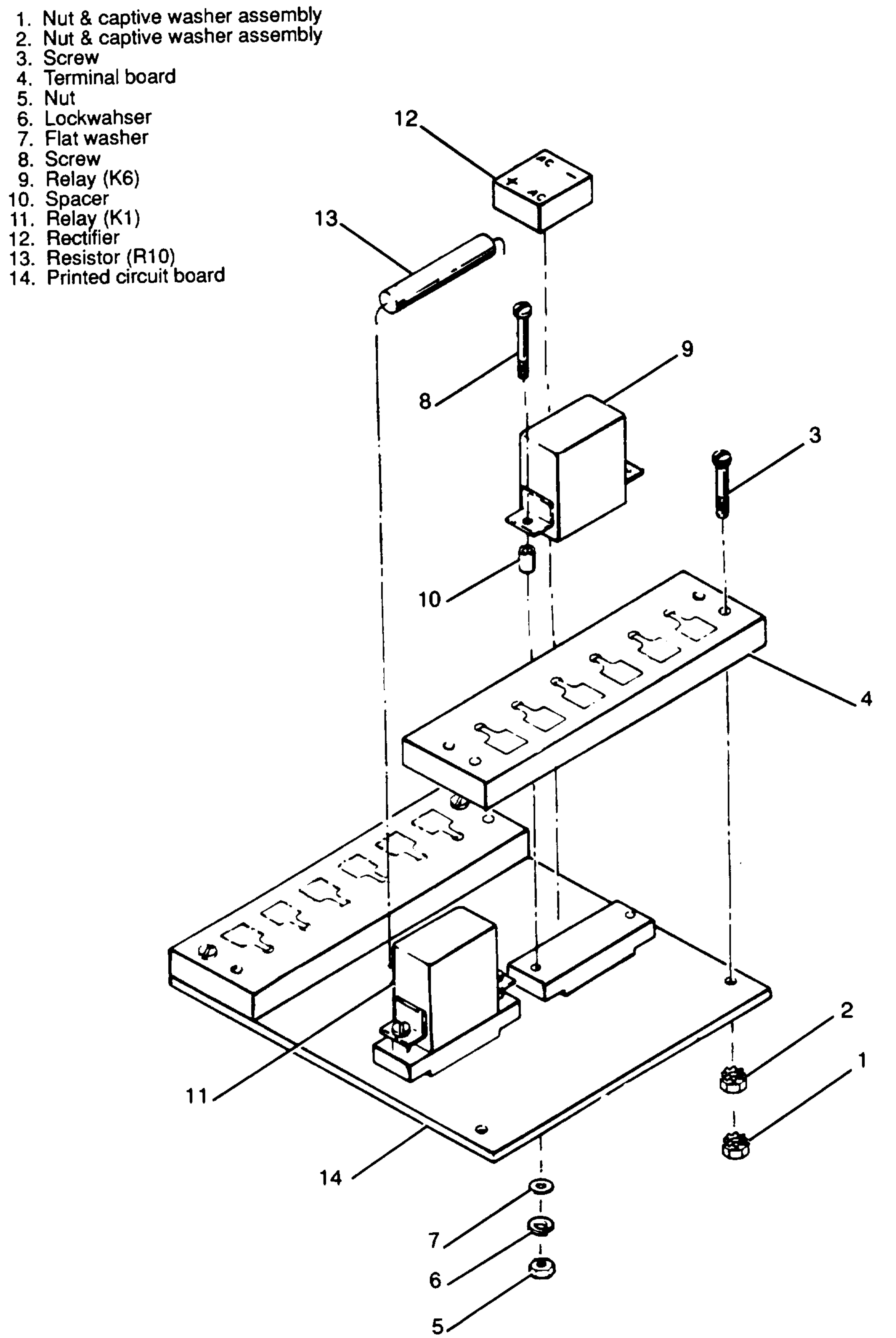


Figure 3–57. Control Cubicle Relay Assembly, Exploded View

(5) Testing.

(a) Using an ohmmeter or similar device, check relay assembly continuity using figure 3-58 as a guide.

CAUTION

Make sure that power supply leads are properly connected. Damage to the relay assembly will result if leads are connected to the wrong terminals. Failure to observe this caution could result in damage to the equipment.

(b) Connect a 120 Vac, 60 Hz power supply to terminals 4 and 12. Using a suitable voltmeter, measure voltage at terminals 6 and 10. Voltage shall be 120 Vac. If voltage is not as specified, relay (K6) is defective. Check for open circuit across 10 and 5 and 6 and 11. There shall be no sign of continuity.

C2 Capacitor
CR1 Diode
K1 Stop run relay
K6 Remote voltage sensing relay
R10 Resistor

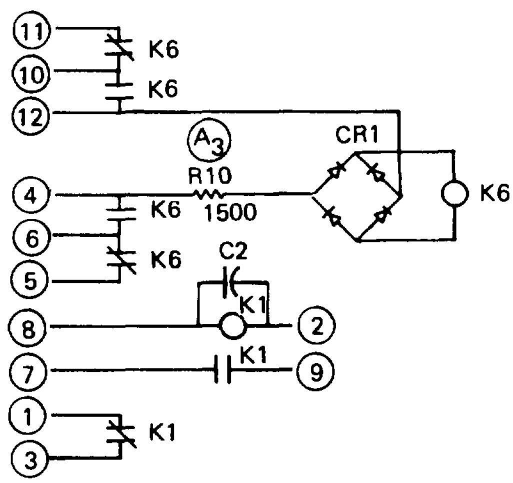


Figure 3-58. Control Cubicle Relay Assembly, Schematic Diagram

(c) If relay (K6) fails to function properly, proceed as follows:

1. Remove 120 Vac power.
2. Remove resin from back of relay (K6).
3. Apply 120 Vac power across terminals 4 and 12 and check voltage across relay (K6) coil. Voltage shall be 18 to 24 Vdc.
4. If voltage is not as specified, remove 120 Vac and check resistance across resistor (R10). Resistance shall be 150 ±10 ohms. If resistance is not as specified, replace resistor.
5. If resistance is as specified, rectifier (CR1) is defective and must be replaced.

(d) Connect a 24 Vdc source across terminals 8 and 2 and check for continuity across terminals 7 and 9 and for open circuit across terminals 1 and 3. Replace relay (K1) if continuity is not as specified.

(6) Installation.

(a) Install relay assembly (2, figure 3-56), nut and capive washer assemblies (1).

(b) Connect electrical leads to relay assembly.

e. Control Cubicle Terrminal Board.

(1) Removal.

(a) Tag and disconnect electrical leads to terminal board.

(b) Remove nut and captive washer assemblies (3, figure 3-56) and screw (4) to remove terminal board (5).

(c) Remove screws (6) and jumpers (7) only if inspection indicates replacement is necessary.

(2) Cleaning, Inspection, and Repair.

WARNING

Solvent, Dry Cleaning P–D-680, Type II is flammable and moderately toxic to skin, eyes and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate. Failure to observe this warning could result in servere personal injury or death.

(a) Clean terminal board with a clean, lint–free cloth lightly moistened with solvent P–D- 680 Type II.

(b) Visually inspect terminal board for cracks, burns, and corrosion. Check insulating material for cracks, breaks, and other damage.

(c) Using an ohmmeter, check jumpers for continuity.

(d) Check all threads for crossing, stripping, and peening.

(e) Replace any damaged or defective parts.

(3) Installation.

(a) If removed, install jumpers (7, figure 3-56), and screws (6).

(b) Install terminal board (5), screw (4), nut and captive washer assemblies(3).

(c) Connect electrical leads to terminal board.

f. Control Cubicle Wiring Harness.

(1) Refer to the Operator and Unit Maintenance Manual for wiring harness removal, cleaning, inspection, and repair procedures.

(2) If the wiring harness has sustained damage and requires repair, or rebuild, refer to figure NO TAG for layout, identification and material requirements and Appendix A for detailed soldering and replacement procedures.

(3) Refer to the Operator and Unit Maintenance Manual for wiring harness installation procedures.

g. Control Cubicle Housing Assembly.

(1) Removal. Remove screws (8, figure 3-56) and lockwashers (9) to remove control cubicle housing assembly from generator set.

(2) Disassembly.

(a) Remove pin (10) to remove fastener (11) and seal (12).

(b) Remove nut (13), door holder (14), fiat washer (15) and screw (16).

(c) Remove nut and captive washer assemblies (17) and screws (18) to remove panel (19).

(d) Remove pivot pin (20) and hinge (21) from housing (22) only if replacement is necessary.

(3) Cleaning, Inspection, and Repair.

(a) Clean all parts in dry cleaning solvent (Federal Specification P-D-680) and dry with filtered compressed air.

(b) Visually inspect housing for cracks, dents, and defective paint. Check hinge for cracks, excessive wear, and cracked or broken welds.

(c) Inspect panel for cracks, dents, warping, defective paint and illegible marking. Check fasteners for wear, damaged or deteriorated seals, and damaged pins.

(d) Check all threaded parts for crossed, stripped, and peened threads.

(e) Repair dents and warping by straightening.

(f) Remove defective paint and repaint,

(9) Replace any parts worn or damaged beyond repair.

(4) Assembly.

(a) Position housing (22), to install hinge (21) and pivot pin (20).

(b) Install panel (19), screws (18), nut and captive washer assemblies (17).

(c) Install screws (16), flat washers (15), door holder (14) and nut (13).

(d) Install seal (12), fastener(n) and pin (10).

(5) Installation. Install control cubicle housing onto generator set with Iockwashers (9) and screws (8).

h. Refer to the Operator and Unit Maintenance Manual for maintenance procedures of the remainder of the controls in the control cubicle assembly.

3-60. FAULT LOCATING INDICATOR.

a. Removal.

(1) Disconnect wiring harness from back of fault locating indicator.

(2) Remove screws (1, figure 3-60) and Iockwashers (2) to remove fault locating indicator from generator set.

b. 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).

c. Cleaning, Inspection, and Repair.

WARNING

Solvent, Dry Cleaning P-D-680, Type II is flammable and moderately toxic to skin, eyes and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate. Failure to observe this warning could result in servere personal injury or death.

WARNING

Compressed air used for cleaning and drying purposes can create airborne particles that may enter the eyes. Pressure shall not exceed 30 psig and use only with adequate chip guards and chipping goggles. Failure to observe this warning could result in servere personal injury or death.

(1) Clean all metallic, non-electrical parts with dry cleaning solvent (Federal Specification P-D-680) and dry with filtered compressed air.

(2) Clean electrical components with filtered compressed air and a soft bristle brush. If necessary, electrical components may be cleaned with a clean, lint–free cloth moistened with an approved solvent.

(3) Visually inspect housing and cover plates for cracks, corrosion, warping, and other damage.

(4) Inspect panel assembly as follows:

(a) Check panel for cracks, corrosion, warping, illegible markings and other damage.

(b) Inspect indicator lights for cracked, or damaged lens, defective lamp, and corroded or damaged base.

(c) Inspect fuse holder assembly for cracked or damaged cap, defective fuse, and burned, cracked, or corroded fuse holder.

(d) Inspect, test, or reset switch for cracks, corrosion, and evidence of shorting.

(e) Check continuity of test or reset switch using figure 3-61 as a guide.

(5) Inspect component board assembly for burned components, damaged wires and cracked or broken board.

(6) Test individual components of component board using figures 3-61 and 3-62 and table 3-4 as a guide.

NOTE

Disconnect one lead to component being tested to avoid erroneous test readings.

(7) If any circuit board component must be replaced or encapsulating coating repaired or replaced, refer to Appendix A references for detailed procedures. Repair/replace encapsulation by applying a 0.007 inch (minimum) coating of polyurethane resin (Scotchcoat 221, Minnesota Mining and Mfg. Co., or equal).

NOTE

Prior to coating, deaerate resin by evacuating at room temperature to between 5 and 10 Hg absolute to remove air bubbles.

Table 3-4. COMPONENT BOARD TEST VALUES

COMPONENT	TEST VALUE
C1 through C10	0.10 UF ± 0.01 UF
CR1 through CR10	1N2610 (100PRV)
R1 through R10	2200 ± 220
R11 through R20	1000 ± 100
SCR1 through SCR10	2N1596

(8) Use an ohmmeter to test resistance of relay K1 (figure 3-61). Resistance shall be 300 ± 30 ohms. Replace relay if defective.

(9) Visually inspect fault locating wiring harness connector for cracks, corrosion, and loose or damaged pins.

(10) Check individual wires for corroded or damaged terminals, burned insulation and other damage.

(11) Check individual wires for continuity using figure 3-63 as a guide.

(12) If the wiring harness has sustained damage and requires repair or rebuild, refer to figure 3-63 for layout, identification, and material requirements and Appendix A for detailed soldering and replacement procedures.

d. Assembly.

(1) Position housing (35) to install wiring harness (34), screw and captive washer assemblies (33).

(2) If removed, assembly cover plate assembly (items 32 through 27) for replacement of damaged parts as needed.

(3) Install cover plate assembly (26), screw and captive washer assemblies (25). Connect electrical leads and untag.

(4) If removed, assemble panel assembly (items 24 through 7) for replacement of damaged or defective components as needed.

(5) Connect electrical leads and untag. Carefully push indicator panel assembly (6) onto housing and install screw and captive washer assemblies (5).

(6) Install cover plate (4), screw and captive washer assemblies (3).

WIRE MARKING NO	FROM		TO				
	STATION NO	LUG FIND NO	STATION NO	LUG FIND NO	WIRE FIND NO.	CUT LENGTH IN (REF)	MARKING COLOR
D20B16	J1-1		A1-L1	8	1	21.5	BLACK
D21B16	J2-2		A1-L2	8	1	22	
D22B16	J1-3		A1-L3	8	1	22.5	
D24A16	M8-(-)	10	S8-41	8	1	8	
D24B10	J1-D	-	M8-(-)	10	1	38	
D29A18	A1-(+)	4	M7-(+)	7	2	53.5	
D30A18	A1-(-)	4	M7-(-)	7	2	52.5	
D68A16	A1-S2	8	S8-33	8	1	48.5	
D69A16	A1-S1	8	S8-32	8	1	54	
D70A16	A1-S3	8	S8-34	8	1	48.5	
D83A18	S8-31	8	M8(+)	10	1	7	
D84A18	S8-11	4	M9(-)	7	2	10	
D85A18	S8-21	4	M9-(+)	7	2	11	
D86A18	A2-(+)	4	M6-(+)	7	2	44.5	
D87A18	A2-(-)	4	M6-(-)	7	2	47.5	
E35A18	J1-Y	-	M4-(-)	7	2	32	RED
E36A18	J1-Z	-	M4-(-)	7	2	33	
E37A18	J1-X	-	M3-(-)	6	2	34	
E38A18	J1-W	-	M2-(-)	6	2	39	
E39A18	J1-V	-	M1-(-)	6	2	42	
K32A18	J1-N	-	R1-N	5	2	29.5	BLACK
K33A18	J1-N	-	R1-R	5	2	30	BLACK
K34A18	J1-T		R1-L	5	2	31	BLACK
L23A18	DS1-2	4	S4-2	4	2	22.5	RED
L23B18	DS1-2	4	DS2-2	4	2	10	RED
L23C18	DS2-2	4	DS3-2	4	2	17	RED
L25A18	J1-J		S6-3	4	2	34.5	BLACK
L26A18	J1-K	-	S6-6	4	2	33.5	BLACK
L34A18	S7-12	4	DS7-2	1/4 STRIP	2	10	RED

Figure 3-59. Control Cubicle Wiring Harness (Sheet 1 of 6) Drawing No. 69-677

WIRE MARKING NO	FROM		TO				
	STATION NO	LUG FIND NO	STATION NO	LUG FIND NO	WIRE FIND NO.	CUT LENGTH IN (REF)	MARKING COLOR
L92A18	S6-2	4	DS4-2	4	2	10	BLACK
L93A18	S6-5	4	DS5-2	4	2	8	BLACK
L93B18	J1-B		DS5-2	4	2	32.5	BLACK
P40N16	J1-V	-	TB1-5	11	1	12	RED
P40P16	J1-U	-	TB1-5	11	1	12	
P40R16	TB1-5	11	S2-11	8	1	42.5	
P40S16	S2-2	8	S2-11	8	1	7	
P40T16	S2-5	8	S2-2	8	1	6	
P40U16	S2-5	4	S4-1	4	2	14	
P40V16	S4-1	4	DS8-3	1/4 STRIP	2	10	
P40W18	DS7-3	1/4 STRIP	DS6-3	l/4 STRIP	2	16.5	
P40X18	TB1-5	11	DS8-3	1/4 STRIP	2	52	
P43A16	S7-5	8	S2-12	8	1	22	RED
P44A16	S1-1	8	S7-4	8	1	23	
P44B16	J1-G	-	S7-4	8	1	37	
P45A16	TB1-10	11	S2-3	8	1	45	
P45B16	S2-3	8	S7-8	8	1	22	
P45C16	S7-8	8	S7-11	8	1	7	
P45D16	J1-R		TB1-10	11	1	14.5	
P45E16	TB1-10	11	A4-7	11	1	11	
P46A16	J1-X	-	S1-2	8	1	34	
P47A16	S2-6	8	S7-9	8	1	22.5	
P47B16	J1-E		S7-9	8	1	38	
P50A16	TB1-8	11	A4-9	11	1	12	
P50B16	J1-W	-	TB1-8	11	1	13	
P50C16	TB1-8	11	S3-2	8	1	38	
P50D16	M1-(+)	9	S3-2	8	1	23	
P50E18	M1-(+)	6	M2-(+)	6	2	7	
P50F18	M3-(+)	6	M2-(+)	6	2	25	
P50G18	M5-(+)	4	M3-(+)	6	2	6.5	
P55AA16	J1-F		TB1-3	11	1	10	
P55CC18	TB1-3	5	DS1-1	4	2	47	

Figure 3-59. Control Cubicle Wiring Harness (Sheet 2 of 6) Drawing No. 69-677

WIRE MARKING NO	FROM		TO				
	STATION NO	LUG FIND NO	STATION NO	LUG FIND NO	WIRE FIND NO.	CUT LENGTH IN (REF)	MARKING COLOR
P55DD18	DS1-1	4	DS2-1	4	2	9.5	
P55EE18	DS2-1	4	DS3-1	4	2	17	
P55FF18	M5-(-)	4	DS3-1	4	2	30	
P55GG18	M5-(-)	4	DS6-1	1/4 STRIP	2	14	
P55HH18	DS6-1	1/4 STRIP	DS7-1	1/4 STRIP	2	16.5	
P55KK16	J1-P		M1-CASE	9	1	42	
P55MM16	A4-2	11	TB1-4	11	1	10.5	
P55XX18	TB1-4	5	DS8-1	1/'4 STRIP	2	50	
P56A16	S3-3	8	S3-6	8	1	7	
P56B16	J1-K	-	S3-3	8	1	31	
P57A16	S7-2	8	S3-5	8	1	19	
P57C16	J1-T		S7-2	8	1	38	
P62D16	J1-H		S7-3	8	1	38.5	
P80E16	J1-M	-	A4-8	11	1	25	
P199A18	J1-A		DS6-2	1/4 STRIP	2	32	
P198A18	J1-C		DS8-2	1/4 STRIP	2	40	
X7D18	J1-E	-	A1-V1	4	2	23.5	BLACK
X8D18	J1-F	-	A1-V2	4	2	23.5	
X9D18	J1-Z		TB1-6	11	1	12	
X9F18	TB1-7	5	A1-V3	4	2	12	
x9G18	A2-2	4	TB1-6	5	2	12.5	
X194A18	J1-P		S6-11	4	2	36	
X195A18	J1-F		S6-10	4	2	36	
X197A18	J1-N	-	S6-8	4	2	36	
X9H18	TB1-7	5	R2-L	1/4 STRIP	2	43	BLACK
X12D16	J1-Y	-	TB1-1	11	1	9	
X12E18	A2-1	4	TB1-1	5	2	10	
X12G18	TB1-1	5	A4-5	5	2	7.5	
X12H18	TB1-1	5	S5-4	4	2	36	
X12J18	TB1-2	5	A1-U3	4	2	15	
X12K18	TB1-2	5	S8-17	4	2	38	

Figure 3-59. Control Cubicle Wiring Harness (Sheet 3 of 6) Drawing No. 69-677

WIRE MARKING NO	FROM		TO				
	STATION NO	LUG FIND NO	STATION NO	LUG FIND NO	WIRE FIND NO.	CUT LENGTH IN (REF)	MARKING COLOR
X12L18	A1-N1	4	A1-N1	4	2	5.5	
X14D18	J1-G	-	DS4-1	4	2	31	
X14E18	S8-12	4	DS4-1	4	2	18	
X14F18	S8-12	4	S8-24	4	2	4.5	
X15D18	J1-H	-	DS5-1	4	2	33.5	
X15E18	S8-22	4	DS5-1	4	2	20	
X16D18	J1-1		S8-13	4	2	34	
S29A18	J1-S	-	A4-12	5	2	23	
X31A18	J1-0		A4-4	5	2	14	
X78A18	A4-10	5	S5-3	4	2	51.5	
X79A10	A4-6	5	S5-6	4	2	40	
X82A18	S5-1	4	R2-M	5/8 STRIP	2	14	
X82B18	A4-11	5	S5-1	4	2	50	
X90A18	J1-U	-	S5-2	4	2	32	
X90B18	S6-7	4	S5-2	4	2	11.5	
X91A18	J1-L	-	S5-5	4	2	32.5	

Figure 3-59. Control Cubicle Wiring Harness (Sheet 4 of 6) Drawing No. 69-677

FIND NO.	QTY REQD.	NOMENCLATURE OR DESCRIPTION
1	AR	WIRE, ELECTRICAL, 600-VOLT, COPPER AIRCRAFT NO. AN-18
2	AR	WIRE, ELECTRICAL, 600-VOLT, COPPER AIRCRAFT NO. AN-18
3	AR	STRAP, CABLE, ADJUSTABLE, SELF-CLINCHING, PLASTIC, TYPE 1, CLASS 1
4	62	TERMINAL, LUG, CRIMP STYLE, COPPER, INS CLASS 1, NO. 6 STUD SIZE, NO. 22-18 W SIZE
5	19	TERMINAL, LUG, CRIMP STYLE, COPPER, INS CLASS 1, NO. 8 STUD SIZE, NO. 22-18 W SIZE
6	8	TERMINAL, LUG, CRIMP STYLE, COPPER, INS CLASS 1, NO. 10 STUD SIZE, NO. 22-18 W SIZE
7	8	TERMINAL, LUG, CRIMP STYLE, COPPER, INS. CLASS 1, 1/4 STUD SIZE, NO. 22-18 W SIZE
8	39	TERMINAL, LUG, CRIMP STYLE, COPPER, INS. CLASS 1, NO. 6 STUD SIZE, NO. 16-14 W SIZE
9	2	TERMINAL, LUG, CRIMP STYLE, COPPER, INS. CLASS 1, NO. 10 STUD SIZE, NO. 16-14 W SIZE
10	3	TERMINAL, LUG, CRIMP STYLE, COPPER, INS. CLASS 1, 1/4 STUD SIZE, NO. 16-14 W SIZE
11	18	TERMINAL, LUG, CRIMP STYLE, COPPER, INS. CLASS 1, NO. 8 STUD SIZE, NO. 16-14 W SIZE
12	1	CONNECTOR, RECEPTACLE, ELECTRICAL
13	12 3/4 IN.	INSULATION TUBING, ELECTRICAL HEAT SHRINKABLE BLACK 187 DIA

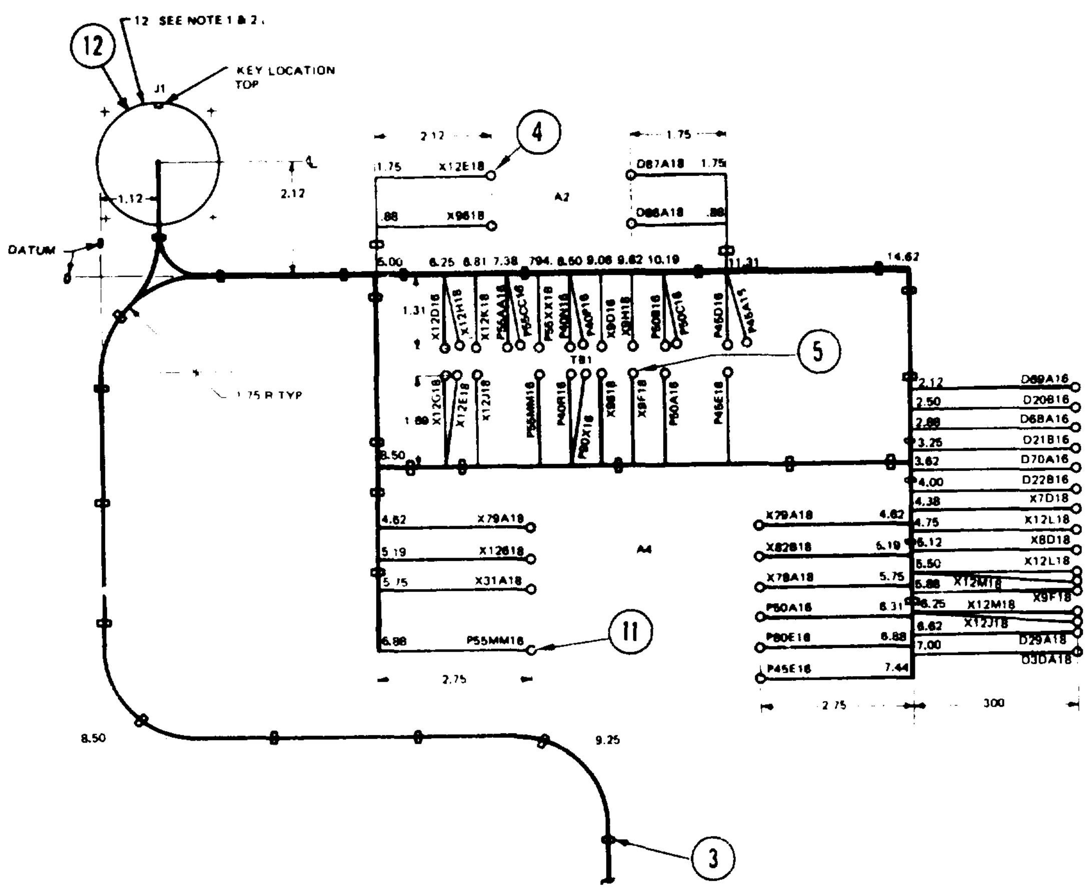


Figure 3-59. Control Cubicle Wiring Harness (Sheet 5 of 6) Drawing No. 69-677

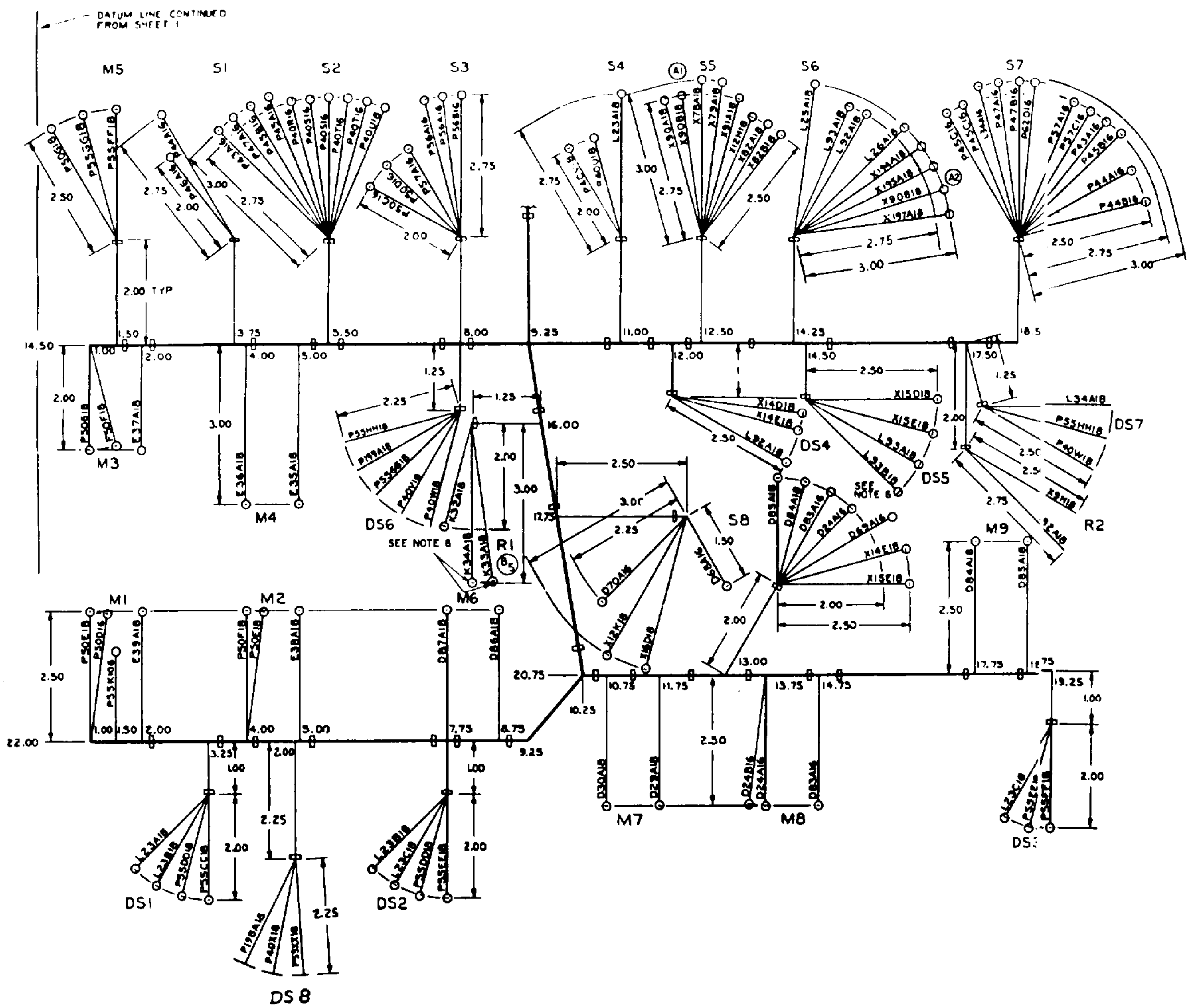


Figure 3–59. Control Cubicle Wiring Harness (Sheet 6 of 6) Drawing No. 69-677

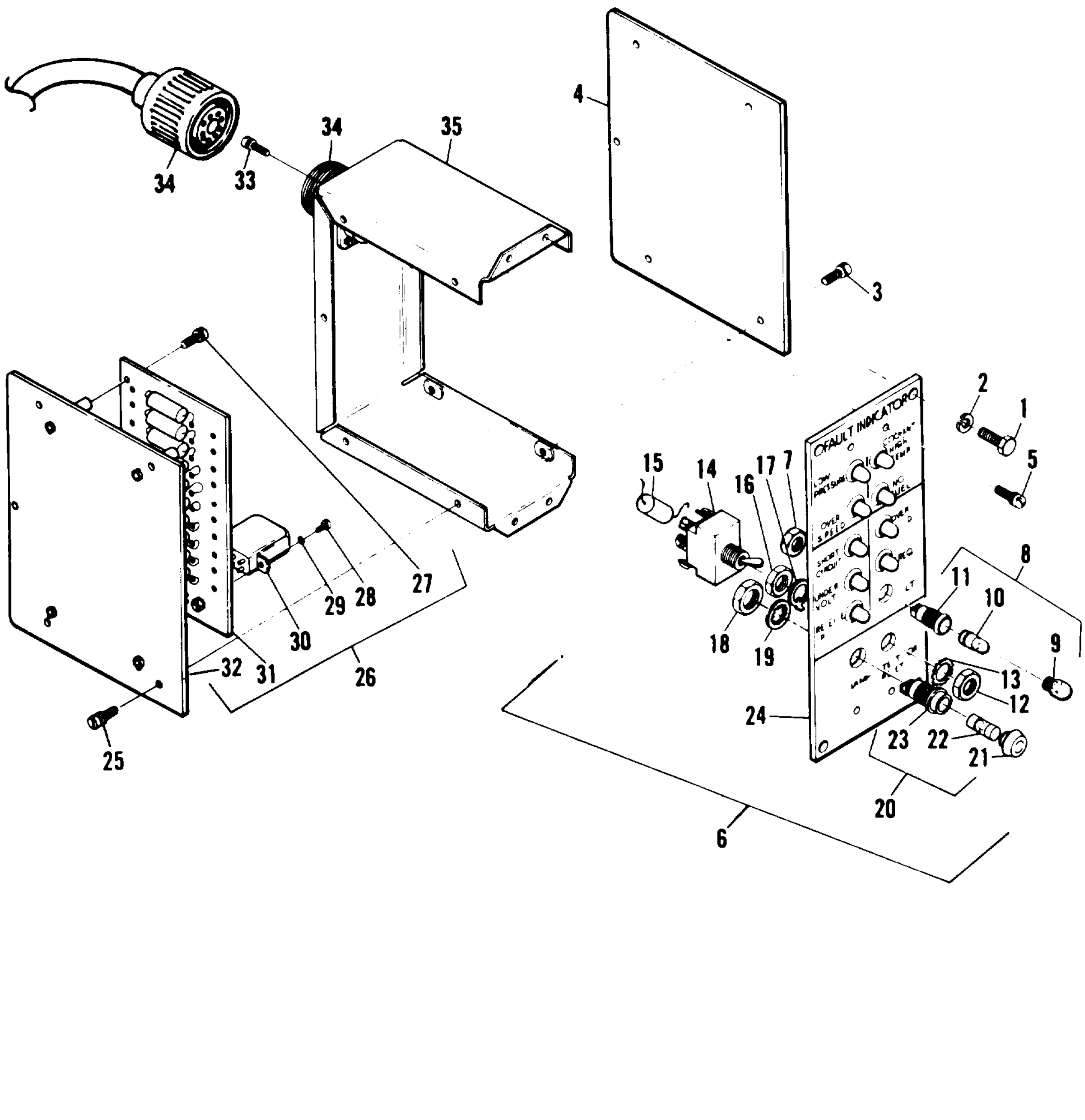


Figure 3-60. Fault Locating Indicator, Exploded View (Sheet 1 of 2)

1. Screw and assembled washer	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 3-60. Fault Locating Indicator, Exploded View (Sheet 2 of 2)

e. Testing.

(1) Refer to figure 3-61 and connect the positive lead of a 24 Vdc source to pin A of connector J12.

(2) Connect the negative lead to pin B.

(3) Place test or reset switch in the TEST or RESET position. All indicator lights shall illuminate.

(4) Release test or reset switch. All indicator lights shall go dark.

(5) Install a jumper between connector pins C and D. Low oil pressure indicator light shall illuminate.

(6) Remove jumper from pin D. Low oil pressure indicator light shall remain lit.

(7) Connect jumper between connector pins C and E and reset test or reset switch.

(8) Low oil pressure indicator light shall go dark and overspeed indicator light shall illuminate.

(9) Repeat steps (5) through (8) for connector pins F through N.

(10) If any indicator light fails to function properly, disassemble fault locating indicator and test that portion pertinent to the malfunctioning light.

f. Installation.

(1) Install fault locating indicator onto generator set with lockwashers (2, figure 3-60), and screws (l).

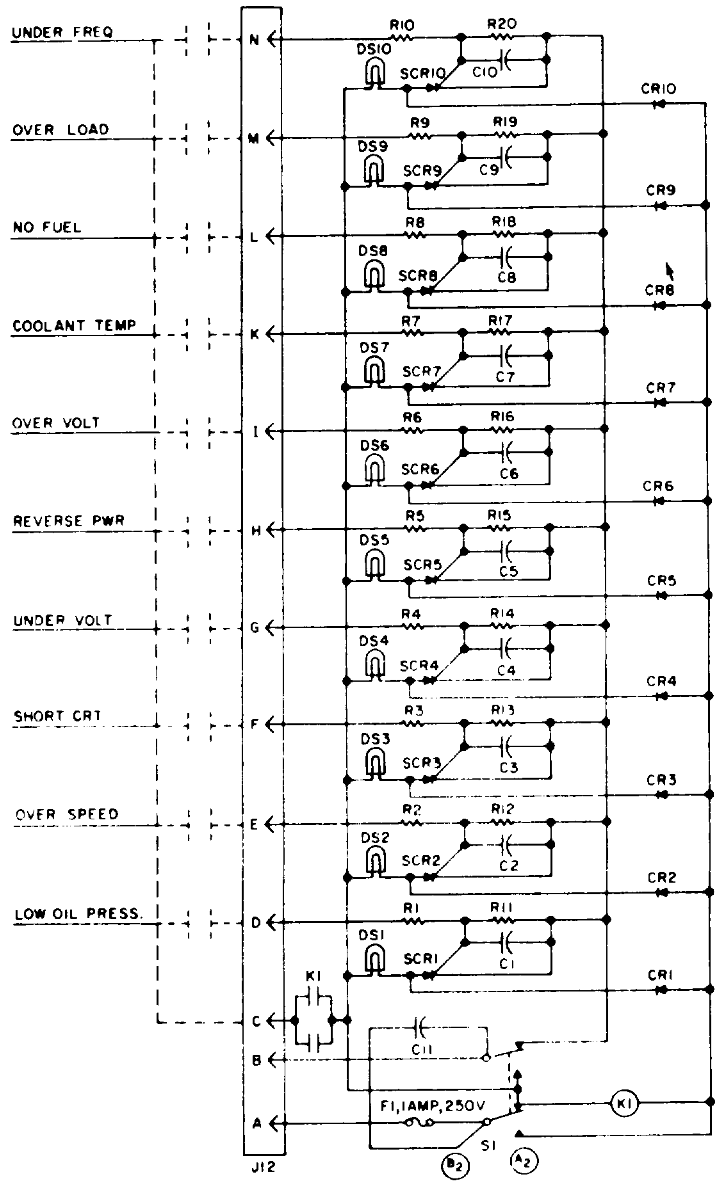
(2) Connect wiring harness to back of fault locating indicator.

3-61. MANUAL SPEED CONTROL.

Refer to the Operator and Unit Maintenance Manual for manual speed control maintenance instructions.

3-62. DC CONTROL CIRCUIT BREAKER.

Refer to the Operator and Unit Maintenance Manual for dc control circuit breaker maintenance instructions.



CR1 THRU CR10 - DIODE

R1 THRU R20 - RESISTOR

DS1 THRU DS10 - LAMP

SCR1 THRU SCR10 - DIODE

K1, RELAY
C11, CAPACITIOR
F1, FUSE
S1, SWITCH
J12, CONNECTOR

Figure 3-61. Fault Locating Indicator, Schematic Diagram

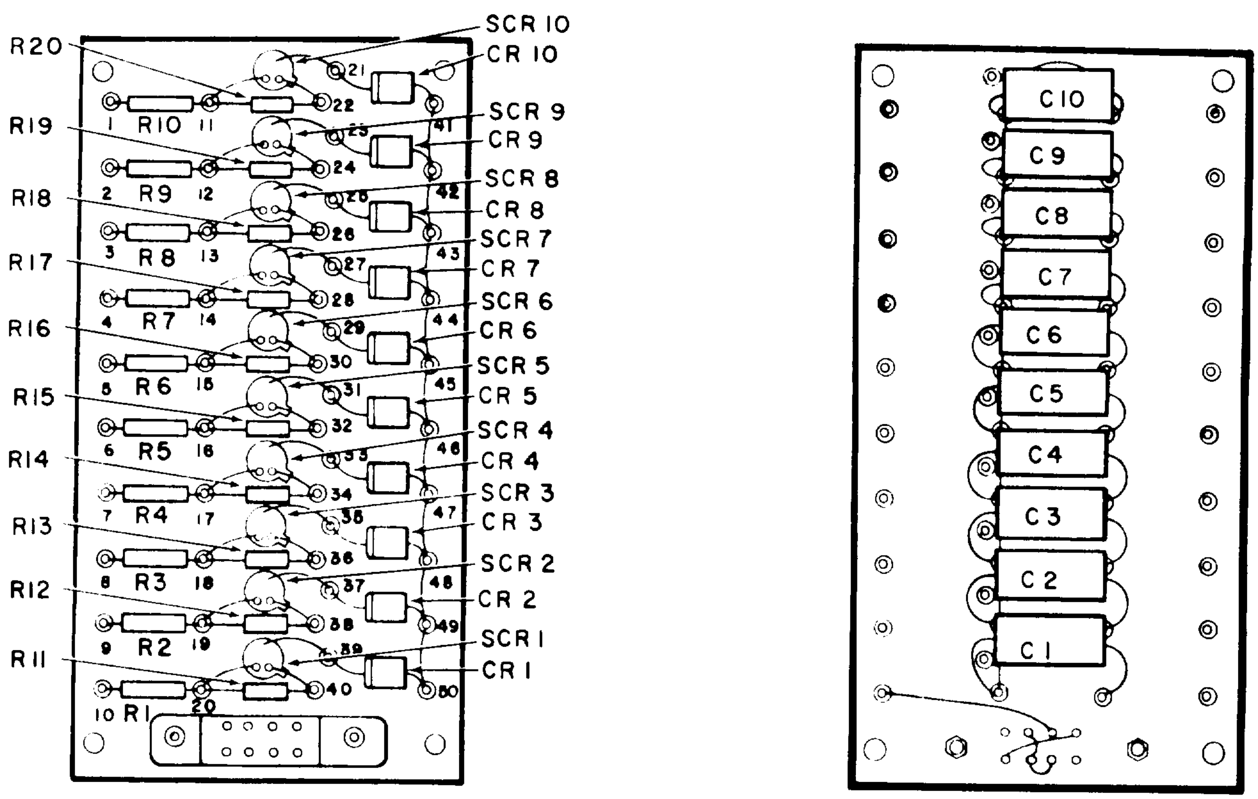
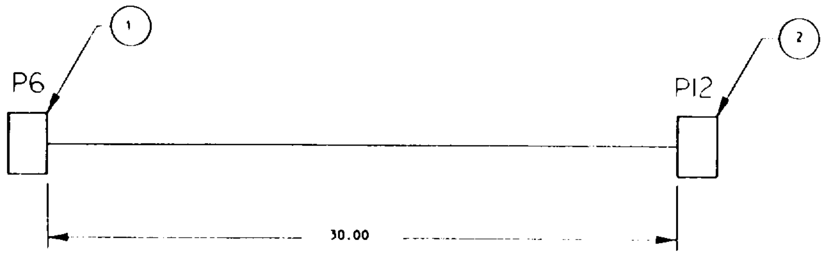


Figure 3-62. Fault Locating Indicator Component Board Assembly

NOTES:

1. ALL SOLDERED CONNECTIONS SHALL BE IN ACCORDANCE WITH MIL–STD–454, REQUIREMENTS.
2. INSTALL STRAPS, FIND NO. 4, AT 3.0 MAX. INTERVALS.
3. WIRE MARKING TO BE IN ACCORDANCE WITH MIL–W–5088 EXCEPT THAT LENGTH BETWEEN GROUPS OF NUMBERS SHALL NOT EXCEED 6 INCHES.
4. INSTALL END SEAL PLUGS, FIND NO. 5 IN UNUSED HOLES OF CONNECTOR FIND NO. 1 AND 2.
5. INTERPRET DRAWING PER MIL–STD–100.
6. REFERENCES
   a) FOR WIRING DIAGRAM, SEE DRAWING 72–2205.
   b) FOR SCHEMATIC DIAGRAM, SEE DRAWING 72–2200.
   FOR PRECISE UNITS, 72–2200 AND 72–2269.
   FOR UTILITY UNITS, 72–2295 AND 72–2277.



MARKING COLOR	WIRE MARKING	TERMINATION FROM	FIND NO. REF.	TERMINATION TO	FIND NO. REF.	WIRE FIND NO. REF.	WIRE LENGTH
RED	P45K16	P6–A	1	P12–A	2	3	31.00
RED	P66B16	P6–B	1	P12–B	2	3	31.00
RED	P200A16	P6–C	1	P12–C	2	3	31.00
RED	P201A16	P6–D	1	P12–D	2	3	31.00
RED	P202A16	P6–E	1	P12–E	2	3	31.00
RED	P203A16	P6–F	1	P12–F	2	3	31.00
RED	P204A16	P6–G	1	P12–G	2	3	31.00
RED	P205A16	P6–H	1	P12–H	2	3	31.00
RED	P206A16	P6–I	1	P12–I	2	3	31.00
RED	P207A16	P6–K	1	P12–K	2	3	31.00
RED	P208A16	P6–L	1	P12–L	2	3	31.00
RED	P209A16	P6–M	1	P12–M	2	3	31.00
RED	P210A16	P6–N	1	P12–N	2	3	31.00

FIND NO.	FSCM	CODE IDENT	DWG SIZE	PART OR IDENTIFYING NO.	QTY REQD	NOMENCLATURE OR DESCRIPTION	SPECIFICATION	MATERIAL
1				MS3106R20-27P	1	CONNECTOR, PLUG, ELECT. P6		
2				MS3106R20-27S	1	CONNECTOR, PLUG, ELECT. P12		
3				M5086/2-16-9	AR	WIRE, ELECT. 16 AWG	MIL-W-5086/2	
4				MS3367-5-9	9	STRAP, CABLE ADJUSTABLE		
5				MS25251-16	2	PLUG, END SEAL, ELECT. CONNECTOR		

Figure 3-63. Fault Locating Indicator Wiring Harness Drawing No. 72–2247

3-63. LOAD MEASURING UNIT.

a. Removal. Refer to the Operator and Unit Maintenance Manual for load measuring unit removal instructions.

NOTE

Disassemble load measuring unit only as is necessary for inspection, testing, and replacement of components.

b. Disassembly

(1) Remove nut (1, figure 3-64), lockwashers (2), flatwasher (3) to remove cover(4).

(2) Remove screws (5), and lockwashers (6) to remove connector (7).

(3) Remove nut (8), lockwasher (9), flatwasher (10), screw (11), and connector bracket (12).

(4) Remove nut (13), lockwasher (14), flatwasher (15), insulating washer (16), load resistor (17), insulating washer (18) and screw (19).

(5) Remove screw (20), lockwasher (21), flatwasher (22), spacer sleeve (23), insulating washer (24), transformer (25), diode (26) from base (27).

c. Cleaning and Inspection

WARNING

Solvent, Dry Cleaning P–D-680, Type II is flammable and moderately toxic to skin, eyes and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate. Failure to observe this warning could result in servere personal injury or death.

WARNING

Compressed air used for cleaning and drying purposes can create airborne particles that may enter the eyes. Pressure shall not exceed 30 psig and use only with adequate chip guards and chipping goggles. Failure to observe this warning could result in servere personal injury or death.

(1) Clean all non-electrical metal parts in dry cleaning solvent (Federal Specification P-D-680) and dry with filtered compressed air.

(2) Clean electrical components with filtered compressed air and a soft bristle brush.

(3) Visually inspect cover connector bracket and base for cracks, corrosion, dents, and other damage.

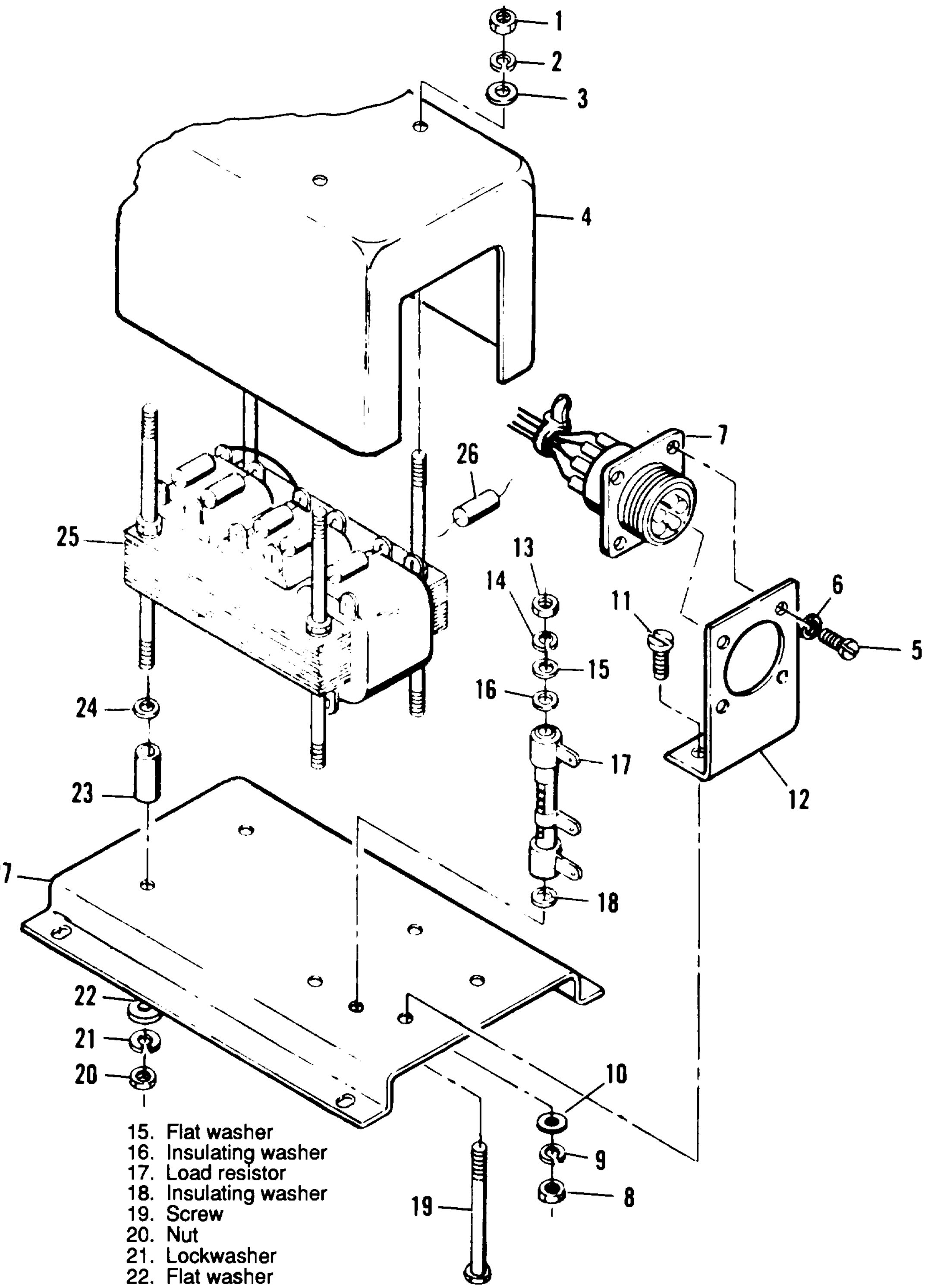
(4) Inspect load resistor for cracks, corrosion, burns, and evidence of overheating.

(5) Inspect diodes for burns and other damage.

(6) Inspect electrical connector for bent or broken pins, burns, cracks, and other damage.

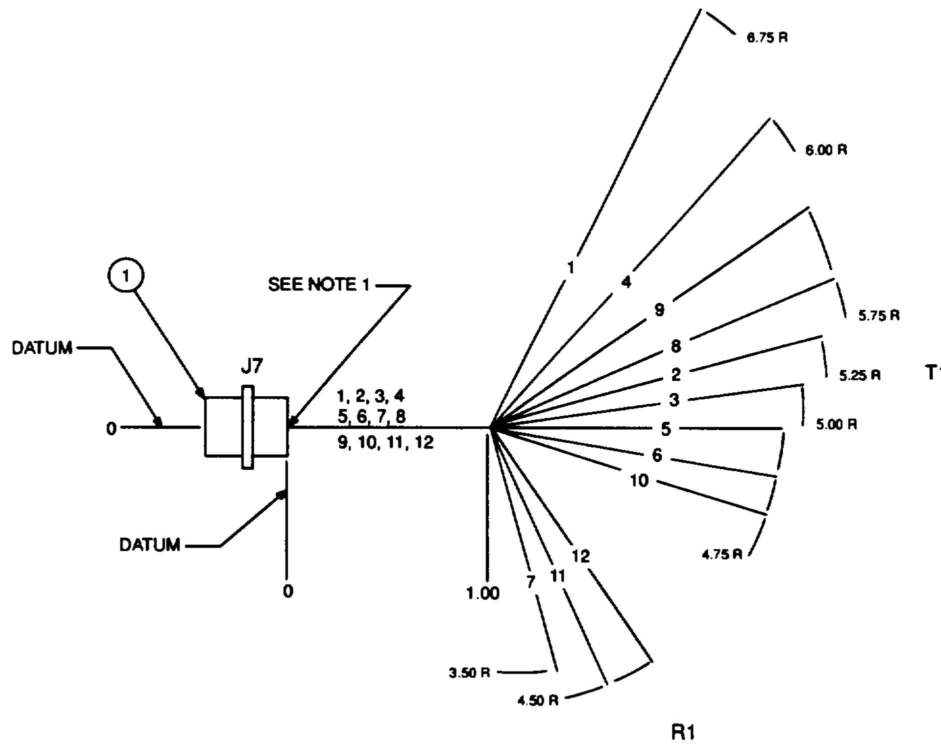
(7) Check all wiring for burned insulation, bare wires, broken or loose connections and other damage.

(8) If the wiring harness has sustained damage and requires repair or rebuild, refer to figure 3-65 for layout, identification and material requirements and Appendix A for detailed soldering and replacement procedures.



1. Nut
2. Lockwasher
3. Flat washer
4. Cover
5. Screw
6. Lockwasher
7. Connector
8. Nut
9. Lockwasher
10. Flat washer
11. Screw
12. Connector bracket
13. Nut
14. Lockwasher
15. Flat washer
16. Insulating washer
17. Load resistor
18. Insulating washer
19. Screw
20. Nut
21. Lockwasher
22. Flat washer
23. Spacer sleeve
24 Insulating washer
25. Transformer
26. Diode
27. Base

Figure 3-64. Load Measuring Unit, Exploded View



WIRE NO. REF.	WIRES IN HARNESS TERMINATION FROM	TO	CUT	WIRE LENGTH REF
1	17–A	T1–2		8.25
2	J7–B	T1–9		6.75
3	J7–C	T1–16		650
4	J7–D	T1–6		7.50
5	J7–E	T1–13		6.25
6	J7–F	T1–20		6.25
7	J7–G	R1–3		5.00
8	J7–H	T1–1		7.25
9	J7–K	T1–8		7.25
10	J7–M	T1–15		6.25
11	J7–N	R1–1		6.00
12	J7–S	R1–2		6.00

NOTES:
1. INSTALL INSULATION SLEEVING, FIND NO. 4 OVER EACH SOLDERED CONNECTION AND HEAT SHRINK TO A FIRM FIT. SLEEVING SHALL EXTEND OVER WIRE INSULATION A MINIMUM OF .25 INCH.
2. ALL SOLDERED CONNECTIONS SHALL BE IN ACCORDANCE WITH MIL-STD-454, REQUIREMENT 5.
3. CONDUCTOR ENDS WITHOUT TERMINALS OR CONNECTORS SHALL BE STRIPPED .25 INCH AND TRIMMED IN ACCORDANCE WITH MIL-STD-454, REQUIREMENT 5.
4. EACH WIRE SHALL BE PERMANENTLY AND LEGIBLY IDENTIFIED AT EACH END OF THE WIRE.
5. REFERENCES:
   9.1 FOR LMU ASSEMBLY SEE DWG 69-500
   9.2 FOR WIRING DIAGRAM SEE DWG 69-510
   9.3 FOR SCHEMATIC DIAGRAM SEE DWG 69-509
6. FOR INTERPRETATION OF DRAWING SEE MIL-STD-100.
7. INSTALL CABLE STRAP, FIND NO. 3 1.00 INCH FROM CONNECTOR J7, FIND NO. 1 REMOVE EXCESS LENGTH OF STRAP.

FIND NO.	SYM	CODE IDENT	DWG SIZE	PART OR IDENTIFYING NO.	QTY REQD	NOMENCLATURE OR DESCRIPTION	SPEC	MATERIAL
1	M,A		B	69–502–2	1	CONNECTOR, RECPT.		
2	B				AR	WIRE, ELEC, TYPE C20, 105C, MIL–W–16878/2 1000V		
3				MS3367–2–9	1	STRAP, CABLE, ADJ. SELF-CLINCHING, PLASTIC, TYPE 1, CL 1. 4 MAX BOL DIA, NATURAL		
4	B			CL 1	AR	INSULATION SLEEVING ELEC, SHRINKABLE POLY. VINYL CHLORIDE, FLEX. CROSSLINKED .093 MIN 10, AS SUPPLIED .046 MAX I.D. X .020 NOM WALL AFTER SHRINKAGE		

Figure 3-65. Load Measuring Unit Wiring Harness, Drawing No. 69-511.

d. Testing and Repair.

NOTE

Disconnect leads to components prior to testing to avoid erroneous readings.

(1) Test individual components using figure 3-66 as a guide and perform the following steps:

(a) Using a VOM, check for continuity between the following test points of transformer T1, figure 3-66: TP1 and TP2, TP8 and TP9, TP15 and TP16, TP5 and TP6, TP6 and TP7, TP5 and TP7, TP12 and TP13, TP13 and TP14, TP12 and TP14, TP19 and TP20, TP20 and TP21, and TP19 and TP21.

(b) If continuity is not indicated in all of the above checks and open circuit exists in the transformer windings, replace transformer (25, figure 3-64).

NOTE

Continuity of secondary windings of transformer T1 can be checked by using pins K and A, L and B, and M and C of plug P7 if desired. This method could show continuity if the connector P7 is faulty, even though the transformer has an open winding.

(c) Using a VOM, check for open circuit indications (infinity) between the following test points of transformer T1, figure 4-13; TP1 and TP5, TP1 and TP6, TP1 and TP7, TP2 and TP5, TP2 and TP6, TP2 and TP7, TP8 and TP12, TP8 and TP13, TP8 and TP14, TP9 and TP12, TP9 and TP13, TP9 and TP14, TP15 and TP19, TP15 and TP20, TP15 and TP21, TP16 and TP19, TP16 and TP20,TP16 and TP21, TP7 and TP12,TP14 and TP19, TP2 and TP8, TP9 and TP15.

(d) If continuity is indicated in any of the above checks, replace the transformer (25, figure 3-64).

(e) Using a VOM, check diodes (1 through 6, figure 3-66). Check diode CR1 by placing the positive probe of the VOM on TP3 and the negative probe on TP5. The VOM should indicate continuity. Reverse the probes: the VOM should indicate open circuit. If the diode fails either of these tests, replace the diode (26, figure 3-64).

(f) Check the remaining diodes, CR2 through CR6 using the same procedure. Replace any diodes found to be defective.

(2) Install load measuring unit in the test circuit shown in figure 3-67.

(3) Remove load measuring unit cover.

(4) Adjust load bank R1 so that it will apply no load to power source G1.

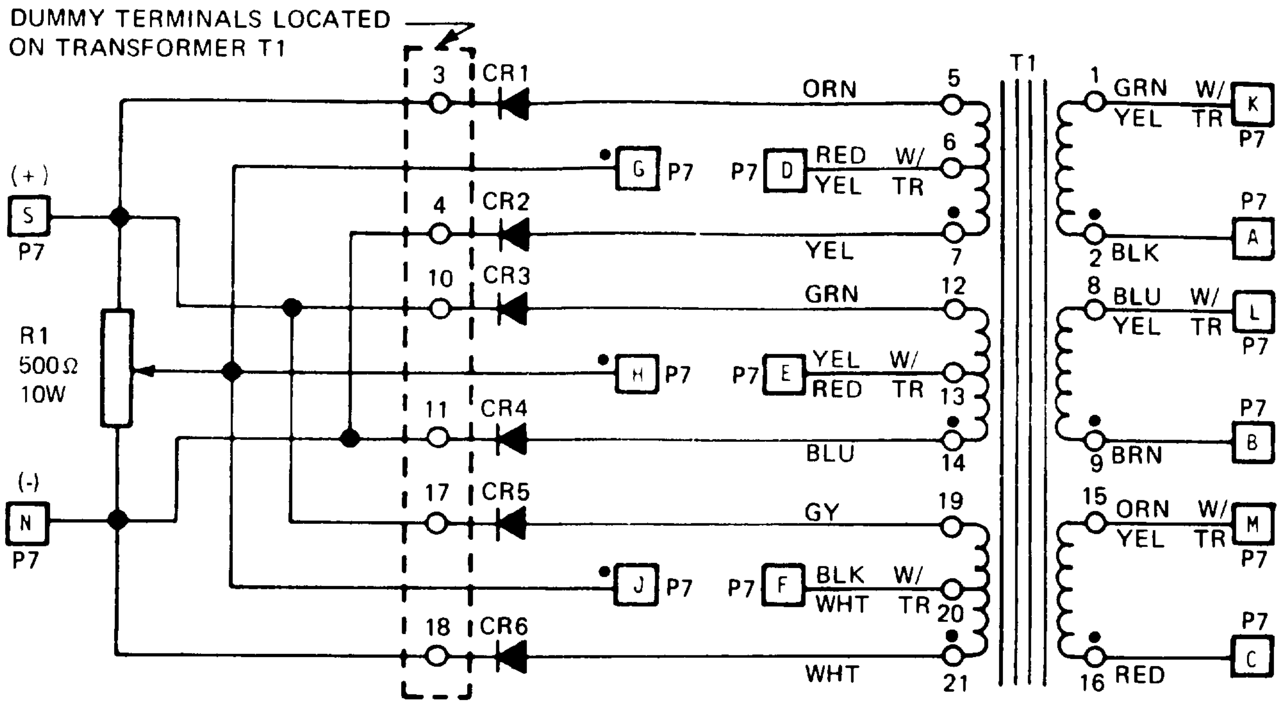
(5) Activate power source and adjust to obtain a reading of 208 Vac on voltmeter M1.

(6) Adjust load measuring unit load resistor (17, figure 3-64) to obtain a reading of 0.0 to 0.4 Vdc on voltmeter M2 (figure 3-67).

(7) Place load bank on the line and check reading of voltmeters M2 and M3. Readings shall be 9.6 ± 0.2 Vdc and 5.4 Vac respectively.

(8) Slowly adjust load bank from zero to full load while observing voltmeter M2 and M3. Indication of voltmeter M2 shall vary from 0.0 to 9.6 ± 0.2 Vdc as indication of voltmeter M3 varies from 0.2 ± 0.2 to 5.6 Vac (figure 3-67).

(9) If necessary, adjust load measuring unit load resistor (17, figure 3-64) to obtain the relationship shown in figure 3-67.



LEGEND

CR1 — Diode
CR2 — Diode
CR3 — Diode
CR4 — Diode
CR5 — Diode
CR6 — Diode
T1 — Transformer
J16— Plug (Mating plug to P16 of wiring harness)
R1 — Resistor

1 through 21 are connections and test points for Diodes CR1 through CR6 and Transformer T1

NOTE

J16-N is positive 9.9 VDC in reference to J16-S with 100% rated load applied.

Figure 3-66. Load Measuring Unit Component Test and Replacement Diagram

(10) If adjustment does not give the proper relationship or if relationship varies outside of acceptability limits at any point, replace load measuring unit load resistor.

(11) Deactivate power source and remove load measuring unit from test circuit.

(12) Install load measuring unit cover (figure 3-64).

e. Assembly.

(1) Position base (27, figure 3-84), to install diode (26), transformer (25), insulation washer (24), spacer sleeve (23), flatwasher (22), lockwasher (21) and screw (20).

(2) Install screw (19), insulating washer (18), load resistor (17), insulating washer, flatwasher (15), lockwasher (14) and nut (13).

(3) Install connector bracket (12), screw (11), flatwasher (10), lockwasher (9), and nut (8).

(4) Install connector (7), lockwasher (6), and screws (5).

(5) Install cover (4), with flatwasher (3), lockwasher (2) and nut (1).

f. Installation. Refer to the Operator and Unit Maintenance Manual for load measuring unit installation instructions.

3-64. ELECTRO-HYDRAULIC GOVERNOR CONTROL UNIT.

a. General.

(1) The electro-hydraulic governing system is a speed (frequency) sensing system used to maintain prime mover speed constant and therefore generator output frequency, during periods of unchanging load and when load additions or deletions occur.

(2) The system consists of a control unit, load measuring unit and hydraulic throttle actuating unit.

(3) The control unit inputs are the generator output voltage, and a dc voltage (O-9.8 Vdc) proportional to the generator load, supplied by the load measuring unit. The generator voltage input is applied to a frequency sensing network and reference voltage network. The differential output of these two networks determines the control current of two magnetic amplifiers whose outputs drive separate coils of the hydraulic actuators pilot valve. The actuator pilot valve positions the actuator power piston which is connected to the input arm of the fuel injection pump. The actuators hydraulic system is comprised of a reservoir, engine driven pump (300-320 psi, 2 gpm), cooler and filter.

(4) Any deviation of engine speed, reflected as a change in frequency at the input of the governor, produces a change in the magnitude and direction of magnetic amplifier control field current. This change in control field current will increase the strength of one coil of the pilot valve while decreasing the strength of the other. The resultant difference repositions the pilot valve in turn repositioning the power piston which changes the output of the fuel injection pump, changing engine speed and consequently restoring generator frequency to its nominal value.

(5) The load measuring units (LMU) input to the governor control provides for automatic load sharing when two or more sets are operated in parallel. Each set is equipped with an LMU.

(6) If the load added to the system is not equally divided, the LMU inputs to their respective governors will differ. The resulting difference acting through additional windings of each sets governor (which are connected in parallel) will reposition each sets actuator power piston such that fuel flow in the more lightly loaded set is increased. Since the power input of each prime mover has been readjusted, equal division of true power (Kw) occurs with no deviation in frequency of any set.

b. Malfunction. The following procedures are to be performed in the generator set unless otherwise specified.

(1) If the FL-NL or NL - FL transient exceeds 1-1/2 percent of rated speed and/or does not reestablish stable engine operating conditions within one second, realign the control unit in accordance with paragraph 3-64j. Also follow this procedure if the engine speed hunts. If the set cannot be stabilized, check sockets A and B of plug P-21 (figure 3-97) for 24 Vdc (A is positive).

(2) If the engine speed increases to above nominal operating speed, check sockets A and B of P-17 (figure 3–97) for 120 Vac. If it is missing, troubleshoot the generator set wiring. Refer to schematic and troubleshooting diagram plates located on inside of left and right engine compartment doors (figure 3-97). If it is present, check the resistance of the frequency adjusting circuit consisting of R4 (250 ohms) rheostat R1 frequency adjust (500 ohms) and R6 (250 ohms) fixed resistor. Measure the total circuit resistance across N and T of harness plug PI 7 (figure 3-97). The circuit resistance should be 1000 ohms (5 percent tolerance). After testing for correct total resistance, test the operation of the frequency adjust rheostat by connecting an ohmmeter across pins M and T and revolving the frequency adjust rheostat through its entire travel. The resistance should vary from 750 ohms to 250 ohms. Repeat this procedure using the ohmmeter across pins M and N of the harness plug. If the problem persists, check sockets A and B of plug P-21 (figure 3-97) for 24 Vdc (A is positive).

(3) If the engine speed remains below the nominal operating speed, adjust RI. If there is no improvement, check the resistance of the frequency adjust circuit. Disconnect P–17 and check the resistance of the frequency adjust circuit consisting of R4 (250 ohms) fixed resistor, RI frequency adjust rheostat (500 ohms) and R5 (250 ohms, 5 percent) fixed resistor. Measure the total circuit resistance across N and T of harness plug P-17. The circuit resistance should be 1000 ohms (5 percent tolerance). After testing for correct total resistance, test the operation of the frequency adjust potentiometer by connecting an ohmmeter across pins M and T and revolving the travel. The resistance should vary from 750 ohms to 250 ohms. Repeat this procedure using the ohmmeter across pins M and N of the harness plug. Disconnect actuator electrical connector before making this measurement. Push actuator piston all the way down and adjust engine speed with manual throttle. If this value resistance is measured, check sockets A and Bat plug P–21 for 24 Vdc (A is positive).

(4) If the set is operating at a constant load and voltage and during an eight–hour period the change in ambient temperature does not exceed 60°F, the set frequency should not drift beyond 1/2 of one percent of rated frequency. The above requirement assumes that the set temperatures were stabilized at the initial and final ambient temperatures.

NOTE

If the drift in paragraph (4) is excessive, realign the control unit following the procedure outlined in paragraph 3-64j.

(5) At constant ambient temperature, constant load, constant voltage and constant barometric pressure, the set frequency should remain within a bandwidth of 1 percent of rated frequency for a period of 4 hours. If this bandwidth has been exceeded, realign the control unit in accordance with paragraph 3-64j.

(6) If the preceding solutions to the specific problem do not resolve the problems, replace and repair the control unit, actuator (paragraph 3-43) or load measuring unit (paragraph 3–63) as required.

c. Removal.

(1) Tag and disconnect electrical connectors to governor control unit.

(2) Remove nuts (1, figure 3-68), Iockwashers (2), nuts (3), Iockwashers (4) and bracket (5), threaded rod (6) and lift governor control unit from mounting bracket.

LEGEND:

G1 POWER SOURCE, 208 VAC, 3 PHASE, 47-430 HZ
M1 VOLTMETER, 0-250 VAC
M2 VOLTMETER, 0-10 VDC
M3 VOLTMETER, 0-10 VAC
R1 LOAD BANK
R2 LOAD RESISTOR, 7.5 OHM, 10 WATT
R3 LOAD RESISTOR, 7.5 OHM, 10 WATT
R4 LOAD RESISTOR, 7.5 OHM, 10 WATT
T1 TRANSFORMER
T2 TRANSFORMER
T3 TRANSFORMER

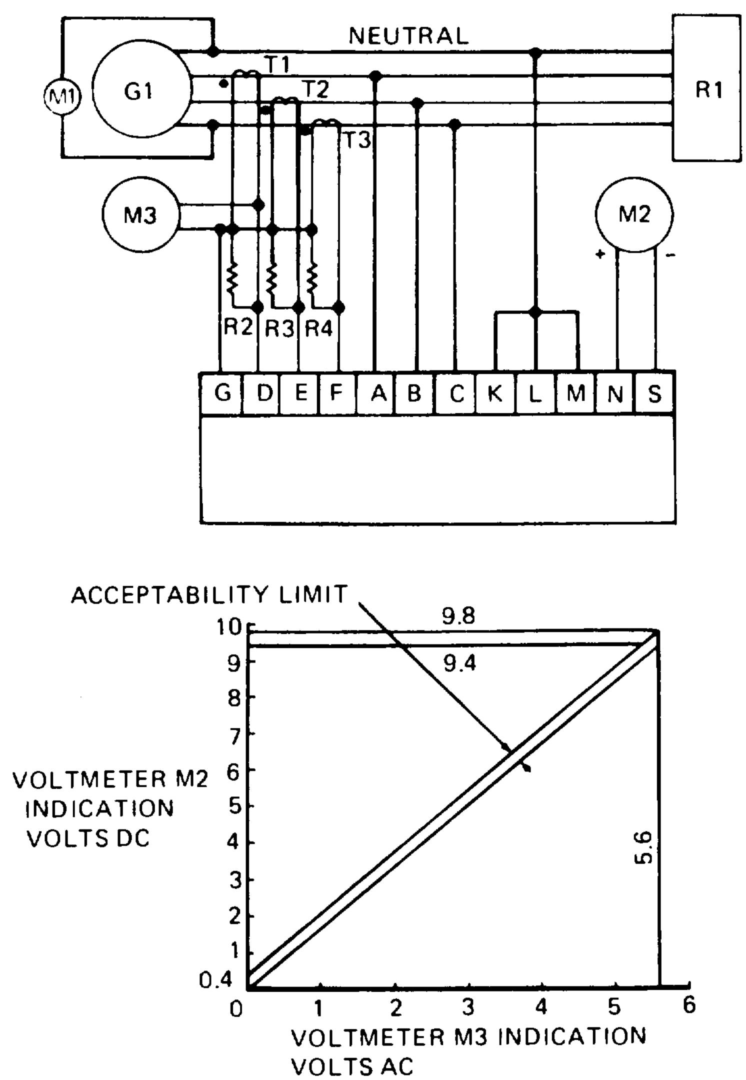


Figure 3-67. Load Measuring Unit Test Circuit and Test Data Relationship

d. Disassembly.

(1) Disassemble governor control unit (7 through 58) only as is necessary for inspection, testing, and replacement of parts.

NOTE

Disassembly and repair of the electric governor control unit at the field level is restricted to removal of the cover, connectors, potentiometers and test jacks. Further disassembly requires unpotting which can be performed by depot maintenance personnel only.

(2) Remove screws (7) and Iockwashers (8) and carefully Iift cover and situate at angle to prevent potting compound from contacting variable resistors and connectors.

CAUTION

Flash point of potting compound is 515°F (268. 3°C). Do not allow oven to reach this temperature. The melting temperature of patting compound is 165°F (73.8°C). Failure to observe this caution could result in damage to the equipment.

(3) Place governor control unit in an oven and bake at + 180°F to 185° (+82.2°C to +85°C) for 11 to 12 hours.

WARNING

Wear protective glasses and heat resistant gloves when removing governor control unit. Hot potting compound will cause severe burns should it come in contact with the skin. Failure to observe this warning could result in servere personal injury or death.

(4) Remove governor control unit from oven.

(5) Slowly lift cover (54) with attached parts and printed circuit board (57) from housing (58).

(6) Place printed circuit board on a drain board and allow to cool.

(7) Remove screws (38, 42, 46, and 50) and Iockwashers (39, 43,47, and 51) and attaching connectors (41, 45, 49, and 53), gaskets (40, 44, 48, and 52) and cover (54).

(8) Disassemble remaining components mounted on cover in accordance with index numbers 9 through 37.

e. Cleaning, Inspection, and Repair.

WARNING

Solvent, Dry Cleaning P-D-680, Type II is flammable and moderately toxic to skin, eyes and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate. Failure to observe this warning could result in servere personal injury or death.

WARNING

Compressed air used for cleaning and drying purposes can create airborne particles that may enter the eyes. Pressure shall not exceed 30 psig and use only with adequate chip guards and chipping goggles. Failure to observe this warning could result in servere personal injury or death.

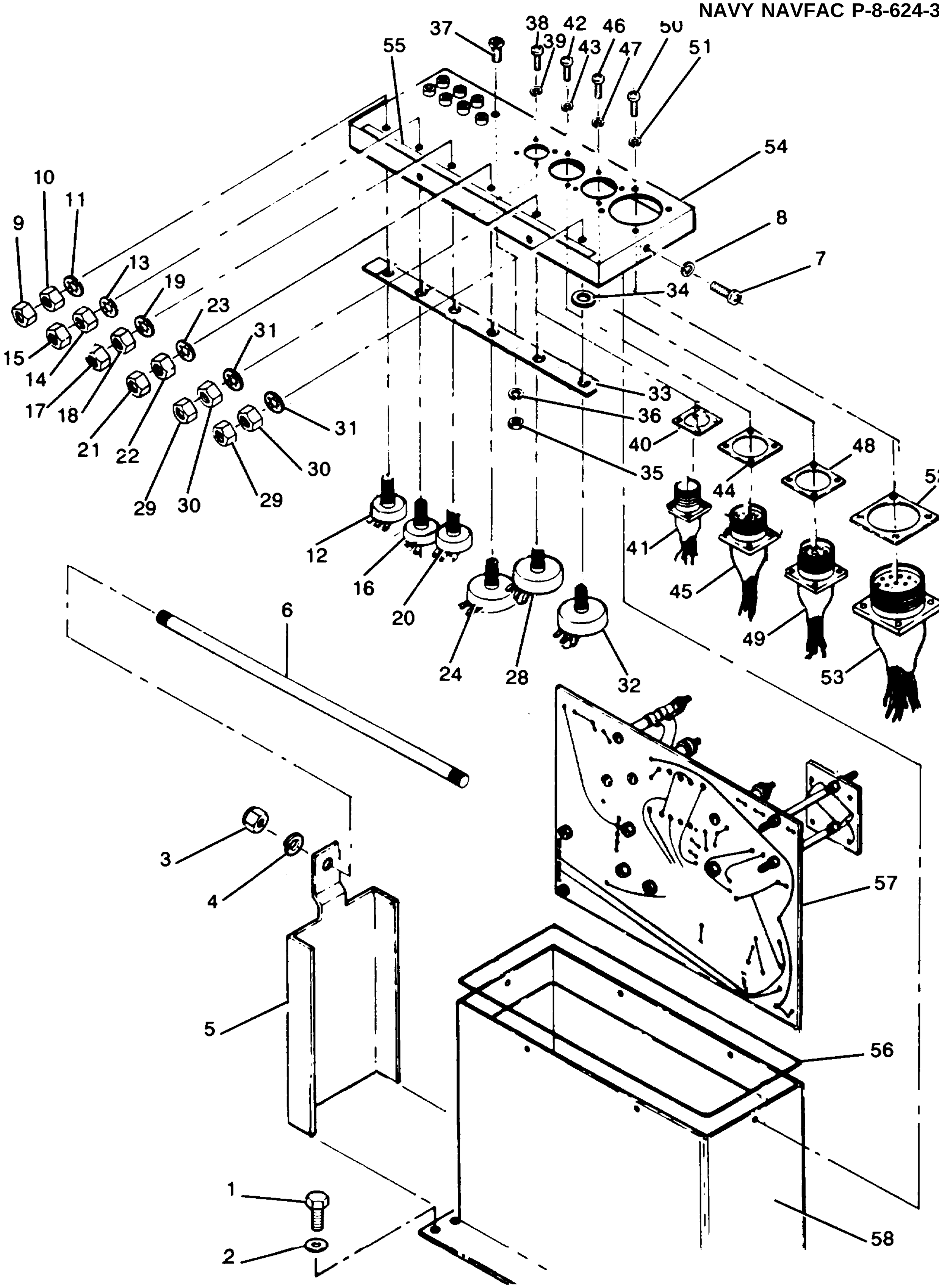


Figure 3-68. Electro-Hydraulic Governor Control Unit. Exploded View (Sheet 1 of 2)

1. Screw
2. Lockwasher
3. Nut
4. Lockwasher
5. Bracket
6. Threaded rod
7. Screw
8. Lockwasher
9. Nut
10. Nut
11. Tooth lockwasher
12. Potentiometer (R18)
13. Nut
14. Nut
15. Tooth lockwasher
16. Potentiometer (R16)
17. Nut
18. Nut
19. Tooth lockwasher
20. Potentiometer (R15)
21. Nut
22. Nut
23. Tooth lockwasher
24. Potentiometer (R15)
25. Nut
26. Nut
27. Tooth lockwasher
28. Potentiometer (R11)
29. Nut
30. Nut
31. Tooth lockwasher
32. Potentiometer (R12)
33. Spacer
34. Sealing washers
35. Nut
36. Tooth lockwasher
37. Test jack
38. Screw
39. Lockwasher
40. Gasket
41. Electrical connector (P2)
42. Screw
43. Lockwasher
44. Gasket
45. Electrical connector (P5)
46. Screw
47. Lockwasher
48. Gasket
49. Electrical connector (J3)
50. Screw
51. Lockwasher
52. Gasket
53. Electrical connector (P1)
54. Cover
55. Nameplate
56. Gasket
57. Printed circuit board assembly
58. Housing

Figure 3-68. Electro-Hydraulic Governor Control Unit, Exploded View (Sheet 2 of 2)

(1) Clean housing and cover with dry cleaning solvent (Federal Specification P-D-680) and dry with filtered compressed air.

(2) Clean electrical components with a clean, lint-free cloth lightly moistened with an approved solvent.

(3) Visually inspect cover and housing for cracks, dents, defective paint and other damage.

(4) Inspect potentiometers for cracks, burns, and other damage.

(5) Inspect electrical connectors for bent or broken pins, cracks, burns, and other damage.

(6) Inspect printed circuit board assembly for cracks, breaks, burned or damaged components and cold solder joints.

(7) Inspect all wiring for burned, chaffed, or damaged insulation and loose connections.

(8) Repair housing and cover as follows:

(a) Straighten dents and warping.

(b) Remove defective paint and corrosion. Treat and paint.

(9) Repair wiring harness as follows: If the wiring harness has sustained damage and requires repair or rebuild, refer to figures 3-69 (50/60 Hz) or 3–70 (400 Hz) as required for layout identification and material requirements and Appendix A for detailed soldering and replacement procedures.

(10) Test and replace printed circuit board components using figures 3-71, 3–72, 3-73,3-74, and 3-75 as appropriate.

(11) If any soldered component on the printed circuit board must be replaced, refer to Appendix A for detailed soldering and replacement procedures.

f. Assembly.

(1) Assemble governor control unit in reverse order of removal procedures using figure 3-68 as a guide.

NOTE

Prior to installing assembled governor control unit in housing and pouring potting compound, perform tests (subparagraph g.) below.

(2) After completing assembly, repeat tests g.(2), (3), (4) (checks only) (5) and (6).

(3) After final assembly, use an ohmmeter to check for open circuit between each pin on all connectors and each test point and the governor control unit housing. There shall be no sign of continuity.

g. Testing.

CAUTION

Unpotted governor control unit printed circuit board must be positioned as specified in step (1) below. Failure to observe this caution could result in damage to the equipment.

(1) Position governor control unit printed circuit board as shown in figure 3-76.

(2) Perform resistance test as follows:

(a) Turn potentiometers (R11, R12, R14, R15, R16 and R18, figure 3-68) to the full clockwise position.

(b) Preset adjustable resistors (R2 and R10, figure 3-71) to mid-range.

(c) Using an ohmmeter, check resistance of points in table 3-5 for specified values (400 Hz resistance test values are given in table 3-6).

NOTE

Observe polarity of connections specified in the table. Return potentiometer to clockwise position after each check.

(3) Perform magnetic amplifier bias test as follows:

(a) Install governor control unit in test circuit illustrated in figure 3-77.

NOTE

Frequency of power source (G1) must conform to frequency of governor control unit being tested (50/60 Hz or 400 Hz).

(b) Turn potentiometers R11, R12, R14, R15, R16, and R18 to full clockwise position.

(c) Adjust R11 and R12 to obtain a balanced reading of 450 milliamperes on M2 and M3.

(d) Turn R12 to full clockwise. Reading of M2 and M3 shall be O to 300 milliamperes and shall be balanced within 50 milliamperes.

(e) Turn R12 to full counterclockwise position. Reading of M2 and M3 shall be 600-1000 milliamperes and be balanced within 50 milliamperes.

(f) Adjust R11 and R12 as in step (c) above and Iock for remainder of test.

(4) Perform frequency sensing test as follows:

(a) Install the governor control unit in test circuit as shown in figure 3-78.

(b) Apply 57.5 to 62.5 Hz, 120 ±2 volts ac to P1-A and P1-B (375 to 425 Hz for 400 Hz units).

(c) Adjust Rb so the resistance between P1-M and P.-T is 250 ohms.

(d) Reduce the frequency of the applied 120 ±2 volt supply until M2 and M3 balance. The frequency shall be 57-58 Hz (375 to 425 Hz on 400 Hz sets).

(e) Adjust Rb so the resistance between P1-M and P1-N is 250 ohms.

(f) Increase the frequency of the applied 120 ±2 volt supply until M2 and M3 balance. The frequency shall be 64-65 Hz (420-425 Hz on 400 Hz units).

(5) Perform rectifier bridge and feedback winding test as follows.

(a) Install governor control unit in test circuit as shown in figure 3-79.

(b) Turn R14 and R15 to full counterclockwise position.

(c) M5 shall indicate -5 to -7 milliamperes.

(d) Adjust R14 clockwise until indication of M2 and M3 are balanced.

(e) Place SW1 in the LOW position. M3 shall indicate 600 to 840 milliamperes. M3 shall indicate 0 to 300 milliamperes. M5 shall indicate less than 0 to + 1.5 milliamperes.

(f) Place SW1 in the HIGH position. M2 shall indicate 0 to 300 milliamperes. M3 shall indicate 600 to 840 milliamperes. M5 shall indicate less than 0 to –1.5 milliamperes.

(6) Perform parallel winding test as follows:

(a) Install governor control unit in test circuit as shown in figure.

(b) M2 shall indicate 0 to 300 milliamperes. M3 shall indicate 600 to 840 milliamperes.

(c) Reverse polarity of connections to pins J1-E and J1-G.

(d) M2 shall indicate 600 to 840 milliamperes. M3 shall indicate 0 to 300 milliamperes.

h. Potting.

(1) Check all connections and if any have been bored for test purposes, or if any defected components have been replaced, the effected area and components must be coated with polyurethane resin to prevent oxidation or other corrosion. The coating must be of a minimum thickness of 0.007 inch and air bubble entry into the applied polyurethane must be controlled so that the legibility of component coding and identification is not impaired.

(2) Check connections of printed circuit board to cover.

Table 3-5. 50/60 Hz Governor Control Unit Resistance Test Values

P1 CONNECTION	POTENTIOMETER POSITION	NOMINAL RESISTANCE (OHMS)	ALLOWABLE RESISTANCE RANGE (OHMS)
(T-N) (T+)		5100	3400-6800
M-N (M+)		2180	1950-2400
(M+)	R18 counterclockwise	12,180	11,000-13,000
F-N (F+)		6000	5000-7000
(F+)	R16 counterclockwise	31,000	30,000-32,000
(F+)	R15 counterclockwise	6500	5500-7500
E-G (E+)		5500	4500-6500
R-G (R+)		120	100-140
F-G (F+)		650	500-750
J–H (J+)		Less than 0.2 ohm	
T-P (T+)		2200	1400-3000
(T+)	R14 counterclockwise	2600	1800-3400
U-S (U+)		525	450-600

Table 3-6. 400 Hz Electro-Hydraulic Governor Control Unit Resistance Test Values

PI CONNECTION	POTENTIOMETER POSITION	NOMINAL RESISTANCE (OHMS)	ALLOWABLE RESISTANCE RANGE (OHMS)
(T-N) (T+)		4850	3400-6300
M-N (M+)		1400	1200-1700
(M+)	R18 counterclockwise	11,480	10,000-12,000
F–N (F+)		4160	3500-5500
(F+)	R16 counterclockwise	29,160	27,000-31,000
(F+)	R15 counterclockwise	4660	4000-5500
E-G (E+)		5500	4500-6500
R-G (R+)		120	100-140
F-G (F+)		650	550-750
J-H (J+)		Less than 0.2 ohm	
T–P (T+)		1950	1400-2500
(T+)	R14 counterclockwise	2150	1500-2800
U–S (U+)		520	450-600

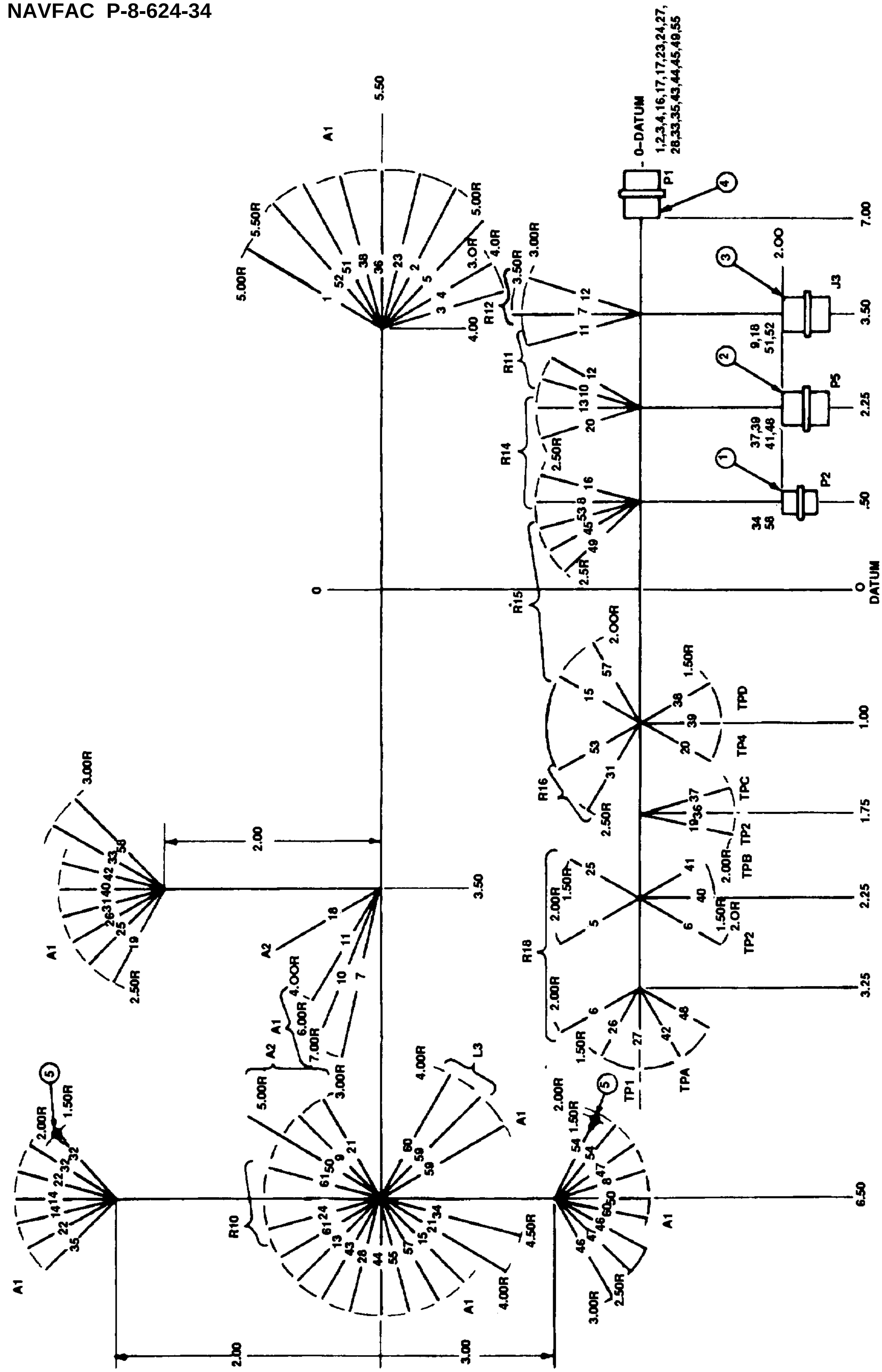


Figure 3-69. 50/60 Hz Governor Control Unit Wiring Harness, Drawing No. 69-731 (Sheet 1 of 2)

WIRE NO. (REF)	TERMINATION FROM	TERM. FIND NO (REF)	TERMINATION TO	TERM. FIND NO. (REF)	WIRE FIND NO.	WIRE CUT-LENGTH (REF)
1	P1–B		A1–1		6	22.00
2	P1–A		A1–2		6	22.00
3	P1–K		A1–3		6	20.00
4	P1–L		A1–4		6	20.00
5	R18–2		A1–5		6	18.50
6	TP2		R18–1		6	6.00
7	R12–3		A1–7		6	24.00
8	R14–1		A1–8		6	20.50
9	J3–A		A2–B		6	21.50
10	R11–1		A1–10		6	20.00
11	R11–3		A1–11		6	20.00
12	R11–2		R12–1		6	7.00
13	R14–3		A1–13		6	20.00
14	Q1–E		A1–E1		6	4.50
15	R15–1		A1–15		6	18.50
16	P1–P		R14–2		6	11.00
17	P1–H		P1–J		6	2.50
18	J3–B		A2–A		6	21.00
19	TP3		A1–19		6	18.00
20	TP4		R14–2		6	8.00
21	A2–D		A1–21		6	7.50
22	Q1–B		A1–B1		6	4.50
23	P1–N		A1–23		6	22.00
24	P1–T		R10–1		6	23.00
25	R18–3		A1–25		6	19.00
26	TP1		A1–26		6	20.00
27	P1–M		TP1		6	13.00
28	P1–G		A1–28		6	23.00
31	R16–2		A1–31		6	19.00
32	Q1–C	5	A1–C1		6	4.00
33	P1–C		A1–33		6	22.00
34	P2–A		A1–34		6	20.00
35	P1–D		A1–35		6	24.00
36	TPC		A1–36		6	19.00
37	P5–C		TPC		6	8.50
38	TPD		A1–38		6	18.00
39	P6–D		TPD		6	7.00
40	TP5		A1–40		6	18.00
41	P5–B		TPB		6	10.00
42	TPA		A1–42		6	18.00
43	P1–E		A1–43		6	23.00
44	P1–R		A1–44		6	23.00
45	P1–S		R15–3		6	12.00
46	Q2–E		A1–E2		6	6.00
47	Q2–B		A1–B2		6	5.00
48	P5–A		TPA		6	10.00
49	P1–F		R15–3		6	11.00
50	A2–C		A1–50		6	11.00
51	J3–D		A1–51		6	22.00
52	J3–C		A1–52		6	22.00
53	R15–2		R16–3		6	6.50
54	Q2–C	5	A1–C2		6	4.00
55	P1–U		A1–15		6	23.00
57	R15–1		A1–44		6	18.50
58	P2–B		A1–33		6	19.00
59	A1–7		L3–1		6	8.50
60	A1–8		L3–2		6	9.50
61	A1–61		R10–2		6	6.50

NOTES:

1. INSTALL CABLE STRAPS, FIND NO. 7, AT 1.5 INTERVALS AND AT EACH CABLE BREAKOUT.
2. CRIMP STYLE TERMINALS, FIND NO. 5, SHALL BE IN ACCORDANCE WITH MIL-STD-454, REQUIREMENT 19.
3. CONDUCTOR ENDS WITHOUT TERMINALS OR CONNECTORS SHALL BE STRIPPED .25 INCH AND TINNED IN ACCORDANCE WITH MIL-STD-454, REQUIREMENT NO. 5.
4. SODER ALL CONNECTORS IN ACCORDANCE WITH MIL-STD-454, REQUIREMENT NO. 5
5. EACH WIRE SHALL BE PERMANENTLY AND LEGIBLY IDENTIFIED AT EACH END OF THE WIRE.
6. INSTALL INSULATION SLEEVING, FIND NO. 8 OVER EACH SOLDER CONNECTION TO CONNECTORS (FIND NO. 1,2,3 AND 4) AND HEAT SHRINK TO A FIRM FIT. SLEEVING SHALL EXTEND OVER WIRE INSULATION AT A MINIMUM OF .25 IN.
7. REFERENCES:
   FOR ELECTRICAL WIRING DIAGRAM, SEE DRAWING 69-730
   FOR ELECTRICAL SCHEMATIC DIAGRAM, SEE DRAWING 69-729
8. FOR INTERPRETATION OF:
   REFERENCE DESIGNATIONS FOR ELECTRICAL AND ELECTRONICS AND EQUIPMENTS, SEE ANS Y32.16
   DIMENSIONING AND TOLERANCING, SEE ANS Y14.5

FIND NO.	SYM	CODE IDENT	DWG SIZE	PART OR IDENTIFYING NO.	QTY REQD	NOMENCLATURE OR DESCRIPTION	SPEC	MATERIAL
1	M		B	69–502–6	1	CONN. RECEPTACLE, PN MS 3102R–10SL–4P		
2	M		B	69–502–4	1	CONN. RECEPTACLE, PN MS 3102R–14S–5P		
3	M		B	69–502–3	1	CONN. RECEPTACLE, PN MS3102R–14S–2S		
4	M		B	69–502–5	1	CONN. RECEPTACLE, PN MS 3102R–22–14P		
5				MS25036–101	2	TERMINAL, LUG, CRIMP STYLE, COP., TIN PLD, INSUL, RING–TONGUE, BELL–MOUTHED, TYPE II, CL 1, 22–18 TERM. SIZE, NO. 6 STUD SIZE		
6	B				AR	WIRE, ELECTRIC, TYPE C–20, 105°C, 1000 V	MIL–W–16878/2	
7				MS3367–1–9	AR	STRAP, CABLE, ADJ, SELF–CLINCHING, PLASTIC, TYPE 1, CL 1, 1.5 MAX BDL DIA, NATURAL		
8	B			CL 1	AR	INSULATION SLEEVING, ELEC, HEAT SHRINKABLE, POLYVINYL CHLORIDE, FLEX, CROSSLINKED, .125 MIN ID, AS SUPPLIED .062 MAX ID X .025 WALL, AFTER UNRESTRICTED SHRINKABLE, AR L	MIL–I–23053/2	

Figure 3-69. 50/60 Hz Governor Control Unit Wiring Harness, Drawing No. 69–731 (Sheet 2 of 2)

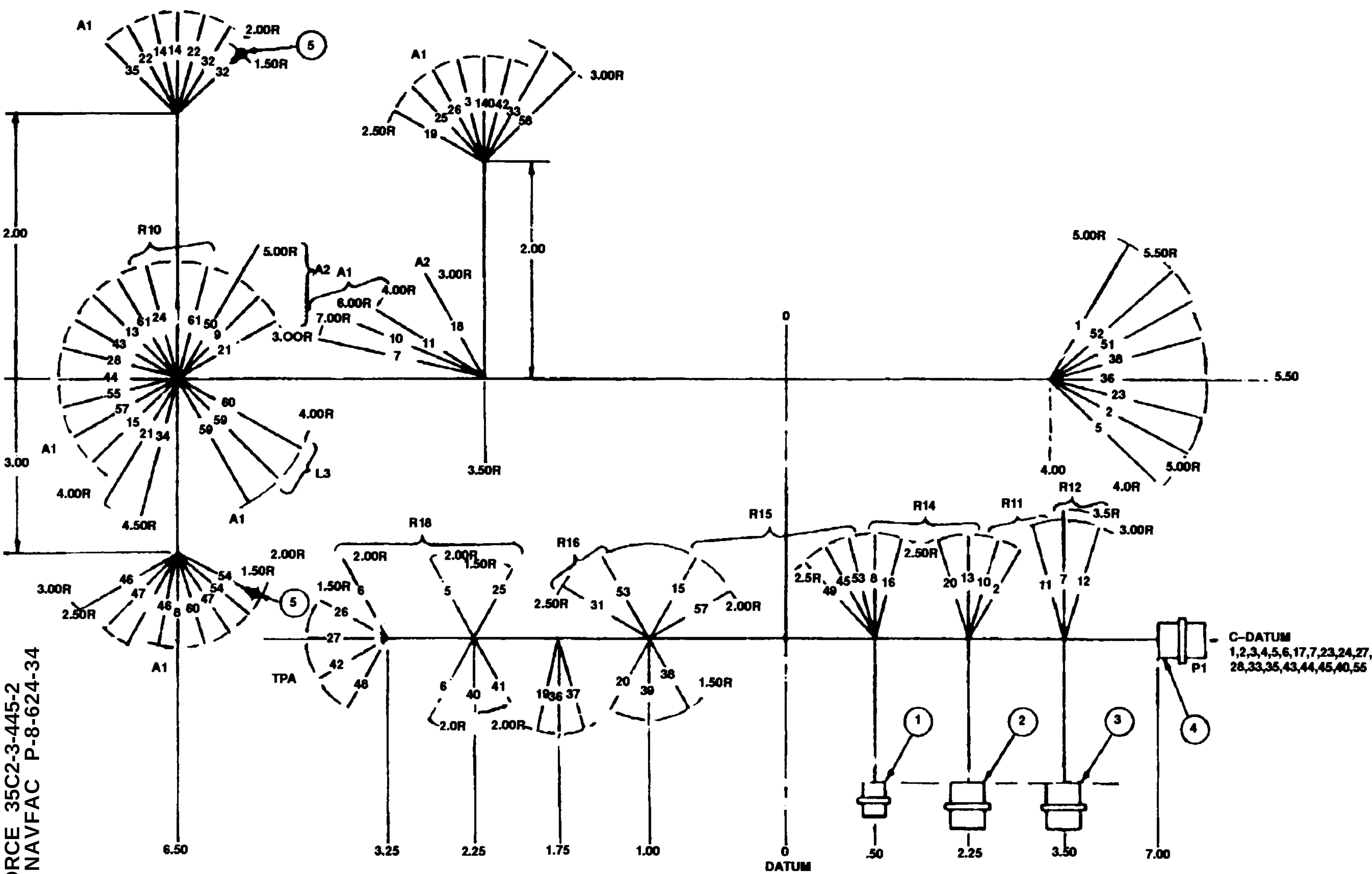


Figure 3-70. 400 Hz Electro-Hydraulic Governor Control Unit Wiring Harness, Drawing No. 69-814
(Sheet 1 of 2)

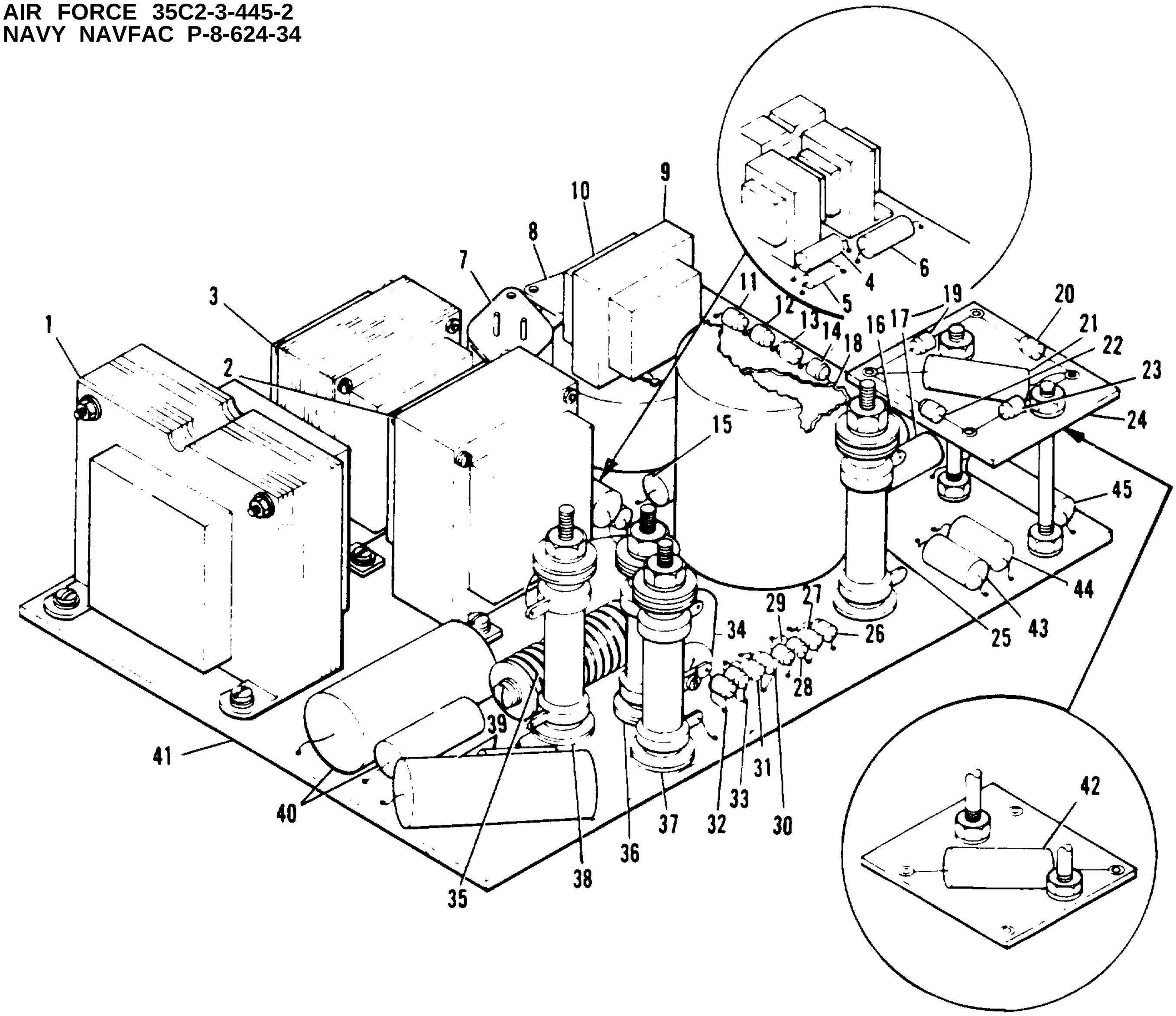
WIRE NO. (REF)	TERMINATION FROM	TERM. FIND NO (REF)	TERMINATION TO	TERM. FIND NO. (REF)	WIRE FIND NO.	WIRE CUT-LENGTH (REF)
1	P1–B		A1–1		6	22.00
2	P1–A		A1–2		6	22.00
5	R18–2		A1–5		6	18.50
6	TP2		R18–1		6	6.00
7	R12–3		A1–7		6	24.00
8	R14–1		A1–8		6	20.50
9	J3–A		A2–B		6	21.50
10	R11–1		A1–10		6	20.00
11	R11–3		A1–11		6	20.00
12	R11–2		R12–1		6	7.00
13	R14–3		A1–13		6	20.00
14	Q1–E		A1–E1		6	4.50
15	R15–1		A1–15		6	18.50
16	P1–P		R14–2		6	11.00
17	P1–H		P1–J		6	2.50
18	J3–B		A2–A		6	21.00
19	TP3		A1–19		6	18.00
20	TP4		R14–2		6	8.00
21	A2–D		A1–21		6	7.50
22	Q1–B		A1–B1		6	4.50
23	P1–N		A1–23		6	22.00
24	P1–T		R10–1		6	23.00
25	R18–3		A1–25		6	19.00
26	TP1		A1–26		6	20.00
27	P1–M		TP1		6	13.00
28	P1–G		A1–28		6	23.00
31	R16–2		A1–31		6	19.00
32	Q1–C	5	A1–C1		6	4.00
33	P1–C		A1–33		6	22.00
34	P2–A		A1–34		6	20.00
35	P1–D		A1–35		6	24.00
36	TPC		A1–36		6	19.00
37	P5–C		TPC		6	8.50
38	TPD		A1–38		6	18.00
39	P5–D		TPD		6	7.00
40	TPB		A1–40		6	18.00
41	P5–B		TPB		6	10.00
42	TPA		A1–42		6	18.00
43	P1–E		A1–43		6	23.00
44	P1–R		A1–44		6	23.00
45	P1–S		R15–3		6	12.00
46	Q2–E		A1–E2		6	6.00
47	Q2–B		A1–B2		6	5.00
48	P5–A		TPA		6	10.00
49	P1–F		R15–3		6	11.00
50	A2–C		A1–50		6	11.00
51	J3–D		A1–51		6	22.00
52	J3–C		A1–52		6	22.00
53	R15–2		R16–3		6	6.50
54	Q2–C	5	A1–C2		6	4.00
55	P1–U		A1–15		6	23.00
57	R15–1		A1–44		6	18.50
58	P2–B		A1–33		6	19.00
59	A1–7		L3–1		6	8.50
60	A1–8		L3–2		6	9.50
61	A1–61		R10–2		6	6.50

NOTES:

1. INSTALL CABLE STRAPS FIND NO. 7, AT 1.5 INTER– VALS AND AT EACH CABLE BREAKOUT.
2. CRIMP STYLE TERMINALS, FIND NO. 5 SHALL BE IN ACCORDANCE WITH MIL–STD–464, REQUIRE– MENT 19.
3. CONDUCTOR ENDS WITHOUT TERMINALS OR CON– NECTORS SHALL BE STRIPPED .25 INCH AND TINN– ED IN ACCORDANCE WITH MIL–STD–454, REQUIRE– MENT NO. 5.
4. SODER ALL CONNECTORS IN ACCORDANCE WITH MIL–STD–454, REQUIREMENT NO. 5.
5. EACH WIRE SHALL BE PERMANENTLY AND LEGIBLY IDENTIFIED AT EACH END OF THE WIRE.
6. INSTALL INSULATION SLEEVING, FIND NO. 8 OVER EACH SOLDER CONNECTION TO CONNECTORS (FIND NO. 1,2,3 AND 4) AND HEAT SHRINK TO A FIRM FIT, SLEEVING SHALL EXTEND OVER WIRE INSULATION AT A MINIMUM OF .25 IN.
7. REFERENCES:
   FOR ELECTRICAL WIRING DIAGRAM, SEE DRAWING 69–813
   FOR ELECTRICAL SCHEMATIC DIAGRAM, SEE DRAWING 69–812
8. FOR INTERPRETATION OF:
   REFERENCE DESIGNATIONS FOR ELEC– TRICAL AND ELECTRONICS AND EQUIPMENTS, SEE ANS Y32.16
   DIMENSIONING AND TOLERANC– ING, SEE ANS Y14.5

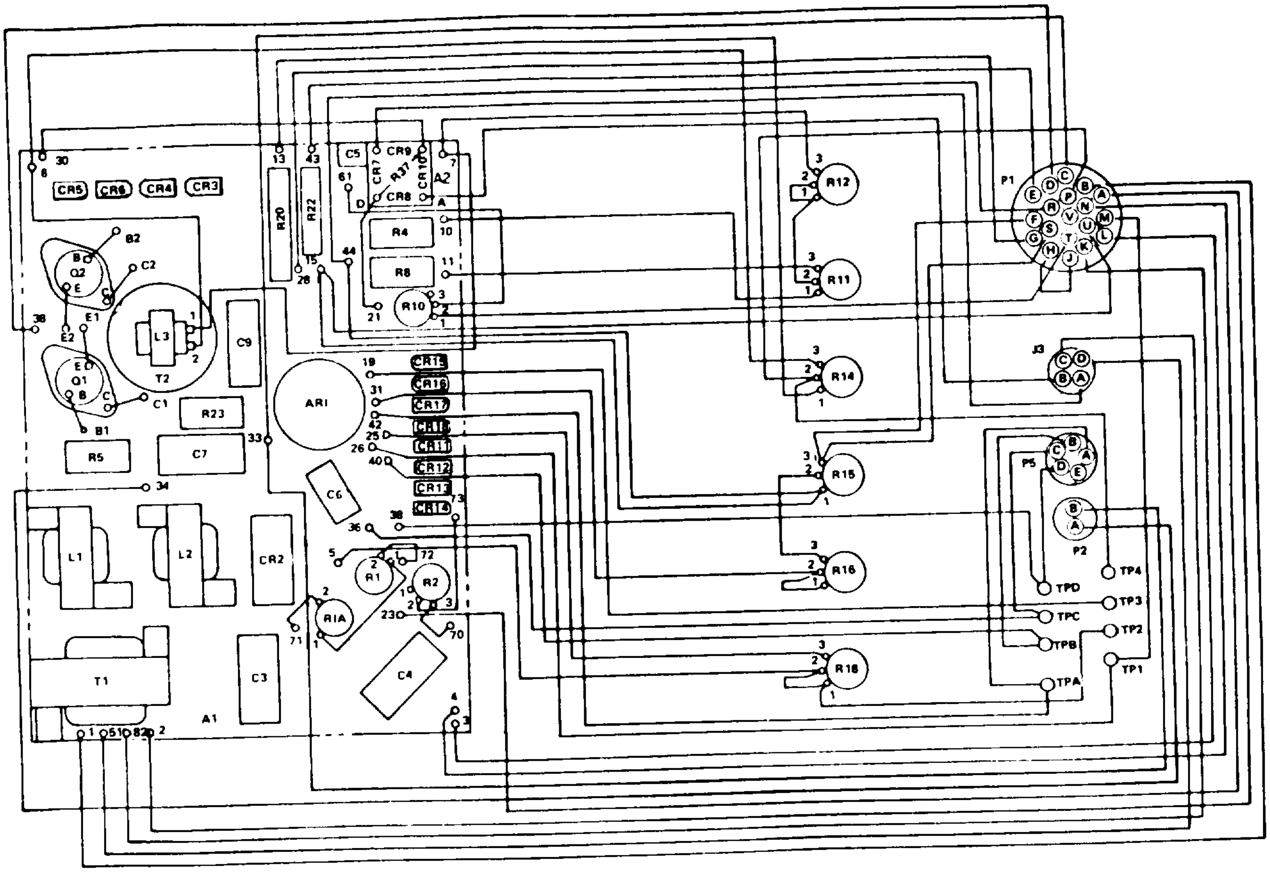
FIND NO.	SYM	CODE IDENT	DWG SIZE	PART OR IDENTIFYING NO.	QTY REQD	NOMENCLATURE OR DESCRIPTION	SPEC	MATERIAL
1	M		B	69–502–6	1	CONN, RECEPTACLE, PN MS 3102R–10SL–4P		
2	M		B	69–502–4	1	CONN, RECEPTACLE, PN MS 3102R–14S–5P		
3	M		B	69–502–3	1	CONN, RECEPTACLE, PN MS 3102R–14S–2S		
4	M		B	69–502–5	1	CONN, RECEPTACLE, PN MS 3102R–2214P		
5				MS25036–101	2	TERMINAL, LUG, CRIMP STYLE, COP., TIN PLD, INSUL, RING–TONGUE, BELL– MOUTHED, TYPE II, CL 1, 22–18 TERM. SIZE, NO. 6 STUD SIZE		
6	B				AR	WIRE, ELECTRIC, TYPE C–20, 105 °C, 1000 V	MIL–W–16878/2	
7				MS3367–1–9	AR	STRAP, CABLE, ADJ, SELF–CLINCHING, PLASTIC, TYPE 1, CL 1, 1.5 MAX BDL DIA, NATURAL		
8	B			CL 1	AR	INSULATION SLEEVING, ELEC, HEAT SHRINKABLE, POLYVINYL CHLORIDE, FLEX, CROSSLINKED, .125 MIN ID, AS SUPPLIED .062 MAX ID X .025 WALL, AFTER UNRESTRICTED SHRINKABLE, AR L	MIL–I–23053/2	

Figure 3-70. 400 Hz Electro-Hydraulic Governor Control Unit Wiring Harness, Drawing No. 69-814 (Sheet 2 of 2)



1. Power transformer (T1)
2. Filter reactor (L2)
3. Filter reactor (L1)
4. Fixed capacitor (C7)
5. Resistor R23)
6. Resistor (R5)
7. Power transistor (Q1)
6. Power transistor (Q2)
9. Reactor
10. Transformer (T2)
11. Silicone rectifier (CR5)
12. Silicone rectifier (CR6)
13. Silicone rectifier (CR4)
14. Silicone rectifier (CR3)
15. Fixed capacitor (C9)
16, Resistor (R20)
17. Resistor (R22)
18. Magamp (AR1)
19. Silicone rectifier (CR7)
20. Silicone rectifier (CR9)
21. Resistor (R37) (50/60 Hz)
22. Silicone rectifier (CR8)
23. Silicone rectifier (CR10)
24. Panel assembly
25. Adjustable resistor (R10) (50/60 Hz only)
26. Silicone rectifier (CR15)
27. Silicone rectifier (CR16)
28. Silicone rectifier (CR17)
29. Silicone rectifier (CR18)
30. Silicone rectifier (CR11)
31. Silicone rectifier (CR12)
32. Silicone rectifier (CR13)
33. Silicone rectifier (CR14)
34. Fixed capacitor (C6)
35. Selenium rectifier (CR12)
36. Power resistor (R1)
37. Adjustable resistor (R2)
38. Power resistor (R1A)
39. Fixed capacitor Cr) (400 Hz unit only)
40. Fixed capacitor (C3)
41. Printed circuit board
42. Fixed capacitor (C2)
43. Resistor (R8)
44. Resistor (R4)
45. Capacitor (C5)

Figure 3-71. Electro-Hydraulic Governor Control Unit Printed Circuit Board



ELEC REF DESIG	DESCRIPTION
AR1	MAGAMP
C2	CAPACITOR, FIXED
C3,	CAPACITOR, FIXED
C4	CAPACITOR, FIXED
C5	CAPACITOR, FIXED
C6	CAPACITOR, FIXED
C8	CAPACITOR, FIXED
C9	CAPACITOR, FIXED
CR2	SELENIUM RECTIFIER
CR3-CR18	RECTIFIER, SILICON
J3	CONNECTOR, RECEPTACLE
L1	FILTER REACTOR
L2	FILTER REACTOR
L3	FILTER REACTOR
P1	CONNECTOR, RECEPTACLE
P2	CONNECTOR, RECEPTACLE
	CONNECTOR, RECEPTACLE
Q1,Q2	TRANSISTOR, POWER
A1	PRINTED WIRING BOARD ASSY
A2	PANEL ASSEMBLY

ELEC REF DESIG	DESCRIPTION
R1, R1A R4, R8	RESISTOR, POWER
R22. R37	RESISTOR
R 5	RESISTOR
R2,R10	RESISTOR,ADJUSTABLE
R11	RESISTOR,VARIABLE
R12	RESISTOR,VARIABLE
R14	RESISTOR,VARIABLE
R15	RESISTOR,VARIABLE
R16	RESISTOR,VARIABLE
R18	RESISTOR,VARIABLE
R20	RESISTOR,MIL-R-26/4
R23	RESISTOR
T1	POWER TRANSFORMER
T2	TRANSFORMER
TP1-TP4	CONNECTOR TEST JACK
TPA-TPD	

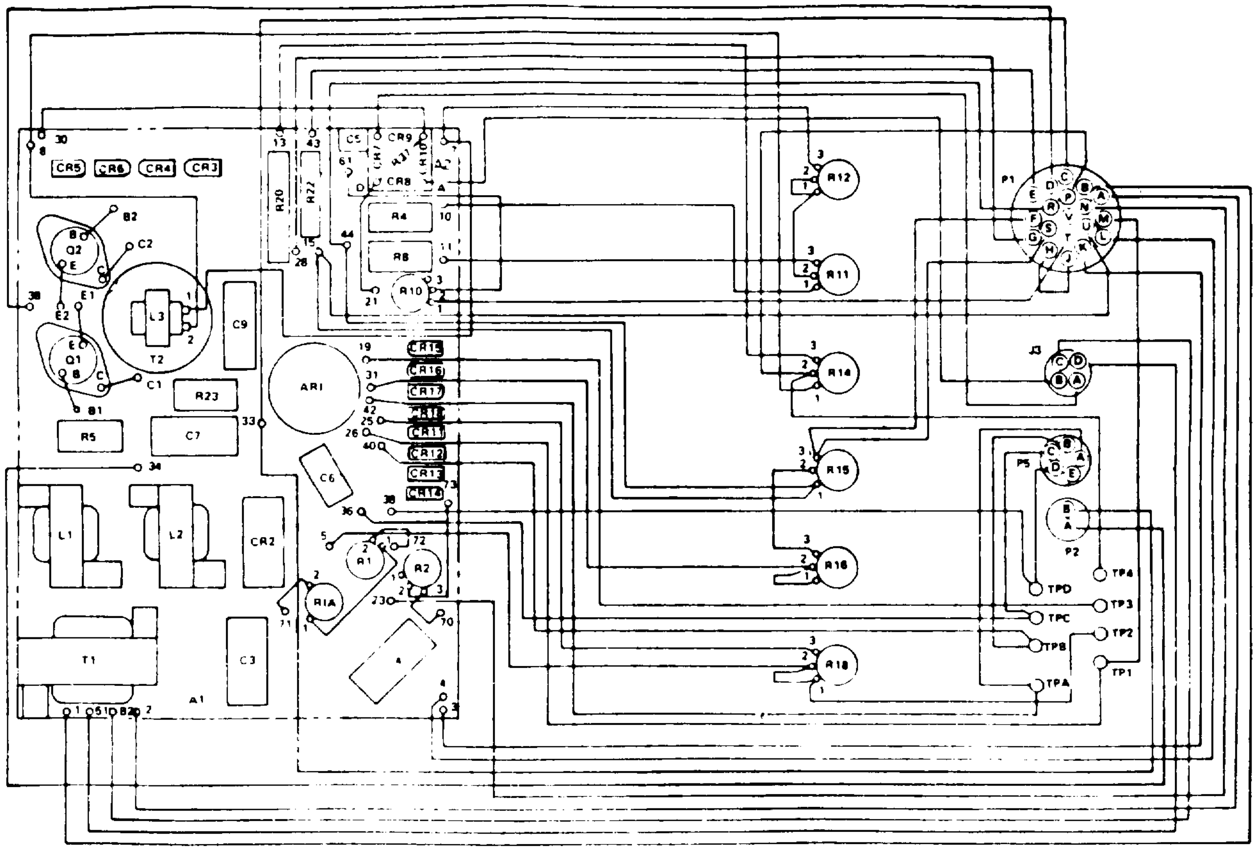
NOTES:

1. REFERENCES:
   FOR CONTROL UNIT ASSEMBLY, SEE DWG 69-700.
   FOR SCHEMATIC DIAGRAM, SEE DWG 69-728.
   FOR WIRING HARNESS, SEE DWG 69-814.

2. FOR INTERPRETATION OF:
   REFERENCE DESIGNATIONS FOR ELECTRICAL AND ELECTRONICS PARTS AND EQUIPMENTS, SEE ANS Y32.16.

3. WIRE NUMBERS ARE FOR REFERENCE ONLY:
   A. DATA FOR WIRE NO. 1 THRU 28,31 THRU 55, AND 57 THRU 61: SEE DWG 68-731.
   B. DATA FOR WIRE NO. 28,30 AND 56: SEE DWG 69-700.
   C. DATA FOR NO. 62 THRU 66: SEE DWG NO. 69-736.

Figure 3-72. 50/60 Hz Governor Control Unit Wiring Diagram, DWG No. 69-730



ELEC REF DESIG	DESCRIPTION
A1	PRINTED WIRING BOARD ASSY
A2	PANEL ASSEMBLY
AR1	MAGAMP
C3	CAPACITOR, FIXED
C5	CAPACITOR, FIXED
C6, C9	CAPACITOR, FIXED
C7	CAPACITOR
CR2	SELENIUM RECTIFIER
CR3-CR18	RECTIFIER, SILICON
J3	CONNECTOR, RECEPTACLE
L1	FILTER REACTOR
L2	FILTER REACTOR
L3	FILTER REACTOR
L3	FILTER REACTOR
P1	CONNECTOR, RECEPTACLE
P2	CONNECTOR, RECEPTACLE
P5	CONNECTOR, RECEPTACLE
Q1,Q2	TRANSISTOR, POWER, NPN, 2N3773
R1, R1A	RESISTOR, POWER - MIL-R-26/3

ELEC REF DESIG	DESCRIPTION
R2, R10	RESISTOR, ADJUSTABLE
R4, R8, R22	RESISTOR
R5	RESISTOR
R11	RESISTOR,VARIABLE
R12	RESISTOR,VARIABLE
R14	RESISTOR,VARIABLE
R15	RESISTOR,VARIABLE
R16	RESISTOR,VARIABLE
R18	RESISTOR,VARIABLE
R20	RESISTOR,VARIABLE
R23	RESISTOR, MIL-R-26/4
T1	POWER TRANSFORMER
T2	TRANSFORMER
TPA-TPD	CONNECTOR TEST JACK
TPD	MIL-C-39024/10
TP1-TP4	CONNECTOR, TEST JACK, MIL-C-39024/10

NOTES:

1. REFERENCES:
   FOR CONTROL UNIT ASSEMBLY, SEE DWG, 69-800.
   FOR SCHEMATIC DIAGRAM, SEE DWG 69-812.
   FOR WIRING HARNESS, SEE DWG 69-814.

2. FOR INTERPRETATION OF:
   REFERENCE DESIGNATIONS FOR ELECTRICAL AND ELECTRONICS PARTS AND EQUIPMENTS, SEE ANS Y32.16.

3. WIRE NUMBERS ARE FOR REFERENCE ONLY:
   A. DATA FOR WIRE NO. 1, 2, 5 THRU 28, 31 THRU 55, AND 57 THRU 61: SEE DWG 69-814.
   B. DATA FOR WIRE NO. 29, 30 AND 56: SEE DWG NO. 69-800
   C. DATA FOR WIRE NOT 62-66: SEE DWG NO. 69-801.

Figure 3-73. 400 Hz Electro-Hydraulic Governor Control Unit Wiring Diagram, DWG No. 69-633

COMPONENTS REFERENCE LIST	
ELEC REF DESIG	DESCRIPTION
AR1	MAGAMP
C2	CAPACITOR, FIXED
C3, C4	CAPACITOR (SEE NOTE 1)
C5	CAPACITOR, FIXED
C6	CAPACITOR, FIXED
C7	CAPACITOR, FIXED
C9	CAPACITOR, FIXED
CR2	SELENIUM RECTIFIER
CR3 THRU CR18	RECTIFIER, SILICONE
J3	CONNECTOR, RECEPTACLE
L1	FILTER REACTOR
L2	FILTER REACTOR
L3	FILTER REACTOR
P1	CONNECTOR, RECEPTACLE
P2	CONNECTOR, RECEPTACLE
P5	CONNECTOR, RECEPTACLE
Q1,Q2	TRANSISTOR, POWER, NPN, 2N3773
R1, R1A	RESISTOR, POWER, MIL-R-26/3
R2, R10	RESISTOR, ADJUSTABLE
R4, R8, R22, R37	RESISTOR
R5	RESISTOR
R11	RESISTOR,VARIABLE
R12	RESISTOR,VARIABLE
R14	RESISTOR,VARIABLE
R15	RESISTOR,VARIABLE
R16	RESISTOR,VARIABLE
R18	RESISTOR,VARIABLE
R20	RESISTOR, MIL-R-26/4
R23	RESISTOR
T1	POWER TRANSFORMER
T2	TRANSFORMER
TPA THRU TPD	CONNECTOR TEST JACK
TP1 THRU TP4	MIL-C-39024/10

NOTES:

1. EXACT VALUES DETERMINED DURING TEST, SEE TEST PROCEDURES DWG 69-737.
   NOMINAL VALUES: C3=8µF
   C4=4µF
2. CB SHALL BE 30µF TO 120µF NON- POLARIZED, TANTALUM. EXACT VALUE DEPENDS ON GOVERNOR APPLICATION.
3. THROTTLE CLOSED BY CURRENT INCREASE IN COIL A-B, OPEN THROTTLE DECREASES OUTPUT OF TRANSDUCER.
4. ACTUATOR PISTON ATTACHED TO ENGINE THROTTLE.
5. REFERENCES:
   FOR CONTROL UNIT ASSEMBLY, SEE DWG 69-700
   FOR WIRING DIAGRAM, SEE DWG 69-730
   FOR WIRING HARNESS, SEE DWG 69-731
6. ALL COMPONENTS SHOWN OUTSIDE THE DOTTED LINES ARE FOR REFERENCE ONLY.

Figure 3-74. 50/60 Hz Governor Control Unit Schematic Diagram, Drawing No. 69-729 (Sheet 1 of 2)

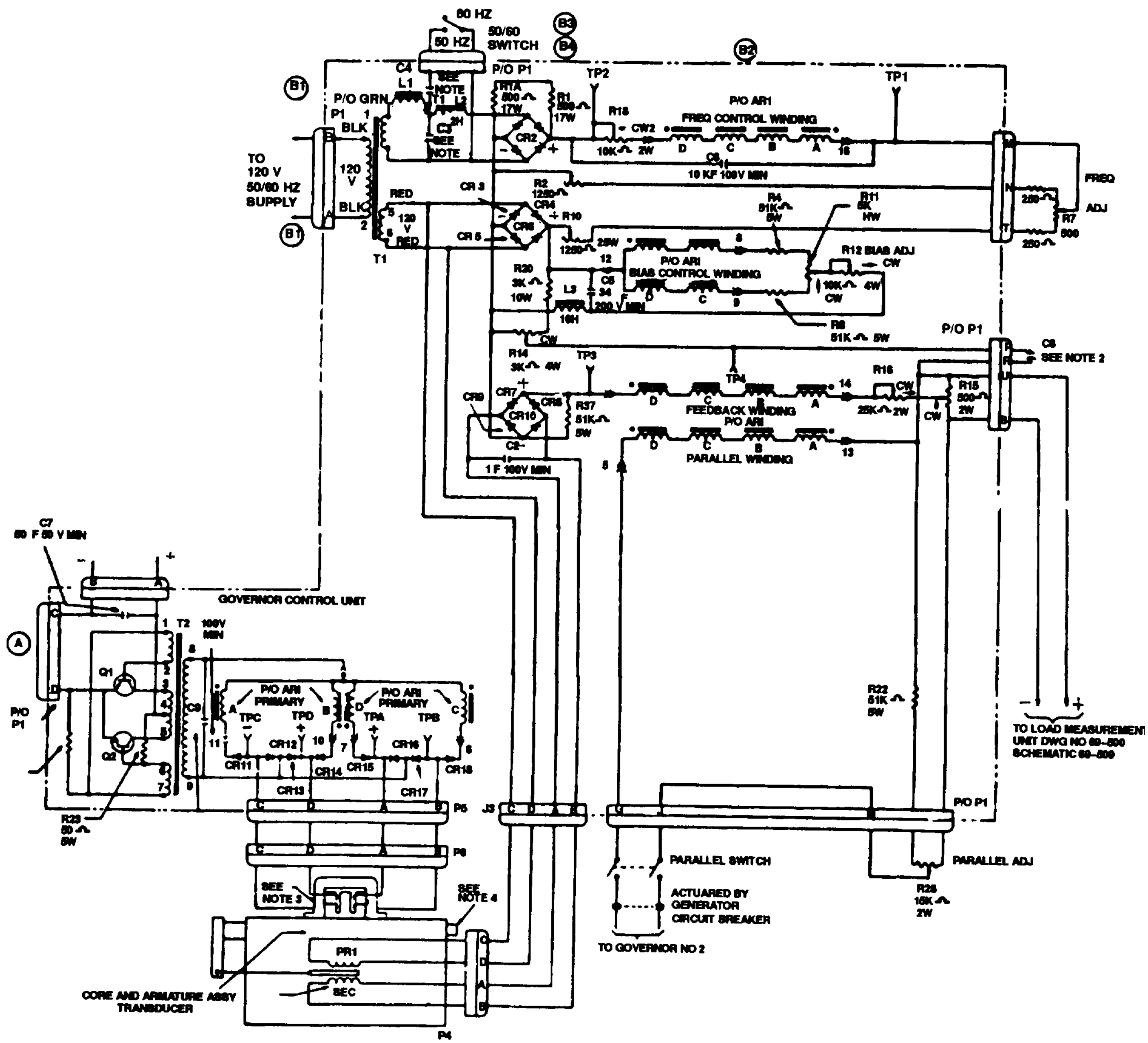


Figure 3-74, 50/60 Hz Governor Control Unit Schematic Diagram, Drawing No. 69-729 (Sheet 2 of 2)

COMPONENTS REFERENCE LIST	
ELEC REF DESIG	DESCRIPTION
AR1	MAGAMP
C3	CAPACITOR (SEE NOTE 1)
C5	CAPACITOR, FIXED
C6, c9	CAPACITOR, FIXED
C7	CAPACITOR, FIXED
CR2	SELENIUM RECTIFIER
CR3 THRU 18	RECTIFIER, SILICONE
J3	CONNECTOR, RECEPTACLE
L1	FILTER REACTOR
L2	FILTER REACTOR
L3	FILTER REACTOR
P1	CONNECTOR, RECEPTACLE
P2	CONNECTOR, RECEPTACLE
P5	CONNECTOR, RECEPTACLE
Q1,Q2	TRANSISTOR, POWER, NPN, 2N3773
R1, R1A	RESISTOR, POWER, MIL–R–26/3
R2, R10	RESISTOR, ADJUSTABLE
R4, R8, R22	RESISTOR
R5	RESISTOR
R11	RESISTOR,VARIABLE
R12	RESISTOR,VARIABLE
R14	RESISTOR,VARIABLE
R15	RESISTOR,VARIABLE
R16	RESISTOR,VARIABLE
R18	RESISTOR,VARIABLE
R20	RESISTOR, MIL-R-26/4
R23	RESISTOR
R37	RESISTOR
T1	POWER TRANSFORMER
T2	TRANSFORMER
TPA THRU TPD	CONNECTOR, TEST JACK
TP1 THRU TP4	MIL–C–39024/10

NOTES:

1. EXACT VALUES DETERMINED DURING TEST, SEE TEST PROCEDURES DWG 69-815. NOMINAL VALUES: C3=8µF
2. CB SHALL BE 30µF TO 120µF NON–POLARIZED, TANTALUM. EXACT VALUE DEPENDS ON GOVERNOR APPLICATION.
3. THROTTLE CLOSED BY CURRENT INCREASE IN COIL A–B, OPEN THROTTLE DECREASES OUTPUT OF TRANSDUCER.
4. ACTUATOR PISTON ATTACHED TO ENGINE THROTTLE.
5. REFERENCES:
   FOR CONTROL UNIT ASSEMBLY, SEE DWG 69-800
   FOR WIRING DIAGRAM, SEE DWG 69-813
   FOR WIRING HARNESS, SEE DWG 69-814
6. FOR INTERPRETATION OF:
   REFERENCE DESIGNATIONS FOR ELECTRICAL AND ELECTRONICS PARTS AND EQUIPMENTS, SEE ANS Y32.16 GRAPHIC SYMBOLS FOR ELECTRICAL AND ELECTRONICS DIAGRAMS, SEE ANS Y32.2
7. ALL COMPONENTS SHOWN OUTSIDE THE DOTTED LINES ARE FOR REFERENCE ONLY.

Figure 3–75. 400 Hz Electro-Hydraulic Governor Control Unit Schematic Diagram, Drawing No. 69-612 (Sheet 1 of 2)

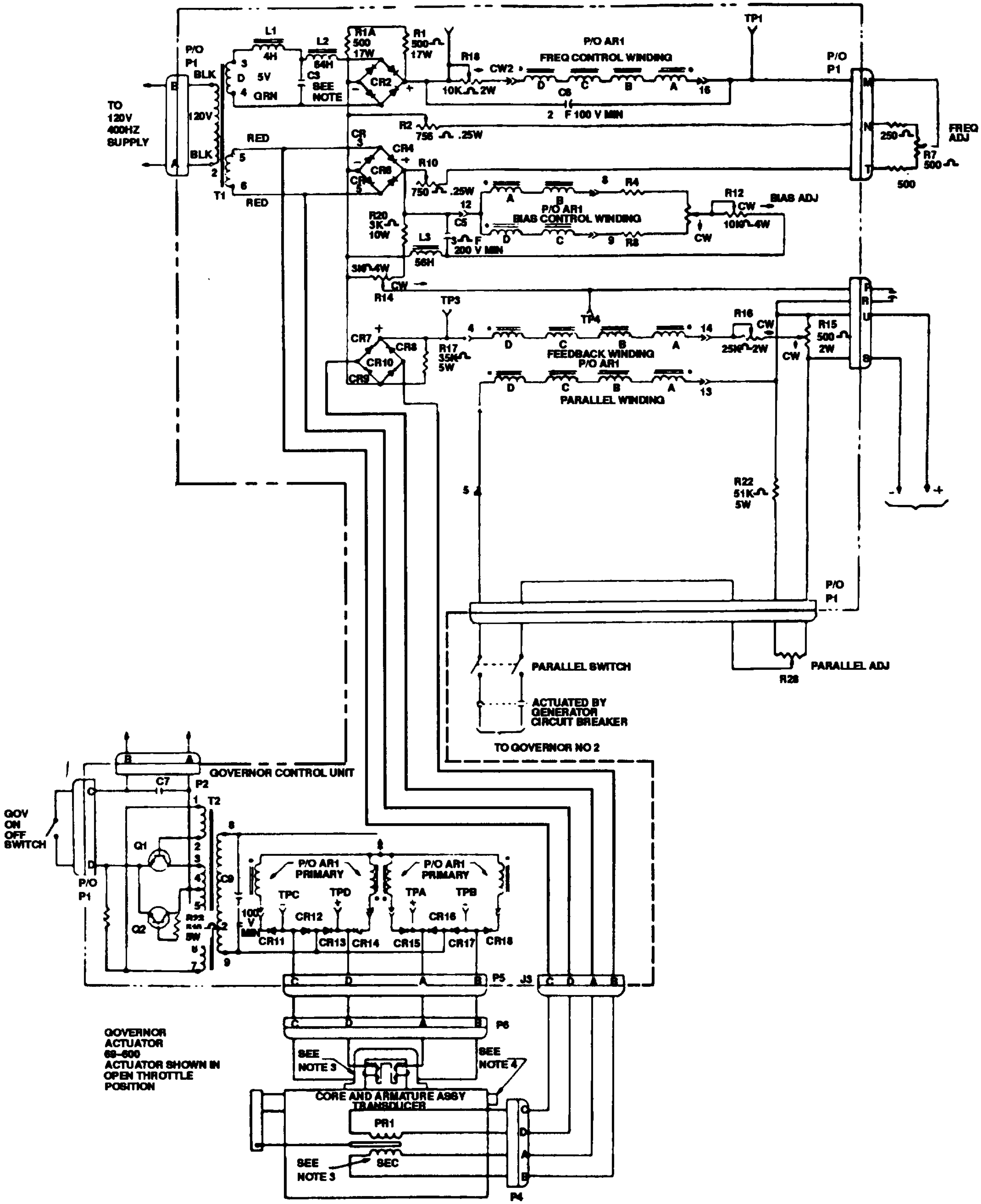


Figure 3-75. 400 Hz Electro-Hydraulic Governor Control Unit Schematic Diagram, Drawing No. 69-812 (Sheet 2 of 2)

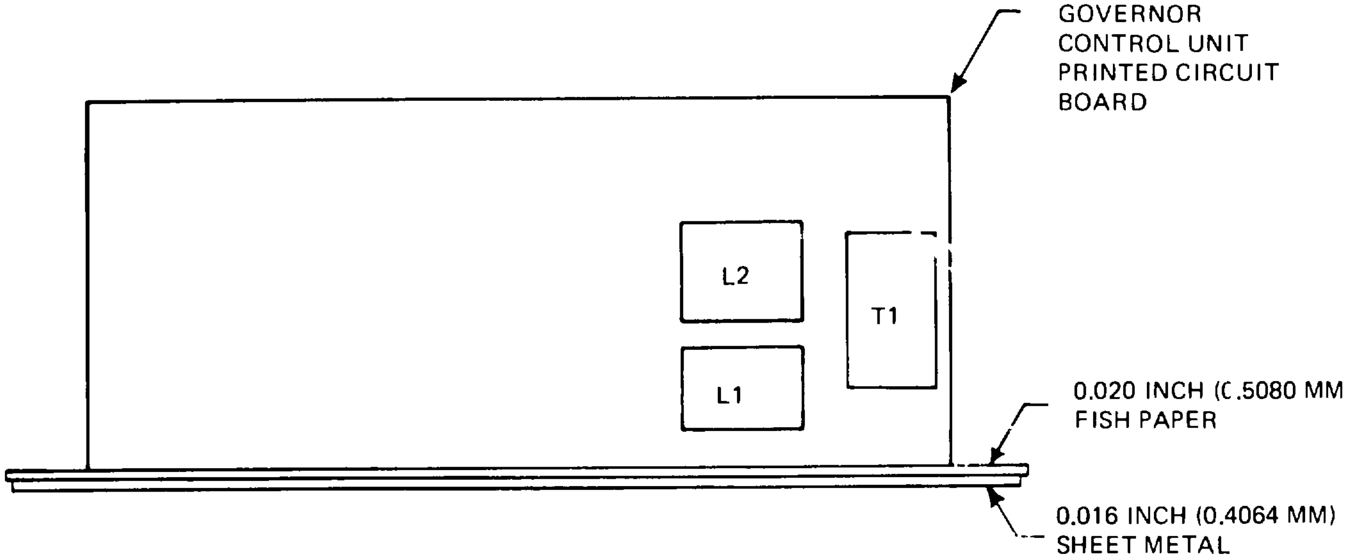


Figure 3–76. Positioning of Unpotted Electro-Hydraulic Governor Control Unit During Testing

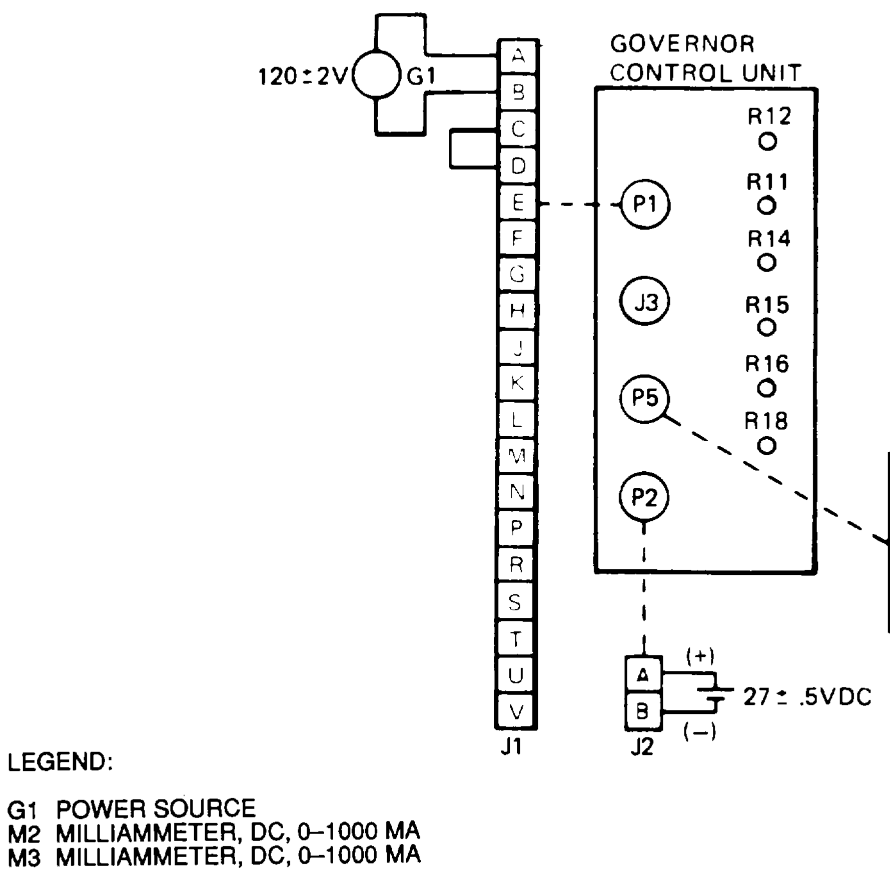


Figure 3-77. Electro-Hydraulic Governor Control Unit Magnetic Amplifier Bias Test Circuit

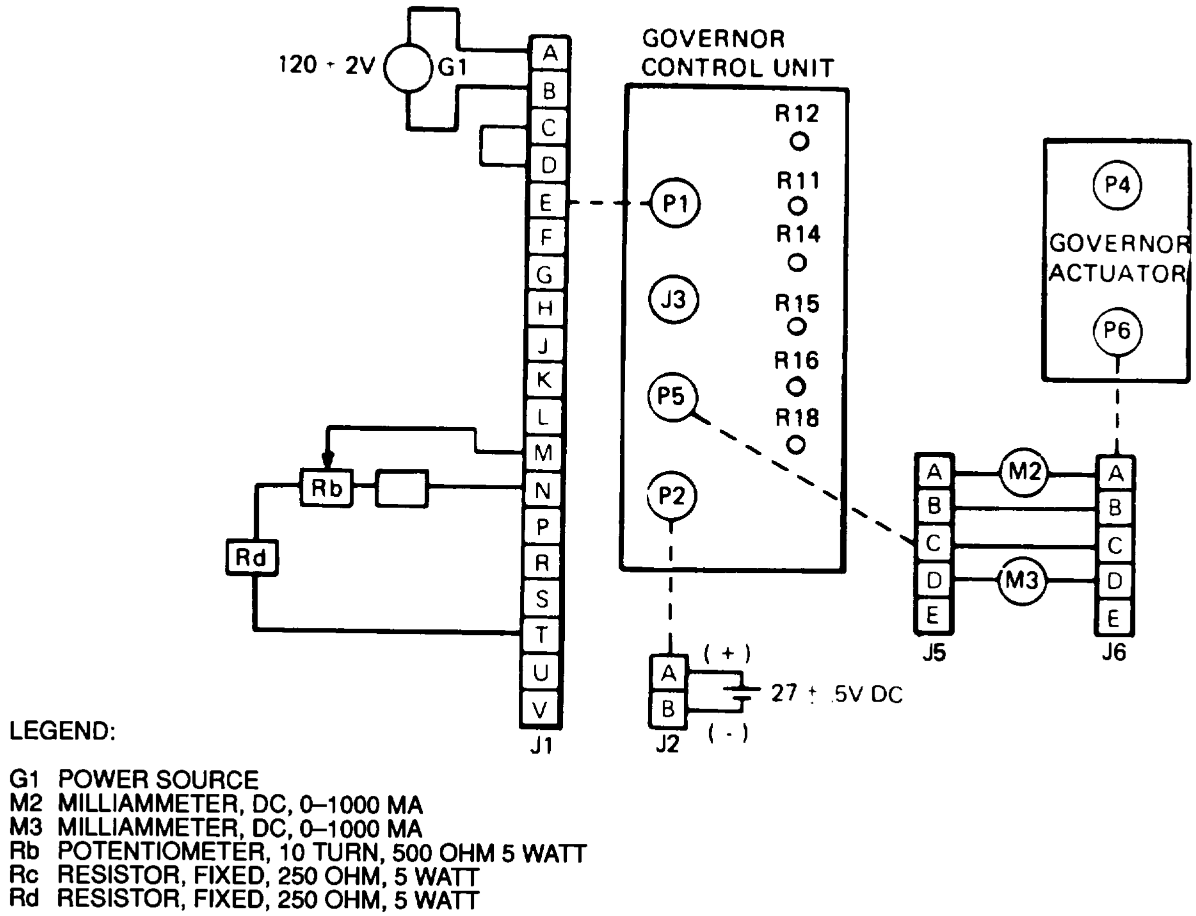


Figure 3-78. Electro-Hydraulic Governor Control Unit Frequency Sensing Test Circuit

(3) Place the container in a temperature controlled oven. Set the oven temperature at +180 to + 185°F (+82.2°C to +85°C) and allow the container to soak 11 to 12 hours or until potting compound is completely melted.

(4) Prior to installing the printed circuit board, remove the container from the oven and make sure that insulation paper is positioned next to the container shell.

(5) Using heavy gloves and safety glasses, slowly lower the printed circuit board into the potting compound.

WARNING

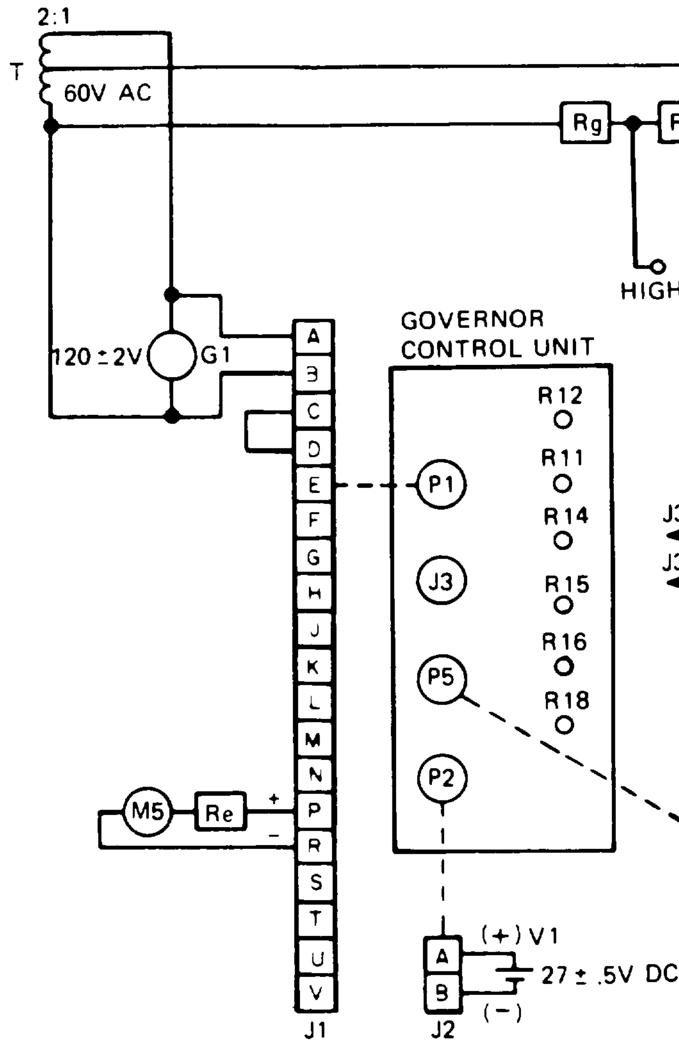
Use care not to splash hot potting compound on operating personnel. It can cause severe injury. Failure to observe this warning could result in servere personal injury or death.

(6) Position the printed circuit board and allow compound to cool.

(7) When compound has cooled and is substantially solid, install top cover and hardware.

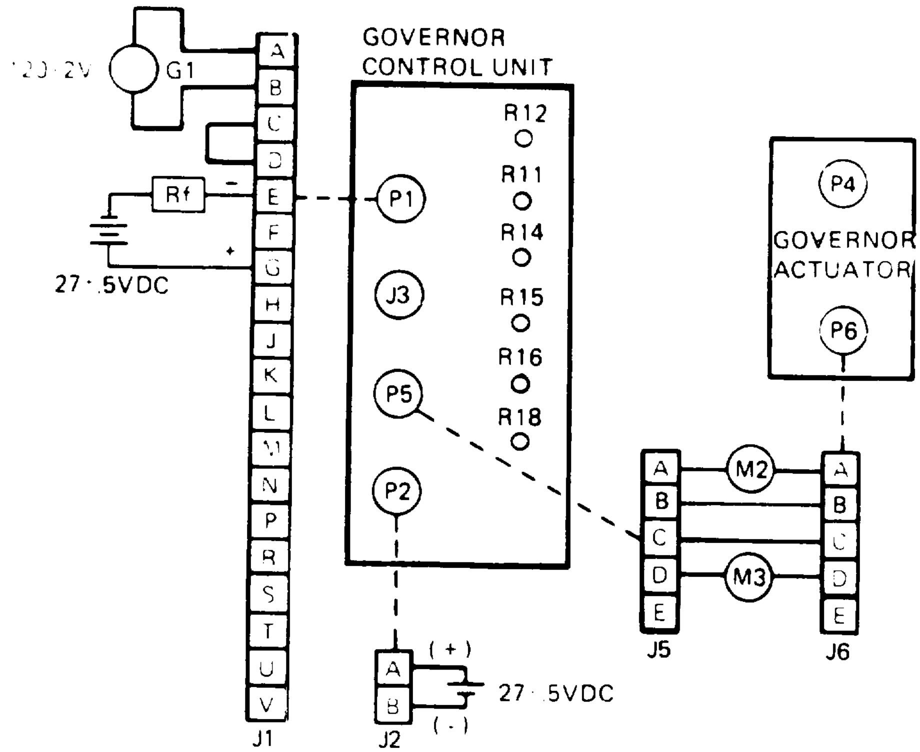
i. Installation

(1) Refer to figure 3-81 for approximate position of controls when connecting linkage. Use figure 3-82 for generators with serial No RZ0001.



G1 POWER SOURCE
M2 MILLIAMMETER, DC, 0–1000 MA
M3 MILLIAMMETER, DC, 0–1000 MA
M5 MILLIAMMETER, DC, ZERO CENTER, (−10)–0(+10) MA
Re RESISTOR, FIXED, 5000 OHM, 1 WATT
Rg RESISTOR, FIXED, 82 OHM, 10 WATT
Rh RESISTOR, FIXED, 82 OHM, 10 WATT
Ri RESISTOR, FIXED, 15 OHM, 5 WATT
Rj RESISTOR, FIXED, 15 OHM, 5 WATT
Rk RESISTOR, FIXED, 25 OHM, 5 WATT
SW1 SWITCH, ROTARY, 3 POSITION, 1 POLE, 1 AMP
V1 POWER SOURCE, DC
T AUTOTRANSFORMER, 2:1 RATIO

Figure 3-79. Electro-Hydraulic Governor Control Unit Rectifier Bridge and Feedback Winding Test Circuit



LEGEND:

G1 POWER SOURCE
M2 MILLIAMMETER, DC, 0–1000 MA
M3 MILLIAMMETER, DC, 0–1000 MA
Rf RESISTOR, FIXED, 50,000 OHM, 1 WATT

Figure 3-80. Electro-Hydraulic Governor Control Unit Parallel Winding Test Circuit

(2) Position governor control unit to install threaded rod (6, figure 3-68), bracket (5), lockwashers (4), nuts (3), lockwashers (2) and nuts (1).

(3) Connect electrical connectors to governor control unit and untag.

NOTE

Desired speeds must be obtained by trial and error adjustments of linkage, position of control arm and performing the alignment procedures in paragraph 3-64j.

j. Alignment Procedure. See figure 3-83 for identification of controls and perform the following procedures.

(1) Set R11, R14, R16 and R18 rheostats at mid-point.

(2) Set R15 full counterclockwise.

(3) Set R12 approximately 3/4 turn counterclockwise.

(4) Refer to Unit Maintenance Manual and start engine. If engine oscillates rapidly, adjust R16 and R18 until operation is stable.

(5) Once set has been stabilized, adjust R1 rheostat on control panel to obtain 60 Hz or 400 Hz.

(6) Connect a dc voltmeter with 0-10 volt range across test points 3 and 4. Test point 4 is positive. Adjust R14 until voltage across test points 3 and 4 is zero at no load.

(7) Connect dc voltmeter across test points 1 and 2. Test point 1 is positive. Adjust R11 for zero volts at 60 Hz or 400 Hz at no load. Repeat adjustment until voltage across test points 1 and 2 and 3 and 4 is zero and frequency is 60 Hz or 400 Hz.

NOTE

If test points 1 and 2 cannot be zeroed, they must be reduced to a minimum,

(8) Adjust R12 to give approximately 5 volts across test points A and B.

(9) Adjust R15 for optimum transient performance. Fully clockwise position is maximum load measurement gain.

(10) Set R18 and R16 for stabilized performance at all load conditions. For optimum performance R18 should be set as far counterclockwise as possible without causing an oscillation for any setting of R15.

(11) Increasing the load measurement gain R15 (turning in a clockwise direction) will improve transient performance; therefore, it should be adjusted as high as possible. The adjustment of R18, R16, and R15 are interdependent. For any position of R18, there is an optimum position for R16. Therefore, to improve transient performance, increase the frequency gain by turning R18 clockwise. If a hunt develops, readjust R16 for stability. If no hunt develops, apply and reject load to check for stability under transient conditions.

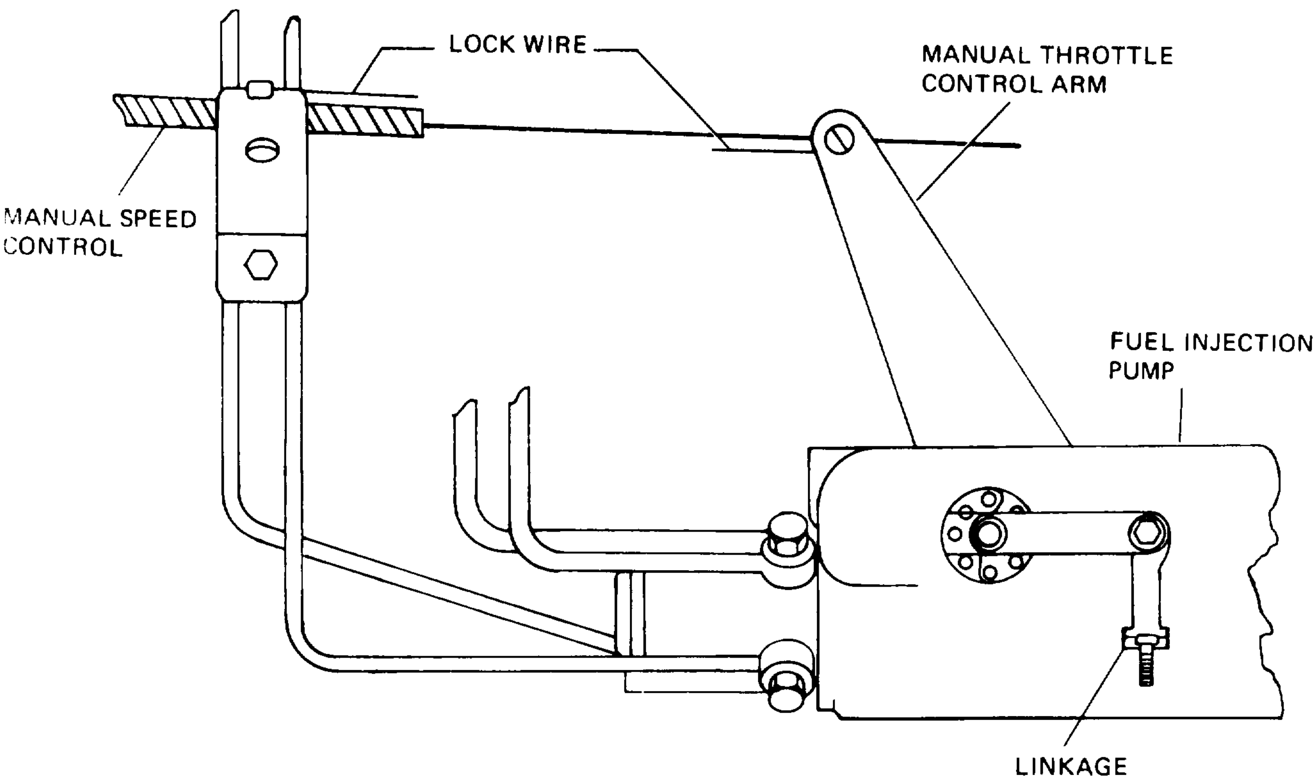


Figure 3-81. Approximate Position of Controls for Connecting Hydraulic Actuator

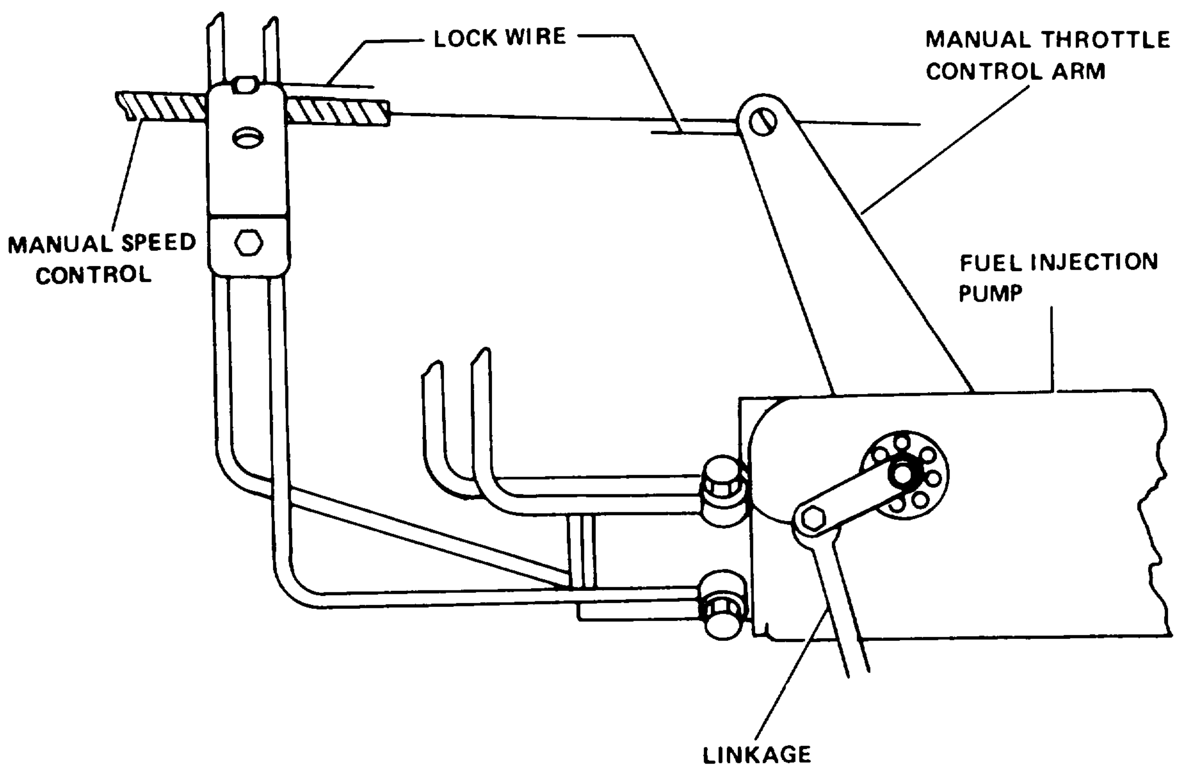


Figure 3-82. Approximate Position of Controls for Connecting Hydraulic Actuator (Effective with Serial No. RZ60001)

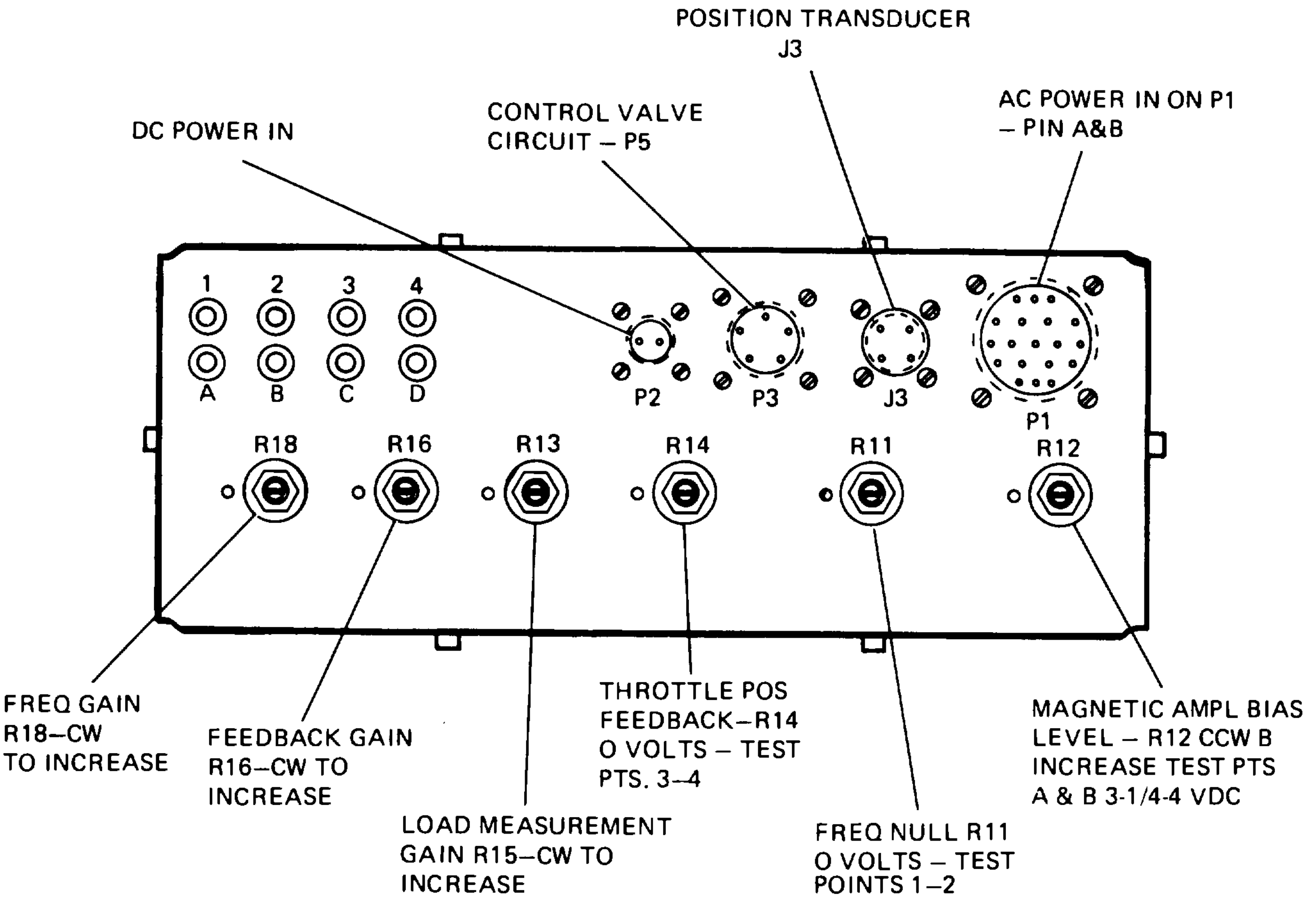


Figure 3-83. Electro-Hydraulic Governor Control Unit Control Panel

NOTES:
1. ALL SOLDERED CONNECTIONS SHALL BE IN ACCORDANCE WITH MIL-STD454, REQUIREMENT 5.

2. INSTALL STRAPS, FIND NO. 4 AT 3.0 MAX. INTERVALS.

3. WIRE MARKING TO BE IN ACCORDANCE WITH MIL-W-5088 EXCEPT THAT LENGTH BETWEEN GROUPS OF NUMBERS SHALL NOT EXCEED 6 INCHES

4. INSTALL END SEAL PLUGS, FIND NO. 5 ON UNUSED HOLES OF CONNECTORS FIND NO. 1 AND 2.

5. INTERPRET DRAWING PER MIL-STD-100.

6. REFERENCES:
   a) FOR ELECTRICAL WIRING DIAGRAM, SEE DRAWING 72-2205
   b) FOR SCHEMATIC DIAGRAM, SEE DRAWING 72-2295 AND 72-2277.

MARKING COLOR	WIRE MARKING	FROM	FIND NO. REF.	TO	FIND NO. REF.	WIRE FIND NO. REF.	WIRE LENGTH
BLACK	D24J16	P50–d	2	P51–d	1	3	28.00
BLACK	K101D16	P50–X	2	P51–x	1	3	
BLACK	K102D16	P50–N	2	P51–N	1	3	
RED	P50CC16	P50–L	2	P51–L	1	3	
	P50PP16	P50–B	1	P51–B	1	3	
	P55AW16	P50–W	2	P51–W	1	3	
	P55TR16	P50–M	2	P51–M	1	3	
	P58A16	P50–A	2	P51–A	1	3	
	P60E16	P50–E	2	P51–E	1	3	
	P62G16	P50–H	2	P51–H	1	3	
	P62DD16	P50–b	2	P51–b	1	3	
	P63B16	P50–a	2	P51–a	1	3	
	P200M16	P50–P	2	P51–P	1	3	
	P203C16	P50–F	2	P51–F	1	3	
	P2005C16	P50–D	2	P51–D	1	3	
	P206C16	P50–C	2	P51–C	1	3	
	P209C16	P50–G	2	P51–G	1	3	
BLACK	X7F16A	P50–S	2	P51–S	1	3	
	X8F16B	P50–R	2	P51–R	1	3	
	X9M16C	P50–J	2	P51–J	1	3	
	X12116N	P50–K	2	P51–K	1	3	
	X17A16	P50–T	2	P51–T	1	3	
	X18A16	P50–U	2	P51–U	1	3	
BLACK	X19A16	P50–V	2	P51–V	1	3	28.00

FIND NO.	SYM	CODE IDENT	DWG SIZE	PART OR IDENTIFYING NO.	QTY REQD	NOMENCLATURE OR DESCRIPTION	SPEC	MATERIAL
1				MS3106R28–12S	1	CONNECTOR, PLUG, ELECT. P51		
2				MS3106R28–12P	1	CONN, PLUG, ELECT. P50		
3				M5086/2–16–9	AR	WIRE, ELECT. , 16 AWG	MIL–W–5086/2	
4				MS3367–5	8	STRAP, CABLE, ADJUSTABLE		
5				MS25251–6	2	PLUG, END SEAL ELECT. CONNECTOR		

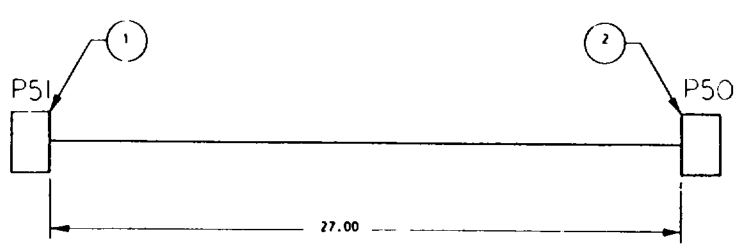


Figure 3-84. Tactical Relay Assembly to Special Relay Assembly Wiring Harness, Drawing No. 72-2224

3-65. ELECTRIC GOVERNOR CONTROL UNIT (MEP-113A).

a. General.

(1) The electric governing system is a speed (frequency) sensing system used to maintain constant engine speed and generator output frequency during periods of unchanging load and when load additions or deletions occur. The system consists of a control unit, magnetic pickup and an electric throttle actuating unit. The engine speed signal is obtained from a magnetic pickup mounted in the flywheel housing in close proximity to the flywheel ring gear. The frequency of the pickup signal is proportional to engine speed. Figure 3-85 shows the functional theory of operation.

(2) The control unit has four distinct circuits: pickup signal amplifier, frequency reference oscillator, phase comparator and output circuit.

(a) The frequency reference oscillator is voltage controlled. The frequency setting is adjusted by applying zero to 10 volts at the frequency reference oscillator input. The internal frequency adjust provides this voltage setting when the control unit is in operation. The reference oscillator does not maintain a constant frequency. It deviates from its nominal frequency as the engine speed changes during load changes. The reference oscillator is forced by the phase comparator to track the amplified pickup signal representing engine speed. The voltage representing speed error is the amount of voltage required to drive the reference oscillator off frequency in proportion to the engine speed deviation.

(b) The phase comparator circuit receives signals from the pickup signal amplifier and the reference frequency oscillator and compares the difference in frequency. The phase comparator measures the amount the engine signal is ahead or behind the reference oscillator signal. Its voltage output is used to force the reference oscillator to the same frequency as the signal from the engine. The phase comparator output is proportional to the speed error. The gain control is used to couple the phase comparator output to the reference oscillator. By increasing the coupling, a small voltage change from the phase comparator represents a large frequency change and vice-versa.

(c) The output circuit allows governing by introducing a temporary drop during a load change for stability purposes. It has an adjustable means to control the magnitude and time constant of the drop to match the dynamic characteristics of the engine. The output current switching portion of the circuit provides current to drive the actuator. The output transistor is switched on and off at a frequency of 200 Hz. This is above the natural frequency of the actuator. The actuator responds to the average current from the transistor and moves in proportion to position the engine throttle. The output transistor is switched on and off to reduce power dissipation.

b. Malfunction.

The following procedures are to be performed with the governor control unit in the generator set.

(1) Connect the breakout cable (7, figure 3-86) as follows: Disconnect P17 (6) from J17(1), connect P17A(7) to J17(1), connect J17A(7) to P17(6).

(2) Using a digital voltmeter, make the voltage readings in table 3-7 at the breakout cable plug. All readings are measured between the terminal and ground. Terminals F, G, H and T are ground.

c. Removal.

(1) Disconnect electrical connector P17 (1, figure 3-86).

(2) Remove 4 hex head screws (2), lockwashers (3) and nuts (4).

(3) Remove the governor control unit (5).

d. Installation

(1) Position governor control unit (5, figure 3-86).

(2) Install nuts (4), lockwashers (3), 4 hex head screws (2).

(3) Connect electrical connector P17 (1).

e. Adjustment Procedure

(1) Disconnect the actuator linkage rod from the engine fuel shutoff lever.

(2) Place the generator set START-RUN- STOP switch (located on the generator set control panel) in the RUN position.

(3) Place the generator set BATTLE SHORT SWITCH (located on the generator set control panel) in the ON (override) position.

(4) Beginning at the fully counterclockwise position, rotate the engine fuel shutoff lever in a clockwise direction until a slight resistance is felt: hold the lever in this position.

NOTE

This resistance is the fuel injection pump's internal governor linkage hook engaging the metering valve arm.

(5) Move the actuator lever to the "full fuel" position. This is the direction against the spring resistance (fully counterclockwise).

(6) Measure the center to center distance between the hole in the fuel shutoff lever and the hole in the actuator lever. Adjust the rod ends on the threaded linkage rod so that the center to center distance of the rod ends is the same or slightly longer than that measured between the fuel shutoff lever and the actuator lever. (The 3.75 dimension is only approximate. If the linkage is too short, the actuator lever will attain its "no fuel" position (full clockwise) before the fuel shutoff lever reaches its "no fuel" position; the fuel shutoff lever will never reach "no fuel". If the linkage is too long, the actuator lever will reach its "full fuel" (full counterclockwise) before the fuel shutoff lever reaches its "full fuel" position; full load will not be reached). It maybe necessary to readjust the position of the fuel shutoff lever and/or the actuator lever to accommodate the center to center distance of the rod ends and to assure complete fuel shutoff and full load operation. Fuel shutoff and actuator lever adjustments are covered under replacement procedures. Tighten the nuts on the linkage rod against the rod ends to maintain proper spacing.

(7) Return the generator set START-RUN- STOP switch to the STOP position and the BATTLE SHORT switch to the OFF position.

(8) Reconnect the actuator linkage rod end to the engine fuel shutoff lever.

(9) Adjust the control unit gain control to its approximate mid–range position.

(10) Adjust the control unit stability control to its fully counterclockwise position.

(11) Adjust the generator set frequency adjust potentiometer (pot) (located on the generator set control panel) to mid-range.

(12) Using a small screwdriver, slowly turn the control unit frequency adjust potentiometer (located on the left side vertical face of the control unit) to the fully counterclockwise position (turn opposite increase arrow). This may require up to 22 turns. The generator set will now be operating at the lowest possible engine governed speed.

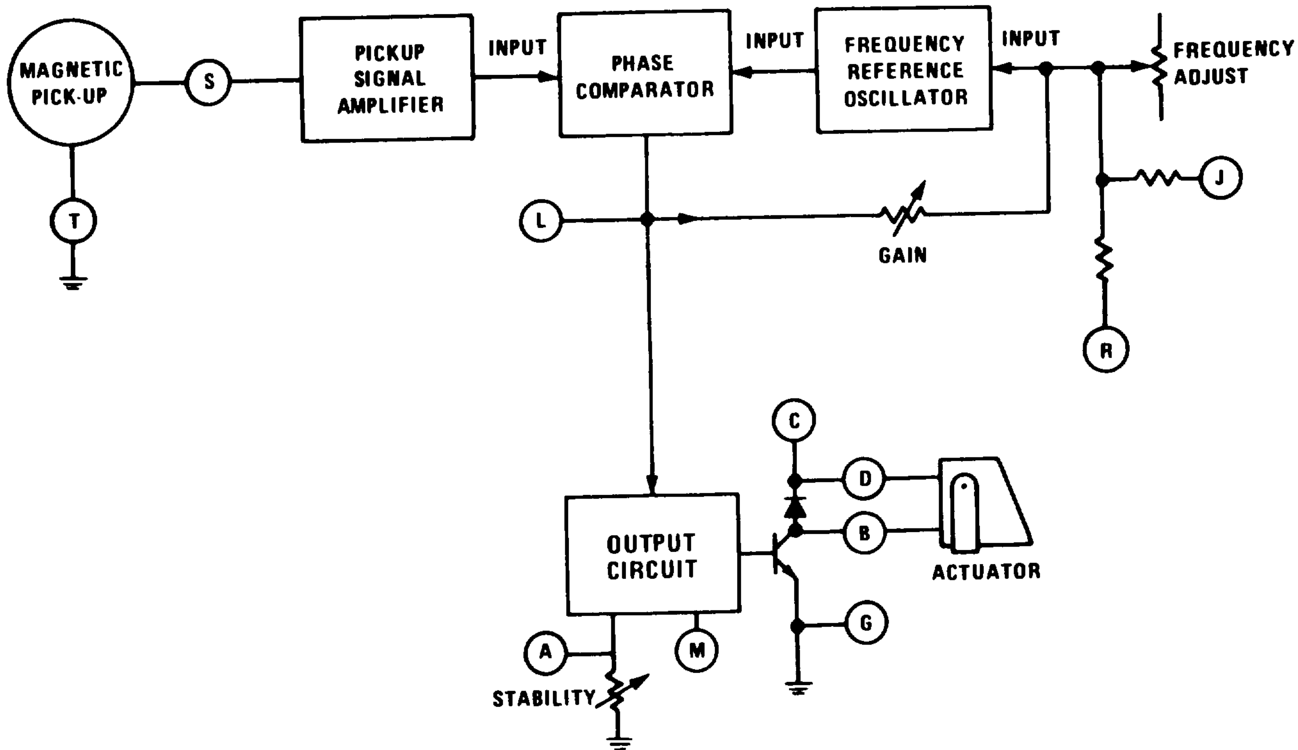


Figure 3-85. Functional Theory of Operation

1. J17
2. Hex head screws (4)
3. Lockwasher (4)
4. Nuts (4)
5. Control unit
6. (P17)
7. (Breakout cable
   see Figure 2–1)

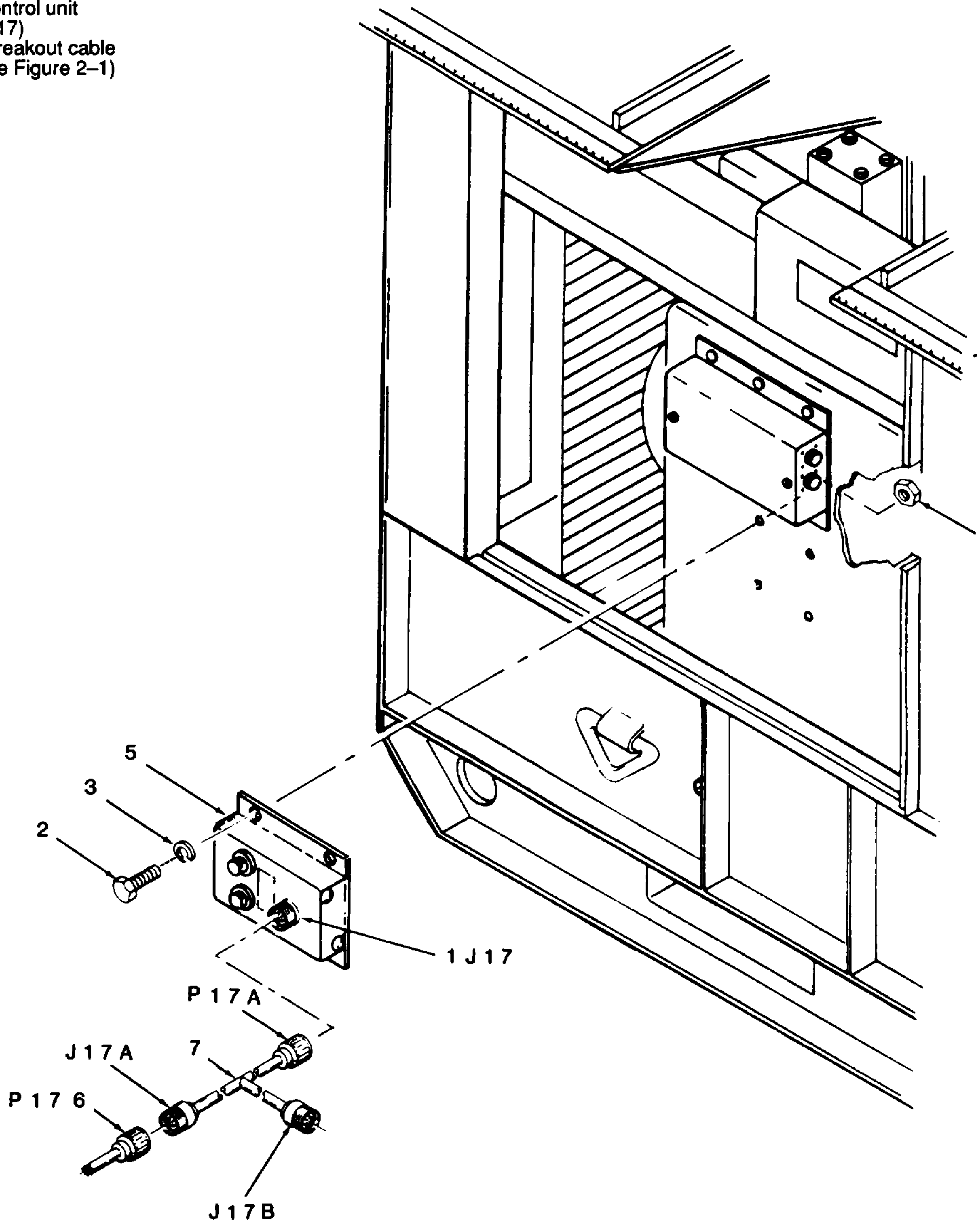


Figure 3-86. Governor Control Unit Removal and Installation

Table 3-7. Electric Governor Malfunction Testing

TERMINAL	NORMAL	PROBABLE CAUSE OF NON-NORMAL READING	CORRECTIVE ACTION
S	1.0 volt AC-RMS minimum while cranking.	1. Defective magnetic pickup. 2. Gap too large between magnetic pickup and gear teeth. 3. Improper or defective wiring to the magnetic pickup.	1. Replace magnetic pickup. 2. Readjust magnetic pickup. 3. Replace wiring harness.
K	10.1±.20 volts DC while energized (Internal regulated D.C. supply).	1. DC power not connected or low battery voltage. 2. Frequency trim potentiometer shorted, grounded or miswired. 3. Wiring error. 4. Defective control unit.	1. Connect DC power supply; replace DC battery. 2. Replace control unit. 3. Replace wiring harness. 4. Replace control unit.
L	Above 5.1 volts DC while running. (inverse speed error signal). Above 5.1 volts is under speed signal. Below 5.1 volts is over speed signal. On speed will indicate a steady 5.1 volts.	1. Frequency adjust set too low. 2. Defective control unit.	1. Turn frequency adjust screw clockwise. 2. Replace control unit.
N	8.5 to 9.5 volts DC while cranking. (Proportional actuator voltage).	1. Battery voltage maybe too low while cranking. 2. Defective control unit.	1. Charge DC battery; replace DC battery. 2. Replace control unit.
R	2.5 volts DC maximum while cranking. (Transister voltage).	1. Output transistor open (defec–tive control unit). 2. Defective actuator. 3. Error in wiring to actuator.	1. Replace control unit. 2. Replace actuator. 3. Replace wiring harness.

NOTE

Two people will be required to adjust the control unit. Ensure that the actuator linkage rod and all levers are securely fastened and move freely (without binding) before operating the engine. Manually overcome the actuator until adjustment of the control unit is completed and the governor is in control. Adjustment of the control unit will be made with the engine operating in a no–load condition.

(13) Start the engine, manually operating the fuel shutoff lever.

(14) Turn the control unit frequency adjust screw clockwise until the proper engine speed is obtained. Several turns may be required. The generator set frequency adjust pot should now have sufficient adjustment travel to cause the generator set frequency meter to indicate beyond both of its extreme limits (388-412 Hz).

(15) If the engine is unstable as indicated by continuous movement of the actuator lever, turn the control unit gain control counterclockwise until stability is obtained as indicated by a stationary actuator lever. Readjust the control unit frequency adjust screw to the proper engine speed.

(16) Turn the control unit gain control clockwise until the engine becomes just unstable; back the gain control counterclockwise until the engine is again stable.

(17) Turn the control unit stability control clockwise until the engine becomes just unstable; back the stability control counterclockwise until the engine is again stable.

NOTE

The governor is now set to a nominally good operating point.

(18) Adjust control unit gain, stability and frequency under various load conditions and load changes to obtain the desired governing characteristics.

(19) When the electric governor system is properly adjusted, the locknuts on the control unit gain and stability controls should be tightened.

3-66. ACTUATOR UNIT.

a. Removal

(1) Disconnect electrical connector P22, (1, figure 3-87).

(2) Disconnect the actuator lever (2) from the actuator linkage rod (3) by removing the hex head cap screw (4), flatwasher (5) and the self–locking nut (6).

NOTE

It maybe necessary to remove the actuator bracket to gain access to the hardware securing the actuator to the actuator bracket. If this is not necessary, proceed to paragraph (3). If removal is required, then proceed as follows:

(a) Loosen the drive belt of the engine alternator.

(b) Remove the two hex head screws (7), lockwashers (8), and spacers (9) securing the actuator bracket (10) to the engine through the alternator mounting bracket (11).

(3) Disconnect the actuator (12) from the actuator bracket (10) by removing two hex head screws (13), flatwashers (14), lock-spring washers (15) and nuts (16). Remove the actuator.

b. Testing.

(1) Using an ohmmeter, check for continuity between pins A and B and pins C and D. Replace actuator if there is no continuity.

(2) Check for short circuit between each pin on the connector and the housing. Replace actuator if any pin is shorted to case.

c. Installation.

(1) Position the actuator level (2, figure 3-88) roughly horizontal by loosening the nut on the splined shaft end of the actuator lever, rotating the lever and tightening the nut.

(2) Align the actuator with the two holes in the actuator bracket (10), secure the actuator to the actuator bracket with two hex head screws (13), flatwashers (14), lock-spring washers (15) and nuts (16).

NOTE

If the actuator bracket has not been removed, proceed with paragraph (3). If the bracket must be installed, proceed as follows:

(a) Insert the spacers (9) through the alternator mounting bracket (11).

(b) Secure the actuator bracket (10) to the engine by inserting the two hex head screws (7) (with lockwashers (8) already mounted) into the appropriate holes in the actuator bracket, through the spacers and into the threaded holes in the engine; tighten the two screws.

(c) Adjust the drive belt of the engine alternator to the required tension and secure the alternator.

(3) Attach the actuator lever(2) to the actuator linkage rod (3) with the hex head cap screw (4), two flatwashers (5) and the self-locking nut (6).

(4) Connect electrical connector P22 (1).

3-67. ELECTRIC GOVERNOR MAGNETIC PICKUP.

a. Removal.

(1) Disconnect electrical connector P23 (1, figure 3-88),

(2) Loosen locknut (2) and unscrew the threaded magnetic pickup (3) from the flywheel housing (4). Remove the magnetic pickup.

b. Testing

(1) Using an ohmmeter, test for continuity between pins A and Bon the connector.

(2) If the circuit is open discard the magnetic pickup.

c. Installation

(1) Rotate the engine until the top land of one gear tooth is in line with the center of the threaded hole in the flywheel housing.

(2) Replace the magnetic pickup (3) into the threaded hole in the flywheel housing (4) until the tip contacts the top of the gear tooth. Back the magnetic pickup out one-half to three-quarters turn and secure with the locknut (2) provided.

(3) Connect electrical connector P23 (1).

Section IX. MAINTENANCE OF INTERCONNECTING WIRING HARNESSES

3-68. GENERAL.

The interconnecting wiring harnesses provide electrical interconnection between generator set control devices and the control cubicle assembly. Each interconnecting wiring harness consists of connectors, terminals, and wires. The wires of each harness are strapped together to conserve space, prevent unnecessary movement, and provide ease of removal and installation. Wiring harnesses which are internal to an assembly are not covered in this section. Refer to the maintenance paragraph for the assembly for internal wiring harness repair procedures.

1. (P22)
2. Connector cap screw
3. Flat washer
4. Self–locking nut
5. 1 3/4" Lg hex head
6. Lock washer
7. Spacer
8. 3/4" Lg hex head
9. Flat washer
10. Lock washer
11. Nut
12. Actuator lever
13. Actuator linkage rod
14. Engine fuel shutoff lever

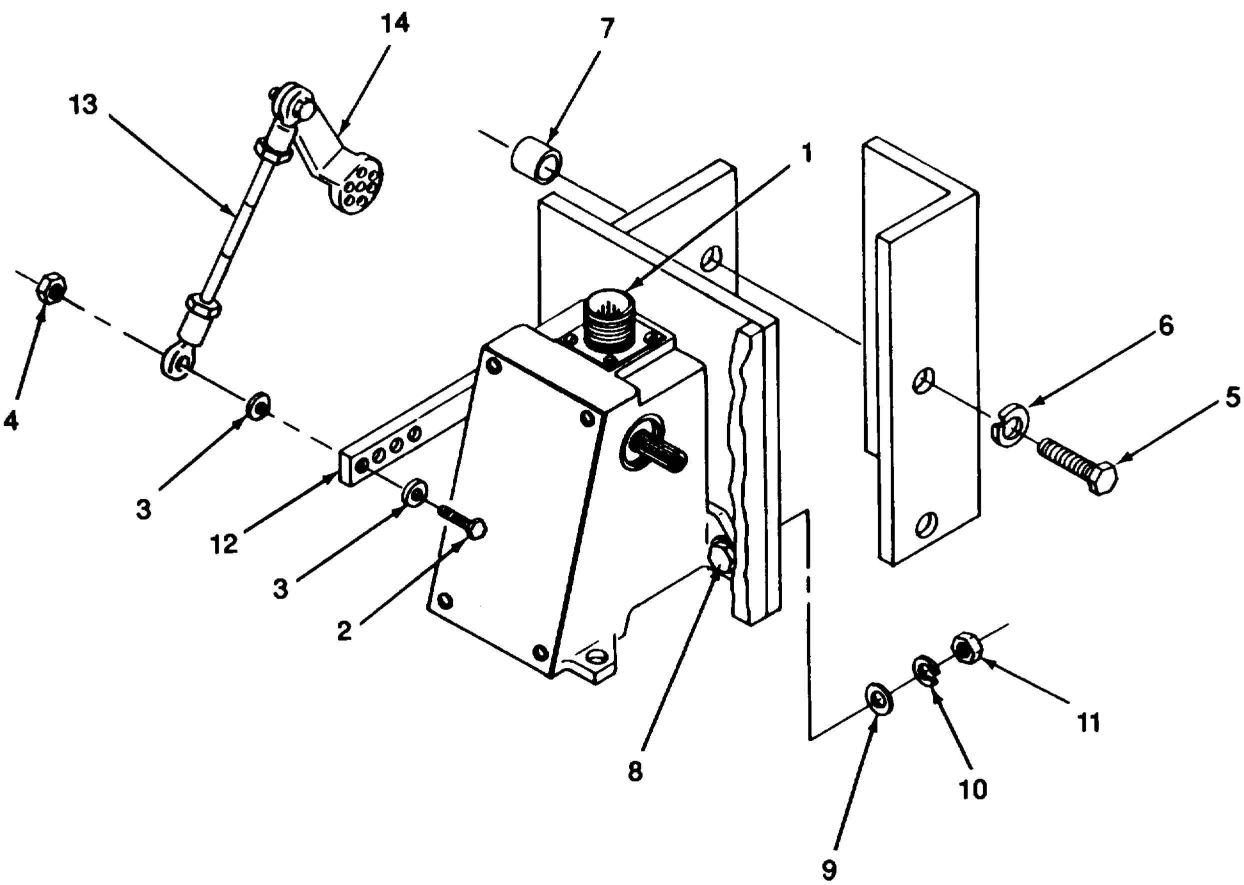
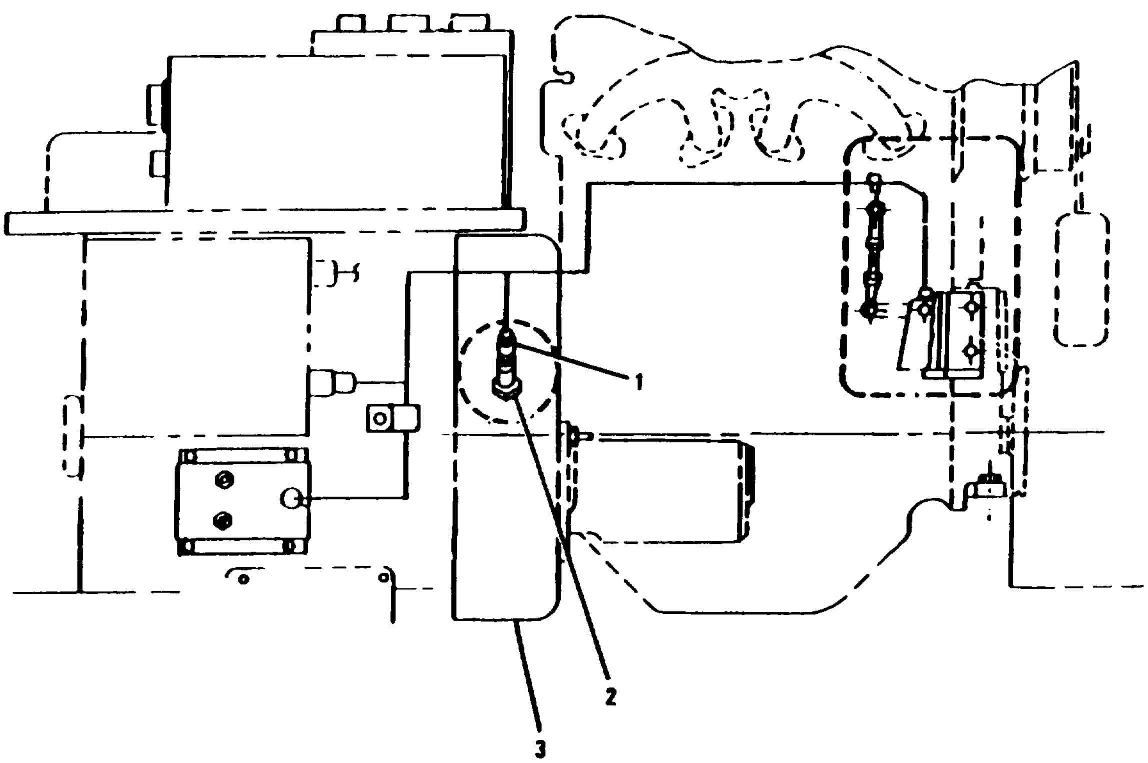


Figure 3-87. Actuator Removal and Installation



1. (P23)
2. Magnetic Pickup
3. Flywheel Housing

Figure 3-88. Magnetic Pickup Removal and Installation

3-69. TACTICAL RELAY ASSEMBLY TO SPECIAL RELAY ASSEMBLY WIRING HARNESS.

a. Refer to the Operator and Unit Maintenance Manual for removal, cleaning, inspection, and repair procedures of tactical relay assembly to special relay assembly wiring harness.

b. If the wiring harness has sustained damage and requires repair or rebuild, refer to figure 3-84 for layout, identification, and material requirements and Appendix A for detailed soldering and replacement procedures.

c. Refer to the Operator and Unit Maintenance Manual for installation instructions.

3-70. SPECIAL RELAY ASSEMBLY TO STATIC EXCITER WIRING HARNESS.

a. Refer to the Operator and Unit Maintenance Manual for special relay assembly to static exciter wiring harness removal, cleaning, inspection, and repair instructions.

b. If the wiring harness has sustained damage and requires repair or rebuild, refer to figure 3-89 for layout, identification, and material requirements and Appendix A for detailed soldering and replacement procedures.

c. Refer to the Operator and Unit Maintenance Manual for wiring harness installation procedures.

3-71. LOAD MEASURING UNIT TO TACTICAL RELAY ASSEMBLY WIRING HARNESS.

a. Refer to the Operator and Unit Maintenance Manual for load measuring unit to tactical relay assembly wiring harness removal, cleaning, inspection, and repair instructions.

b. If the wiring harness has sustained damage and requires repair or rebuild, refer to figure 3-90 for layout, identification, and material requirements and Appendix A for detailed soldering and replacement procedures.

c. Refer to the Operator and Unit Maintenance Manual for wiring harness installation instructions.

3-72. GOVERNOR CONTROL UNIT TO HYDRAULIC ACTUATOR UNIT WIRING HARNESS. (ELECTRO-HYDRAULIC GOVERNOR EQUIPPED PRECISE SETS ONLY)

a. Refer to the Operator and Unit Maintenance Manual for governor control unit to hydraulic actuator unit wiring harness removal, cleaning, inspection, and repair instructions.

b. If the wiring harness has sustained damage and requires repair or rebuild, refer to figure 3–91 for layout, identification, and material requirements and Appendix A for detailed soldering and replacement procedures.

c. Refer to the Operator and Unit Maintenance Manual for installation instructions.

3-73. AC POWER CONTROL WIRING HARNESS.

a. Refer to the Operator and Unit Maintenance Manual for ac power control wiring harness removal, cleaning, inspection, and repair instructions.

b. If the wiring harness has sustained damage and requires repair or rebuild, refer to figure 3–93 for layout, identification, and material requirements and Appendix A for detailed soldering and replacement procedures.

c. Refer to the Operator and Unit Maintenance Manual for wiring harness installation instructions.

3-74. EXCITER CONTROL WIRING HARNESS.

a. Refer to the Operator and Unit Maintenance Manual for exciter control wiring harness removal, cleaning, inspection, and repair instructions.

b. If the wiring harness has sustained damage and requires repair or rebuild, refer to figure 3-94 for layout, identification, and material requirements and Appendix A for detailed soldering and replacement procedures.

c. Refer to the Operator and Unit Maintenance Manual for wiring harness installation procedures.

3-75. SPECIAL RELAY ASSEMBLY TO FAULT LOCATING INDICATOR WIRING HARNESS.

a. Refer to the Operator and Unit Maintenance Manual for special relay assembly to fault locating indicator wiring harness removal, cleaning, inspection, and repair procedures.

b. If the wiring harness has sustained damage and requires repair or rebuilding, refer to figure 3-95 for layout, identification, and material requirements and Appendix A for detailed soldering and replacement procedures.

c. Refer to the Operator and Unit Maintenance Manual for wiring harness installation instructions.

3-76. SPECIAL RELAY ASSEMBLY TO CONTROL CUBICLE ASSEMBLY WIRING HARNESS.

a. Refer to the Operator and Unit Maintenance Manual for special relay assembly to control cubicle assembly wiring harness removal, cleaning, inspection, and repair procedures.

b. If the wiring harness has sustained damage and requires repair or rebuild, refer to figure 3-96 for layout, identification, and material requirements and Appendix A for detailed soldering and replacement procedures.

c. Refer to the Operator and Unit Maintenance Manual for wiring harness installation instructions.

3-77. PRECISE RELAY ASSEMBLY TO GOVERNOR CONTROL UNIT WIRING HARNESS. (ELECTRO-HYDRAULIC GOVERNOR EQUIPPED PRECISE SETS ONLY).

a. Refer to the Operator and Unit Maintenance Manual for precise relay assembly to governor control unit wiring harness removal, cleaning, inspection, and repair instructions.

b. If the wiring harness has sustained damage and requires repair or rebuild, refer to figure 3-97 for layout, identification, and material requirements and Appendix A for detailed soldering and replacement procedures.

c. Refer to the Operator and Unit Maintenance Manual for wiring harness installation instructions.

3-78. SPECIAL RELAY ASSEMBLY TO PRECISE RELAY ASSEMBLY WIRING HARNESS.

a. Refer to the Operator and Unit Maintenance Manual for special relay assembly to precise relay assembly wiring harness removal, cleaning, inspection, and repair instructions.

b. If the wiring harness has sustained damage, and requires repair or rebuild, refer to figure 3-98 for layout, identification, and material requirements and Appendix A for detailed soldering and replacement procedures.

c. Refer to the Operator and Unit Maintenance Manual for wiring harness installation instructions.

NOTES:
1. ALL SOLDERED CONNECTIONS SHALL BE IN ACCORDANCE WITH MIL-STD-454, REQUIREMENT 5.
2. INSTALL STRAPS, FIND NO. 5 AT 3.0 MAX. INTERVALS.
3. WIRE MARKING TO BE IN ACCORDANCE WITH MIL-W–5088 EXCEPT THAT LENGTH BETWEEN GROUPS OF NUMBERS SHALL NOT EXCEED 6 INCHES
4. INSTALL END SEAL PLUGS, FIND NO. 4 ON UNUSED HOLES OF CONNECTORS FIND NO. 1 AND 2.
5. INTERPRET DRAWING PER MIL-STD-100.
6. REFERENCES:
   a) FOR ELECTRICAL WIRING DIAGRAM, SEE DRAWING 72–2205.
   b) FOR SCHEMATIC DIAGRAM, SEE DRAWING 72-2200 AND 72–2269 FOR PRECISE, 72-2295 AND 72-2277 FOR UTILITY

MARKING COLOR	WIRE MARKING	FROM	FIND NO. REF.	TO	FIND NO. REF.	WIRE FIND NO.	WIRE LENGTH REF.
BLACK	X91016	P3–A	1	P9–A	2	3	31.00
BLACK	X197J16	P3–B	1	P9–B	2	3	
RED	D11B16	P3–C	1	P9–C	2	3	
RED	D12B16	P3–D	1	P9–D	2	3	31.00

FIND NO.	SYM	CODE IDENT	DWG SIZE	PART OR IDENTIFYING NO.	QTY REQD	NOMENCLATURE OR DESCRIPTION	SPEC	MATERIAL
1				MS3106R14S–6P	1	CONNECTOR, PLUG, ELECT. (P3)		
2				MS3106R14S–6S	1	CONNECTOR, PLUG, ELECT. (P9)		
3				M5086/2–16–9	AR	WIRE, ELECT. , 16 AWG	MIL–W–5088/2	
4				MS25251–16	4	PLUG, END SEAL, ELECT, CONNECTOR		
5				MS3367–5	9	STRAP, CABLE, ADJUSTABLE		

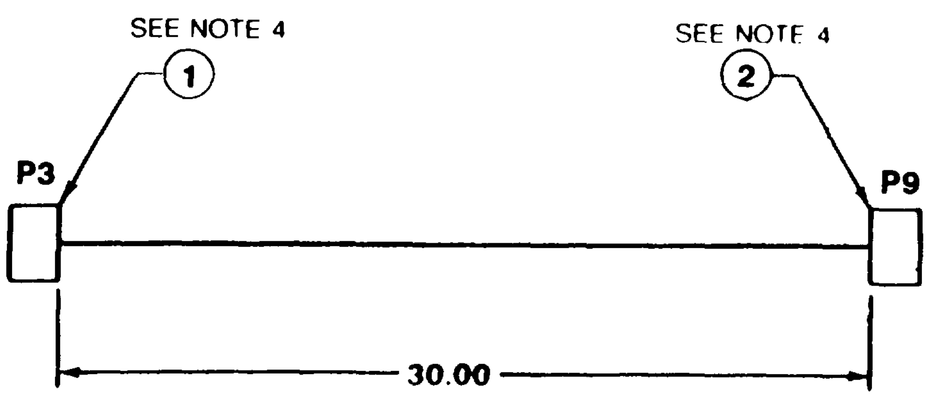
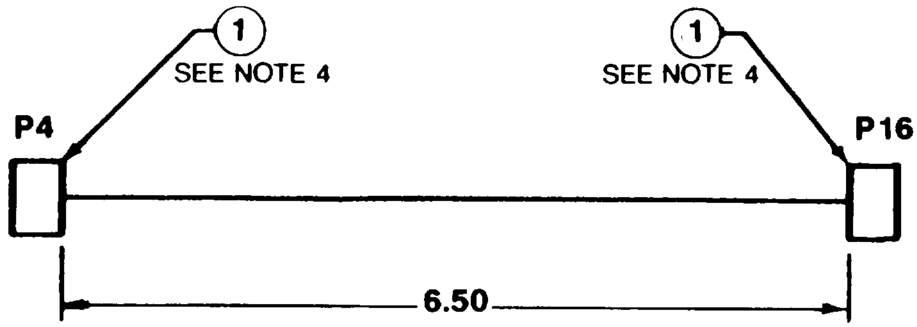


Figure 3-89. Special Relay Assembly to Static Exciter Assembly Wiring Harness, Drawing No. 72-2220

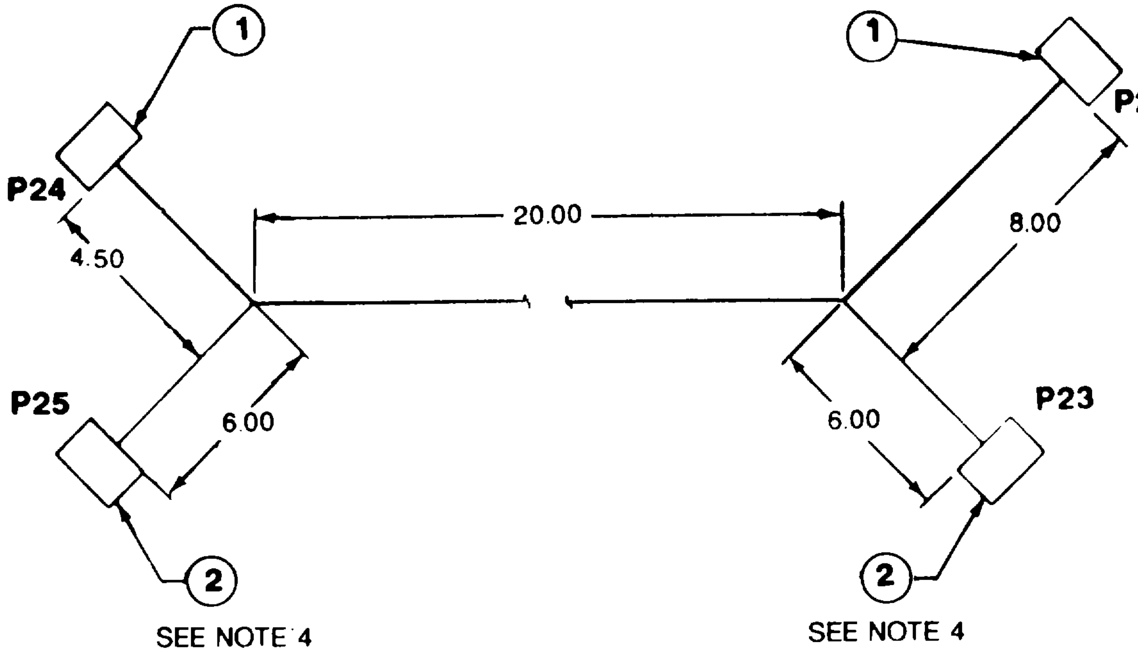


NOTES:
1. ALL SOLDERED CONNECTIONS SHALL BE IN ACCORDANCE WITH MIL-STD-454, REQUIREMENT 5.
2. INSTALL STRAPS, FIND NO. 3 AT 3.0 MAX. INTERVALS AND AT EACH CABLE BREAK-OUT.
3. WIRE MARKING TO BE IN ACCORDANCE WITH MIL–W–5088 EXCEPT THAT LENGTH BETWEEN GROUPS OF NUMBERS SHALL NOT EXCEED 6 INCHES.
4. INSTALL END SEAL PLUGS, FIND NO. 4 ON UNUSED HOLES OF CONNECTORS FIND NO. 1.
5. INTERPRET DRAWING PER MIL–STD-100.
6. REFERENCES:
   a) FOR ELECTRICAL WIRING DIAGRAM, SEE DRAWING 72–2205.
   b) FOR SCHEMATIC DIAGRAM, SEE DRAWING 72-2200 AND 72-2269.

MARKING COLOR	WIRE MARKING	FROM	FIND NO. REF.	TO	FIND NO. REF.	WIRE FIND NO.	WIRE LENGTH REF.
BLACK	X7G16A	P4–A	1	P16–A	1	2	7.50
	X8G16B	P4–B	1	P16–B	1	2	
	X9N16C	P4–C	1	P16–C	1	2	
	X115D16	P4–D	1	P16–D	1	2	
	X116D16	P4–E	1	P16–E	1	2	
	X117D16	P4–F	1	P16–F	1	2	
	D24G16	P4–G	1	P16–G	1	2	
	X12Y16N	P4–K	1	P16–K	1	2	
	X12Z16N	P4–L	1	P16–L	1	2	
	X12AA16 N	P4–M	1	P16–M	1	2	
	K101A16	P4–N	1	P16–N	1	2	
BLACK	K102A16	P4–S	1	P16–S	1	2	7.50

FIND NO.	SYM	CODE IDENT	DWG SIZE	PART OR IDENTIFYING NO.	QTY REQD	NOMENCLATURE OR DESCRIPTION	SPEC	MATERIAL
1				MS3106R20–29S	2	CONNECTOR, PLUG ELECT. P4, P16		
2				M5086/2–16–9	AR	WIRE, ELECT., 16 AWG	MIL–W–5086/2	
3				MS3367–5	2	STRAP, CABLE, ADJUSTABLE		
4				MS25251–16	10	PLUG, FIND SEAL, ELECT. CONNECTOR		

Figure 3-90. Load Measuring Unit to Tactical Relay Assembly Wiring Harness, Drawing No. 72-2234

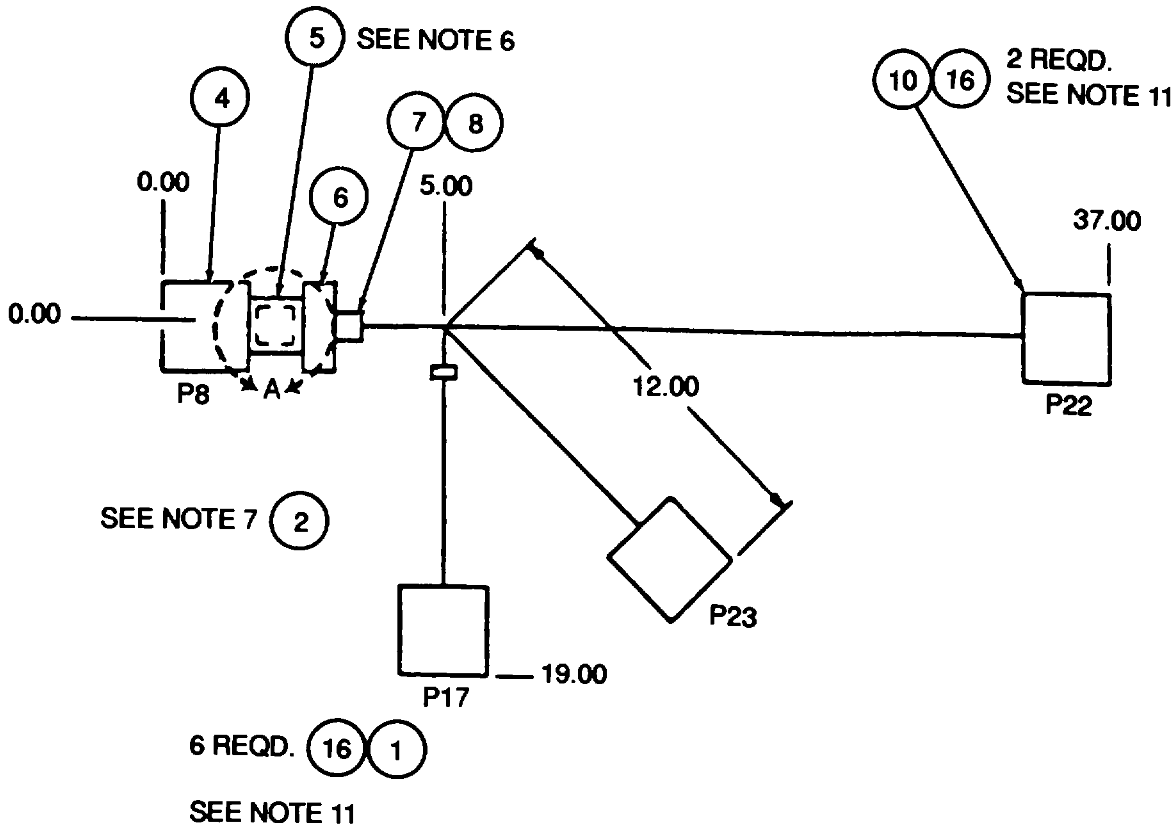


NOTES:
1. ALL SOLDERED CONNECTIONS SHALL BE IN ACCORDANCE WITH MIL-STD-454, REQUIREMENT 5.
2. INSTALL STRAPS, FIND NO. 4 AT 3.0 MAX. INTERVALS AND AT EACH CABLE BREAK-OUT.
3. WIRE MARKING TO BE IN ACCORDANCE WITH MIL-W-5088 EXCEPT THAT LENGTH BETWEEN GROUPS OF NUMBERS SHALL NOT EXCEED 6 INCHES
4. INSTALL END SEAL PLUGS, FIND NO. 5 ON UNUSED HOLES OF CONNECTORS FIND NO. 1 AND 2.
5. INTERPRET DRAWING PER MIL-STD-100.
6. REFERENCES:
a) FOR ELECTRICAL WIRING DIAGRAM, SEE DRAWING 72-2205.
b) FOR SCHEMATIC DIAGRAM, SEE DRAWING 72-2200 AND 72-2269.

MARKING COLOR	WIRE MARKING	FROM	FIND NO REF.	TO	FIND NO REF.	WIRE FIND NO.	WIRE LENGTH REF.
BLACK	K120A16	P22-A	1	P24-A	1	2	34.00
BLACK	K121A16	P22-B	1	P24-B	1	3	34.00
BLACK	K122A16	P22-C	1	P24-C	1	3	34.00
BLACK	K123A16	P22-D	1	P24-D	1	3	34.00
BLACK	K124A16	P23-A	1	P25-A	2	3	33.50
BLACK	K125A16	P23-B	1	P25-B	2	3	33.50
BLACK	K126A16	P23-C	1	P25-C	2	3	33.50
BLACK	K127A16	P23-D	1	P25-D	2	3	33.50

FIND NO.	SYM	CODE IDENT	DWG SIZE	PART OR IDENTIFYING NO.	QTY REQD	NOMENCLATURE OR DESCRIPTION	SPEC	MATERIAL
1				MS3106R14S-2P	2	CONNECTOR, PLUG, ELECT., P22, P24		
2				MS3106R14S-5S	2	CONNECTOR, PLUG, ELECT.,		
3				MS5086/2-16	AR	WIRE, 16 A.G. P23, P25	MIL-W-5086/2	
4				MS3367-5		17STRAP, CABLE, ADJUSTABLE		
5				MS25251-16		2 PLUG, END SEAL, ELECT.		

Figure 3-91. Governor Control Unit to Hydraulic Actuator Unit Wiring Harness, Drawing No. 72-2223 (Electro-Hydraulic Governor Equipped Precise Sets Only)



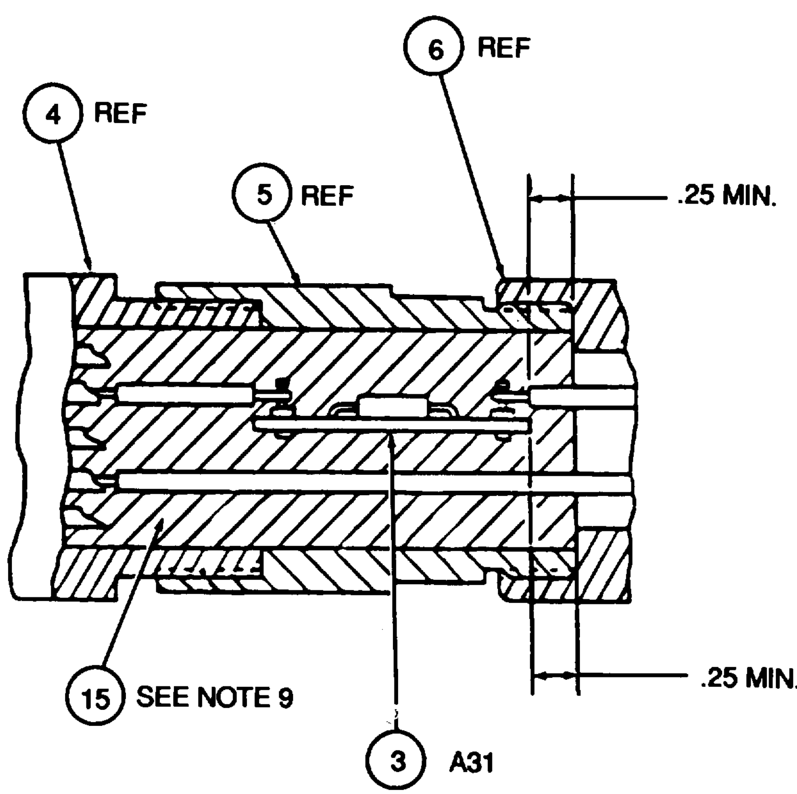


Figure 3-92. 400 Hz Electric Governor System Wiring Harness Assembly Drawing No. 84-704 (Sheet 1 of 2)

NOTES:
1. ALL CONDUCTORS SHALL BE STRIPPED .50+ .12 AND TINNED BEFORE ASSEMBLY USING SOLDER, FIND NO 12.
2. ELECTRICAL CONNECTIONS SHALL BE SOLDERED IN ACCORDANCE WITH MIL-STD-454. REQUIREMENT 5, USING SOLDER, FIND NO. 12.
3. WIRE MARKING SHALL BE IN ACCORDANCE WITH MIL-W-5068 EXCEPT THAT INTERVALS SHALL NOT EXCEED 6.00.
4. TIEDOWN STRAPS. FIND NO. 13, SHALL BE LOCATED APPROXIMATELY 3.00 APART AND ALL BREAKOUTS.
5. CONNECTORS FIND NO. 1,4,10, 11, SHALL BE MARKED WITH REFERENCE DESIGNATIONS SHOWN IN ACCORDANCE WITH MIL-STD-130, USING .25 HIGH CHARACTERS.
6. EXTENSION, FIND NO. 5, SHALL BE MARKED "A31" IN ACCORDANCE WITH MIL-STD-130, USING .25 HIGH CHARACTERS.
7. BAND MARKER, FIND NO. 2, SHALL "30554/8> 2005" IN ACCORDANCE WITH MIL-STD-130.
8. FOR INTERPRETATION OF: DRAWING, SEE DOD-STD-1C0
9. FILL COMPLETE INSIDE AREA OF CONNECTOR EXTENSION, FIND NO. 5 WITH POTTING COMPOUND. FIND NO. 15.
10. CONNECTOR, FIND NO. 11, SHALL BE IN ACCORDANCE WITH MS3106R, INSERT ARRANGEMENT 105L-45.
11. SEAL UNUSED HOLES IN GROMMETS OF CONNECTORS, FIND NO. 1 AND 10, WITH PLUGS, FIND NO. 16.
12. THE CONNECTORS OF WIRE NUMBERS 13, 14, 15 and 21 SHALL BE TWISTED TOGETHER AND SOLDERED. THE CONNECTION SHALL BE WITH HEAT SHRUNK INSULATION SLEEVING, FIND NO. 17. THIS CONNECTION SHALL BE POSITIONED TO CLEAR THE PRINTED WIRING BOARD ASSEMBLY, FIND NO. 3, PRIOR TO POTTING IN ACCORDANCE WITH NOTE 9.

WIRE NO.	WIRE MARKING (SEE NOTE 3)	TERMINATION FROM	TERMINATION FIND NO. REF.	TERMINATION TO	TERMINATION FIND NO. REF.	WIRE FIND NO.	WIRE LENGTH REF.	
1	(JUMPER)	P8-J		A31-1		9	1.50	
2	(JUMPER)	P8-M		A31-2		9	1.50	
3	(JUMPER)	P8-P		A31-3		9	1.50	
4	(JUMPER)	P8-T		A31-4		9	1.50	
5	K111A16	A31-5		P17-M		14	22.00	
6	K108316	A31-6		P17-J		14	22.00	
7	K10481C	A31-7		P17-K		14	22.00	
8	K32F16	P7-M		P17-R		14	24.00	
9	K103816	P8-N		P-17F		14	24.00	
10	P81A16	P8-C		P-17C		14	24.00	
11	P55GX16	P8-D		P17-G		14	24.00	
12	(JUMPER)	P8-U		P8-F		9	2.00	
13	(JUMPER)	P8-G		--		9	1.50	SEE NOTE 1
14	(JUMPER)	P8-R		--		9	1.50	SEE NOTE 1
15	(JUMPER)	P8-E		--		9	1.50	SEE NOTE 1
16	K122A16	P17-T		P23-A		14	31.00	TWISTED PAIR
17	K123A16	P17-S		P23-B		14	31.00	TWISTED PAIR
18	(JUMPER)	P22-8		P22-C		14	3.00	
19	K126A16	P17-8		P22-A		14	51.00	
20	K127A16	P17-D		P22-D		14	51.00	
21	(JUMPER)	P8-5				9	1.50	SEE NOTE 12

FIND NO.	FSCM	CODE IDENT	DWG SIZE	PART OR IDENTIFYING NO.	QTY REQD	NOMENCLATURE OR DESCRIPTION	SPECIFICATION	MATERIAL
1				MS3106R20-295	1	CONNECTOR PLUG P17		
2				M43436/1-3	1	BAND MARKER, BLANK	MIL-8-43436/1	
3				83-2012	1	PRINTED WIRING BOARD ASSY, LOAD SHARING A31		
4				MS3106A24-28P	1	CONNECTOR PLUG P8		
5				81-4917	1	EXTENSION CONNECTOR		
6				MS3057-16A	1	CLAMP CABLE		
7				MS3420-12	1	ADAPTER		
8				MS3420-16	1	ADAPTER		
9				M5086/2-18-9	AR	WIRE, ELECTRICAL, 18 AWG. WHT	MIL-W-5086/2	
10				MS3106R14S-6S	1	CONNECTOR PLUG P22		
11				SEE NOTE 10	1	CONNECTOR PLUG P23	MIL-C-5015	
12				SM60WRP2	AR	SOLDER	QQ-S-571	
13				MS3367-7-9	AR	STRAP, TIEDOWN		
14				M5086/2-16-9	AR	WIRE, ELECTRICAL, 16 AWG. WHT	MIL-W-5086/2	
15				TYPE I, CL 1, GR81	AR	SEALING COUPOUND	MIL-S-23586	
16				MS25251-16	8	PLUG END SEAL (22-16 WIRE SIZE)		
17				M23053/7-104-C	AR	INSULATION SLEEVING, 187 ID AS SUPPLIED	MIL-I-23053/7	

Figure 3-92.400 Hz Electric Governor System Wiring Harness Assembly Drawing No. 84-704 (Sheet 2 of 2)

NOTES:

1. ALL SOLDERED CONNECTIONS SHALL BE IN ACCORDANCE WITH MIL-STD-454, REQUIREMENT 5.
2. INSTALL STRAPS, FIND NO. 9, AT 3.0 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 TERMINALS SHALL MEET THE PERFORMANCE REQUIREMENTS OF MIL-T-7928.
5. INSTALL END SEAL PLUGS, FIIND NO. 2 IN UNUSED HOLES OF CONNECTOR, FIND NOS 1 AND 3.
6. INTERPRET DRAWING PER MIL-STD-100.
7. REFERENCES
   a) FOR WIRING DIAGRAM, SEE DRAWING 72-2205.
   b) FOR SCHEMATIC DIAGRAM, SEE DRAWING 72-2200 AND 72-2269.

WIRE MARKING	FROM	TERMINATION FIND NO. REF.	TERMINATION TO	TERMINATION FIND NO REF.	WIRE FIND NO.	WIRE LENGTH REF.	WIRE MARKING COLOR
D20E16	P10–A	1	CT1–A2	5	6	16.75	BLACK
D21E16	P10–B	1	CT2–B2	5	6	21.50	BLACK
D22E16	P10–C	1	CT3–C2	5	6	25.00	BLACK
X17E16	P10–D	1	CT1–A1	5	6	19.00	BLACK
X18E16	P10–J	1	CT2–B1	5	6	23.00	BLACK
X19E16	P10–k	1	CT3–C1	5	6	25.50	BLACK
X195M16	P10–V	1	CT7–A2	10	6	26.25	BLACK
X194F16	P10–W	1	CT7–A1	10	6	25.50	BLACK
X14H16	P10–G	1	TB6–1	7	6	35.50	BLACK
X7316A	P10–E	1	TB6–7	7	6	34.75	BLACK
X15F16	P10–H	1	TB6–2	7	6	35.50	BLACK
X8A16B	P10–F	1	TB6–8	7	6	34.75	BLACK
X16H16	P10–L	1	TB6–3	7	6	39.25	BLACK
X9K16C	P10–a	1	TB6–9	7	6	38.50	BLACK
X12EG16N	P10–f	1	TB6–12	7	6	35.75	BLACK
X6A16	P10–g	1	TB6–6	7	6	37.50	BLACK
P55V12	P10–O	1	E5–GND	8	11	88.00	RED
X21S16	P10–X	1	CB2–A2	7	6	38.00	BLACK
X22S16	P10–Y	1	CB2–B2	7	6	38.00	BLACK
P63F16	P10–U	1	P41–A	3	8	31.50	RED
P55DY16	P10–Z	1	P41–B	3	6	31.50	RED
P56L16	P10–d	1	P41–C	3	6	31.50	RED
P50Z16	P10–c	1	P41–D	3	6	31.50	RED
X97B16	P10–M	1	P41–E	3	6	31.50	BLACK
X98G16	P10–N	1	P41–F	3	8	31.50	BLACK
K112H16	P10–j	1	P41–G	3	6	31.50	BLACK
K110E16	P10–h	1	P41–H	3	6	31.50	BLACK
P50XX16	P10–a	1	P41–J	3	6	31.50	RED
P199D16	P10–b	1	P41–K	3	6	31.50	RED

FIND NO.	SYM	CODE IDENT	DWG SIZE	PART OR IDENTIFYING NO.	QTY REQD	NOMENCLATURE OR DESCRIPTION	SPEC	MATERIAL
1				MS3106R32–7S	1	CONNECTOR, PLUG, ELECTRICAL P10		
2				MS25251–16	13	PLUG, END SEAL, ELEC. CONN.		
3				MS3106R20–29S	1	CONNECTOR, PLUG, ELECTRICAL P41		
4						(NOT USED)		
5				MS25036–153	6	TERMINAL LUG, NO. 8 STUD, 16 AWG		
6				M5086/2–16–9	AR	WIRE, ELECTRICAL, 16 AWG	MIL–W–5086/2	
7				MS25036–110	10	TERMINAL LUG, 3/8 STUD, 16 AWG		
8				MS25036–113	1	TERMINAL LUG, 5/16 STUD, 12 AWG		
9				MS3367–4–9	AR	STRAP, CABLE, ADJUSTABLE		
10				MS25036–108	2	TERMINAL LUG, NO. 10 16 AWG		
11				M5086/2–12–9	AR	WIRE ELECTRICAL 12 AWG	MIL–W5086/2	

Figure 3-93. AC Power Control Wiring Harness, Drawing No. 72-2259 (Sheet 1 of 2)

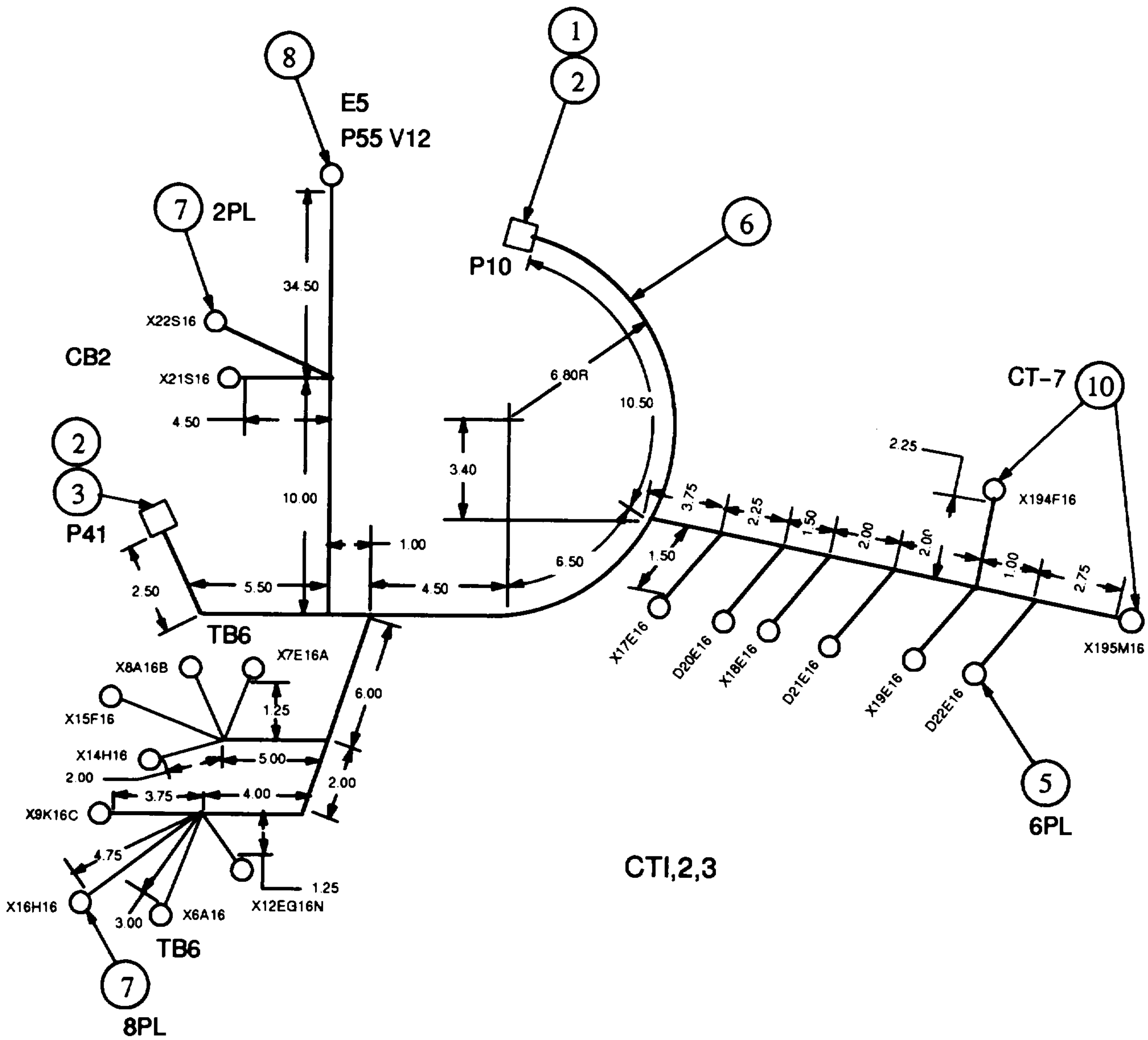
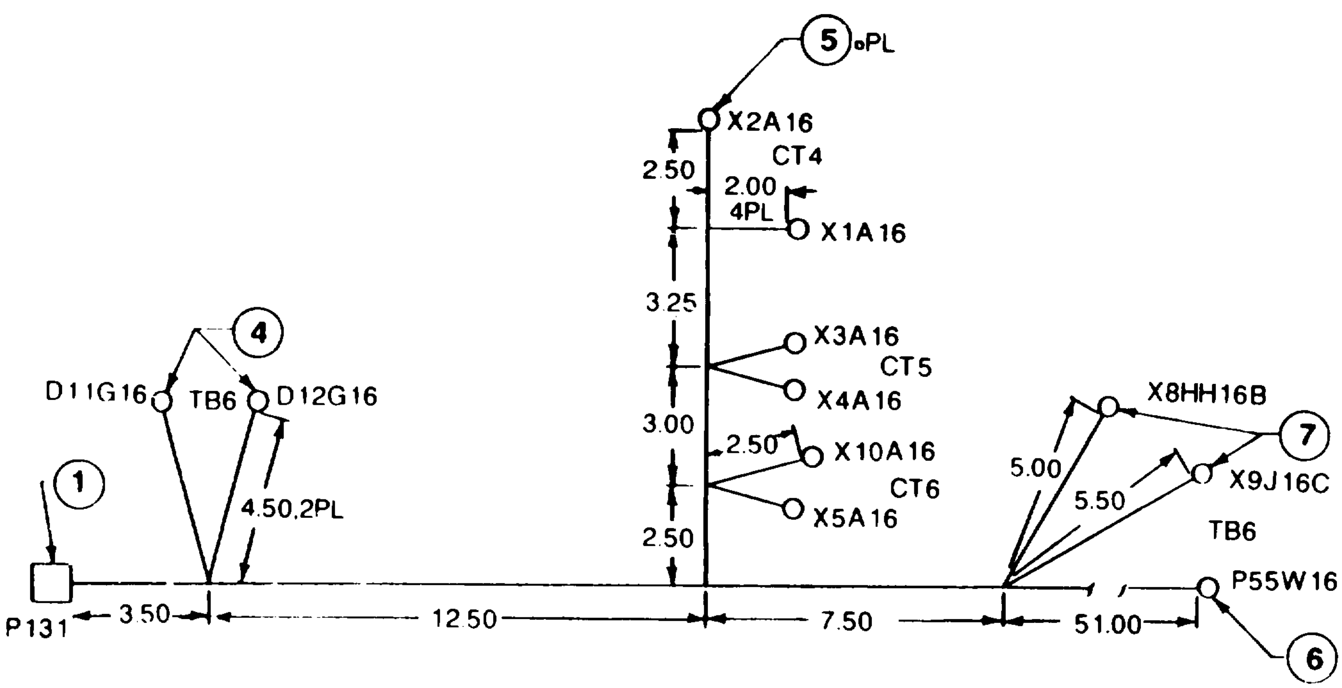


Figure 3-93. AC Power Control Wiring Harness, Drawing No. 72-2259 (Sheet 2 of 2)

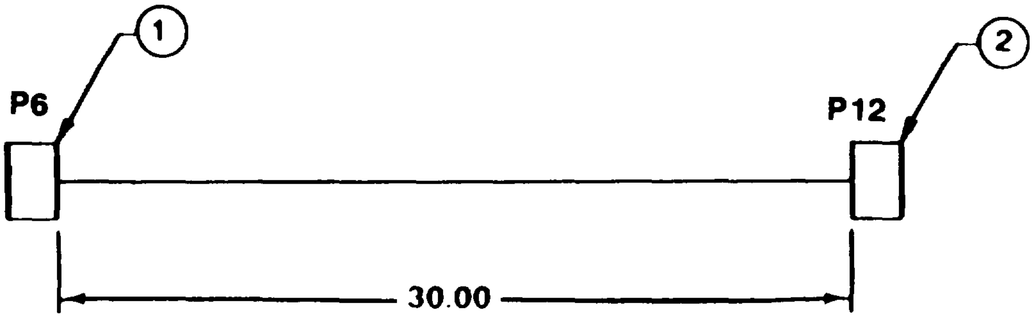
NOTES:
1. SOLDERING SHALL BE IN ACCORDANCE WITH MIL-STD-454, REQUIREMENT 5.
2. INSTALL STRAP, FIND NO. 8, AT 3.00 MAXIMUM INTERVALS AND AT EACH CABLE BREAK-OUT.
3. WIRE MARKING TO BE IN ACCORDANCE WITH MIL-W-5088 EXCEPT THAT LENGTH BETWEEN GROUPS OF NUMBERS SHALL EXCEED 6,00 INCHES.
4. CRIMPED TERMINAL 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. FOR INTERPRETATION OF REFERENCE DESIGNATIONS FOR ELECTRICAL AND ELECTRONIC PARTS AND EQUIPMENT, SEE ANSY 32.16.
7. REFERENCES:
   a. FOR WIRING DIAGRAM SEE DRAWING 72-2205.
   b. FOR SCHEMATIC DIAGRAM SEE DRAWINGS: 72-2200 AND 72-2269 FOR PRECISE, 72-2277 AND 72-2295 FOR UTILITY.

WIRE MARKING	FROM	TERMINATION			WIRE FIND NO.	WIRE LENGTH REF.	WIRE MARKING COLOR
		FIND NO. REF.	TO	FIND NO. REF.			
X1A16	P13–A	1	CT4–A1	5	3	26.00	BLACK
X2A16	P13–B	1	CT4–A2	5	3	26.50	BLACK
X3A16	P13–E	1	CT5–B1	5	3	24.75	BLACK
X4A16	P13–F	1	CT5–B2	5	3	24.75	BLACK
X5A16	P13–J	1	CT6–C1	5	3	21.75	BLACK
X10A16	P13–K	1	CT6–C2	5	3	22.25	BLACK
X9J166	P13–L	1	TB6–9	7	3	30.25	BLACK
X8HH16B	P13–M	1	TB6–8	7	3	29.75	BLACK
D12G16	P13–R	1	TB16–2	4	3	9.25	RED
D11G16	P13–S	1	TB16–1	4	3	9.25	RED
P55W16	P13–T	1	E5	6	3	75.75	RED



FIND NO.	SYM	CODE IDENT	DWG SIZE	PART OR IDENTIFYING NO.	QTY REQD	NOMENCLATURE OR DESCRIPTION	SPEC	MATERIAL
1				MS3106R22–145	1	CONNECTOR, PLUG, ELECT. P13		
2				MS25251–16	8	PLUG, END SEAL, ELECT. CONN.		
3				M5086/2–16–9	AR	WIRE, ELECT, 16 AWG	MIL–W–5086/2	
4				MS25036–153	2	TERMINAL LUG, NO. 8 STUD, 16 AWG		
5				MS25036–108	6	TERMINAL LUG, NO. 10 STUD, 16 AWG		
6				MS25036–154	1	TERMINAL LUG, 1/4 STUD, 16 AWG		
7				MS25036–110	2	TERMINAL LUG, 3/8 STUD, 16 AWG		
8				MS3367–4–9	AR	STRAP, CABLE ADJUSTABLE		

Figure 3-94. Exciter Control Wiring Harness, Drawing No. 73-2288



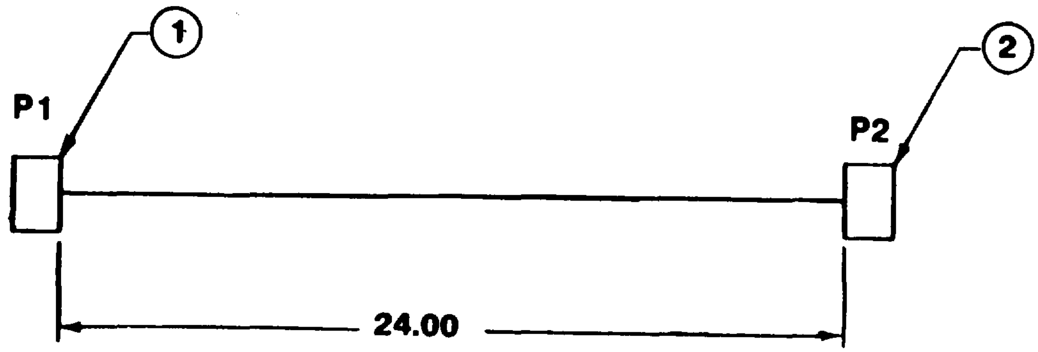
NOTES:

1. ALL SOLDERED CONNECTIONS SHALL BE IN ACCORDANCE WITH MIL-STD-454, REQUIREMENT 5.
2. INSTALL STRAPS, FIND NO. 4, AT 3.0 MAX INTERVALS.
3. WIRE MARKING TO BE IN ACCORDANCE WITH MIL-W-5088 EXCEPT THAT LENGTH BETWEEN GROUPS OF NUMBERS SHALL NOT EXCEED 6 INCHES.
4. INSTALL END SEAL PLUGS, FIND NO. 5 IN UNUSED HOLES OF CONNECTOR FIND NO. 1 AND 2.
5. INTERPRET DRAWING PER MIL-STD-100.
6. REFERENCES:
   a) FOR WIRING DIAGRAM, SEE DRAWING 72-2205
   b) FOR SCHEMATIC DIAGRAM, SEE DRAWINGS 72-2200
      FOR PRECISE UNITS, 72-2200 AND 72-2269
      FOR UTILITY UNITS, 72-2295 AND 72-2277

MARKING COLOR	WIRE MARKING	TERMINATION		TERMINATION		WIRE FIND NO.	WIRE LENGTH REF.
		FROM	FIND NO. REF.	TO	FIND NO. REF.		
RED	P45K16	P6–A	1	P12–A	2	3	31.00
RED	P66B16	P6–B	1	P12–B	2	3	31.00
RED	P200A16	P6–C	1	P12–C	2	3	31.00
RED	P201A16	P6–D	1	P12–D	2	3	31.00
RED	P202A16	P6–E	1	P12–E	2	3	31.00
RED	P203A16	P6–F	1	P12–F	2	3	31.00
RED	P204A16	P6–G	1	P12–G	2	3	31.00
RED	P205A16	P6–H	1	P12–H	2	3	31.00
RED	P206A16	P6–I	1	P12–I	2	3	31.00
RED	P207A16	P6–K	1	P12–K	2	3	31.00
RED	P208A16	P6–L	1	P12–L	2	3	31.00
RED	P209A16	P6–M	1	P12–M	2	3	31.00
RED	P210A16	P6–N	1	P12–N	2	3	31.00

FIND NO.	SYM	CODE IDENT	DWG SIZE	PART OR IDENTIFYING NO.	QTY REQD	NOMENCLATURE OR DESCRIPTION	SPEC	MATERIAL
1				MS3106R20–27P	1	CONNECTOR, PLUG, ELECT. P6		
2				MS3106R20–27S	1	CONNECTOR, PLUG, ELECT. P12		
3				M5086/2–16–9	AR	WIRE, ELECT. 16 AWG	MIL–W–5086/2	
4				MS3367–5–9	9	STRAP, CABLE ADJUSTABLE		
5				MS25251–16	2	PLUG, END SEAL, ELECT. CONNECTOR		

Figure 3-95. Special Relay Assembly to Fault Locating Indicator Wiring Harness, Drawing No. 76-2247



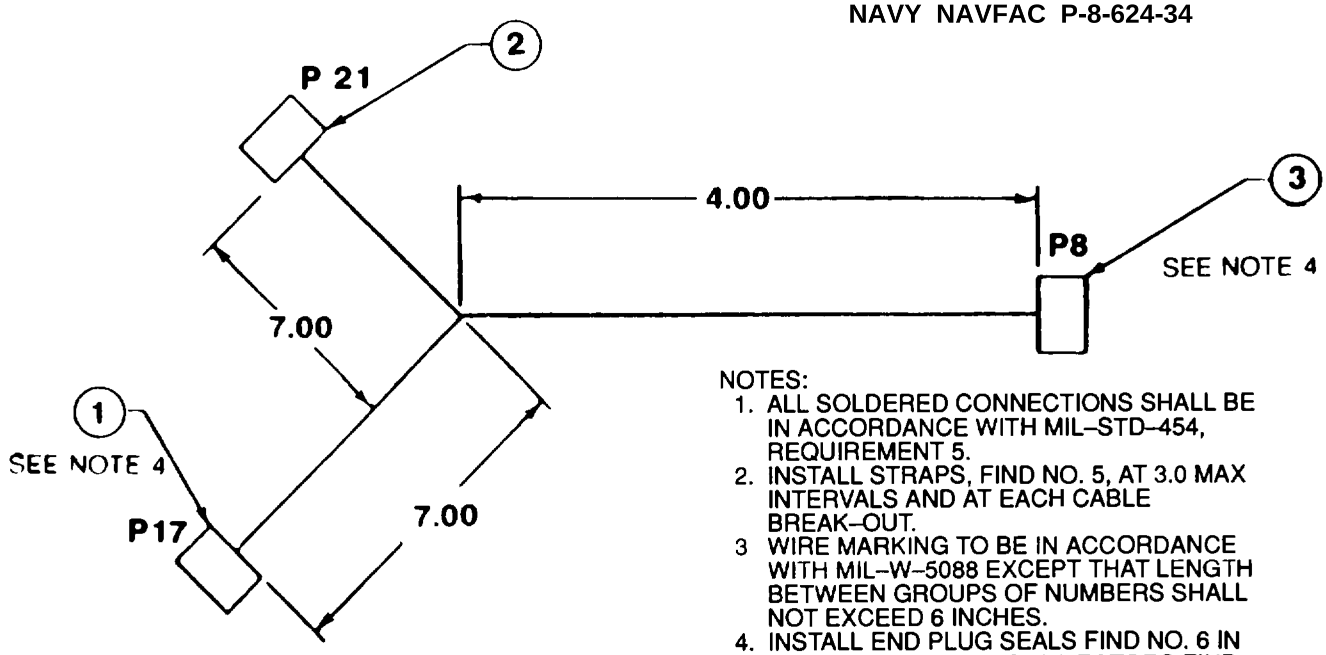
MARKING COLOR	WIRE MARKING	TERMINATION FROM	TERMINATION FIND NO. REF.	TERMINATION TO	TERMINATION FIND NO. REF.	WIRE FIND NO. REF.	WIRE LENGTH REF.
BLACK	D20A16	P1–A	1	P2–A	2	3	25.00
BLACK	D21A16	P1–B	1	P2–B	2	3	25.00
BLACK	D22A16	P1–C	1	P2–C	2	3	25.00
BLACK	D24D16	P1–D	1	P2–D	2	3	25.00
BLACK	X7B16A	P1–E	1	P2–E	2	3	25.00
BLACK	X8C16B	P1–F	1	P2–F	2	3	25.00
BLACK	X14G16	P1–G	1	P2–G	2	3	25.00
BLACK	X15G16	P1–H	1	P2–H	2	3	25.00
BLACK	X16E16	P1–I	1	P2–I	2	3	25.00
BLACK	L25B16	P1–J	1	P2–J	2	3	25.00
BLACK	L26B16	P1–K	1	P2–K	2	3	25.00
BLACK	X91B16	P1–L	1	P2–L	2	3	25.00
BLACK	K32B16	P1–M	1	P2–M	2	3	25.00
BLACK	K33B16	P1–N	1	P2–N	2	3	25.00
BLACK	X31B16	P1–O	1	P2–O	2	3	25.00
BLACK	X194B16	P1–P	1	P2–P	2	3	25.00
RED	P45F16	P1–R	1	P2–R	2	3	25.00
BLACK	X92B16	P1–S	1	P2–S	2	3	25.00
BLACK	K34B16	P1–T	1	P2–T	2	3	25.00
BLACK	X90C16	P1–U	1	P2–U	2	3	25.00
RED	E39B16	P1–V	1	P2–V	2	3	25.00
RED	E38B16	P1–W	1	P2–W	2	3	25.00
RED	E37B16	P1–X	1	P2–X	2	3	25.00
RED	E36B16	P1–Z	1	P2–Z	2	3	25.00
RED	P199B16	P1–a	1	P2–a	2	3	25.00
BLACK	L93C16	P1–b	1	P2–b	2	3	25.00
RED	P198B16	P1–c	1	P2–c	2	3	25.00
RED	P47C16	P1–e	1	P2–e	2	3	25.00
BLACK	X195B16	P1–f	1	P2–f	2	3	25.00
RED	P44C16	P1–g	1	P2–g	2	3	25.00
RED	P62C16	P1–h	1	P2–g	2	3	25.00
RED	P56C16	P1–k	1	P2–h	2	3	25.00
RED	P80D16	P1–m	1	P2–m	2	3	25.00
BLACK	X197B16	P1–n	1	P2–n	2	3	25.00
RED	P55A16	P1–p	1	P2–p	2	3	25.00
RED	P55BC16	P1–r	1	P2–r	2	3	25.00
RED	P57D16	P1–t	1	P2–t	2	3	25.00
RED	P40M16	P1–u	1	P2–u	2	3	25.00
RED	P40L16	P1–v	1	P2–v	2	3	25.00
RED	P50H16	P1–w	1	P2–w	2	3	25.00
RED	P46B16	P1–x	1	P2–x	2	3	25.00
BLACK	X12A16N	P1–y	1	P2–y	2	3	25.00
BLACK	X9B16C	P1–z	1	P2–z	2	3	25.00

NOTES:

1. ALL SOLDERED CONNECTIONS SHALL BE IN ACCORDANCE WITH MIL–STD–454, REQUIREMENT 5.
2. INSTALL STRAPS, FIND NO. 5, AT 3.0 MAX INTERVALS.
3. WIRE MARKING TO BE IN ACCORDANCE WITH MIL–W–5088 EXCEPT THAT LENGTH BETWEEN GROUPS OF NUMBERS SHALL NOT EXCEED 6 INCHES.
4. INSTALL END SEAL PLUGS, FIND NO. 4 IN UNUSED HOLES OF CONNECTOR, FIND NOS. 1 AND 2.
5. INTERPRET DRAWING PER MIL–STD–100.
6. REFERENCES:
   a) FOR WIRING DIAGRAM, SEE DRAWING 72–2205.
   b) FOR SCHEMATIC DIAGRAM, SEE DRAWINGS 72–2200 AND 72–2269 FOR PRECISE AND 72–2295 AND 72–2277 FOR UTILITY.

FIND NO.	SYM	CODE IDENT	DWG SIZE	PART OR IDENTIFYING NO.	QTY REQD	NOMENCLATURE OR DESCRIPTION	SPEC	MATERIAL
1				MS3106R36–7S	1	CONNECTOR, PLUG, ELEC– TRICAL, P1		
2				MS3106R36–7P	1	CONNECTOR, PLUG, ELEC–		
3				M5086/2–16–9	AR	WIRE , ELECT. 16 AWG TRICAL, P2	MIL–2–5086/2	
4				NS25251–16	6	PLUG, END SEAL, ELECT. CONNECTOR		
5				MS3367–5–9	AR	STRAP, CABLE, ADJUSTABLE		

Figure 3-96. Special Relay Assembly to Control Cubicle Wiring Harness, Drawing No. 72-2248

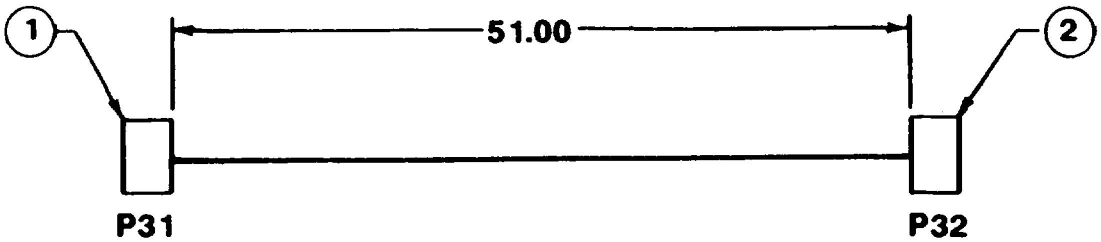


NOTES:
1. ALL SOLDERED CONNECTIONS SHALL BE IN ACCORDANCE WITH MIL–STD–454, REQUIREMENT 5.
2. INSTALL STRAPS, FIND NO. 5, AT 3.0 MAX INTERVALS AND AT EACH CABLE BREAK–OUT.
3. WIRE MARKING TO BE IN ACCORDANCE WITH MIL–W–5088 EXCEPT THAT LENGTH BETWEEN GROUPS OF NUMBERS SHALL NOT EXCEED 6 INCHES.
4. INSTALL END PLUG SEALS FIND NO. 6 IN UNUSED HOLES OF CONNECTORS FIND NO. 1 AND 3.
5. INTERPRET DRAWING PER MIL–STD–100.
6. REFERENCES:
   a) FOR WIRING DIAGRAM, SEE DRAWING 72–2205.
   b) FOR SCHEMATIC DIAGRAM, SEE DRAWINGS 72–2200 AND 72–2269.

MARKING COLOR	WIRE MARKING	TERMINATION FROM	FIND NO. REF.	TERMINATION TO	FIND NO. REF.	WIRE FIND NO. REF.	WIRE LENGTH
BLACK	X9CC16C	P8–A	3	P17–A	1	4	12.00
BLACK	X12CC16N	P8–B	3	P17–B	1	4	12.00
RED	P81A16	P8–C	3	P21–A	2	4	12.00
RED	P55GX16	P8–D	3	P21–B	2	4	12.00
BLACK	K105B16	P8–E	3	P17–E	1	4	12.00
BLACK	K107B16	P8–F	3	P17–F	1	4	12.00
BLACK	K110A16	P8–G	3	P17–G	1	4	12.00
BLACK	K106B16	P8–H	3	P17–H	1	4	12.00
BLACK	K111A16	P8–J	3	P17–J	1	4	12.00
BLACK	K114B16	P8–K	3	P17–K	1	4	12.00
BLACK	K115B16	P8–L	3	P17–L	1	4	12.00
BLACK	K32F16	P8–M	3	P17–M	1	4	12.00
BLACK	K103B16	P8–N	3	P17–N	1	4	12.00
BLACK	K108B16	P8–P	3	P17–P	1	4	12.00
BLACK	K109B16	P8–R	3	P170R	1	4	12.00
BLACK	K102B16	P8–S	3	P17–S	1	4	12.00
BLACK	K104B16	P8–T	3	P17–T	1	4	12.00
BLACK	K101B16	P8–U	3	P18–U	1	4	12.00
BLACK	K113A16	P17–C	1	P17–D	1	4	12.00

FIND NO.	SYM	CODE IDENT	DWG SIZE	PART OR IDENTIFYING NO.	QTY REQD	NOMENCLATURE OR DESCRIPTION	SPEC	MATERIAL
1				MS3106R22–14S	1	CONNECTOR, PLUG ELECT, P17		
2				MS3106R10SL–4S	1	CONNECTOR, PLUG, ELECT, P21		
3				MS3106R24–28B	1	CONNECTOR, PLUG, ELECT, P8		
4				M5086/2–16–9	AR	WIRE, ELECT, 16 AWG	MIL–W–5086/2	
5				MS3367–5–9	6	STRAP, CABLE, ADJUSTABLE		
6				MS25251–16	7	PLUG, END SEAL, ELECT, CONNECTOR		

Figure 3-97. Precise Relay Assebly to Governor Control Unit Wiring Harness, Drawing No. 72-2245 (Electro-Hydraulic Governor Equipped Precise Sets Only)



NOTES:
1. ALL SOLDERED CONNECTIONS SHALL BE IN ACCORDANCE WITH MIL–STD–454, REQUIREMENT 5.
2. INSTALL STRAPS, FIND NO. 4, AT 3.0 MAX INTERVALS.
3. WIRE MARKING TO BE IN ACCORDANCE WITH MIL–W–5088 EXCEPT THAT LENGTH BETWEEN GROUPS OF NUMBERS SHALL NOT EXCEED 6 INCHES.
4. INSTALL END SEAL PLUGS, FIND NO. 5 IN UNUSED HOLES OF CONNECTORS FIND NO. 1 AND 2.
5. INTERPRET DRAWING PER MIL–STD–100.
6. REFERENCES:
   a) FOR WIRING DIAGRAM, SEE DRAWING 72–2205.
   b) FOR SCHEMATIC DIAGRAM, SEE DRAWING 72–2200 AND 72–2269.

MARKING COLOR	WIRE MARKING	TERMINATION		TERMINATION		WIRE FIND NO.	WIRE LENGTH REF.
		FROM	FIND NO. REF.	TO	FIND NO. REF.		
BLACK	X9R16C	P31–A	1	P32–A	2	3	52.00
BLACK	X12S16N	P31–B	1	P32–B	2	3	52.00
RED	P61C16	P31–C	1	P32–C	2	3	52.00
RED	P55HH16	P31–D	1	P32–D	2	3	52.00
RED	P50U16	P31–E	1	P32–E	2	3	52.00
RED	P204C16	P31–F	1	P32–F	2	3	52.00
BLACK	K110C16	P31–G	1	P32–G	2	3	52.00
RED	P60D16	P31–H	1	P32–H	2	3	52.00
BLACK	K111C16	P31–J	1	P32–J	2	3	52.00
RED	P200F16	P31–K	1	P32–K	2	3	52.00
RED	P57K16	P31–L	1	P32–L	2	3	52.00
BLACK	K32D16	P31–M	1	P32–M	2	3	52.00
BLACK	K33D16	P31–N	1	P32–N	2	3	52.00
BLACK	L93E16	P31–P	1	P32–P	2	3	52.00
BLACK	K15K16	P31–R	1	P32–R	2	3	52.00
BLACK	K102C16	P31–S	1	P32–S	2	3	52.00
BLACK	K34D16	P31–T	1	P32–T	2	3	52.00
BLACK	K101C16	P31–U	1	P32–U	2	3	52.00
RED	P210C16	P31–V	1	P32–V	2	3	52.00
RED	P55R16	P31–Z	1	P32–Z	2	3	52.00

FIND NO.	SYM	CODE IDENT	DWG SIZE	PART OR IDENTIFYING NO.	QTY REQD	NOMENCLATURE OR DESCRIPTION	SPEC	MATERIAL
1				MS3106R24–28P	1	CONNECTOR, PLUG, ELECT. P31		
2				MS3106R24–28S	1	CONNECTOR, PLUG, ELECT, P32		
3				M5086/2–16–9	AR	WIRE , ELECT. 16 AWG	MIL–W–5086/2	
4				MS3367–5–9	16	STRAP, CABLE, ADJUSTABLE		
5				MS25251–16	8	PLUG, END SEAL, ELECT. CONNECTOR		

Figure 3-98. Special Relay Assembly to Precise Relay Assembly, Drawing No. 72-2238

Section X. MAINTENANCE OF CONVENIENCE AND PARALLELING RECEPTACLES AND WIRING HARNESS

3-79. GENERAL.

a. All models of the generator set are equipped with a 125 volt, 15 amp convenience receptacle. The receptacle is equipped with a spring loaded weather cover and protected by a 15 amp circuit breaker.

b. The paralleling receptacles permit interconnection of the voltage regulator assemblies of two or more generator sets for parallel operation. They are part of the convenience and paralleling receptacles wiring harness.

3-80. CONVENIENCE RECEPTACLE AND CIRCUIT BREAKER.

Refer to the Operator and Unit Maintenance Manual for convenience receptacle and circuit breaker maintenance instructions.

3-81. CONVENIENCE AND PARALLELING RECEPTACLES WIRING HARNESS.

a. Refer to the Operator and Unit Maintenance Manual for convenience and paralleling receptacles wiring removal, cleaning, inspection, and repair instructions.

b. If the wiring harness has sustained damage and requires repair or rebuild, refer to figure 3–99 for layout, identification, and material requirements and Appendix A for detailed soldering and replacement procedures.

c. Refer to the Operator and Unit Maintenance Manual for installation instructions for the wiring harness.

Section XI. MAINTENANCE OF LOAD CONNECTION GROUP

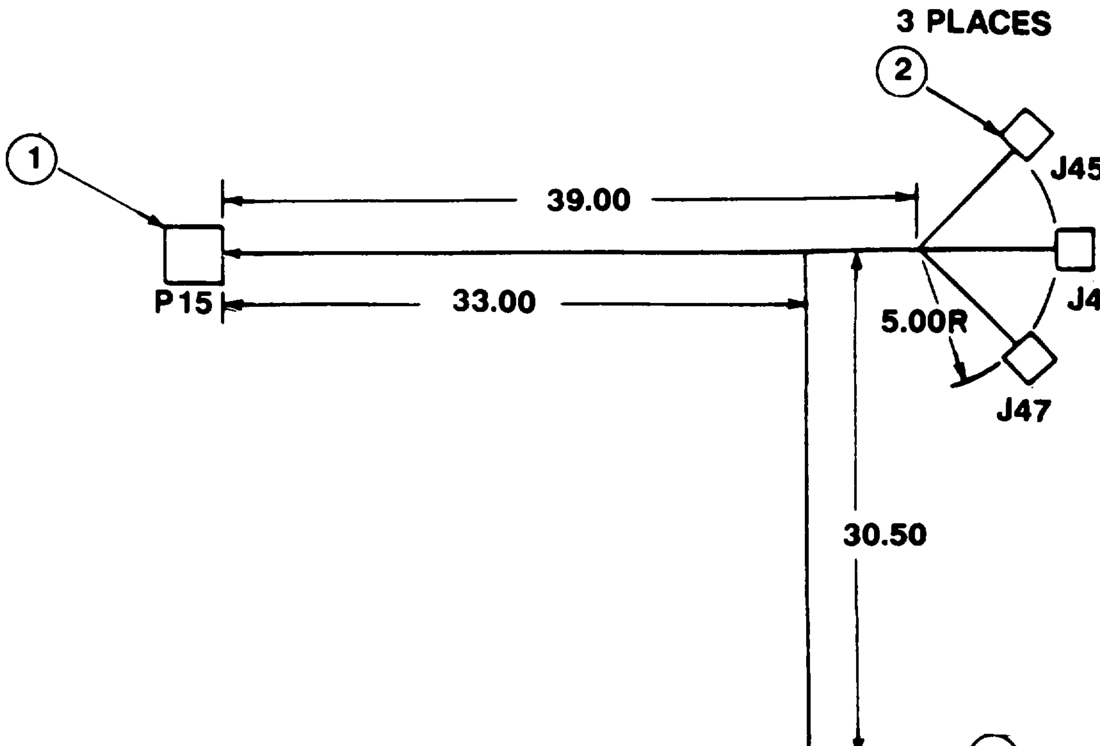
3-82. GENERAL.

a. The load connection group consists of the voltage reconnection board, the main load contactor, the load terminal board, the current transformers and the electromagnetic interference capacitor assembly.

b. The voltage reconnection board consists of a stationary terminal board and a movable link–type board. It provides a means of connecting the two coils of each phase of the generator assembly to provide all specified output voltages. Simultaneously, it reconnects all other circuits necessary to convert the generator set from 120/208 to 240/416 Vac operation.

c. The voltage reconnection board is connected to the load terminal board through a three-pole three-phase main load contactor. This contactor is controlled by the circuit breaker switch of the control cubicle assembly. The main load contacts will automatically open when any of the protective devices actuate or when the START–RUN-STOP switch is placed in the STOP position.

d. One lead of each of the two coils of each generator phase is connected directly to the voltage reconnection board. The remaining two leads of each phase pass through a three-window current transformer. The proportional current induced in the transformer is used by the static exciter and voltage regulator assembly as a current boost. The leads then pass through a second three-window transformer. The proportional current induced in this transformer is used in the load measuring unit and the ammeter and watt-meter circuit of the control cubicle. The leads of two of the generator phases then pass through a single-window crosscurrent transformer. The current induced in the crosscurrent transformer is used for reactive power compensation during parallel operation. Local voltage sensing and adjustment are accomplished across a single coil of the remaining phase.



WIRE MARKING	FROM	TERMINATION FIND NO. REF.	TO	FIND NO. REF.	WIRE FIND NO.	WIRE LENGTH REF.	WIRE MARKING COLOR
X96AA16	P15–A	1	J45–D	2	4	36.00	BLACK
X98AA16	P15–B	1	J45–C	2	2	36.00	BLACK
K111AA16	P15–C	1	J45–B	2	4	36.00	BLACK
K112AA16	P15–D	1	J45–A	2	4	36.00	BLACK
X96BB16	P15–E	1	J46–D	2	4	36.00	BLACK
X98BB16	P15–F	1	J46–C	2	4	36.00	BLACK
K111BB16	P15–G	1	J46–B	2	4	36.00	BLACK
K112BB16	P15–H	1	J46–A	2	4	36.00	BLACK
X96CC16	P15–J	1	J47–D	2	4	36.00	BLACK
X98CC16	P15–K	1	J47–C	2	4	36.00	BLACK
K111CC16	P15–L	1	J47–B	2	4	36.00	BLACK
K112CC16	P15–M	1	J47–A	2	4	36.00	BLACK
X12GG16	P15–P	1	J55–S	3	4	56.00	BLACK
X9GG16	P15–S	1	CB3–1	3	4	56.00	BLACK
X100A16	CB3–2	2	J55–C	3	4	14.00	BLACK

FIND NO.	SYM	CODE IDENT	DWG SIZE	PART OR IDENTIFYING NO.	QTY REQD	NOMENCLATURE OR DESCRIPTION	SPEC	MATERIAL
1				MS3106R20–29P	1	CONNECTOR, ELECTRICAL P15		
2				MS3102R18–4P	3	CONNECTOR, ELECTRICAL J46, J47, J45		
3				MS25036–153	4	TERMINAL, LUG, NO. 8 STUD NO.16 AWG		
4				M5086/2–16–9	AR	WIRE, ELECTRICAL 16 AWG	MIL–W–5086/2	
5				M23053/5–105–0	9"	INSULATION SLEEVING	MIL–I–25053/5	
6				MS3367–5–9	AR	STRAP, CABLE ADJUSTABLE		
7				MS25251–16	3	END SEAL PLUG		

Figure 3-99. Convenience and Paralleling Receptacles Wiring Harness, Drawing No. 72-2286

e. There is a bypass capacitor connected from each of the output terminals to ground in order to prevent electromagnetic interference. The capacitors are mounted on a bracket just below the load terminal board.

3-83. VOLTAGE RECONNECTION BOARD ASSEMBLY.

Refer to the Operator and Unit Maintenance Manual for voltage reconnection board assembly removal, maintenance, and installation procedures.

3-84. MAIN LOAD CONTACTOR.

Two types of contractors are used interchangeably. The following material covers both types. Determine which type is to be repaired by referring to the applicable text and illustrations to follow and proceed accordingly.

a. Removal (Type A).

(1) Remove screws (1, figure 3-100), Iockwashers (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.

b. Removal (TypeB).

(1) Remove screws (3, figure 3-101), Iockwashers (4), and flat washers (5) to remove shields (6).

(2) Tag and disconnect electrical leads to terminals.

(3) Disconnect wiring harness connector from main load contactor connector.

(4) Remove four nuts and screws to remove contactor subassembly (7).

c. Disassembly Type A.

WARNING

Solvent, Dry Cleaning P–D-680, Type II is flammable and moderately toxic to skin, eyes and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate. Failure to observe this warning could result in servere personal injury or death.

WARNING

Compressed air used for cleaning and drying purposes can create airborne particles that may enter the eyes. Pressure shall not exceed 30 psig and use only the adequate chip guards and chipping goggles. Failure to observe this warning could result in servere personal injury or death.

(1) (Type A). Thoroughly clean the exterior of the contactor with a clean, lint-free cloth moistened with solvent P-D-680 Type II. Blow dust and dirt from crevices with compressed air.

(2) Remove Screws (7, figure 3-100), and Iockwashers (8),

(3) Remove screws (9), Iockwashers (10), flatwashers (11), cover assembly (12), base gasket (13), and receptacle gasket (14) from housing (15).

(4) Remove screws (16), Iockwashers (17), flatwashers (18), chamber base (19), arc chamber gasket (20).

(5) Remove nut (21) Iockwasher (22), and main contactor assemblies (23),

(6) Remove retaining ring (24), main contactor operator (31), shim (26), locating bushing (27), contact spring (28), shim (29) and shim (30) from bridge assembly (25).

(7) Remove nut (39), Iockwasher (40), terminal washer (41).

(8) Remove screw (42), Iockwasher (43), adjusting bushing (44), and actuator& connector assembly (45).

(9) Remove nut (35), Iockwasher (36), flatwasher (37), and connector assembly (38).

(Io) Remove arc chute (32), grommet (33), and arc chute spacer (34) from main base (46)

(11) Remove screw (47), Iockwasher (48), auxiliary contact assembly (54) from connector& wire assembly (55).

(12) Remove screw (49), Iockwasher (50), Iockwasher (51), cable clamp (52) and auxiliary contact assemably (53 and 54).

(13) Remove nut (56), Iockwasher (57), flat washer (58), screw (59) to remove bracket assembly (60).

(14) Remove screws (61), Iockwashers (62) and economizing switch (63).

(16) Remove screws (64), Iockwasher (65), flat washer (66) and switch bracket (67).

(17) Remove nut (68), Iockwasher (69), guide rod (70), nut (71), Iockwasher (72), auxiliary operator (73), and return spring (74).

(18) Remove nut (75), Iockwasher (76) and terminal (77).

(19) Remove spacer (78), core and rod (79).

(20) Remove screw (80), Iockwasher (81) and flatwasher (82).

(21) Remove core and frame (83), coil washer (84), coil (85) and end plate (86).

NOTE

Observe the following precautions before disassembling type B contactor, figure 3-101.

1. Do not loosen or remove screws (51) or (74). Keeping the relationship of base (37), frame (76) and frames (80) and (81) intact facilitates re-assembly.
2. When disassembling movable contact assemblies (items 39,40,41,49,48,45,43, 53), note arrangement of metallic washers (53) on each stud (70) and rod (68) (contacts A, B and C) so that they can be reassembled in the same order.

d. Disassembly Type B.

(1) Remove identification plate (1, Figure 3-101).

(2) Remove wiring diagram plate (2).

(3) Remove screw (3), Iockwasher (4), flatwasher (5) and shield (6).

(4) Remove contactor subassy (7).

(5) Remove screw (8), Iockwasher (9).

(6) Remove screw (10), Iockwasher (11) and screw (12).

(7) Remove screws (13), lockwasher (14), from cover (15).

(8) Remove Switch-Connector assy (16), Aux switch (17 and 18).

(9) Remove connector (19) and gasket (20).

(10) Remove locking spacer (21), Iockwasher (22), flatwasher (23), Chamber (24), and gasket (25).

(11) Remove nut (26), lockwasher (27), flatwasher (28), and base assembly (29).

(12) Remove flatwasher (32 and 33), nut (34), insert (36) from base (37).

(13) Remove nut (39), Iockwasher (40), flatwasher (41), spacer (42), bushings (43 and 44) and bridge assembly (45).

(14) Remove spring (48), bushing (49), arc-chute (50).

(15) Remove screw (51), Iockwasher (52), metallic washer (53), insulation (54), and detent (55).

(16) Remove solenoid assembly (64), moveable core-rod assembly (65), core assembly (69), frame assemby (73), and micro switch assembly (84).

e. Cleaning Inspection and Repair (Type A.)

(1) Clean all parts with a clean lint-free cloth moistened with solvent P-D-680 Type Il.

(2) Check terminal covers (4) and housing (15) for cracks, breaks, and other damage.

(3) Inspect chamber base (19), main base (46), and main contact operator (31) for cracks, breaks, and other damage.

(4) Inspect bridge assembly (25) for pitting, corrosion, and other damage.

(5) Inspect contact assembly (38) for burns, corrosion, melting and other damage.

(6) Inspect auxiliary operator (73) for cracks.

(7) Check core and rod (79), core and frame (83), bracket assembly (60), and end plate (86) for cracks, breaks, and other damage.

(8) Check coil (85) for swelling of encapsulated materials, burns, and evidence of corrosion. Using an ohmmeter, check coil for continuity.

(9) Check economizing switch (63) for cracks, corrosion, burns, and evidence of shorting.

(10) Check contacts of contact assemblies (53 and 54) for corrosion, pitting, burns, and other damage.

(11) Check connector and wire assembly for cracks, stripped or otherwise damaged threads, burned or chaffed insulation, bare wires and other damage. Refer to Appendix A references to solder or repair wire and connector damage.

(12) Check all threads for crossing, stripping, peening, and other damage.

(13) Discard gaskets (20, 14, and 13) and spacer (78).

(14) Repair minor threat damage to parts using thread chaser. Discard hardware with thread damage.

(15) Remove minor pitting from contact surfaces of bridge assemblies with fine grit abrasive paper or a fine file. Replace bridge assemblies if deeply pitted.

(16) Replace any parts found defective or damaged beyond repair.

e. Cleaning Inspection and Repair (Type A and B.)

(1) Clean all components with cloth dampened in cleaning solvent, Federal Specification P-D-680.

(2) Inspect all components for insecure mounting, loose electrical connections, cracks, corrosion and evidence of shorting or other damage.

(3) Replace any parts found defective or damaged beyond repair.

f. Assembly (Type A).

(1) Assemble core and frame (83), coil washer (84), and coil (85).

(2) Install end plate (86) and loosely install flat washers (82), Iockwashers (81) and screws (80).

(3) Secure terminals (77) to auxiliary operator (73) with Iockwashers (76) and nuts (75).

(4) Install adhesive back spacer (78) (adhesive side up) over core and rod (79).

(5) Secure core and rod to auxiliary operator with nut (71) and Iockwasher (72).

(6) Insert guide rods (70) through auxiliary operator (73) and install return springs (74).

(7) Thread guide rods into core and frame (83) until a sufficient length extends out the bottom to loosely install Iockwashers (69) and nuts (68).

(8) Install the economizing switch (63) onto bracket (67) and secure with Iockwashers (62) and screws (61).

(9) Loosely secure bracket (67) to core and frame (83) with flat washers (66), Iockwashers (65) and screws (64).

(10) Fit bracket (60) over economizing switch and secure to auxiliary operator (73) with screw (59), flat washer (58), Iockwasher (57), and nut (56).

(11) Adjust assembled actuator assembly as follows: (See figure 3-102)

(a) Install a suitable clamp across points (A) and (B) of actuator assembly. Tighten clamp sufficiently to insure that no air gap exists at points (C) and (D).

(b) Tighten loosely installed screws (1).

(c) Remove clamp.

(d) Insert a 0.150 ± 0.010 inch feeler gauge into the movable core gap.

(e) Adjust guide rods (2) until the gauge is snug throughout the perimeter.

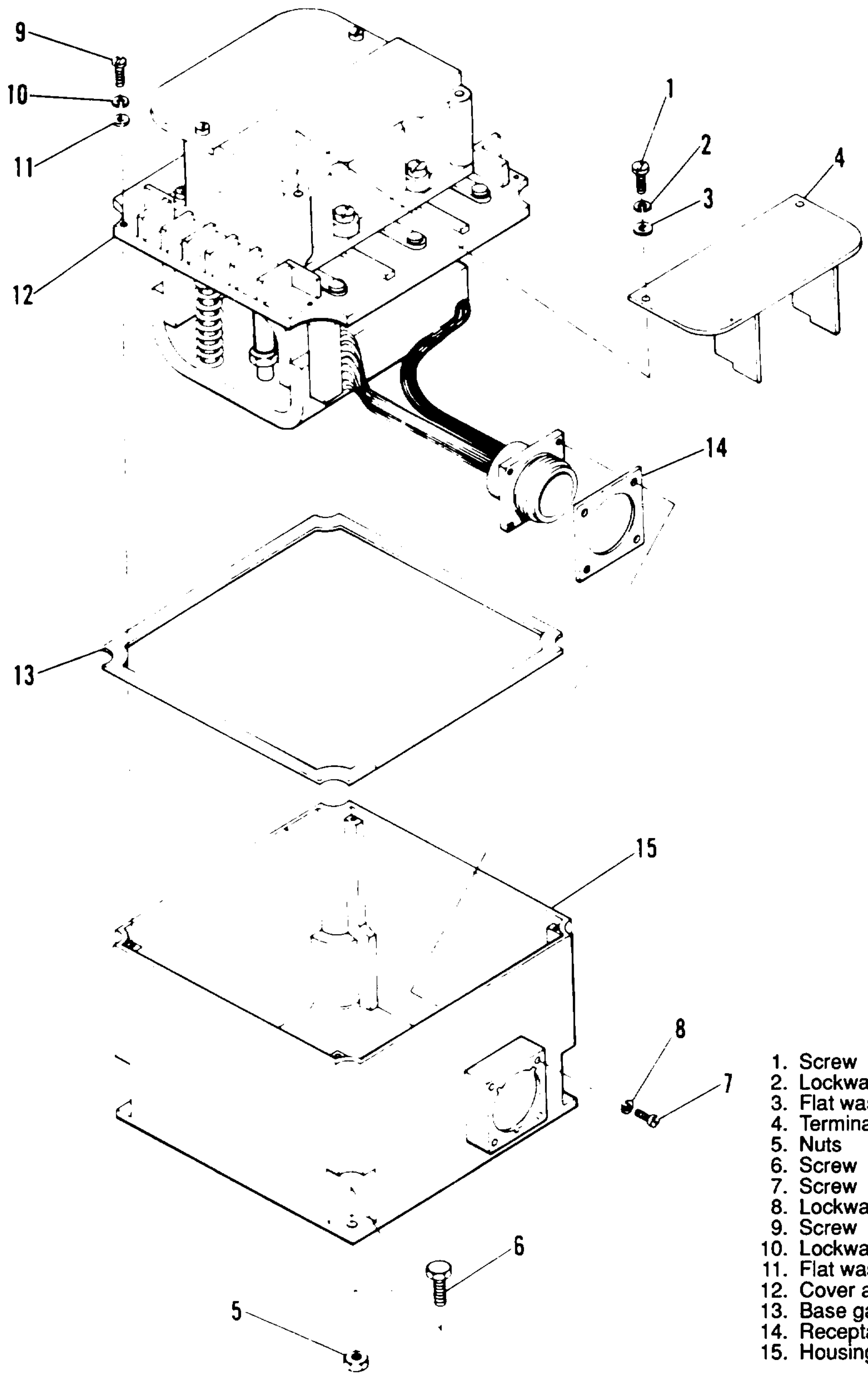
(f) Secure the adjustment by tightening loosely installed nuts (3).

(12) Install contact assemblies (54 and 53, figure 3-100) and cable clamp (52) and secure with flat washer (51), Iockwasher (50), screw (49), Iockwashers (48), and screws (47).

(13) Secure contact assemblies (38) to main base (46) with flat washers (37), Iockwashers (36), and nuts (35). Install terminal washers (41), Iockwashers (40) and nuts (39).

(14) Install grommets (33), spacers (34), and arc chutes (32).

(15) Install shims (30 and 29), springs (28), bushings (27), and shims (26) onto bridge assemblies (25). Secure bridge assemblies to main contact operator (31) with retaining rings (24).



1. Screw
2. Lockwashser
3. Flat washer
4. Terminal cover
5. Nuts
6. Screw
7. Screw
8. Lockwasher
9. Screw
10. Lockwasher
11. Flat washer
12. Cover assembly
13. Base gasket
14. Receptacle gasket
15. Housing

Figure 3-100. Main Load Contactor (Type A), Exploded View (Sheet 1 of 3)

16. Screw
17. Lockwasher
18. Flat washer
19. Chamber base
20. Arc chamber gasket
21. Nut
22. Lockwasher
23. Main contact assy
24. Retaining ring
25. Bridge assy
26. Shim
27. Locating bushing
28. Contact spring
29. Shim
30. Shim
31. Main contact operator
32. Arc chute
33. Grommet
34. Arc chute spacer
35. Nut
36. Lockwasher
37. Flat washer
38. Contact assembly
39. Nut
40. Lockwasher
41. Terminal washer
42. Screw
43. Lockwasher
44. Adjusting bushing
45. Actuator & connector assembly
46. Main base

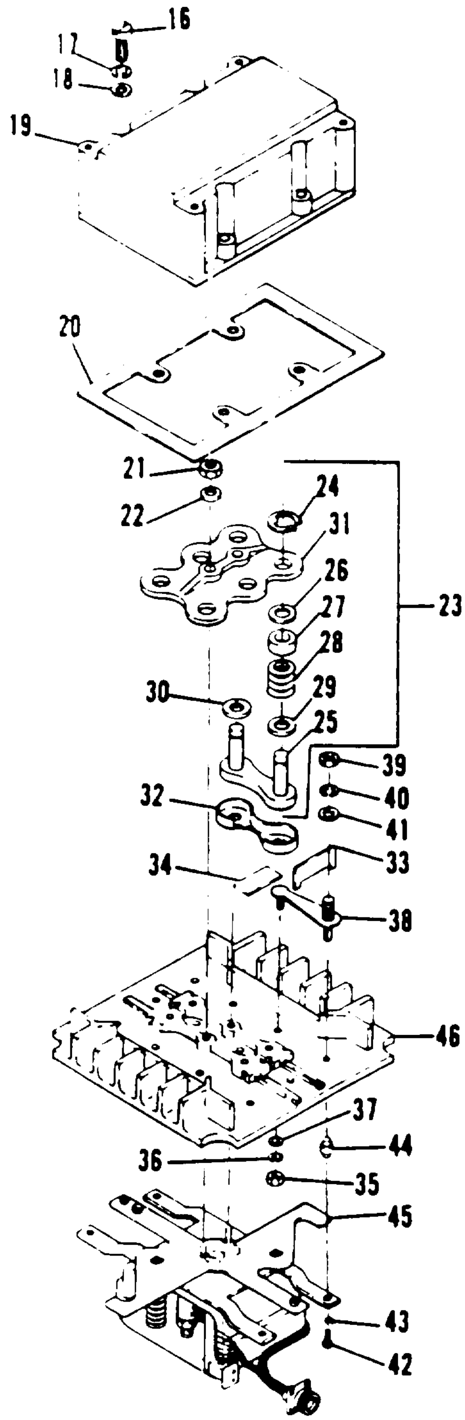
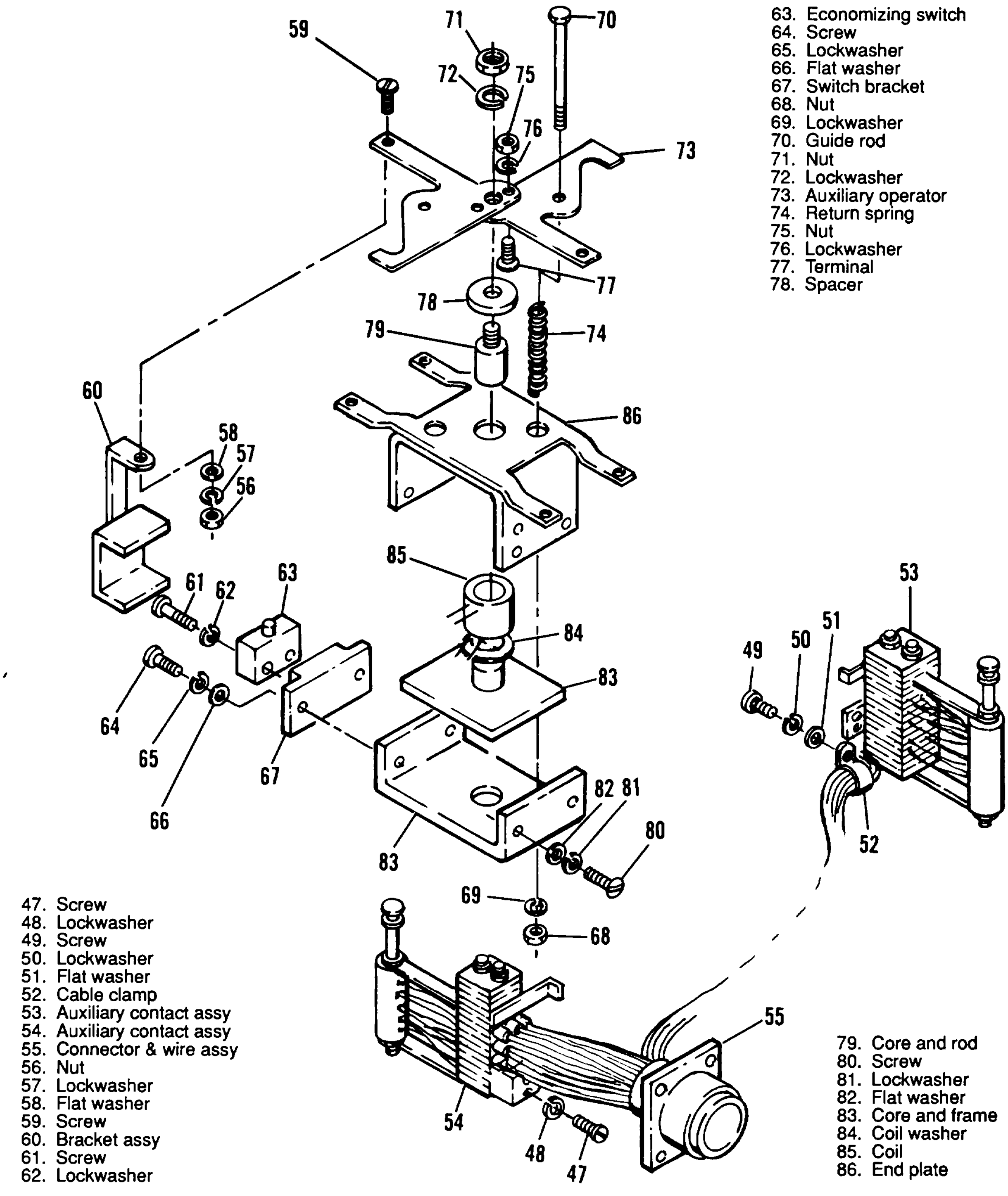


Figure 3-100. Main Load Contactor (Type A), Exploded View (Sheet 2 of 3)

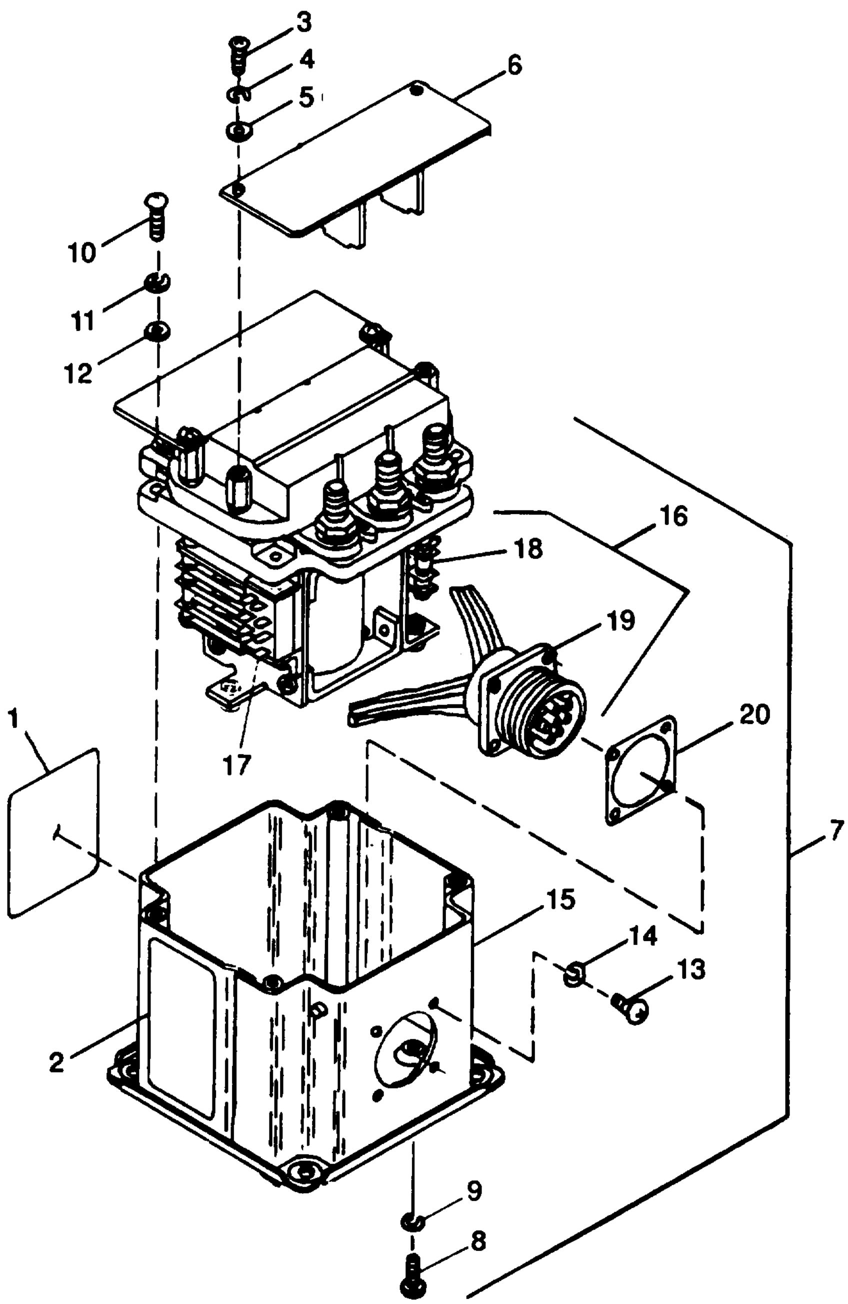


63. Economizing switch
64. Screw
65. Lockwasher
66. Flat washer
67. Switch bracket
68. Nut
69. Lockwasher
70. Guide rod
71. Nut
72. Lockwasher
73. Auxiliary operator
74. Return spring
75. Nut
76. Lockwasher
77. Terminal
78. Spacer

47. Screw
48. Lockwasher
49. Screw
50. Lockwasher
51. Flat washer
52. Cable clamp
53. Auxiliary contact assy
54. Auxiliary contact assy
55. Connector & wire assy
56. Nut
57. Lockwasher
58. Flat washer
59. Screw
60. Bracket assy
61. Screw
62. Lockwasher

79. Core and rod
80. Screw
81. Lockwasher
82. Flat washer
83. Core and frame
84. Coil washer
85. Coil
86. End plate

Figure 3-100. Main Load Contactor (Type A), Exploded View (Sheet 3 of 3)



1. Identification plate	8. Screw	15. Cover
2. Wiring diagram plate	9. Lock washer	16. Switch–Connector assy
3. Screw	10. Screw	17. Aux switch
4. Lock washer	11. Lock washer	18. Aux switch
5. Flat washer	12. Flat washer	19. Connector
6. Shield	13. Screw	20. Gasket
7. Contactor subassy	14. Lock washer	

Figure 3-101. Main Load Contactor Type B (Sheet 1 of 3)

21. Locking spacer
22. Lock washer
23. Flat washer
24. Chamber
25. Gasket
26. Nut
27. Lock washer
28. Flat washer
29. Base assy
30. Screw
31. Lock washer
32. Flat washer
33. Flat washer
34. Nut
35. Bus bar
36. Insert
37. Base
38. Gasket
39. Nut
40. Lock washer
41. Flat washer
42. Spacer
43. Bushing
44. Bushing
45. Bridge assy
46. Housing
47. Bridge
48. Spring
49. Bushing
50. Arc chute
51. Screw
52. Lock washer
53. Metallic washer
54. Insulation
55. Detent

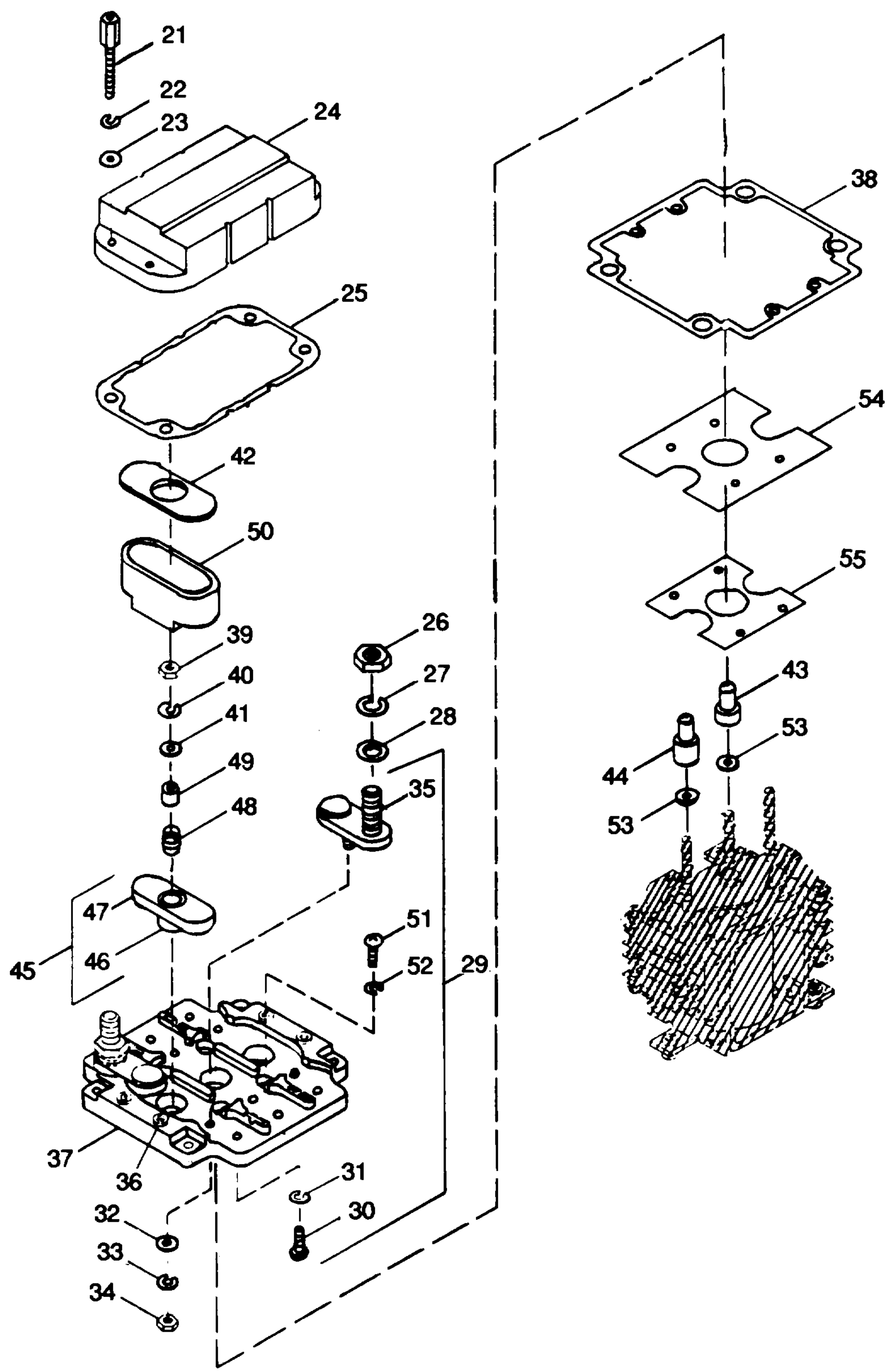
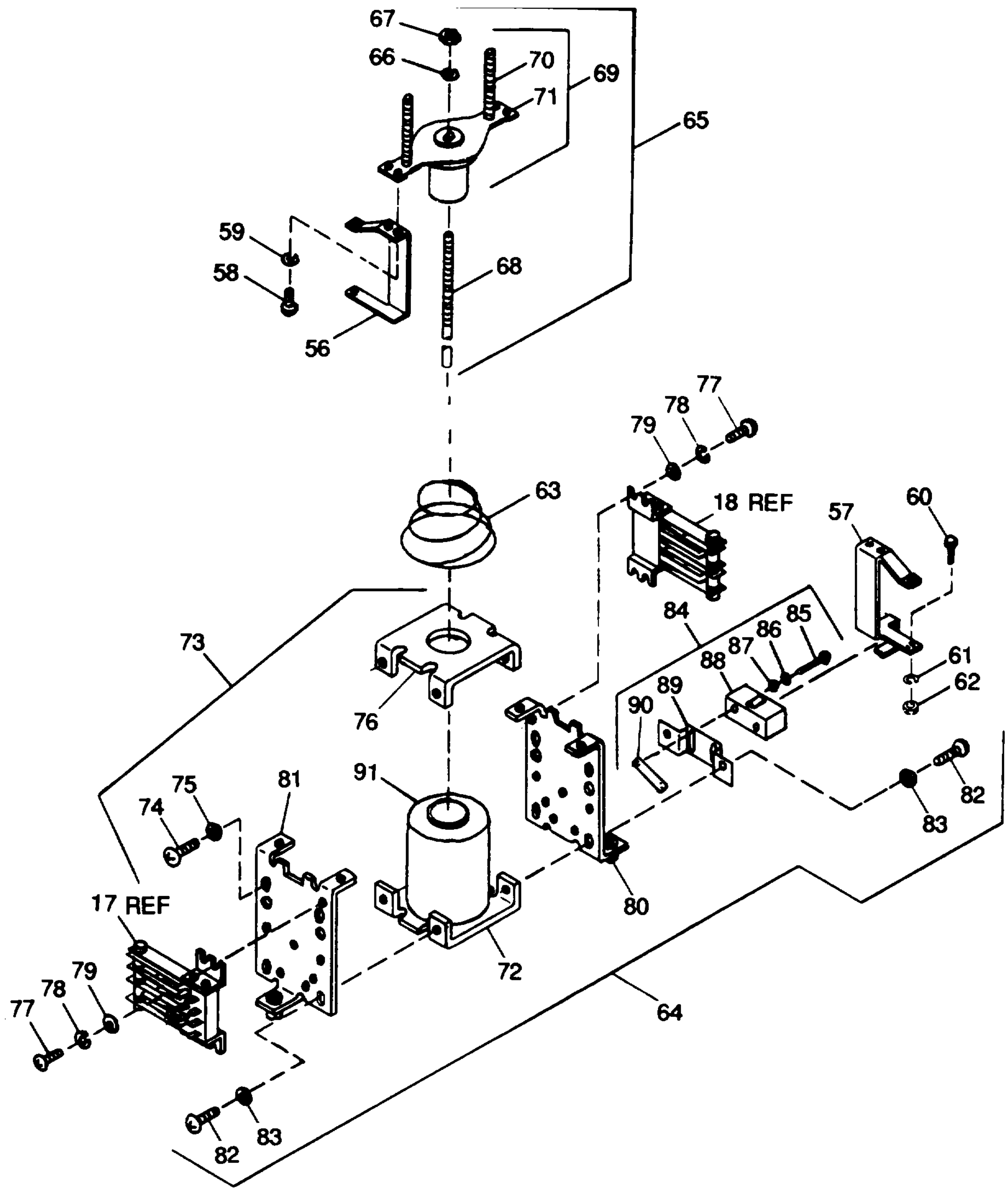


Figure 3-101. Main Load Contactor (Sheet 2 of 3)



56. Operator	68. Rod	80. Frame
57. Operator	69. Core assy	81. Frame
58. Screw	70. Stud	82. Screw
59. Lock washer	71. Operator	83. Flat washer
60. Screw	72. Frame–core assy	84. Micro switch assy
61. Lock washer	73. Frame assy	85. Screw
62. Nut	74. Screw	86. Lock washer
63. Spring	75. Flat washer	87. Flat washer
64. Solenoid subassy	76. Frame	88. Switch
65. Movable core–rod assy	77. Screw	89. Bracket
66. Lock washer	78. Lock washer	90. Plate
67. Nut	79. Flat washer	91. Coil

Figure 3-101. Main Load Contactor (Sheet 3 of 3)

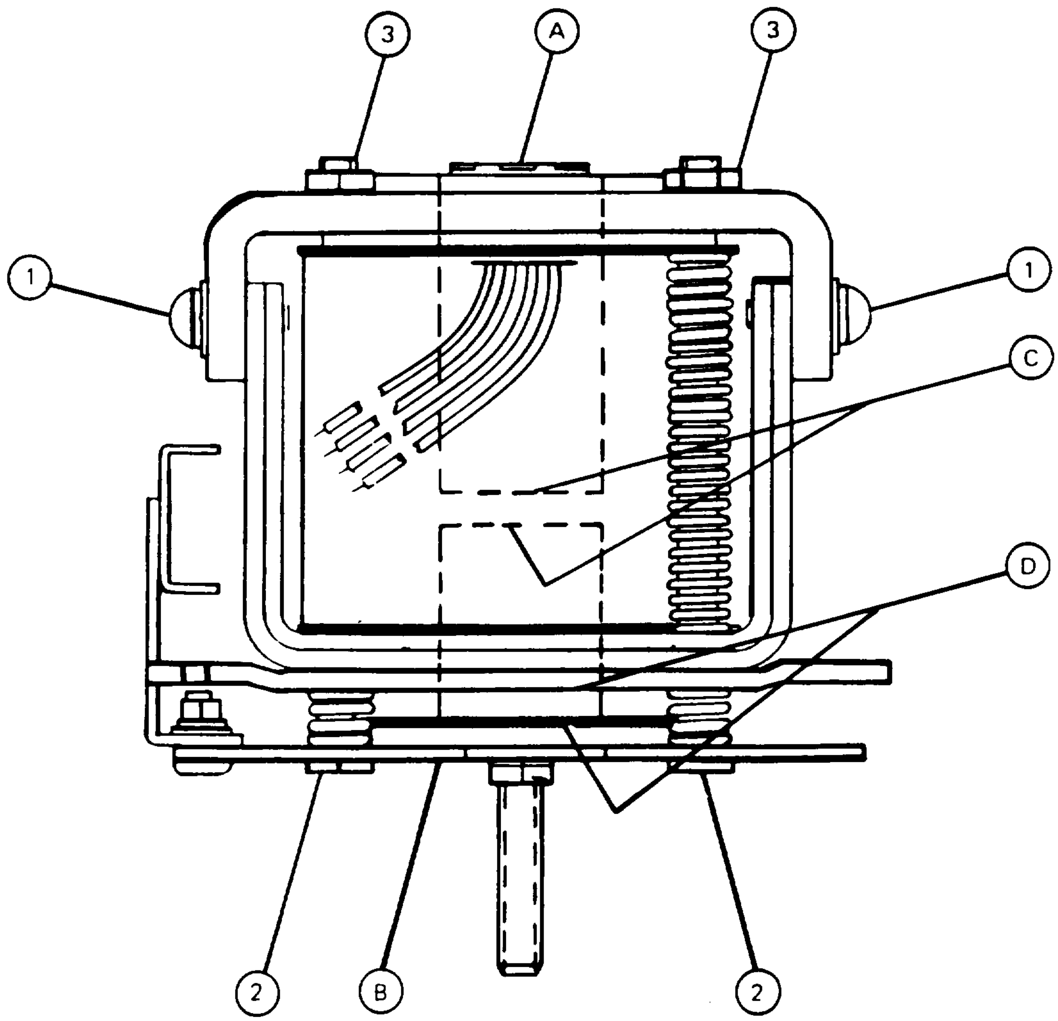


Figure 3-102. Actuator Assembly Adjustment Points (Type A)

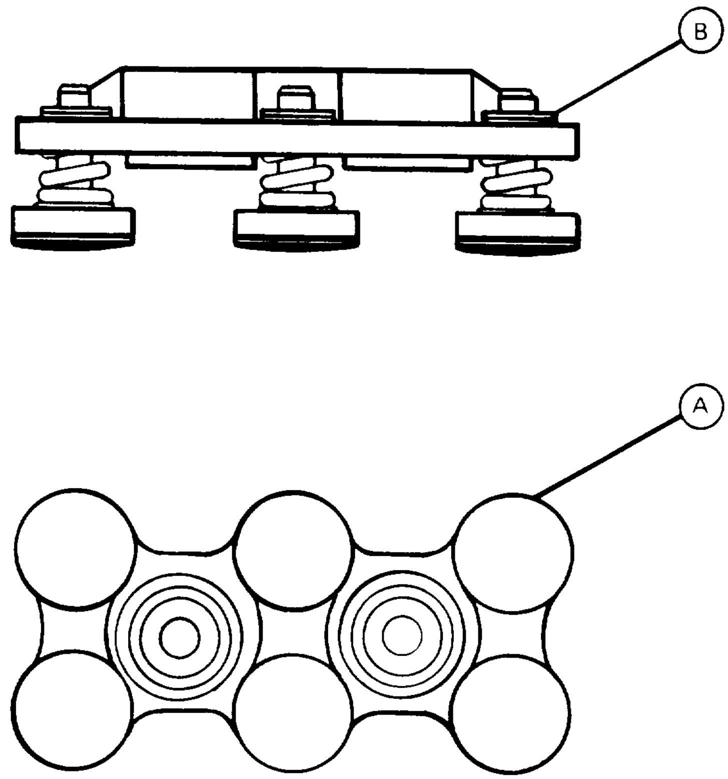


Figure 3-103. Main Contact Preload Check Points (Type A)

(16) Check preload of each contact as follows: (See figure 3-103.)

NOTE

Preload is checked by the initial breakaway of retaining ring (point (B)).

(a) Using a force gauge, check each individual contact at its edge (point (A)). Preload should be 1.5 to 2.5 pounds.

(b) If preload is not as specified, add or subtract shims (26, 29, and 30, figure 3-100).

(17) Install actuator and connector assembly (45, figure 3-1 00) onto main base (46) and secure with bushing (44), Iockwashers (43) and screws (42).

(18) Install main contact assembly (23) and secure with Iockwashers (22) and nuts (21). Adjust contact over travel as follows: (See figure 3–104.)

(a) Attach an ohmmeter to terminals A1-A2 and C1-C2.

(b) Insert a 0.035 inch feeler gauge into core gap (point A).

(c) Energize coil by applying 24 Vdc across connector pins A and B (See figure 3-105).

(d) Adjust carrier bushing at point (B) (Figure 3-104) until continuity is indicated at terminals A1-A2 and C1-C2.

(e) Secure adjustment by tightening nuts (1).

(f) Recheck for continuity at a clearance of 0.035 inch and for open circuit at 0.040 inch.

(19) Adjust economizing switch as follows: (See figure 3-104).

(a) Move loosely installed bracket (3) to transfer switch.

(b) Check that the switch button is fully depressed, and allow 0.0l inch clearance between the switch button and the top operator (point (C)).

(c) lnsert a 0.010 inch feeler gauge into the core gap (point (A)).

(d) Apply 24 Vdc to connector pins A and B (See figure 3-105).

(e) Bend the tab (point D, figure 3-104) of bracket toward the switch until the switch actuates.

(f) Remove 24 Vdc, and then apply it again to insure that the switch actuates properly.

(9) Remove 24 Vdc and replace 0.010 inch feeler gauge with 0.018 inch feeler gauge.

(h) Apply 24 Vdc again to check that the switch does not transfer.

(i) Readjust if necessary.

(20) Adjust auxiliary contacts as follows: (See figure 3-104.)

(a) Loosen nuts (4) and position lift comb (5) so that the deflection on the guide leaf springs (6) is nearly equal in the energized and deenergized positions.

(b) Secure adjustment by tightening nuts (4).

(c) Insert a 0.018 inch feeler gauge between the guide rod head and the operator (point E).

(d) Using an ohmmeter to determine continuity, adjust the stationary contacts of the normally closed contacts until they just touch the movable contacts (see figure 3-105) for contact positions).

(e) Replace the 0.018 inch feeler gauge with a 0.025 inch feeler gauge and recheck for open circuit of normally closed contacts. Readjust if necessary.

(f) Insert 0.018 inch feeler gauge in core gap.

(9) Apply 24 Vdc to connector pins A and B.

(h) Using an ohmmeter to determine continuity, adjust the stationary contacts of the normally open contacts.

(i) Replace the 0.018 inch feeler gauge with a 0.025 inch feeler gauge by removing and reapplying 24 Vdc. Recheck for open circuit of normally open contacts. Readjust if necessary.

(21) Install chamber base (19, figure 3-100) and gasket (20) and secure with flat washers (18), Iockwashers (17) and screws (16).

(22) Install cover assembly (12) with receptacle gasket (14) and base gasket (13) onto housing (15) and secure with flat washers (11), Iockwashers (10), screws (9), Iockwashers (8), and screws (7).

g. Assembly (Type B). See figure 3–101 and reassemble the main load contactor in reverse order of disassembly, observing the following:

(1) Actuator Assembly.

(a) Leave screws (82) loose.

(b) Place a clamp across frame (76) and frame core-assembly (72). Tighten clamp until the inner surfaces of (72) and (76) are parallel and 56.3 mm apart.

(c) Fasten screws (82).

(d) Remove clamp.

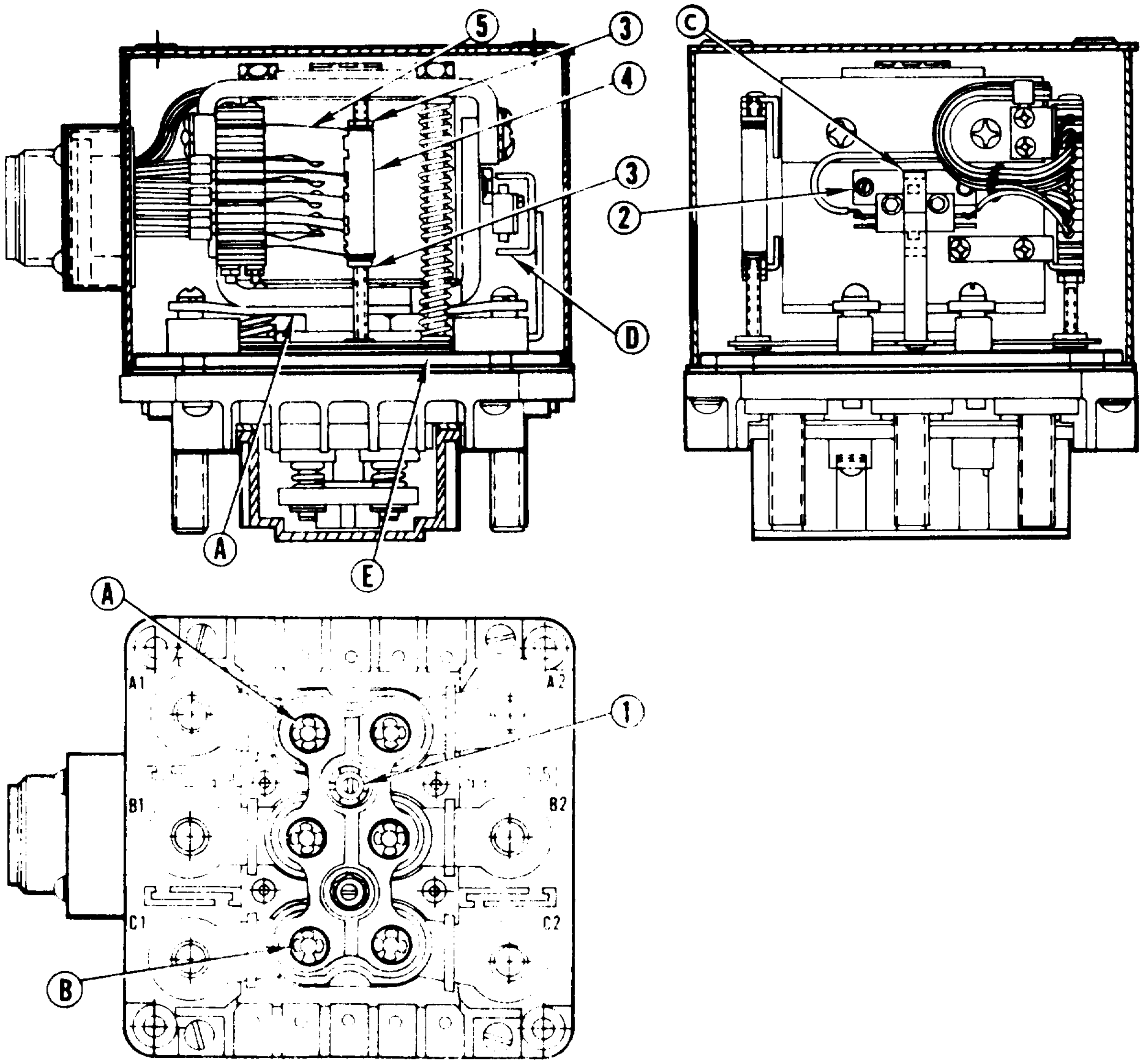


Figure 3-104. Main Load Contactor Adjustments (Type A)

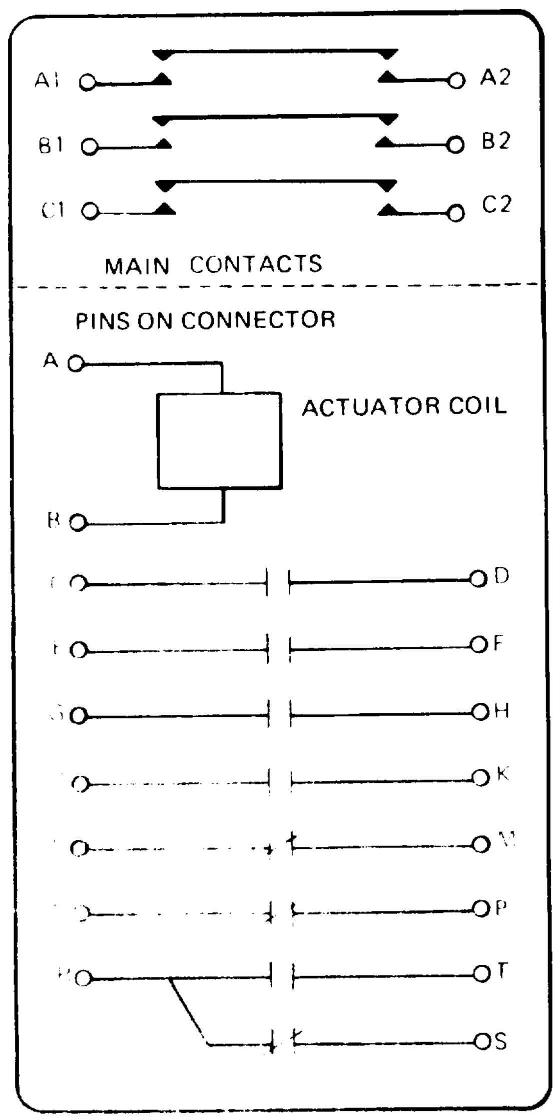
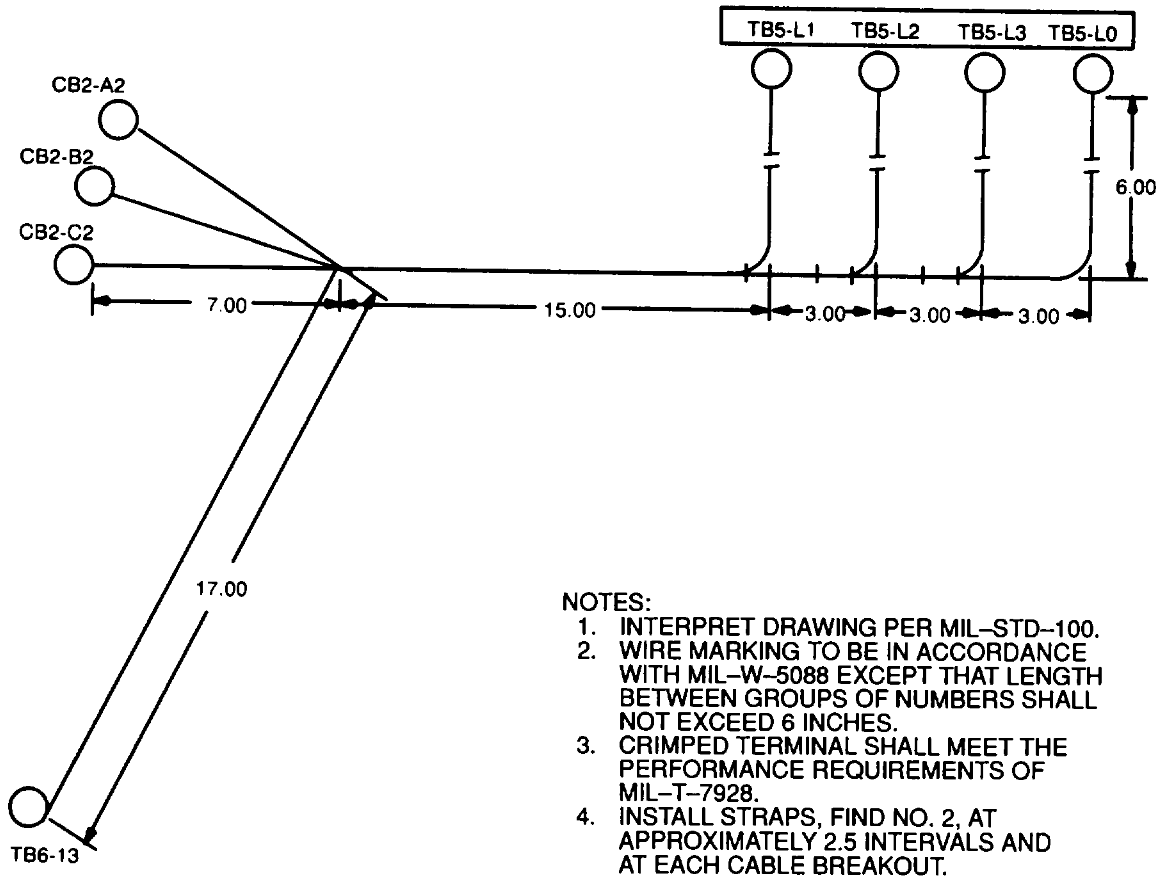


Figure 3-105. Main Load Contactor Schematic Diagram, Contactor to Load Terminals Wiring Harness, Dwg. No. 72-2290, and Contactor to Reconnection Board Wiring Harness, Dwg. No. 72-2225 (Sheet 1 of 3)

DASH NO.	WIRE MARKING	TERMINATION FROM	TERMINATION FIND NO. REF.	TERMINATION TO	TERMINATION FIND NO. REF.	WIRE FIND NO.	WIRE LENGTH REF.
–1 (15 KW)	X21R8A	CB2–A2	1	TB5–L1	4	3	28.00
	X22R8A	CB2–B2	1	TB5–L2	4	3	31.00
	X23R8A	CB2–C2	1	TB5–L3	4	3	34.00
	X13A8N	TB6–13	1	TB5–L0	4	3	47.00
–2 (30 KW)	X21R4A	CB2–A2	5	TB5–L1	7	6	28.00
	X22R4A	CB2–B2	5	TB5–L2	7	6	31.00
	X23R4A	CB2–C2	5	TB5–L3	7	6	34.00
	X13A4N	TB6–13	5	TB5–L0	7	6	47.00



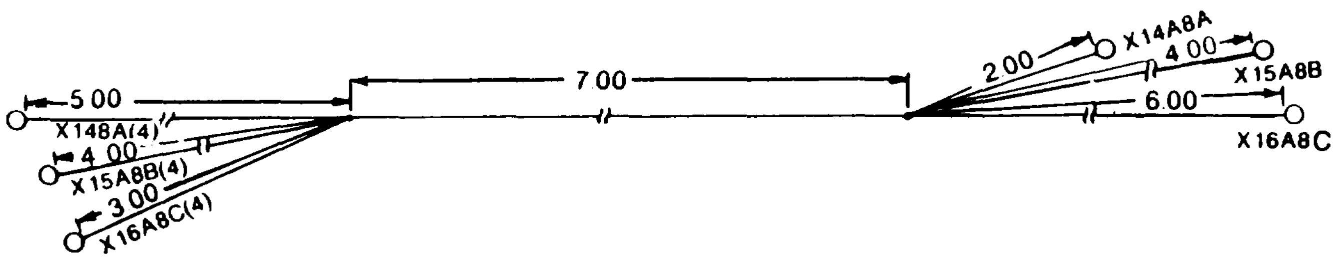
NOTES:
1. INTERPRET DRAWING PER MIL–STD–100.
2. WIRE MARKING TO BE IN ACCORDANCE WITH MIL–W–5088 EXCEPT THAT LENGTH BETWEEN GROUPS OF NUMBERS SHALL NOT EXCEED 6 INCHES.
3. CRIMPED TERMINAL SHALL MEET THE PERFORMANCE REQUIREMENTS OF MIL–T–7928.
4. INSTALL STRAPS, FIND NO. 2, AT APPROXIMATELY 2.5 INTERVALS AND AT EACH CABLE BREAKOUT.

FIND NO.	SYM	CODE IDENT	DWG SIZE	PART OR IDENTIFYING NO.	QTY REQD	NOMENCLATURE OR DESCRIPTION	SPEC	MATERIAL
1				MS25036–118	AR	TERMINAL, LUG, 8 AWG, 3/8 HOLE		
2				MS3367–5	AR	STRAP, TIEDOWN, ADJUSTABLE		
3				MS5086/2–8–9	AR	WIRE, ELECT, 8 AWG, WHITE	MIL–W–5086/2	
4				MS20659–142	AR	TERMINAL, LUG, 8 AWG, 1/2 HOLE		
5				MS25036–125	AR	TERMINAL, LUG, 4 AWG, 3/8 HOLE		
6				M5086/2–4–9	AR	WIRE, ELECT, 4 AWG WIRE	MIL–W–5086/2	
7				MS20659–145	AR	TERMINAL, LUG, 4 AWG. 1/2 HOLE		

B. Contactor to Load Terminals Wiring Harness, Dwg. No. 72–2290

Figure 3–105. Main Load Contactor Schematic Diagram, Contactor to Load Terminals Wiring Harness, Dwg. No. 72–2290, and Contactor to Reconnection Board wiring Harness, Dwg. No. 72-2225 sheet 2 of 3)

DASH NO.	WIRE MARKING	TERMINATION FROM	TERMINATION FIND NO. REF.	TERMINATION TO	TERMINATION FIND NO. REF.	WIRE FIND NO.	WIRE LENGTH REF.	MARKING COLOR
–1 (15 KW)	X14A8A	TB6–1	3	CB2–A1	3	2	14.00	BLACK
	X15A8B	TB6–2	3	CB2–B1	3	2	15.00	BLACK
	X16A8C	TB6–3	3	CB2–C1	3	2	16.00	BLACK
–2 (30 KW)	X14A4A	TB6–1	4	CB2–A1	4	1	14.00	BLACK
	X15A4B	TB6–2	4	CB2–B1	4	1	15.00	BLACK
	X16A4C	TB6–3	4	CB2–C1	4	1	16.00	BLACK



NOTES:
INTERPRET DRAWING PER MIL-STD–100.
1. ALL SOLDERED CONNECTIONS SHALL BE IN ACCORDANCE WITH MIL-STD-454, REQUIREMENT 5.

3. INSTALL STRAPS, FIND NO. 5, AT 3.0 MAXIMUM INTERVALS AND AT EACH CABLE BREAKOUT.
4. WIRE MARKING TO BE IN ACCORDANCE WITH MIL-W-5088 EXCEPT THAT LENGTH BETWEEN GROUPS OF NUMBERS SHALL NOT EXCEED 6 INCHES.
5. CRIMPED TERMINAL SHALL MEET THE PERFORMANCE REQUIREMENTS OF MIL–T–7928.
6. REFERENCES:
a. FOR WIRING DIAGRAM SEE 72-2205.
b. FOR SCHEMATIC DIAGRAM SEE 72-2200 AND 72-2269 FOR PRECISE AND 72-2295 AND 72-2277 FOR UTILITY.

FIND NO.	SYM	CODE IDENT	DWG SIZE	PART OR IDENTIFYING NO.	QTY REQD	NOMENCLATURE OR DESCRIPTION	SPEC	MATERIAL
1				M5086/2–4–9	AR	WIRE, ELECT, 4 AWG, WHITE	MIL–W–5086/2	
2				MS5086/2–8–9	AR	WIRE, ELECT, 8 AWG, WHITE	MIL–W–5086/2	
3				MS25036–118	AR	TERMINAL, LUG, 8 AWG, 3/8 STUD		
4				MS25036–125	AR	TERMINAL, LUG, 4 AWG, 3/8 STUD		
5				MS3367–5–9	AR	STRAP, TIEDOWN		

C. Contactor to Reconnection Board Wiring Harness, Dwg. No. 72–2225

Figure 3-105. Main Load Contactor Schematic Diagram, Contactor to Load Terminals Wiring Harness, Dwg. No. 72-2290, and Contactor to Reconnection Board wiring Harness, Dwg. No. 72-2225 (sheet 3 of 3)

(2) Economizing Switch.

(a) Apply 24 Vdc to connector pins A and B (See figure 3-105).

(b) Adjust placement of switch (88, figure 3-101) on bracket (89) so that green button of switch is actuated by operator (57).

(c) Check that the switch button is fully depressed, and allow 0.010 inch clearance between the switch button and the operator.

(d) Remove 24 Vdc. White button of switch should be actuated by lower tab of operator. If not, bend tab to actuate switch.

(e) Repeat steps (a), (c) and (d) to check switch operation.

(3) Auxiliary Contacts.

(a) These contacts should be adjusted so that the deflection on the guide leaf springs is nearly equal in the energized and de-energized positions. Adjust screws (60) and nuts (62) to accomplish this.

(b) With feeler gauge, measure any gap between operator (71) and detent (55), on both sides.

(c) Insert a feeler gauge equal to the measured value plus 0.018 inch between (71) and (55), on both sides.

(d) Using an ohmmeter to determine continuity, adjust the stationary contacts of the normally closed contacts until they just touch the movable contacts (see figure 3–105 for contact positions).

(e) Replace the feeler gauges with a feeler gauge equal to the measured value plus 0.025 inch and recheck for open circuit of normally closet contacts. Readjust if necessary.

(f) Insert 0.018 inch feeler gauge between operator (71) and frame (76).

(g) Apply 24 Vdc to connector pins A and B.

(h) Using an ohmmeter to determine continuity, adjust the stationary contacts of the normally open contacts.

(i) Replace the 0.018 inch feeler gauge with a 0.025 inch feeler gauge by removing and reapplying 24 Vdc. Recheck for open circuit of normally open contacts. Readjust if necessary.

(4) Contact Overtravel.

(a) Tighten nuts (39) until lockwashers (40) are flat.

(b) Attach an ohmmeter to terminals A1-A2.

(c) Insert a 0.035 inch feeler gauge between operator and frame (76).

(d) Energize coil by applying 24 Vdc across connector pins A and B (See figure 3-105).

(e) Check for continuity at a clearance of 0.035 inch and for open circuit at 0.040 inch.

(f) If these requirements are not met, select the proper thickness of washer (53, figure 3-101) until they are met.

(g) Repeat steps (b) through (f) for terminals B1-B2 and C1-C2.

(5) Preload of Contacts.

(a) Using a force gauge, check each individual contact at its edge. Preload should be 1.5 to 2.5 pounds.

(b) If preload is not as specified, replace spring (48) with a known good spring.

h. Installation. (Type A and Type B). Install main load contactor in reverse order of Removal procedures given in paragraph a.

1. Screw
2. Lockwasher
3. Plastic shield
4. Standoff
5. Lockwasher
6. Load terminal board assy
7. Nut
8. Nut
9. Stud
10. Board

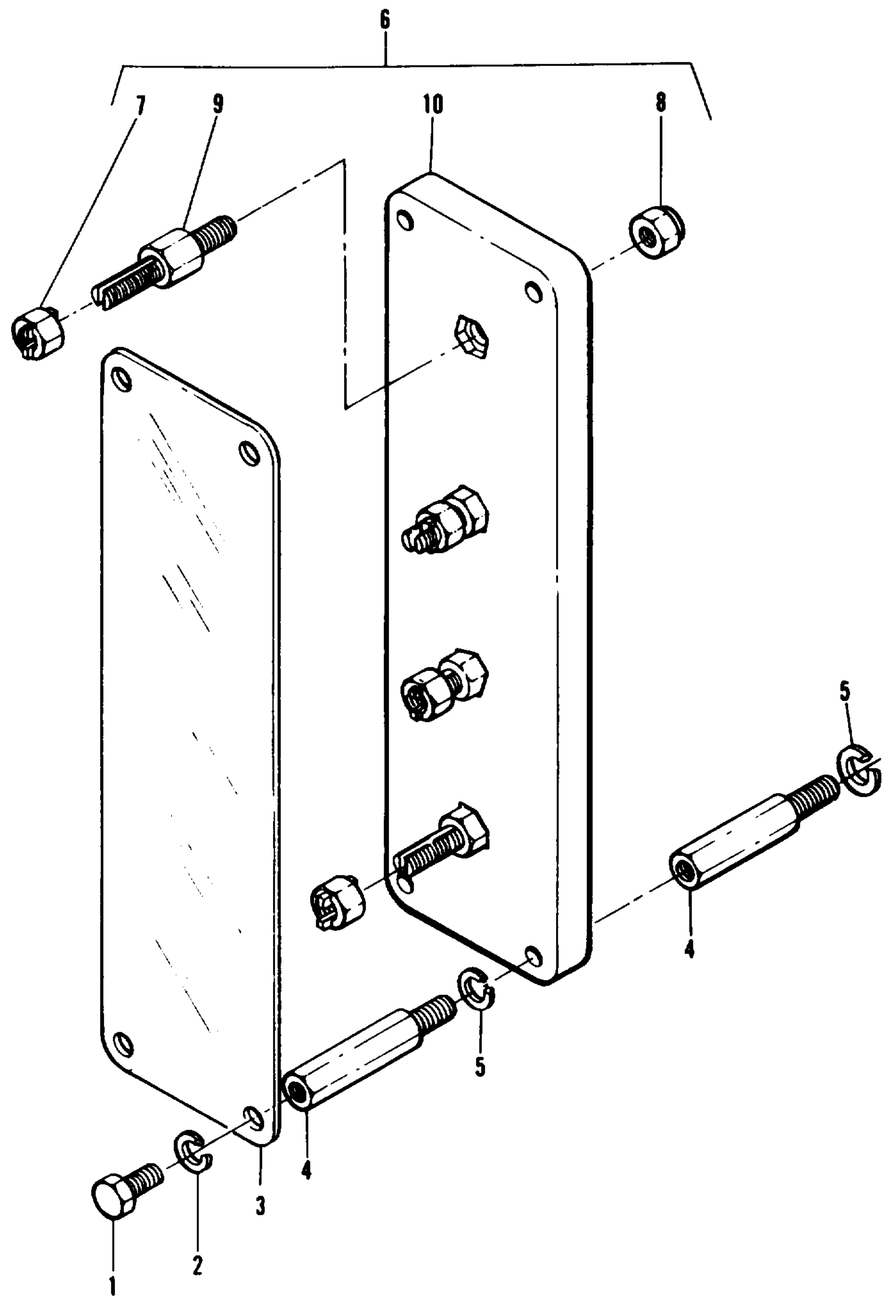


Figure 3-106. Load Terminal Board Assembly, Exploded View

3-85. LOAD TERMINAL BOARD ASSEMBLY.

a. Removal.

WARNING

Lethal voltages are present at the load terminal board when the generator set is in operation. Do not attempt to perform maintenance on the load terminal board while the generator set is in operation. Serious electrical shock or death may result from failure to observe this warning.

(1) Tag and disconnect electrical leads to load terminal board assembly.

(2) Remove screws (1, figure 3-106), lockwashers (2) and plastic shield (3).

(3) Remove stand-off (4) and lockwashers (5) to remove load connection terminal board assembly (6).

b. Disassembly. Remove nut (7, figure 3-106), nut (8), stud (9) and board (10).

c. Cleaning, Inspection, and Repair.

(1) Clean load terminal board with filtered compressed air and a soft bristle brush.

(2) If necessary, wipe load terminal board assembly with a clean, lint–free cloth moistened with an approved solvent.

(3) Inspect load terminal board for warping, cracks, damaged threads, corroded terminals, and burns.

(4) Replace any damaged or defective parts.

d. Assembly. Position board (10, figure 3-106) to install stud (9), nut (8), and nut (7).

d. Installation.

(1) Position load terminal board assembly (6, figure 3-106) to install lockwashers (5) and standoff (4).

(2) Install plastic sheild (3), lockwashers (2) and screws (1).

(3) Connect electrical leads to load terminal baard assembly.

3-86. CURRENT TRANSFORMER ASSEMBLIES.

a. Removal.

(1) Tag and disconnect electrical leads from transformer winding terminals.

(2) Tag generator leads and record their routing through transformer windows (noting polarity) as shown in figure 3-107; then disconnect and remove them.

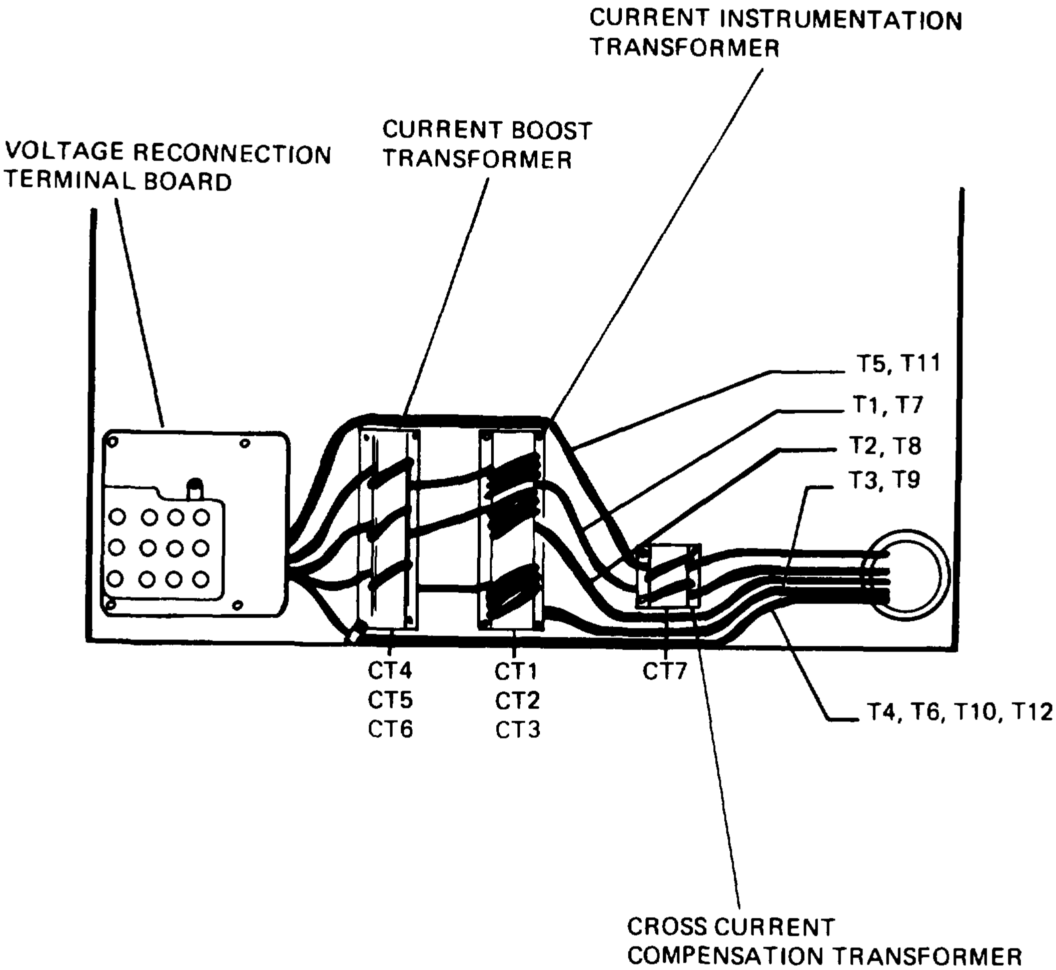
(3) Remove nuts (1, figure 3-108), lockwashers (2), screws (3) and current boost transformer (4).

(4) Do not remove screw and washer assemblies (5), flat washers (6) and mounting brackets (7) unless inspection reveals damage and replacement is necessary.

(5) Remove screw and washer assemblies (8), flat washers (9) and instrumentation transformer (10).

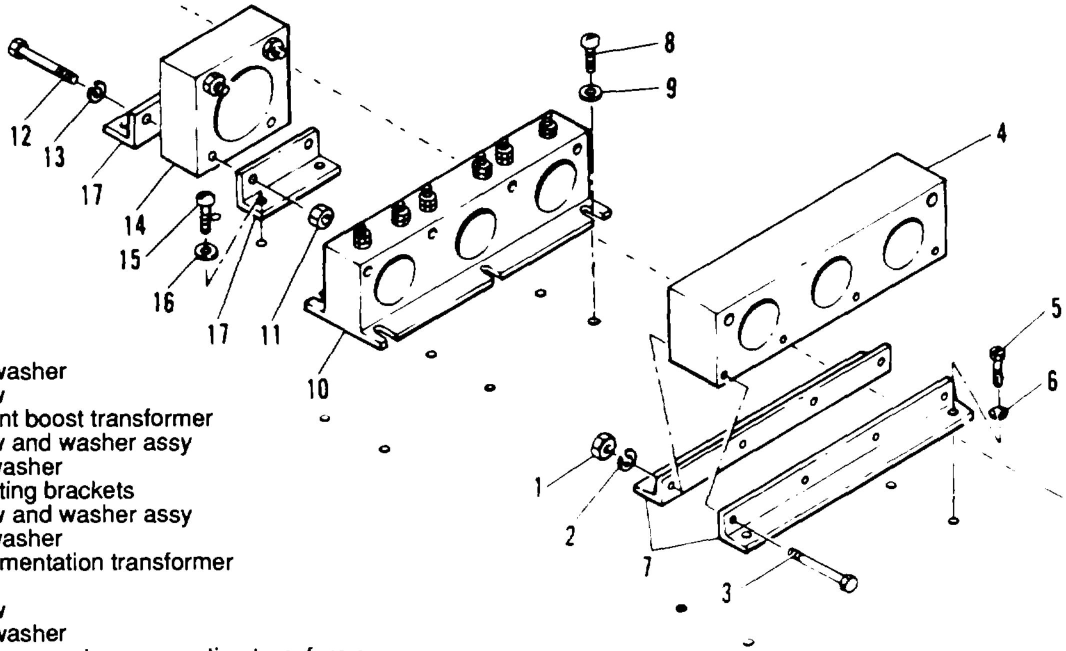
(6) Remove nuts (11), screws (12), lockwashers (13), and cross-current compensation transformer (14).

(7) Do not remove screw and washer assemblies (15), flat washers (16) and mounting brackets (17) unless inspection reveals damage and replacement is necessary.



NOTE 1: Drawing reflects 15 KW 400 Hz Precise.
NOTE 2: On 15 KW 50/60 Hz Precise and Utility Sets, leads T5 and T11 are routed the same as T4, T6, T10, and T12.

Figure 3-107. Routing of Generator Leads Through Current Transformers



1. Nut
2. Lockwasher
3. Screw
4. Current boost transformer
5. Screw and washer assy
6. Flat washer
7. Mounting brackets
8. Screw and washer assy
9. Flat washer
10. Instrumentation transformer
11. Nut
12. Screw
13. Lockwasher
14. Cross–current compensation transformer
15. Screw and washer assy
16. Flat washer
17. Mounting bracket

Figure 3–108. Transformer assemblies, Removal and Installation

b. Cleaning. Inspection. and Testing.

(1) Clean transformer assemblies with a clean, lint-free cloth moistened with an approved solvent and dry thoroughly.

(2) Inspect transformer assemblies for cracks, corroded terminals, and evidence of shorting.

(3) Test current boost transformer as follows:

(a) Using an ohmmeter, check resistance between terminals A1 and A2, B1 and 62, and C1 and C2, figure 3-109. Resistance shall be 0.19 ohm in each case.

(b) Apply 7V-60 Hz to secondary winding. Excitation current shall be 0.075 amp (maximum).

(4) Test instrumentation transformer as follows:

(a) Using an ohmmeter, check resistance between terminals A1 and A2, B1 and B2, C1 and C2 (figure 3-102). Resistance shall be 0.11 ohm in each case.

(b) Apply 10V-60 Hz to secondary winding. Excitation current shall be 0.050 amp (maximum).

(5) Test cross-current compensation transformer as follows:

(a) Using an ohmmeter, check resistance between terminals. Resistance shall be 0.3 ohm.

(b) Apply 10V-60 Hz to secondary winding. Excitation current shall be 0.050 amp (maximum).

(6) Replace defective or damaged transformers.

(1) If removed, install mounting brackets (17, figure 3–108) flat washers (16), screw and washer assemblies (15).

(2) Install cross-current compensation transformer (14), Iockwashers (13), screws (12), and nuts (11).

(3) Install instrumentation transformer (10), flat washers (9) screw and washer assemblies (8).

(4) If removed, install mounting bracket (7), flat washers (6) screw and washer assemblies (5).

(5) Install current boot transformer (4), screws (3), Iockwashers (2) and nuts (1).

(6) Route generator leads through transformer windows (noting polarity) as shown in figure 3-107; then connect the wires and remove tags.

(7) Connect electrical leads to transfer winding terminals.

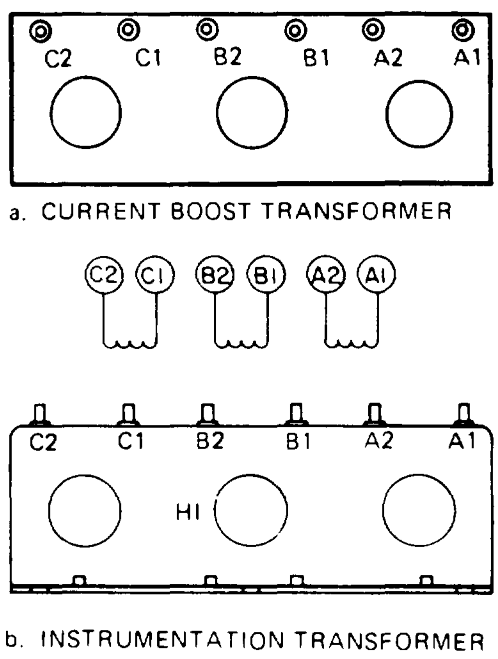


Figure 3-109. Current Transformer Test Point

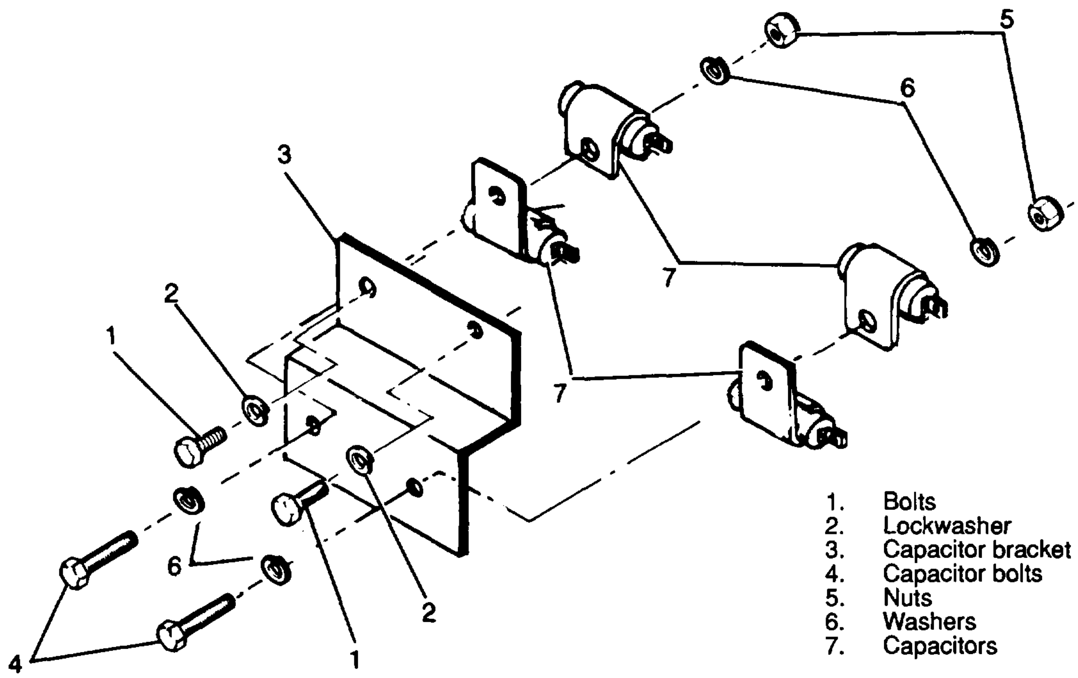


Figure 3–110. Electromagnetic Interference Capacitors

3-87. ELECTROMAGNETIC INTERFERENCE CAPACITORS

a. Removal

(1) Disconnect capacitor leads from terminal.

(2) Loosen and remove two capacitor bracket bolts (1, figure 3-110), and two lockwashers (2) from chassis.

(3) Remove capacitor bracket (3).

(4) Loosen and remove two capacitor bolts (4), nuts (5), and four washers (6) and remove four capacitors (7).

b. Cleaning,Inspection and Testing.

WARNING

Solvent, Dry Cleaning P-D-680, Type II is flammable and moderately toxic to skin, eyes and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate. Failure to observe this warning could result in servere personal injury or death.

(1) Clean capacitor assembly with a clean, lint free cloth moistened with solvent P-D-680 Type II and dry thoroughly.

(2) Inspect capacitor assembly for cracks, corroded terminals, and evidence of shorting.

(3) Test capacitors as follows:

Test the capacitors for leaks and shorts on a capacitor tester, replace defective capacitors. If test equipment is not available and interference is indicated, isolate the cause of interference by the trial and error method of replacing each capacitor in turn until the cause of interference is located and eliminated.

c. Installation.

(1) Install four capacitors (7, figure 3-110), four washers (6), nuts (5) and two capacitors bolts (4) and tighten.

(2) Install capacitor bracket (3).

(3) Position chassis to install two Iockwashers (2), two capacitor bracket bolts (1) and tighten.

Section X11. MAINTENANCE OF RELAY TABLE COMPONENTS

3-88. GENERAL.

The relay table components consist of the tactical relay assembly, the special relay assembly, and the precise relay assembly. The tactical relay assembly, which is common to all three models, contains relays to shutdown the generator set in the event of overvoltage, short circuit, overload, and reverse power. It also houses the current transformer load resistors. The special relay assembly, also common to all three models, contains the relays for the remainder of the protective devices and the paralleling controls for the voltage regulator. The precise relay assembly is used only on the 50/60 Hz and 400 Hz precise models. It contains the paralleling controls for the governor control unit and the fixed resistors of the frequency adjustment system. The 50/60 Hz model of the precise relay assembly also contains a frequency selector switch which changes its operation from 50 to 60 Hz.

3-89. TACTICAL RELAY ASSEMBLY.

WARNING

Do not attempt to perform maintenance on the tactical relay assembly while the generator set is operating. Severe electrical shock or death may result from failure to observe this warning.

a. Removal.

(1) Disconnect electrical connectors to the tactical relay assembly.

(2) Remove screws (1, figure 3-111) and Iockwashers (2) to remove relay assembly from generator set.

NOTE

Tag and disconnect electrical leads to each component prior to disassembly.

b. Disassembly.

(1) Remove screw (1, figure 3-111), and Iockwasher (2).

(2) Remove screw (3), and cover(4).

(3) Remove nut & captive washer assembly (5), screw (6) and tactical relay resistor assembly. (7).

(4) Remove nut & captive washer assemlby (8), screw (9), terminal board assembly (10) and terminal jumper (11).

(5) Remove screw & captive washer assembly (12), reverse power relay (13), overvoltage relay (14) and short circuit relay (15).

(6) Remove screw and captive washer assembly (16) and overload protective device (17).

(7) Remove nut & captive washer assembly (18), flatwashers (19), ground screw (20), nut (21), screw& captive washer assembly (22), nut (23), screw & captive washer assembly (24), and wiring harness assembly (25), from Chassis (26).

c. Cleaning, Inspection, and Repair.

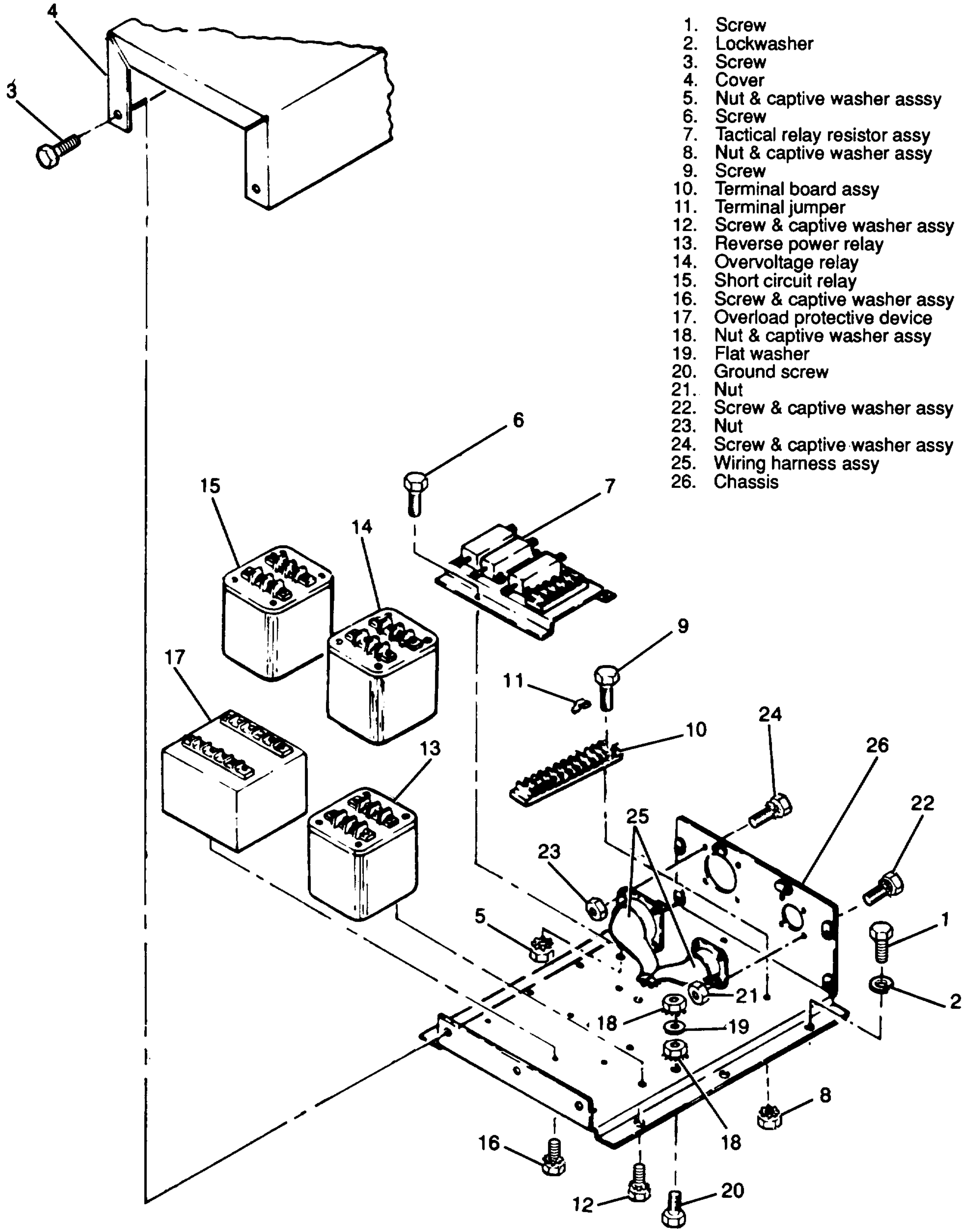
WARNING

Compressed air used for cleaning and drying purposes can create airborne particles that may enter the eyes. Pressure shall not exceed 30 psig and use only with adequate chip guards and chipping goggles. Failure to observe this warning could result in servere personal injury or death.

WARNING

Solvent, Dry Cleaning P-D-680, Type II is flammable and moderately toxic to skin, eyes and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate. Failure to observe this warning could result in servere personal injury or death.

(1) Clean tactical relay assembly with filtered compressed air and a soft bristle brush. If necessary, dirt deposits may be removed with a clean, lint-free cloth moistened with solvent P–D-680 Type II. Dry thoroughly after cleaning with solvent.



1. Screw
2. Lockwasher
3. Screw
4. Cover
5. Nut & captive washer asssy
6. Screw
7. Tactical relay resistor assy
8. Nut & captive washer assy
9. Screw
10. Terminal board assy
11. Terminal jumper
12. Screw & captive washer assy
13. Reverse power relay
14. Overvoltage relay
15. Short circuit relay
16. Screw & captive washer assy
17. Overload protective device
18. Nut & captive washer assy
19. Flat washer
20. Ground screw
21. Nut
22. Screw & captive washer assy
23. Nut
24. Screw & captive washer assy
25. Wiring harness assy
26. Chassis

Figure 3-111. Tactical Relay Assembly, Exploded View

2) Inspect cover and chassis for cracks, corrosion, warping, dents, and defective paint.

(3) Inspect relays for cracked casing, corroded terminals and evidence of shorting or overheating.

(4) Inspect overload protective device for cracked casing, corroded terminals, and evidence of shorting or overheating.

(5) Inspect tactical relay resistor assembly for burns, cracked or damaged components, and evidence of shorting.

(6) Inspect terminal board assembly for cracks, corroded terminals and terminal jumpers, and evidence of shorting.

(7) Inspect wiring harness assembly for excessive wear, cracks, stripped threads, damaged or loose pins in connectors, and burned wires indicating shorts. Check individual wires for continuity using figure 3-112 as a guide.

(8) Check all threads for crossing, stripping, and peening.

(9) Test reverse power relay as follows:

(a) Install reverse power relay in test circuit shown in figure 3-113.

(b) Place all switches in the open position and activate power source G1. Adjust output until voltmeter V1 indicates 3 volts.

(c) Place switch S2 in position B and activate power source G3.

(d) Place switches S1, S4, and S5 in the closed position.

(e) Test lamp DS2 shall illuminate.

(f) Activate power source G2 and adjust output until voltmeter V2 indicates 5 volts.

(9) Adjust output of power source G1 until voltmeter V1 indicates less than 1 volt.

(h) Position switch S2 in A position and switch S3 in closed position.

(i) Slowly increase output of power source G1 until test lamp DS2 extinguishes and test lamp DS1 illuminates.

(j) Check indication of voltmeter V1. Indication shall be 1 to 3 volts.

(10) Test over voltage relay as follows:

(a) Install relay in test circuit shown on figure 3–114.

(b) Activate power source G1 and adjust voltage to 120 Vac at 50 Hz.

(c) Activate power source G2 and close switch S2.

(d) Test lamp DS1 shall illuminate and test lamp DS2 shall remain extinguished.

(e) Vary frequency output of power source G1 from 50 to 450 Hz. There shall be no change in test lamp illumination.

(f) Slowly increase output voltage of power source G1 to 149 Vac. Vary frequency from 350 to 450 Hz. DS1 shall remain illuminated and DS2 shall extinguish.

(9) Slowly increase output voltage of power source G1 to 154 Vac. Vary output frequency from 50 to 100 Hz. DS1 shall remain illuminated and DS2 shall remain extinguished.

WIRE MARKING	FROM	TERMINATION FIND NO REF.	TO	FIND NO REF.	WIRE FIND NO.	WIRE LENGTH REF.	MARKING COLOR
D24E18	J4–G	2	TB107–4	4	1	5.25	BLACK
D24F18	K13–4	4	TB107–4	4	1	11.50	BLACK
D24H18	J51–d	3	TB107–4	4	1	8.25	BLACK
K101E18	J51–X	3	TB105–7	4	1	9.00	BLACK
K101G18	K15–2	4	TB105–7	4	1	12.50	BLACK
K101H18	J4–N	2	TB105–7	4	1	6.00	BLACK
K102E18	J51–N	3	TB105–8	4	1	8.75	BLACK
K102G18	K15–1	4	TB105–6	4	1	11.50	BLACK
K102H18	J4–S	2	TB105–6	4	1	6.00	BLACK
P50V18	J51–L	3	TB105–4	4	1	9.25	RED
P50W18	K14–1 (+)	4	TB105–4	4	1	14.75	RED
P50X18	J51–B	3	K2–4	4	1	9.75	RED
P50GG18	TB105–4	4	K15–3	4	1	12.50	RED
P55L18	J51–M	3	TB105–5	4	1	9.50	RED
P55AX18	J51–W	3	E3(GND)	5	1	13.00	RED
P55JJ18	K15–4	4	TB105–5	4	1	13.50	RED
P55KL18	K14–2(–)	4	TB105–5	4	1	14.75	RED
P58B18	J51–A	3	K2–3	4	1	9.50	RED
P60B18	J51–E	3	K15–7	4	1	12.00	RED
P61A18	K15–8	4	K14–5 (NC)	4	1	8.00	RED
P82H18	J51–H	3	K14–6 (NC)	4	1	10.50	RED
P62J18	J51–b	3	K13–6	4	1	5.75	RED
P63A18	J51–a	3	K13–5	4	1	8.25	RED
P200S18	J51–P	3	TB105–B	4	1	8.75	RED
P200T18	K14–3 (NO)	4	TB105–9	4	1	14.50	RED
200V18	K2–8	4	TB105–8	4	1	11.25	RED
P200X18	K15–5	4	TB105–8	4	1	7.50	RED
P200Y18	K13–8	4	TB105–9	4	1	9.00	RED
P203D18	J51–F	3	K13–7	4	1	5.25	RED
P205D18	J51–D	3	K15–6	4	1	11.25	RED
P206D18	J51–C	3	K2–7	4	1	6.50	RED
P209D18	J51–G	3	K14–4 (N0)	4	1	11.00	RED
X7UU18	J51–S	3	J4–A	2	1	7.25	BLACK
X8VV18	J51–R	3	J4–B	2	1	7.00	BLACK
X9T18C	J4–C	2	TB105–1	4	1	8.25	BLACK
X9U18C	J51–J	3	TB105–1	4	1	11.00	BLACK
X9V18C	K2–1	4	TB105–1	4	1	7.25	BLACK
X12F18N	K2–2	4	TB105–2	4	1	6.50	BLACK
X12P18N	J51–K	3	TB105–2	4	1	10.25	BLACK
X12V18N	J4–K	2	TB105–3	4	1	7.00	BLACK
X12X18N	J4–11	2	TB105–2	4	1	7.50	BLACK
X12DD18N	J4–L	2	TB105–3	4	1	8.75	BLACK
X17B18	J51–T	3	K14–A1	4	1	11.50	BLACK
X18B18	J51–U	3	K14–B1	4	1	12.00	BLACK
X19B18	J51–V	3	K14–C1	4	1	12.25	BLACK
X115A18	J4–D	2	TB107–1	4	1	5.25	BLACK
X115B18	K14–A2	4	TB107–1	4	1	14.25	BLACK
X115C18	K13–1	4	TB107–1	4	1	13.00	BLACK
X116A18	J4–E	2	TB107–2	4	1	5.00	BLACK
X116B18	K14–B2	2	TB107–2	4	1	14.50	BLACK
X116C18	K13–2	2	TB107–2	4	1	12.75	BLACK
X117A18	J4–F	2	TB107–3	4	1	4.75	BLACK
X117B18	K14–C2	4	TB107–3	4	1	15.25	BLACK
X117C18	K13–3	4	TB107–3	4	1	12.00	BLACK

NOTES:

1. ALL SOLDERED CONNECTIONS SHALL BE IN ACCORDANCE WITH MIL-STD-454. REQUIREMENT 5.
2. CUT INSULATION SLEEVING, FIND NO. 8, INTO 32 PIECES .750 INCHES LONG AND INSTALL OVER WIRES AND PINS, AFTER SOLDERING, TO THE CONNECTORS, FIND NOS. 2 AND 3. THEN APPLY HEAT OF 400°F FOR 2-3 SEC. FOR PROPER SHRINKAGE.
3. INSTALL STRAPS, FIND NO. 7, AT 3.0 MAX INTERVALS AND AT EACH CABLE BREAK-OUT.
4. WIRE MARKING TO BE IN ACCORDANCE WITH MIL-W-5088 EXCEPT THAT LENGTH BETWEEN GROUPS OF NUMBERS SHALL NOT EXCEED 6 INCHES.
5. CRIMPED TERMINAL SHALL MEET THE PERFORMANCE REQUIREMENTS OF MIL-T-7928.
6. INTERPRET DRAWING PER MIL-STD-100.
7. REFERENCES:
   a) FOR WIRING DIAGRAM, SEE DRAWING 72-2205.
   b) FOR SCHEMATIC DIAGRAMS, SEE DRAWINGS 72-2200 AND 72-2269. 72-2295 AND 72-2277 FOR UTILITY. 72-2200 AND 72-2269 FOR PRECISE.

FIND NO.	SYM	CODE IDENT	DWG SIZE	PART OR IDENTIFYING NO.	QTY REQD	NOMENCLATURE OR DESCRIPTION	SPEC	MATERIAL
1				M5086/2–18–9	AR	WIRE ELECTRIC AWG 18		
2				MS3102R20–29P	1	CONNECTOR, RECEPTACLE, ELECTRICAL J4	MIL–W–5086/2	
3				MS3102R28–12P	1	CONNECTOR, RECEPTACLE, ELECTRICAL J51		
4				MS25036–102	71	LUG, TERMINAL, NO. 6 STUD, 18 AWG		
5				MS25036–149	1	LUG, TERMINAL, NO. 8 STUD, 18 AWG		
6						(NOT USED)		
7				MS3367–5–9	AR	STRAP, CABLE, ADJUSTABLE		
8				MS23053/5–105–0	24	INSULATION SLEEVING	MIL–I–23053/5	

Figure 3-112. Tactical Relay Assembly Wiring Harness, Drawing No. 72-2243 (Sheet 1 of 2)

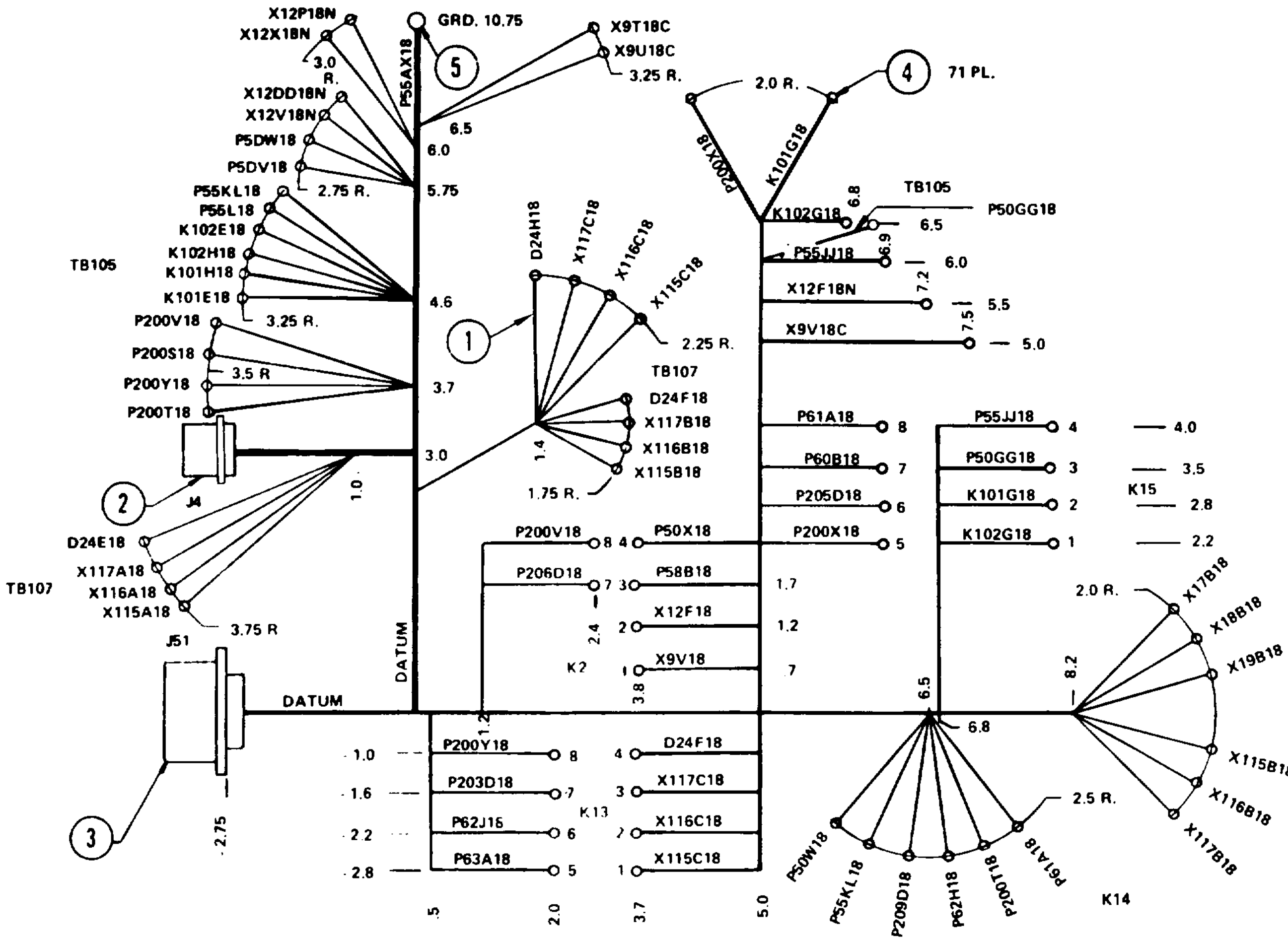
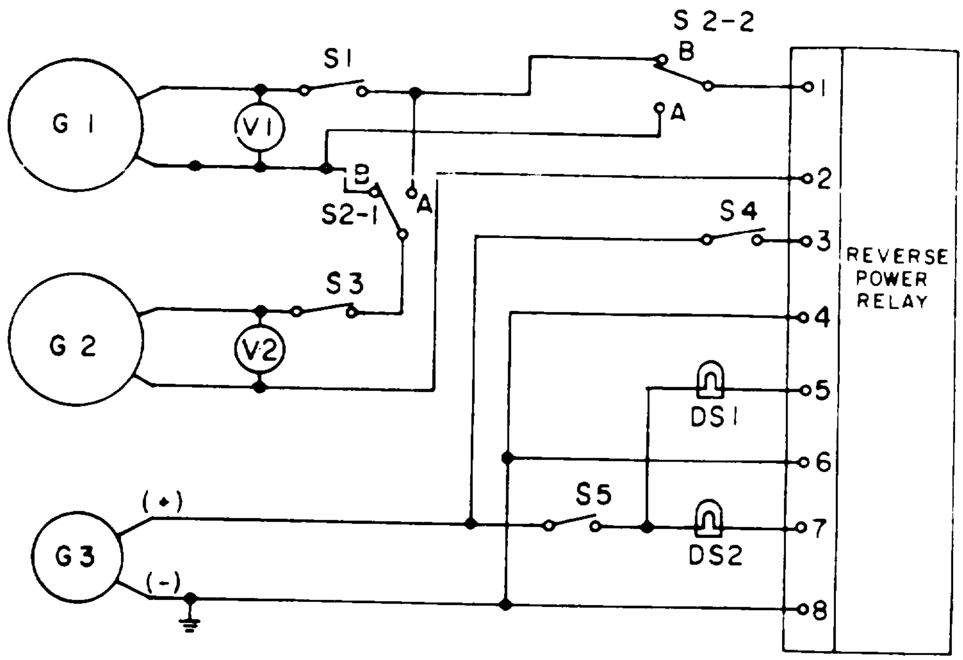


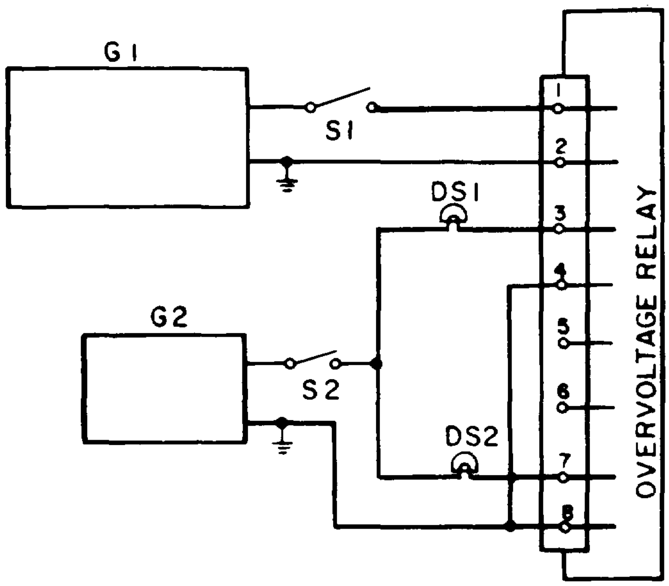
Figure 3-112. Tactical Relay Assembly Wiring Harness, Drawing No. 72–2243 (Sheet 2 of 2)



LEGEND:

G1 POWER SOURCE, 0–5 VOLT DC, VARIABLE
G2 POWER SOURCE, 0–10 VOLT AC, 60HZ, VARIABLE
G3 POWER SOURCE, 24 VOLT DC
DS1 TEST LAMP
DS2 TEST LAMP
S1 SWITCH
S2 SWITCH
S3 SWITCH
S4 SWITCH
S5 SWITCH
V1 VOLTMETER
V2 VOLTMETER

Figure 3-113. Reverse Power Relay Test Circuit



LEGEND:

G1 POWER SOURCE, VARIABLE 0–160 VAC, 50–450 HZ
G2 POWER SOURCE, 24 VDC
DS1 TEST LAMP
DS2 TEST LAMP
S1 SWITCH
S2 SWITCH

Figure 3-114. Overvoltage Relay Test Circuit

(h) Set output frequency of power source G1 to 50 Hz. Slowly increase output voltage to 156 volts. DS1 shall extinguish and DS2 shall illuminate. Momentarily open switch S1 and allow relay to reset.

(i) Repeat step (h) for frequencies of 60,70 and 100 Hz.

(j) Set output frequency of power source G1 to 350 Hz. Increase output voltage to 151 volts ac. DS1 shall extinguish and DS2 shall illuminate. Momentarily open switch S1 and allow relay to reset.

(k) Repeat step (j) for frequencies of 400 and 450 Hz.

(11) Test short circuit relay as follows:

(a) Install short circuit relay in test circuit shown in figure 3-115.

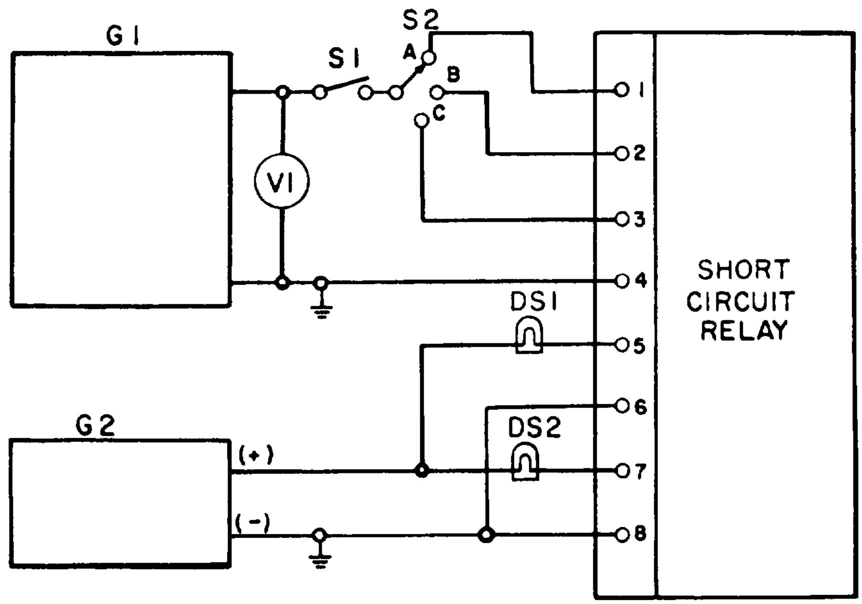
(b) Activate power sources G1 and G2.

(c) Place switch S2 in the A position and close S1.

(d) Slowly increase output voltage of power source G1. Test lamp DS1 shall illuminate.

(e) Observe voltmeter V1 while continuing to increase voltage. At a voltage of 24 ± 1 Vac. test lamp DS1 shall extinguish and DS2 shall illuminate.

(f) Return output voltage of G1 below 24 Vac and open A allowing the relay to reset.



G1 POWER SOURCE, VARIABLE, 0–120VAC, 50–400 HZ
G2 POWER SOURCE, 24 VDC
DS1 TEST LAMP
DS2 TEST LAMP
S1 SWITCH
S2 SWITCH
V1 VOLTMETER, AC

Figure 3-115. Short Circuit Relay Test Circuit

(g) Place switch S2 in B position and dose switch S1.

(h) Repeat steps (d) through (f).

(i) Place switch S2 in C position and dose switch S1.

(j) Repeat steps (d) through (f).

(k) The voltage at which relay trips in step (e), (h) and (j) shall be within 1 volt.

(12) Test overload protective device as follows:

(a) Install over load protective device in test circuit shown in figure 3-116.

(b) Activate generator G2 and power source G1 and dose switch S1. Test lamp DS1 shall illuminate.

(c) Adjust auto transformers T1, T2 and T3 until ammeters A1, A2, and S3 indicate 0.75 amperes each.

(d) Adjust auto transformer T1 until ammeter Al indicates 0.975 amperes. After 8 ± 2 minutes, test lamp DS1 shall extinguish and test lamp DS2 shall illuminate.

(e) Adjust auto transformer T1 until ammeter Al again indicates 0.75 amperes. Test lamp DS2 shall extinguish and test lamp DS1 shall illuminate.

(f) Repeat steps (d) and (e) for auto transformers T2, and T3. Result shall be the same as for T1.

(13) Replace any relay or protective device found to be defective.

(14) Test tactical relay resistor assembly as follows:

(a) Ccmnect one lead of an ohmmeter to terminal number (4, figure 3-117).

LEGEND:

A1 AMMETER
A2 AMMETER
A3 AMMETER
DS1 TEST LAMP
DS2 TEST LAMP
G1 POWER SOURCE, 120/208 VAC, 60 HZ
G2 POWER SOURCE, 24 VDC
R1 RESISTOR, 35 OHM, 50 WATT
R2 RESISTOR, 35 OHM, 50 WATT
R3 RESISTOR, 35 OHM, 50 WATT
S1 SWITCH
T1 AUTOTRANSFORMER
T2 AUTOTRANSFORMER
T3 AUTOTRANSFORMER

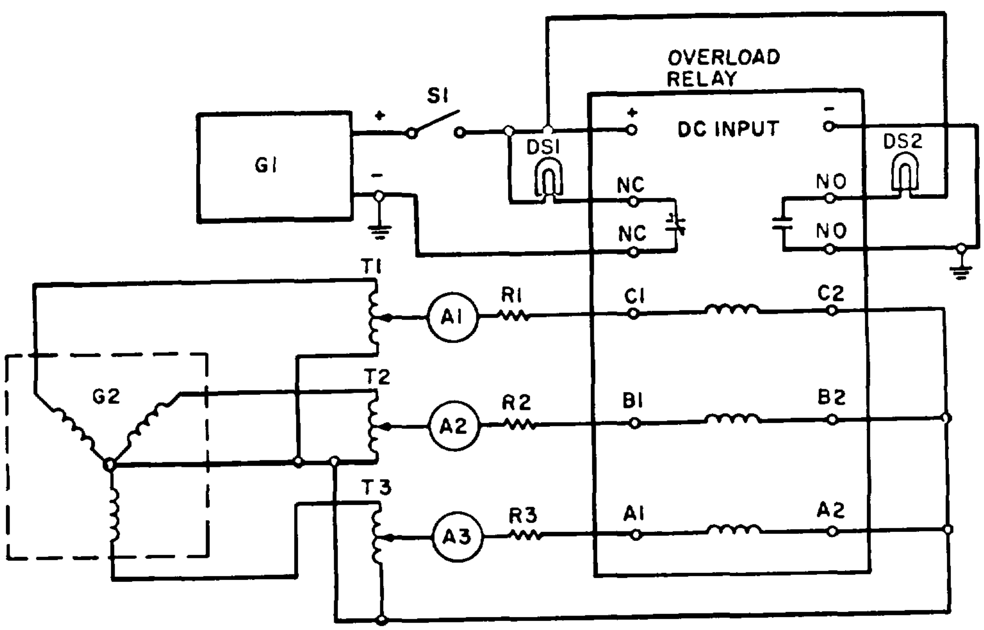


Figure 3-116. Overload Protective Device Test Circuit

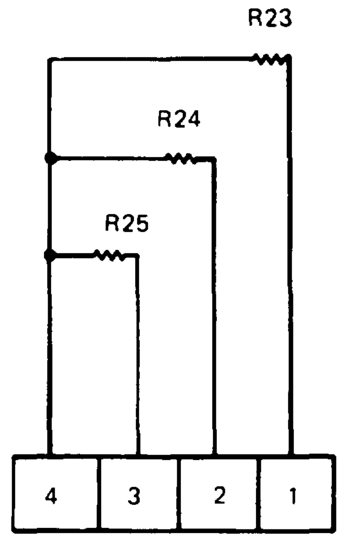


Figure 3–117. Tactical Relay Resistor Assembly Schematic Diagram

(b) Touch other lead to terminals 3,2, and 1.

(c) Ohmmeter should indicate 7.5 ohms in each case.

(15) Replace defective components of tactical relay resistor assembly using figure 3-118 as a guide.

(16) If the wiring harness has sustained damage and requires repair or rebuild, refer to figure 3-112 for layout, identification, and material requirements and Appendix A for detailed soldering and replacement procedures.

d. Assembly.

(1) Position relay assembly to install Iockwashers (2, figure 3-111) and screws (1).

(2) Connect electrical leads to tactical relay assembly.

e. Installation.

(1) Position chassis (26, figure 3-111), to install wiring harness (25), screw& captive washer assembly (24), nut (23), screw & captive washer assembly (22), nut (21), ground screw (20), flatwashers (19), nut & captive washer assembly (18).

(2) Install overload protective device (17), and screw& captive washer assembly (16).

(3) Install short circuit relaly (15), over–voltage relay (14), reverse power relay (13), and screw& captive washer assembly (12).

(4) Install terminal jumper (11), terminal board assembly (10), screw (9), nut & captive washer assembly (8).

(5) Install tactical relay resistor assembly (7), screw (6), nut & captive washer assembly (5).

(6) Install cover(4) with screw (3).

(7) Install Iockwasher (2) and screw (1).

3-90. SPECIAL RELAY ASSEMBLY.

WARNING

Do not attempt to perform maintenance on the special relay assembly while the generator set is operating. Severe electrical shock or death may result from failure to observe this warning.

a. Removal.

(1) Tag and disconnect electrical connectors to special relay assembly,

(2) Remove screws (1, figure 3-119) and lockwashers (2) to remove special relay assembly.

NOTE

Disassemble special relay assembly only as required for inspection, testing, and replacement of components.

b. Disassembly.

(1) Remove screw &captive washer assembly (3, figure 3-119), cover (4) from chassis (46).

(2) Remove locking nut(5), nut(6), tooth lockwasher (7) and potentiometer (8).

(3) Remove nut (9) and screw &captive washer assembly (10).

(4) Remove nut (11), screw&captive washer assembly (12) and wiring harness assembly.

(5) Remove nut (14), screw & captive washer assembly (15) and shorting plug (16).

(6) Remove nut (17), screw and captive washer assembly (18) and protective cap assembly (19).

(7) Remove nut & captive washer assembly (20), flat washer (21), and screw (22).

(8) Remove nut & captive washer assembly (23) and dc relay assembly (24)

(9) Remove nut & captive washer assembly (25), screw (26) and instrument shunt (27).

(10) Remove nut &captive washer assembly (28), screw (29) and special current transformer (30).

(11) Remove nut (31), lockwasher (32), screw (33), cranking relay (34).

(12) Remove nut & captive washer assembly (35), screw (36) and terminal board assembly (37).

(13) Remove nut (38), screw & captive washer assembly (39), resistor (40) and resistor bracket assembly (41).

(14) Remove nut & captive washer assembly (42), screw (43), terminal board assembly (44) and terminal jumper (45).

(15) Remove resistor (47), bracket assembly (48), nut (49) and screw& captive washer assembly (50).

c. Cleaning, Inspection, and Repair.

WARNING

Compressed air used for cleaning and drying purposes can create airborne particles that may enter the eyes. Pressure shall not exceed 30 psig and use only with adequate chip guards and chipping goggles. Failure to observe this warning could result in servere personal injury or death.

WARNING

Solvent, Dry Cleaning P-D-680, Type II is flammable and moderately toxic to skin, eyes and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate. Failure to observe this warning could result in servere personal injury or death.

(1) Clean special relay components with filtered compressed air and a soft bristle brush. If necessary, dirt deposits may be removed with a clean, lint–free cloth moistened with solvent P-D-680 Type II in paragraph 3-90c(1).

(2) Inspect potentiometer for cracked casing, corroded terminals and burns or other indication or shorting.

(3) Inspect wiring harness assembly for cracked or deteriorated insulation, damaged or loose connector pins, and burned areas indicating shorting.

(4) Inspect protective caps for cracks, excessive wear, broken chain and other damage.

(5) Inspect components of DC relay assembly for cracks, burns, corrosion, and evidence of shorting or overheating.

(6) Inspect instrument shunt for burns, corrosion, and evidence of shorting.

(7) Inspect special current transformer for corroded terminals and burns or other evidence of shorting.

(8) Inspect cranking relay K3 for cracked casing, corroded terminals, and evidence of shorting.

(9) Inspect terminal boards for cracks, burns, corroded terminals and terminal jumpers and other damage.

(10) Inspect resistor for burns, corroded terminals and other damage.

(11) Inspect chassis and cover for cracks, warping, and illegible markings.

(12) Check all threads for crossing, stripping, and peening.

(13) Using an ohmmeter, test potentiometer as follows:

(a) Connect ohmmeter leads between center terminal and either outer terminal.

(b) Slowly, at an even rate, rotate adjustment from full counterclockwise to full clockwise position.

(c) Ohmmeter indication shall change at an even rate from 0 to 12 ohms.

(d) Replace potentiometer if ohmmeter indicates discontinuity at any point or if rate of change is erratic.

(14) Test wiring harness assembly wires for continuity using figure 3-120 as a guide.

(15) If wiring, wiring harness has sustained damage and requires repair or rebuild, refer to figure 3-120 for layout, identification and material requirements and Appendix A for detailed soldering and replacement procedures.

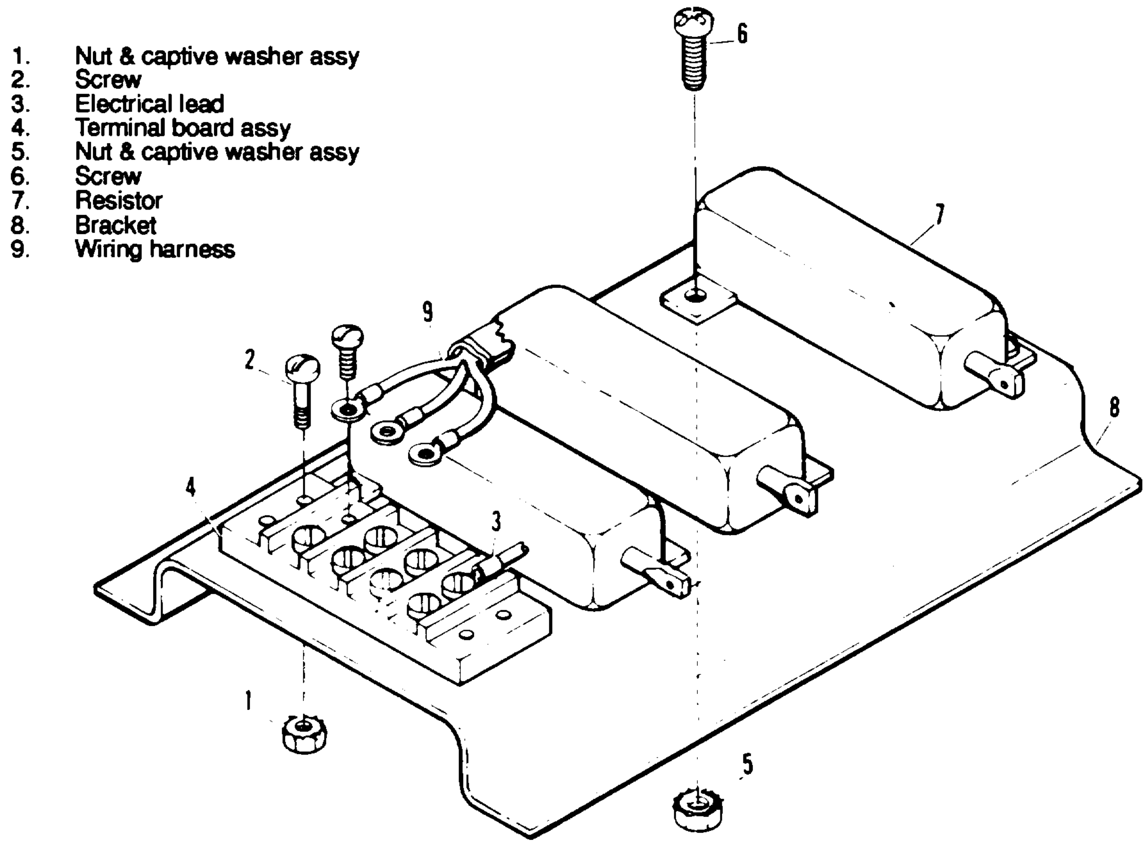


Figure 3-118. Tactical Relay Resistor Assembly, Exploded View

(16) Test dc relay assembly as follows:

(a) Apply 24 Vdc to terminals 6 and 15 (figure 3-121).

(b) Use an ohmmeter to check for continuity across terminals 5 and 17.

(c) Check for open circuit across terminals 4 and 16.

(d) Install a jumper between terminals 9 and 6.

(e) Apply 24 Vdc to terminals 12 and 15 with 12 positive.

(f) Check for continuity between terminals 5 and 17 and for open curcuit between terminals 4 and 16.

(g) Install a jumper between terminals 23 and 6.

(h) Apply 24 Vdcto terminals 21 and 15 with 21 positive.

(i) Check for continuity between terminals 5 and 17 and for open curcuit between terminals 4 and 16.

(j) Apply 24 Vdc to terminals 13 and 15.

(k) Check for continuity between terminals 1 and 14 and between terminals 2 and 15. Check for open curcuit between terminals 3 and 15.

(l) Apply 120V AC to terminals 18 and 22. Use an ohmmeter check for resistance of 2,500 ohms between terminals 19 and 20 and 7 and 8.

(m) Check resistors R3, R6, and R9 for correct values given in figure 3-121.

(17) Replace defective dc relay assembly components (iterns 1 through 21, figure 3-122).

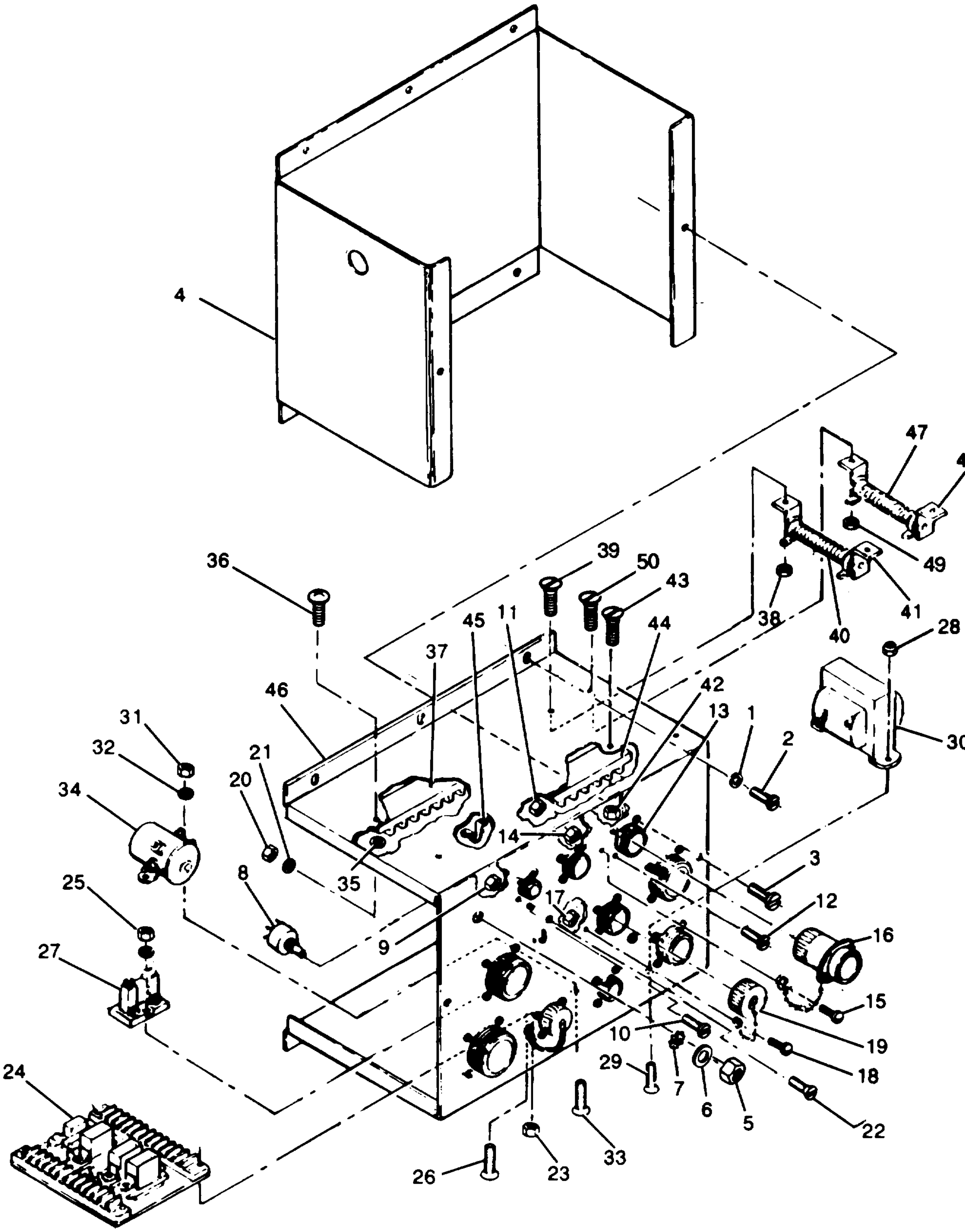


Figure 3-119. Special Relay Assembly, Exploded View (Sheet 1 of 2)

1. Screw
2. Lockwasher
3. Screw & captive washer assy
4. Cover
5. Locking nut
6. Nut
7. Tooth lockwasher
8. Potentiometer
9. Nut
10. Screw & captive washer assy
11. Nut
12. Screw & captive washer assy
13. Wiring harness assy
14. Nut
15. Screw & captive washer assy
16. Shorting plug
17. Nut
18. Screw & captive washer assy
19. Protective cap assy
20. Nut & captive washer assy
21. Flat washer
22. Screw
23. Nut and captive washer assy
24. DC relay assy
25. Nut & captive washer assy
26. Screw
27. Instrument shunt
28. Nut captive washer assy
29. Screw
30. Special current transformer
31. Nut
32. Lockwasher
33. Screw
34. Cranking relay
35. Nut & captive washer assy
36. Screw
37. Terminal board assy
38. Nut
39. Screw & captive washer assy
40. Resistor
41. Resistor bracket assy
42. Nut & captive washer assy
43. Screw
44. Terminal board assy
45. Terminal jumper
46. Chassis
47. Resistor
48. Bracket assy
49. nut
50. Screw & captive washer assy

Figure 3-119. Special Relay Assembly, Exploded View (Sheet 2 of 2)

(18) If any dc relay assembly component must be replaced or encapsulating coating repaired or replaced, refer to Appendix A references for detailed procedures. Repair/replace encapsulating by applying a 0.007 inch (min) coating of polyurethane resin (Scotchcast 221, Minnesota Mining and Mfg. Co. or equal).

(19) Replace any damaged or defective parts.

d. Assembly.

(1) Install screw and captive washer assembly (50, figure 3-119), nut (49), bracket assembly (48) and resistor (47).

(2) Install terminal jumper (45), terminal board assembly (44), screw (43) and nut & captive washer assembly (42).

(3) Install resistor bracket assembly (41), resistor (40), screw & captive washer assembly (39), and nut (38).

(4) Install terminal board assembly (37), screw (36), nut & captive washer assembly (35).

(5) Install cranking relaly (34), screw (33), lockwasher (32), and nut (31).

(6) Install special current transformer (30), screw (29), nut & captive washer assembly (28).

(7) Install instrument shunt (27), screw (26), nut & captive washer assembly (25).

(8) Install dc relaly assembly (24), and nut & captive washer assembly (23).

(9) Install screw (22), flat washer (21), and nut &captive washer assembly (20).

(10) Install protective cap assembly (19), screw & captive washer assembly (18) and nut (17).

(11) Install shorting plug (16), screw&captive washer assembly (15), and nut (14).

(12) Install wiring harness assembly (13), screw &captive washer assembly (12), and nut (11).

(13) Install screw & captive washer assembly (10), and nut (9).

(14) Install potentiometer (8), tooth lockwasher (7), nut (6) and locking nut (5).

(15) Position chassis (46) to install cover (4), and screw & captive washer assembly (3)

e. Installation.

(1) Position special relay assembly to install lockwashers (2, figure 3-119) and screws (l).

(2) Connect electrical connectors to special relay assembly.

3-91. PRECISE RELAY ASSEMBLY.

WARNING

Do not attempt to perform maintenance on the precise relay assembly while the generator is operating. Severe electrical shock may result from failure to observe this warning.

a. Removal.

(1) Disconnect electrical connectors to precise relay assembly.

(2) Remove screws (1, figure 3-123) and lockwashers (2) to remove precise relay assembly from generator set.

NOTE

Disassemble only as required to clean, inspect, test, or replace parts.

b. Disassembly.

(1) Remove screw & captive washer assembly (3, figure 3–1 23) and cover (4).

(2) Remove locknuts (5), nut (6), tooth lockwasher (7) and rheostat (8).

(3) Remove nut (9), tooth lockwasher (10), positioning washer (11), and switch (12).

(4) Remove nut & captive washer assembly (13), flat washer (14), nut & captive washer assembly (15), and screw (16).

(5) Remove nut (17), screw & captive washer assembly (18) and wiring harness (19).

(6) Remove screw and captive washer assembly (20) and under voltage relay (21).

(7) Remove nut (22), screw & captive washer assembly (23) and electronic components assembly (24).

(8) Remove nut & captive washer assembly (25), screw (26), terminal board assembly (27) and terminal jumper (28).

(9) Remove screw & captive washer assembly (29) and under frequency relay (30).

(10) Remove screw & captive washer assembly (31), permissive paralleling relay (32) and chassis (33).

NOTE

Switch and attaching hardware (items 21 through 24) are found only on the 50/60 Hz precise relay assembly.

WIRE RUNNING LIST

		TERMINATION		TERMINATION			
MARKING COLOR	WIRE MARKING	FROM	FIND NO. REF.	TO	FIND NO REF.	FIND NO. REF.	WIRE LEN. REF.
RED	P140B12	J5–w	11	P13–1	21	23	6.50
RED	P50R18	J50–B	10	TB101–4	12	24	23.00
RED	P62A16	J50–H	10	TB101–20	12	24	16.75
RED	P50P16	J50–L	10	TB101–4	12	24	23.00
RED	P62E18	J50–b	10	TB101–20	12	24	16.75
RED	P206B18	J50–C	10	J6–1	2	20.25	20.25
RED	P205B18	J50–D	10	J6–H	2	21.25	20.25
RED	P203B18	J50–F	10	J6–F	2	24	20.25
RED	P209B18	J50–G	10	J6–M	2	24	20.25
RED	P200K18	J50–P	10	TB102–20	12	24	20.25
BLACK	X972218C	J50–J	10	TB102–2	12	24	30.00
BLACK	Z12N188	J50–K	10	TB102–4	12	24	30.00
BLACK	X8ZZ18C	J50–R	10	TB102–5	12	24	27.50
BLACK	X77Z18A	J50–S	10	TB102–6	12	24	27.50
RED	P55J18	J50–M	10	E4–B	12	24	6.00
RED	P44AB18	J50–W	10	E4–B	13	24	6.00
RED	P60A18	J50–E	10	J31–H	9	24	20.25
BLACK	K102F18	J50–N	10	J31–S	9	24	20.25
BLACK	K101F18	J50–X	10	J31–U	9	24	20.25
RED	P63C18	J50–a	10	J10–U	5	24	28.50
BLACK	X197D18	J3–8	4	TB102–14	12	24	11.50
RED	D11A18	J3–C	4	R35–2		24	26.25
RED	D12A18	J3–D	4	A5–2	12	24	26.25
BLACK	X17C18	J10–D	5	J50–T	10	24	28.50
BLACK	X7A18A	J10–E	5	TB102–6	12	24	14.75
BLACK	X8B16B	J10–F	5	TB102–5	12	24	14.75
BLACK	X14B18	J10–G	5	J2–6	1	24	26.00
BLACK	X15B18	J10–H	5	TB102–6	12	24	16.00
BLACK	X18C18	J10–J	5	J50–U	10	24	28.50
BLACK	X18B18	J10–L	5	J2–I	1	24	26.00
BLACK	X195D18	J10–V	5	TB102–13	12	24	17.25
BLACK	X194E18	J10–W	5	TB102–16	12	24	18.75
BLACK	X9A16C	J10–e	5	TB102–1	14	25	13.25
BLACK	X12B16N	J10–f	5	TB102–3	14	25	13.25
BLACK	X19C18	J10–k	5	J50–V	10	24	28.50
BLACK	X97A18	J10–M	5	R29–C		24	7.25
BLACK	X98N18	J10–N	5	RB101–16	12	24	17.50
RED	P50S18	J10–a	5	TB101–3	12	24	10.75
RED	P40N18	J10–c	5	TB101–5	12	24	12.50
RED	P56H18	J10–d	5	TB101–13	12	24	17.50
BLACK	K112G18	J10–j	5	TB101–15	12	24	17.50
RED	P55M12	J10–Q	5	E4–A	16	23	8.25
RED	P55CR18	J10–Z	5	E4–A	13	24	7.25
BLACK	X21T18	J10–X	5	A5–20	12	24	24.00
BLACK	X22T18	J10–Y	5	A5–7	12	24	26.00
BLACK	X6D18	J10–g	5	A5–18	12	24	24.75
BLACK	K110F18	J10–h	5	J31–G	9	24	23.75
BLACK	X96B18	J15–A	6	TB101–17	12	24	8.75
BLACK	X98H18	J15–B	6	TB101–16	12	24	8.25
BLACK	K111E18	J15–C	6	TB101–14	12	24	8.25
BLACK	K112A18	J15–D	6	TB101–15	12	24	8.25
BLACK	X96C18	J15–E	6	TB101–17	12	24	6.75
BLACK	X98J18	J15–F	6	TB101–16	12	24	6.75
BLACK	K111F16	J15–G	6	TB101–14	12	24	5.50
BLACK	K112B18	J15–H	6	TB101–15	12	24	6.00
BLACK	X96D18	J15–J	6	TB101–17	12	24	6.00
BLACK	X98K19	J15–K	6	TB101–16	12	24	6.75
BLACK	K111G18	J15–L	6	TB101–14	12	24	8.25
BLACK	K112C18	J15–M	6	TB101–15	12	24	6.00
BLACK	X128B16N	J15–P	6	TB102–3	14	25	9.75
BLACK	X9YY16C	J15–S	6	TB101–2	14	25	9.75
BLACK	X9L18C	J31–A	9	TB102–2	12	24	15.25
BLACK	X12X2N	J31–B	9	TB102–4	12	24	15.25
BLACK	X15H18	J31–R	9	TB102–8	12	24	13.00
RED	P200K18	J31–K	9	TB102–19	12	24	8.50
RED	P50Y18	J31–E	9	TB101–5	12	24	13.00
BLACK	K111D18	J31–J	9	TB101–14	12	24	7.50
RED	P55P18	J31–D	9	E4–B	13	24	8.50
RED	P55PP18	J31–Z	9	E4–B	13	24	8.50
RED	P204B18	J31–F	9	J6–G	2	24	15.50

WIRE RUNNING LIST

		TERMINATION		TERMINATION			
MARKING COLOR	WIRE MARKING	FROM	FIND NO. REF.	TO	FIND NO REF.	FIND NO. REF.	WIRE LEN. REF.
BLACK	D20C18	J2–A	1	J10–A	5	24	26.00
BLACK	D21C16	J2–B	1	J10–B	5	24	26.00
BLACK	D22C16	J2–C	1	J10–C	5	24	26.00
RED	P199C18	J2–a	1	J10–b	5	24	26.00
BLACK	D24C16	J2–D	1	J50–d	10	24	16.50
BLACK	X7C18A	J2–E	1	TB102–6	12	24	15.25
BLACK	X8E18B	J2–F	1	TB102–5	12	24	17.50
BLACK	X15C18	J2–H	1	TB102–B	12	24	15.25
BLACK	X9C18C	J2–z	1	TB102–1	12	24	17.50
BLACK	X12C18M	J2–y	1	TIB102–3	12	24	17.50
BLACK	X195C18	J2–f	1	TB102–13	12	24	12.00
BLACK	X197C18	J2–n	1	TB102–14	12	24	12.00
BLACK	X90E18	J2–U	1	TB102–15	12	24	12.00
BLACK	X194C18	J2–P	2	TB102–16	12	24	12.00
RED	P40K18	J2–u	1	TB101–1	12	24	17.50
RED	P40J18	J2–v	1	TB101–12	12	24	17.50
RED	J50–J18	J2–w	1	TB101–3	12	24	16.75
RED	P80C18	J2–m	1	TB101–6	12	24	16.75
RED	P57E18	J2–t	1	J31–L/91		24	17.75
RED	P47G18	J2–e	1	TB101–9	12	24	15.50
RED	P44D18	J2–c	1	TB101–10	12	24	14.00
RED	P45G18	J2–R	2	TB101–11	12	24	14.00
RED	P56D18	J2–k	1	TB101–13	12	24	11.25
RED	62B16	J2–h	1	TB101–20	12	24	11.25
BLACK	L25C18	J20j	1	A5–19	12	24	12.75
BLACK	L26C18	J2–K	1	A5–6	12	24	13.00
BLACK	X91C18	J2–L	1	J3–A	4	24	25.00
BLACK	K32C18	J2–M	1	J31–M	9	24	17.75
BLACK	K33C18	J2–N	1	J31–N	9	24	17.75
BLACK	L93D18	J2–b	1	J31–P	9	24	17.75
BLACK	K34C18	J2–T	1	J31–T	9	24	17.75
BLACK	X92C18	J2–S	1	J29–B	8	24	9.00
BLACK	X31C18	J2–0	1	J29–C	8	24	9.00
RED	P198C18	J2–c	1	J5–G	11	24	25.75
RED	P46C18	J2–x	1	J5–H	11	24	25.75
RED	E39C18	J2–V	1	J5–I	11	24	25.75
RED	E38C18	J2–W	1	J5–J	11	24	25.75
RED	E37C16	J2–X	1	J5–K	11	24	25.75
RED	E35C18	J2–Y	1	R13–4	13	24	22.25
RED	E36C18	J2–Z	1	R13–3	13	24	22.25
RED	P44G18	J2–p	1	E4–B	13	24	8.00
RED	P55VV18	J2–r	1	E4–8	13	24	8.00
RED	P207B18	J5–6	11	J6–K	2	24	23.50
RED	P202B18	J5–B	11	J6–E	2	24	23.50
RED	P201B18	J5–C	11	J6–D	2	24	23.50
RED	P44E18	J5–D	11	TB101–10	12	24	19.25
RED	P40B18	J5–M	11	TB101–1	12	24	19.50
RED	P80M18	J5–P	11	TB101–6	12	24	18.25
RED	P80L18	J5–R	11	TB101–6	12	24	20.25
RED	P40M18	J5–c	11	TB101–4	12	24	20.25
RED	P40K18	J5–e	11	TB101–3	12	24	18.25
RED	P40T18	J5–k	11	TB101–5	12	24	20.25
RED	P47F18	J5–n	11	TB101–9	12	24	19.25
RED	P80B18	J5–p	11	TB101–6	12	24	18.25
RED	V65C12	J5–x	11	TB101–18	17	23	23.50
RED	V64C12	J5–y	11	TB101–19	17	23	23.50
RED	P48B18	J5–U	11	A5–12	12	24	24.75
RED	P54B18	J5–V	11	A5–13	12	24	26.25
RED	P52B18	J5–Y	11	A5–4	12	24	26.50
RED	P68A18	J5–b	11	A5–6	12	24	25.75
RED	P200C18	J5–W	11	TB102–20	12	24	26.00
RED	P200D18	J5–Z	11	TB102–19	12	24	26.00
RED	P200E18	J5–m	11	TB102–19	12	24	26.00
RED	P51D18	J5–f	11	TB102–18	12	24	26.00
RED	P51B18	J5–r	11	TB102–18	12	24	26.00
RED	P58C18	J5–E	11	J50–A	10	24	28.25
RED	P44T18	J5–S	11	E4–A	13	24	9.00
RED	P44B18	J5–q	11	E4–A	13	24	9.00
RED	P55LL18	J5–h	11	E4–A	13	24	9.00
RED	P55Z12	J5–t	11	E4–A	16	23	9.00
*RED	P81B18	J5–F	11	E31–C	9	24	23.50
RED	P141A12	J5–z	11	R13–2	21	23	8.00
RED	P142A12	J5–v	11	K3–A2	15	23	11.00

*P8B18 from JF–F to E31–C is changed to P81B18 from E31–C to TB 101–5 for 400 Hz units equipped with electric governor.

Figure 3-120. Special Relay Assembly Wiring Harness, Drawing No. 72-2239 (Sheet 1 of 4)

WIRE MARKING	FROM	TERMINATION FIND NO REF.	TO	FIND NO REF.	WIRE FIND NO.	WIRE LENGTH REF.	WIRE MARKING COLOR
P210B18	J31–V	9	J6–N	2	24	15.50	RED
P40D18	J29–A	8	TB101–1	12	24	22.50	RED
P45H18	J29–D	8	TB101–11	12	24	17.75	RED
P47H18	J29–F	8	TB101–9	12	24	19.00	RED
J44G18	J29–G	8	TB101–10	12	24	17.75	RED
P56E18	J29–H	8	TB101–13	12	24	17.75	RED
P55P18	J29–E	8	E4–B	13	24	5.25	RED
P55D12	J7–A	3	E4–8	16	23	7.50	RED
P51A18	J7–B	3	TB102–18	12	24	31.50	RED
V64B12	J7–C	3	TB101–19	17	23	25.00	RED
V65B12	J7–D	3	TB101–18	17	23	25.00	RED
P141B12	J7–E	3	R13–2	21	23	5.00	RED
P45J18	J6–A	2	TB101–11	12	24	24.50	RED
P200B18	J6–C	2	TB102–20	12	24	24.50	RED
P208B18	J6–L	2	A5–17	12	24	21.00	RED
P66A18	J6–B	2	A5–3	12	24	17.25	RED
X96A18	TB101–17	12	T101–2	12	24	22.25	BLACK
P47E18	TB101–9	12	A5–16	12	24	19.50	RED
P50L18	TB101–5	12	A5–21	12	24	22.50	RED
P40F18	TB101–2	12	A5–1	12	24	26.50	RED
P200J18	TB102–19	12	A5–5	12	24	20.75	RED
P51E18	TB102–18	12	A5–24	12	24	18.00	RED
X194018	TB102–18	12	R29–2	NOTE 8	24	11.50	BLACK
X90D18	TB102–15	12	R31–2	NOTE 8	24	10.00	BLACK
X90E18	TB102–15	12	T101–3	12	24	18.00	BLACK
X197E18	TB102–14	12	R31–1	NOTE 8	24	11.25	BLACK
X197F18	TB102–14	12	T101–4	12	24	19.00	BLACK
X195E18	TB102–13	12	R29–1	NOTE 8	24	10.75	BLACK
X195F18	TB102–13	12	T101–1	12	24	19.00	BLACK
X9Z18C	TB102–1	12	A5–22	12	24	26.50	BLACK
P55C18	A5–15	12	E4–B	13	24	19.50	RED
P49A18	A5–9	12	K3–X1	12	24	21.25	RED
P55F18	K3–X2	12	E4–A	13	24	15.25	RED
P14CD12	X3–A1	15	R13–1	21	23	5.50	RED
P55TT12	E4–A	16	E4–B	16	23	30.00	RED
D13A18	R35–1	NOTE 8	A5–14	12	24	19.25	RED

FIND NO.	SYM	CODE IDENT	DWG SIZE	PART OR IDENTIFYING NO.	QTY REQD	NOMENCLATURE OR DESCRIPTION	SPEC	MATERIAL
1				MS3102R36–7S	1	CONNECTOR, ELECT. J2		
2				MS3102R20–27S	1	CONNECTOR, ELECT. J6		
3				MS3102R18–11S	1	CONNECTOR, ELECT. J7		
4				MS3102R14S–6S	1	CONNECTOR, ELECT. J3		
5				MS3102R32–7P	1	CONNECTOR, ELECT. J10		
8				MS3102R20–29S	1	CONNECTOR, ELECT. J15		
7								
8				MS3012R22–19S	1	CONNECTOR, ELECT. J29		
9				MS3102R24–28S	1	CONNECTOR, ELECT. J31		
10				MS3102R28–12S	1	CONNECTOR, ELECT. J50		
11				MS3102R36–7P	1	CONNECTOR, ELECT. J5		
12				MS25036–102	119	TERMINAL LUG, NO. 10 STUD, 18 AWG.		
13				MS150–36–149	15	TERMINAL LUG, NO. 8 STUD, 18 AWG.		
14				MS25036–106	4	TERMINAL LUG, NO. 6 STUD, 16 AWG.		
15				MS25036–11Z	2	TERMINAL LUG, NO. 10 STUD, 12 AWG.		
16				MS25036–15G	5	TERMINAL LUG, NO. 8 STUD, 12 AWG.		
17				MS17143–6	4	TERMINAL LUG, NO. 6 STUD, 12 AWG.		
18				M23053/5–105–0	141–3/4	INSULATION SLEEVING	MIL–I–23053/5	
19						NOT USED		
20				MS3367–5–9	AR	STRAP, CABLE, ADJUSTABLE		
21				MS25036–157	4	TERMINAL LUG, NO. 250 STUD, 12 AWG		
						NOT USED		
23				M5086/1–12	AR	WIRE, ELECT, 12 AWG MIL–W–5086/2		
24				M5086/2–18	AR	WIRE, ELECTRICAL, 16 AWG MIL–W–5096/2		
25				M5086/2–16	AR	WIRE, ELECTRICAL, 16 AWG MIL–W–5086/2		

NOTES:

1. ALL SOLDERED CONNECTIONS SHALL BE IN ACCORDANCE WITH MIL–STD–454, REQUIREMENT 5.
2. CUT INSULATION SLEEVING, FIND NO. 18, INTO 189 PIECES, .750 INCHES LONG AND INSTALL OVER WIRES AND PINS. AFTER SOLDERING, TO THE CONNECTIONS, FIND NOS. 1 THRU 11. THEN APPLY HEAT OF 400°F FOR 3–5 SEC. FOR PROPER SHRINKAGE.
3. INSTALL STRAPS, FIND NO. 10, AT 3.0 MAXIMUM INTERVALS AND AT EACH CABLE BREAK–OUT.
4. WIRE MARKING SHALL BE IN ACCORDANCE WITH MIL–W–5088 EXCEPT THAT LENGTH BETWEEN GROUPS OF NUMBERS SHALL NOT EXCEED 6 INCHES.
5. INTERPRET DRAWING PER MIL–STD–100.
6. CRIMPED TERMINALS SHALL MEET THE PERFORMANCE REQUIREMENTS OF MIL–T–7928.
7. REFERENCES:
   a) FOR WIRING DIAGRAM, SEE DRAWING 72–2205.
   b) FOR SCHEMATIC DIAGRAM, SEE DRAWING 72–2200.
8. WIRES WITHOUT TERMINATION SHALL BE STRIPPED .375 AND TIMED IN ACCORDANCE WITH MIL–STD–454, REQUIREMENT 5.

Figure 3-120. Special Relay Assembly Wiring Harness, Drawing No. 72-2239 (Sheet 2 of 4)

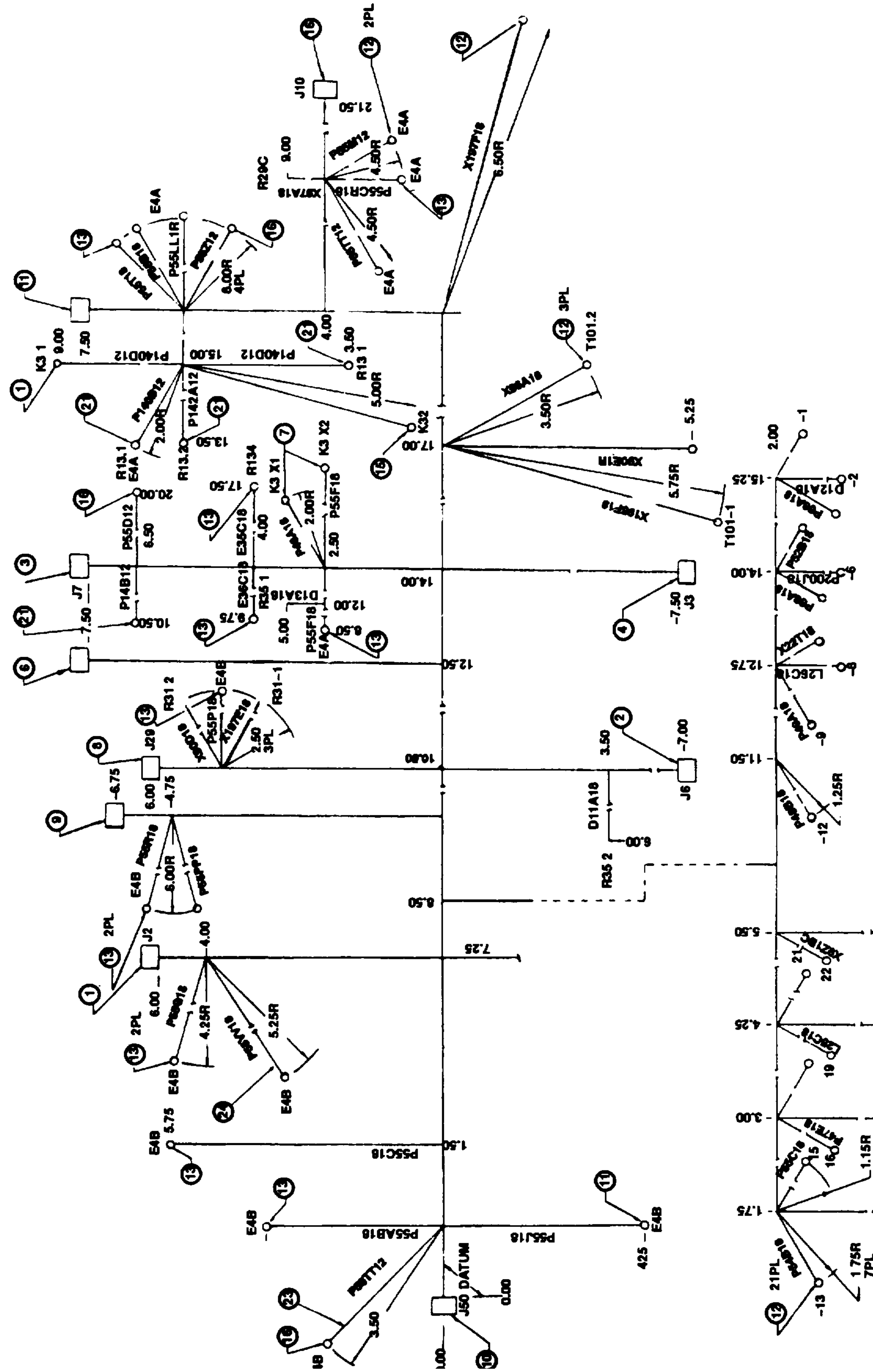


Figure 3-120. Special Relay Assembly Wiring Harness, Drawing No. 72-2239 (Sheet 3 of 4)

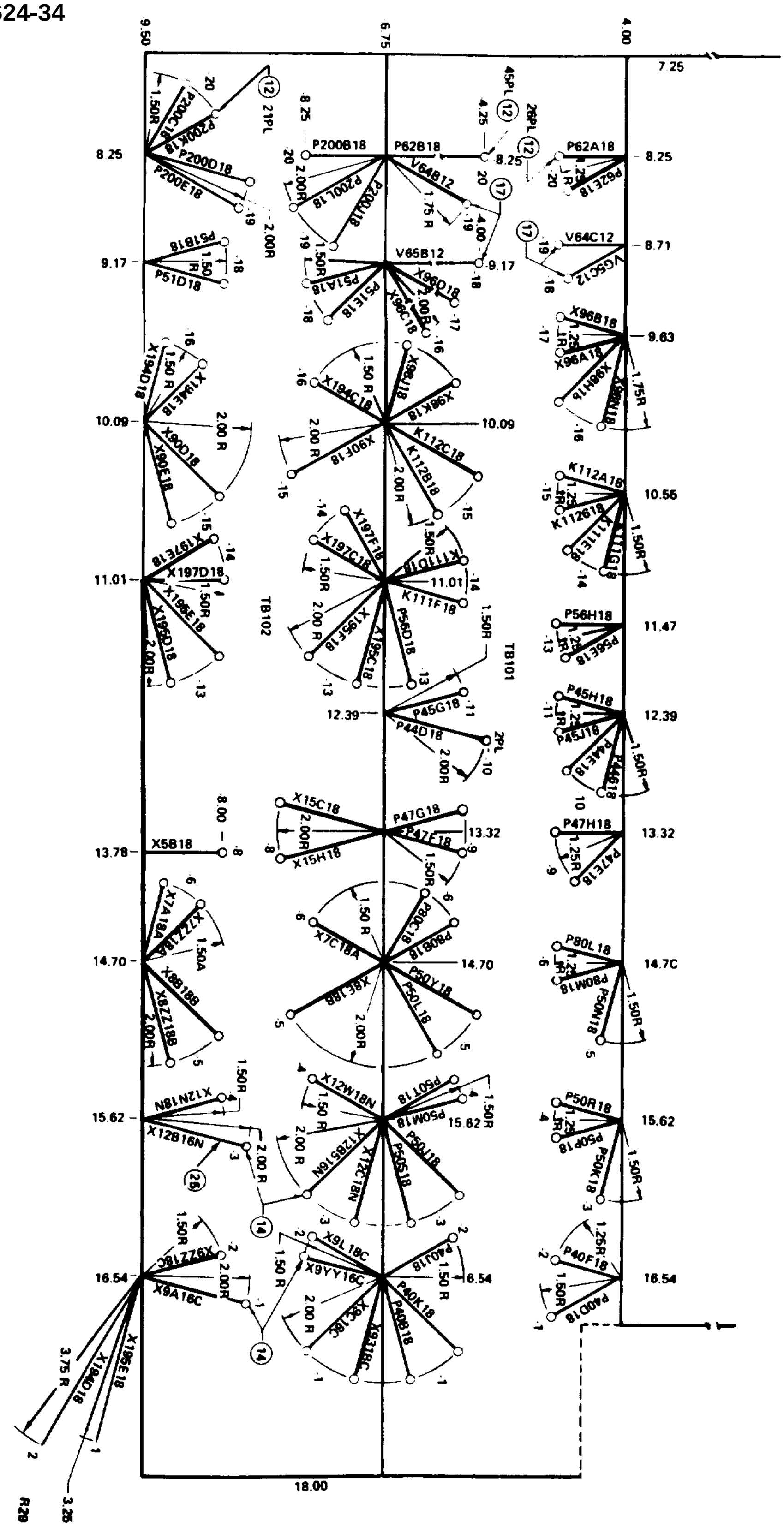


Figure 3-120. Special Relay Assembly Wiring Harness, Drawing No. 72-2239 (Sheet 4 of 4)

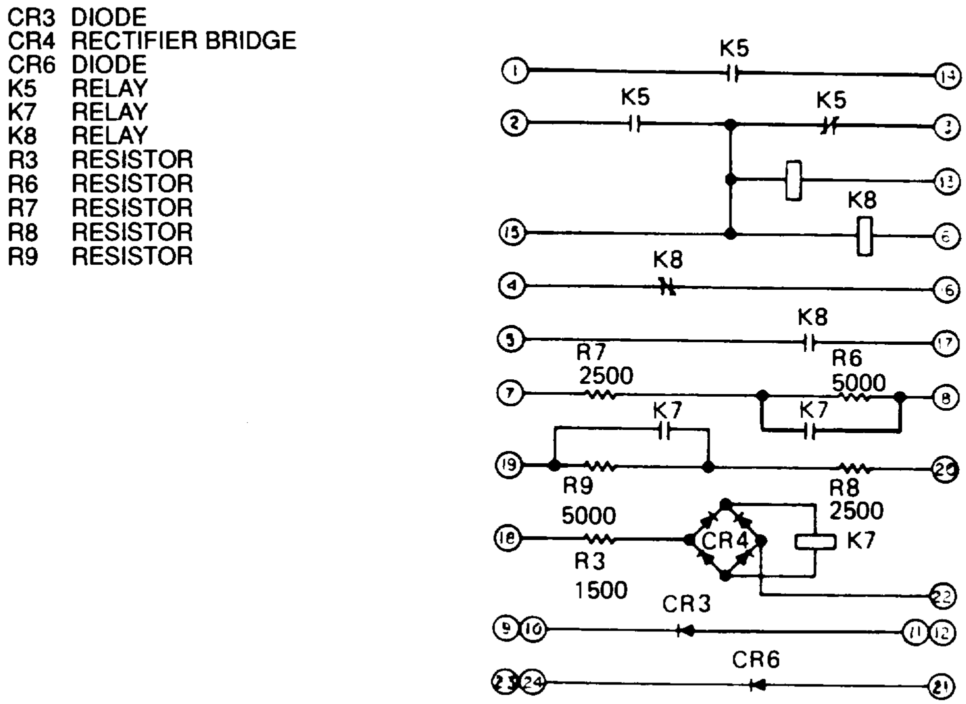


Figure 3-121. DC Relay Assembly Schematic Diagram

c. Cleaning, Inspection, and Repair.

WARNING

Compressed air used for cleaning and drying purposes can create airborne particles that may enter the eyes. Pressure shall not exceed 30 psig and use only the adequate chip guards and chipping goggles. Failure to observe this warning could result in servere personal injury or death.

WARNING

Solvent, Dry Cleaning P-D-680, Type II is flammable and moderately toxic to skin, eyes and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate. Failure to observe this warning could result in servere personal injury or death.

(1) Clean precise relay assembly with filtered compressed air and a soft bristle brush. If necessary, caked deposits may be removed with a clean, lint–free cloth moistened with solvent P-D-680 Type II. Dry thoroughly after cleaning with solvent.

(2) Visually inspect cover and chassis for cracks, corrosion, warping, defective paint and illegible markings.

(3) Inspect wiring harness for damaged wires and connectors for bent or broken connector pins and burned areas indicating shorts.

(4) Inspect switch (50/60 Hz only) for cracked casing, burns, corroded terminals and other damage.

(5) Inspect relays for cracked casing, corroded terminals, and evidence of shorting or other damage.

(6) Inspect resistors and capacitors of electronic components assembly for insecure mounting and burns or other evidence of shorting.

(7) Inspect terminal board assembly for cracks, corroded terminals, damaged terminal jumpers and evidence of shorting.

(8) Test under voltage relay as follows:

(a) Install relay in test circuit shown in figure 3-124.

(b) Activate power source G1 and adjust output voltage to 120 Vac at 50 HZ.

(c) Activate power source G2.

(d) Close switches S1 and S2.

(e) Test lamp DSI shall illuminate, and test lamp DS2 shall remain extinguished.

(f) Vary output frequency of power source G1 from 50 to 450 HZ. There shall be no change in test lamp illumination.

(g) Slowly decrease output voltage of power source G1 to 100 Vac. Vary output frequency from 350 to 450 Hz. Test lamp DSI shall remain illuminated and test lamp DS2 shall remain extinguished.

(h) Slowly decrease output voltage of power source G1 to 95 Vac. Vary frequency from 50 to 100 HZ. DS1 shall remain illuminated and DS2 shall remain extinguished.

(i) Set output frequency of power source G1 to 50 Hz. Slowly decrease output voltage of power source G1 to 90 Vac. Test lamp DS1 shall extinguish and test lamp DS2 shall illuminate. Set output frequency above 95 Vac and momentarily open switches S1 and allow relay to reset.

(j) Repeat steps (i) for frequencies of 60,70, and 100 Hz.

(k) Set output frequency of power source G1 to 350 Hz. Slowly decrease output voltage to 90 Vac. DS1 shall extinguish and DS2 shall illuminate. Return output frequency to 120 Vac and momentarily open switch S1, allowing relay to reset.

(l) Repeat step (k) for output frequency of 400 and 450 Hz.

(9) Test under frequency relay as follows:

(a) Install relay in test circuit shown in figure 3-125.

(b) Activate power source G1 and G2 and adjust output frequency to 50 Hz (400 Hz for 400 Hz units).

(c) Close switch S1. Test lamp DS1 shall illuminate and DS2 shall remain extinguished.

(d) Lower output frequency of power source G1 until test lamps transfer. Test lamp shall transfer at 46 ± 1 Hz (370 Hz for 400 Hz units).

1. Nut
2. Lockwasher
3. Flat washer
4. Screw
5. Lockwasher
6. Relay
7. Spacer
8. Socket
9. Nut & captive washer assy
10. Flat washer
11. Screw
12. Terminal board assy
13. Power resistor
14. Power resistor
15. Power resistor
16. Power resistor
17. Power resistor
18. Junction rectifier
19. Rectifier bridge
20. Junction rectifier
21. Printed circuit board

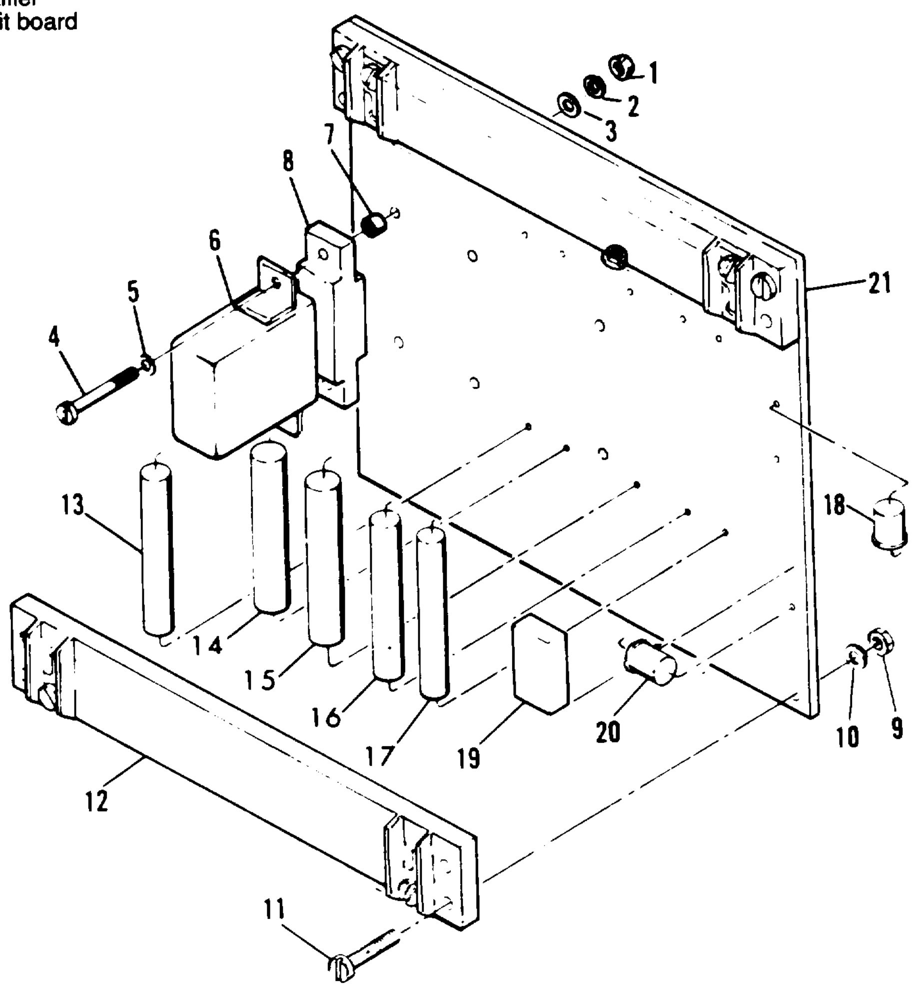
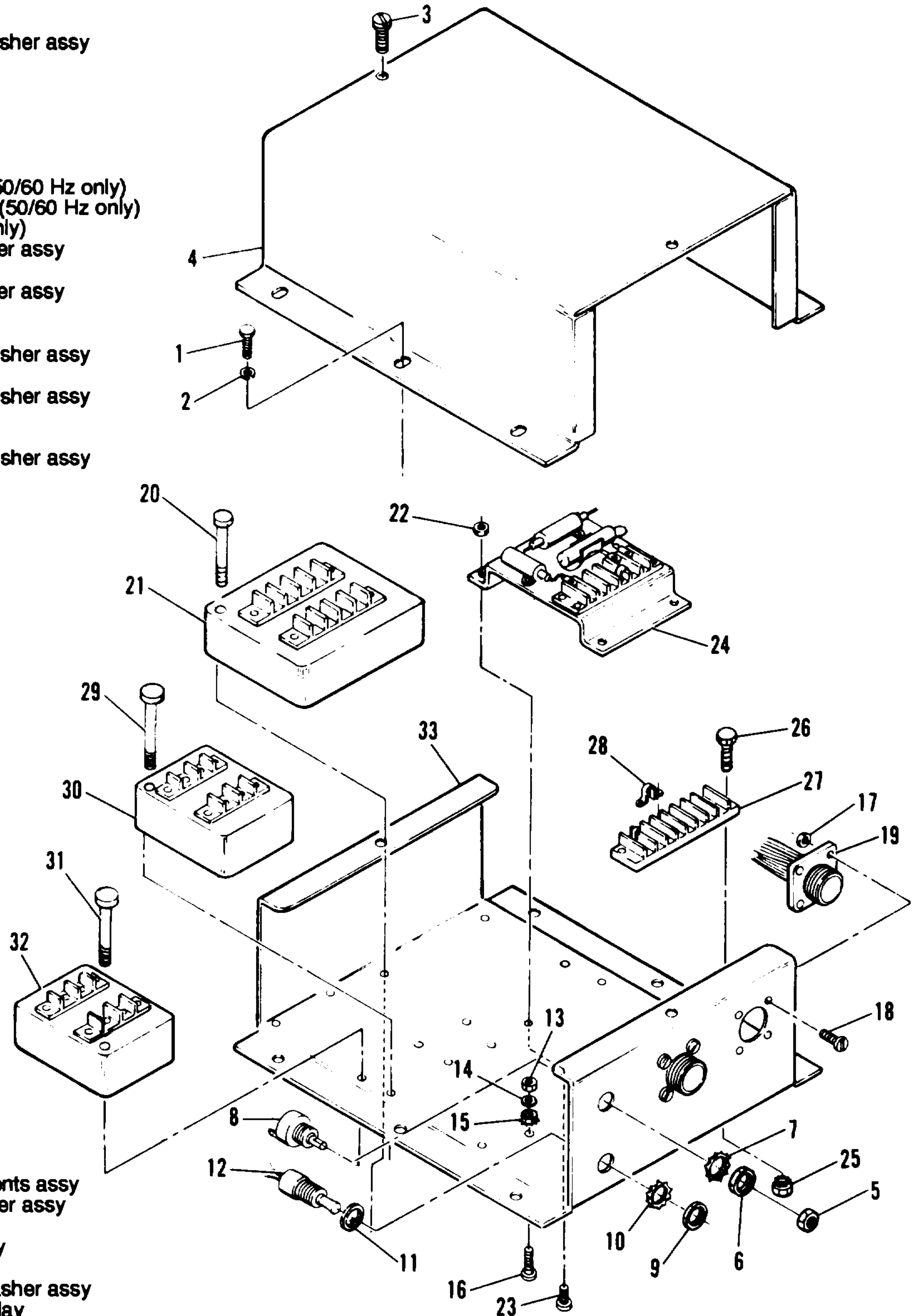


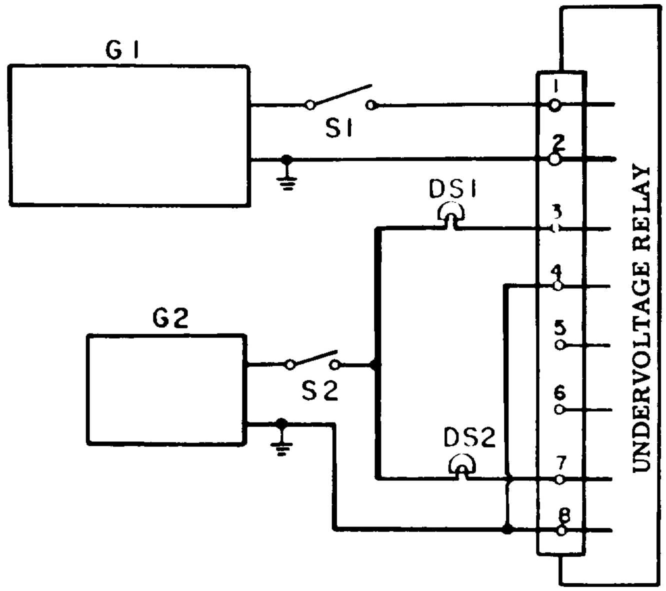
Figure 3–122. DC Relay Assembly, Exploded View

1. Screw
2. Lockwasher
3. Screw & captive washer assy
4. Cover
5. Locknut
6. Nut
7. Tooth lockwasher
8. Rheostat
9. Nut (50/60 Hz only)
10. Tooth lockwasher (50/60 Hz only)
11. Positioning washer (50/60 Hz only)
12. Switch (50/60 Hz only)
13. Nut & captive washer assy
14. Flat washer
15. Nut & captive washer assy
16. Screw
17. Nut
18. Screw & captive washer assy
19. Wiring harness
20. Screw & captive washer assy
21. Undervoltage relay
22. Nut
23. Screw & captive washer assy



24. Electronic components assy
25. Nut & captive washer assy
26. Screw
27. Terminal board assy
28. Terminal jumper
29. Screw & captive washer assy
30. Under frequency relay
31. Screw & captive washer assy
32. Permissive paralleling relay
33. Chassis

Figure 3-123. Precise Relay Assembly, Exploded View



LEGEND:

DS1 TEST LAMP
DS2 TEST LAMP
G1 POWER SOURCE, VARIABLE, 0–160 VAC, 50–450 HZ
G2 POWER SOURCE, 24 VDC
S1 SWITCH
S2 SWITCH

Figure 3-124. Under Voltage Relay Test Circuit

LEGEND:

DS1 TEST LAMP
DS2 TEST LAMP
F1 FREQUENCY METER, 0–400 HZ
G1 POWER SOURCE, 120 VAC, 0–400 HZ
G2 POWER SOURCE, 24 VDC
S1 SWITCH

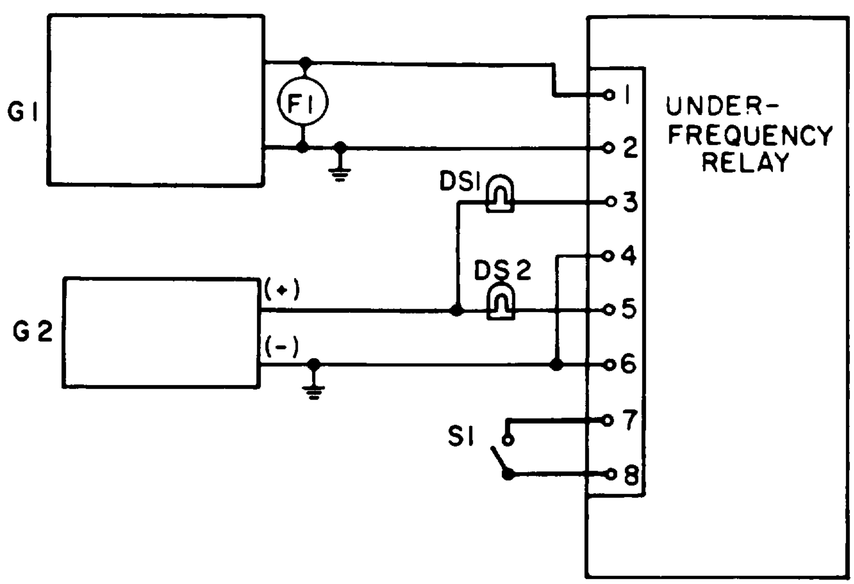


Figure 3-125. Under Frequency Relay Test Circuit

(e) Slowly raise output frequency of power source GI until test lamps transfer. Test lamps shall transfer at 46 ± 1 Hz (375 Hz for 400 Hz units).

(f) Adjust output voltage of power source G1 to 132 Vac. Check for test lamp transfer points. Transfer points shall be within 1 Hz of those of steps (d) and (e).

(g) Adjust output voltage of power source G1 to 108 Vac. Check for test lamp transfer points. Transfer points shall be within 1 Hz of those of steps (d) and (e).

(h) Open switch S1 and repeat steps (d) through (g). Transfer points shall be 55 ± 1 Hz and 58 ± 1 Hz (380 ± Hz and 385 ± 2 for 400 Hz units).

(10) Test permissive paralleling relay as follows:

(a) Install permissive paralleling relay into test circuit shown in figure 3–126.

(b) Check that switch (S1) is open, then energize power sources G1 and G2.

(c) Adjust power source G1 to obtain reading of 15 Vac on voltmeter (M1).

(d) Adjust power source G1 to obtain reading of 50 Hz on frequency meter (M2).

(e) Close switch (S1) and observe test lamp (DS1) and (DS2). DS1 shall be dark and DS2 shall be illuminated.

(f) Slowly reduce the voltage of power source G1 until the relay drops out (DS1 extinguishes and DS2 illuminates). Drop out shall occur at 8 ± 1 Vac.

(g) Slowly increase the voltage of power supply G1 until relay pickup occurs (DS1 illuminates and DS2 extinguishes). Pick up shall occur at a voltage not greater than 1 Vac greater than drop out.

(h) Open switch (S1) and adjust frequency of power source G1 to 60 Hz.

(i) Repeat steps (e) through (g) above. Relay drop out and pick up shall occur at the same voltages.

(j) Open switch (S1) and adjust the frequency of power source G1 to 400 Hz.

(k) Repeat steps (e) through (g) above. Relay drop out and pick up shall occur at the same voltages.

(l) Increase the voltage of power source G1 to 300 Vac for 2 seconds. There shall be no damage as a result of this test.

(11) Replace relays which fail to perform as specified.

(12) Test electronic components assembly as follows: (See schematic diagram in figure 3-127).

(a) Check resistance across terminals 1 and 2 and across terminals 3 and 4. Resistance should be as specified. If it is not, replace the defective resistors as necessary.

(b) Test capacitor (terminals 5 and 6). Replace, if defective.

(13) Replace defective components of electronic components assembly using figure 3-127 as a guide, and Appendix A references for detailed soldering and replacement procedures.

(14) If the wiring harness has sustained damage and requires repair or rebuild, refer to figure 3-128 (50/60 Hz) or 3-129 (400 Hz) for layout, identification and material requirements and Appendix A for detailed soldering and replacement procedures.

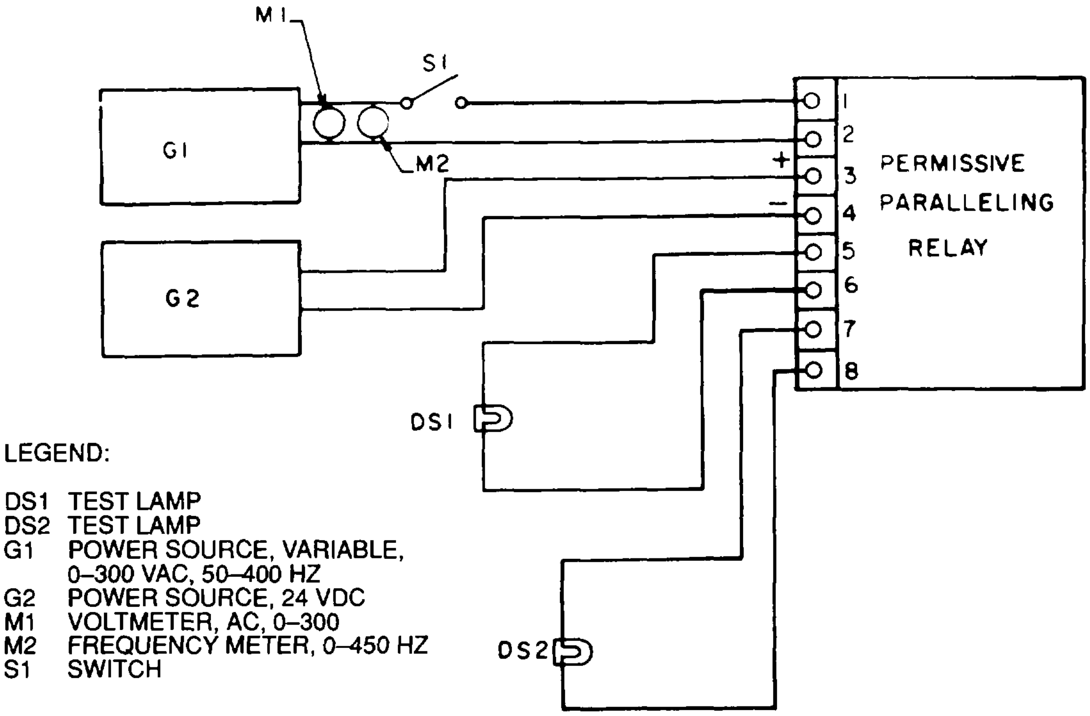


Figure 3–1 26. Permissive Paralleling Relay Test Circuit

(15) Check individual wires for continuity. Replace defective wires using wire conforming to Military Specification MIL-W–5086, Type II. Use figures 3-128 or 3-129 as a guide.

d. Assembly..

(1) Position chassis (33, figure 3-123) to install permissive paralleling relay (32) and screw & captive washer assembly (31).

(2) Install under frequency relay (30), screw & captive washer assembly (29).

(3) Install terminal jumper (28), terminal board assembly (27), screw (26), nut & captive washer assembly (25).

(4) Install electronic components assembly (24), screw & captive washer assembly (23) and nut (22).

(5) Install under voltage relay (21), screw& captive washer assembly (20).

(6) Install wiring harness (19), screw & captive washer assembly (18), and nut (17).

(7) Install screw (16), nut & captive washer assembly (15), flatwasher (14), nut & captive washer assembly (13).

(8) Install switch (12), positioning washer (11), tooth lockwasher (10) and nut (9).

(9) Install rheostat (8), tooth lockwasher (7), nut (6), and locknut (5).

(10) Install cover (4), screw & captive washer assembly (3).

e. Installation.

(1) Position precise relay assembly to install lockwashers (2, figure 3-123) and screws (1).

(2) Connect electrical connectors to precise relay assembly.

3-92. STATIC EXCITER AND VOLTAGE REGULATOR ASSEMBLY.

a. General. The static exciter and voltage regulator assembly provide excitation and voltage regulation for the generator output voltage and compares it to a reference voltage which is established by the voltage adjust rheostat on the generator set control cubicle. If difference exists, an error signal is sent to the static exciter. Excitation current supplied by the current transformer assembly is altered by the error signal until generator output voltage equals the reference voltage.

WARNING

Do not attempt to perform maintenance on the static exciter and voltage regulator assembly while the generator set is operating. Severe electrical shock or death may result from failure to observe this warning.

b. Removal.

(1) Disconnect electrical connectors to static exciter and voltage regulator assembly.

(2) Remove screws (1, figure 3-130) and Iockwasher (2) to remove static exciter and voltage regulator assembly from generator set.

NOTE

Disassemble static exciter and voltage regulator assembly only as required to clean, inspect, test and replace components.

c. Disassembly. .

(1) Remove screw (3, figure 3-130), on chassis cover (4) from chassis (68).

(2) Remove nut and captive washer assembly (5), flat washer (6), screw (7) to remove heat sink assembly (8).

(3) Remove nut and captive washer assembly (9) and screw (10).

(4) Remove wire (11), terminal lug (12), and semiconductor (13) as one assembly. Remove semiconductor (14).

(5) Remove nut and captive washer assembly (15), screws (16), heat sink (17) and heat sink support (18).

(6) Remove nut and captive washer assembly (19), screw (20), and terminal board (21).

(7) Remove nut and captive washer assembly (22), screw (23), and transformer (24).

(8) Remove nuts (25 and 26), screw (27), capacitor (28), Iockwasher (29) and bracket (30).

(9) Remove nut & captive washer assembly (31), terminal (32), and nut& captive washer assembly (33).

(10) Remove nut & captive washer assembly (34), screw (35), and transformer (36).

(11) Remove screw (37), and voltage regulator assembly (38) from chassis (68).

(12) Remove nut & captive washer assembly (39), screw (40), mounting bracket (41) and capacitor C2 (42).

(13) Remove nut & captive washer assembly (43), screw (44) and transformer (45).

(14) Remove nut & captive washer assembly (46), screw (47), nut& captive washer assembly (48), Washer (49), screw (50), mica washer (51), mounting bracket (52), resistors R1 and R2 (53 and 54).

(15) Remove nut & captive washer assembly (55), screw (56), resistor bracket (57) and resistor R3 (58).

(16) Remove nut & captive washer assembly (59), screw (60), and cable clamp (61).

(17) Remove nut & captive washer assembly (62), screw (63), and cable clamp (64).

(18) Remove nut & captive washer assembly (65), screw (66), and wiring harness (67).

(19) Remove nut & captive washer assembly (69), screw (70), nut (71), Iockwasher (72), diode CR1 (73), and heat sink (74).

(20) Remove nut & captive washer assembly (75), screw (76), Remove wiring harness (77), tiedown strap wire (78), wire (79), and shrink tubing (80) as one assembly.

(21) Remove nut & captive washer assembly (81), screw (82), capacitor C14 (83), Remove nut & captive washer assembly (84), screw (85) and capacitor C13 (86).

NOTE

Resistor R23, capacitor C7, resistor R22, capacitor C5 and resistor R9 are on 400 Hz generator sets only. Capacitor C10 and C12 are on 50/60 Hz generator sets only.

(22) Melt solder as necessary and remove R24 (87), R16 (88), R21 (89), R28 (90), R31 (92), R30 (94), R11 (95), R6 (97), R10 (98), R12 (101), R14 (105), R34 (106), R5 (111), R4 (112), R23 (113), R18 (117), R22 (118), R19 (122), R20 (124), R9 (127), R29 (128), R25 (129), R33 (131), R15 (133), R32 (134), R17 (135), R26 (147), R27 (148), R13 (149), R8 (151).

(23) Melt solder as necessary and remove capacitors C16 (91), C4 (100), C6 (99), C3 (102), C8 (110), C7 (114), C15 (119), C5 (125), C9 (136), C11 (146), C10 (152), C12 (153).

(24) Melt solder as necessary and remove diodes CR11 (93), and diodes (96), (109), (115), (116), (121), (123), (126), (130), (132), (137 thru 145), and (150).

(25) Melt solder as necessary and remove transistors (103), (107), (108), (120).

(26) Melt solder as necessary and remove integrated circuit (104).

NOTE

Tag and disconnect electrical leads to each component before removing.

d. Cleaning. Inspection, and Repair.

(1) Clean static exciter and voltage regulator assembly with filtered compressed air and a soft bristle brush. If necessary, caked deposits maybe removed with a clean. lint–free cloth moistened with an approved cleaning solvent. Dry thoroughly if cleaning solvent is used.

(2) Inspect cover and chassis for cracks, corrosion, warping, and other damage.

(3) Inspect heat sink assembly for cracks, corrosion, and signs of overheating or shorting.

(4) Using an ohmmeter, test semiconductors as follows:

(a) Using an ohmmeter, check resistance through semiconductor in both directions.

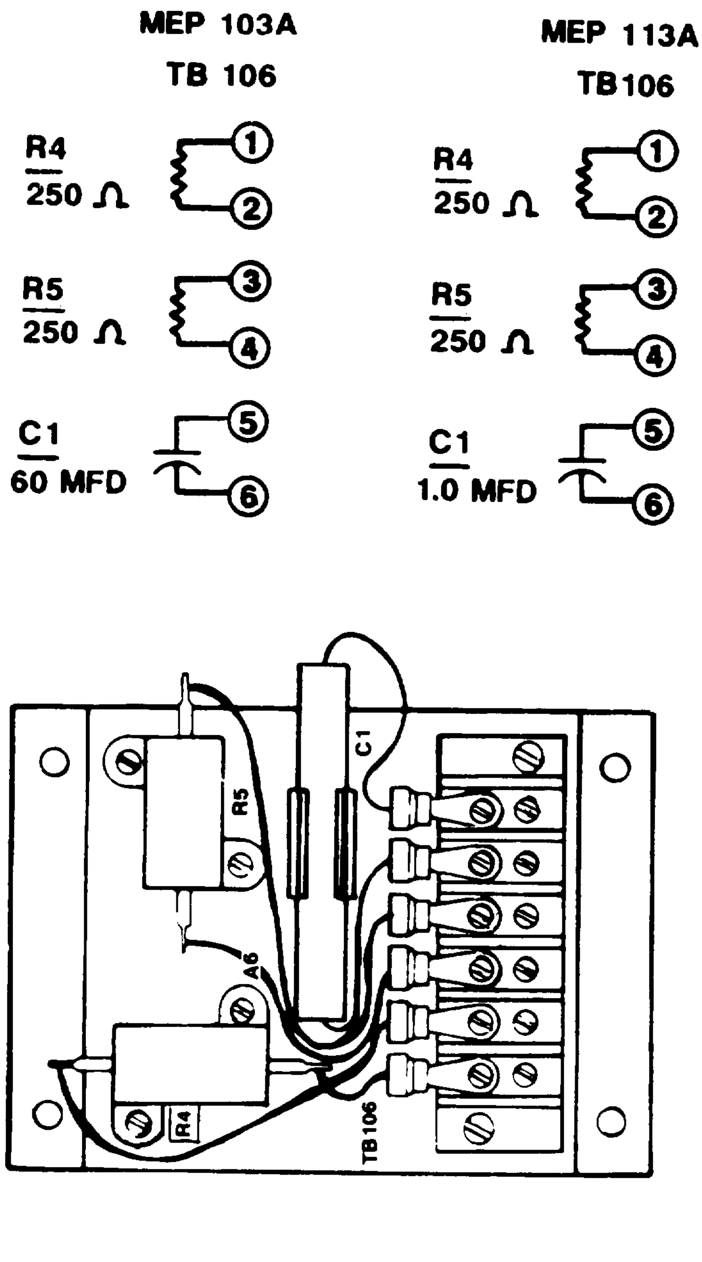


Figure 3-127. Electronics Components Assembly

WIRE MARKING	FROM	TERMINATION FIND NO REF.	TO	FIND NO REF.	WIRE FIND NO	WIRE LENGTH REF.	WIRE MARKING COLOR
P81L18	J32–C	3	J8–C	2	1	8.50	RED
K11OB18	J32–G	3	J8–G	2	1	8.50	BLACK
K111B18	J32–J	3	J8–J	2	1	8.50	BLACK
K102L18	J32–S	3	J8–S	2	1	9.00	BLACK
K101L18	J32–U	3	J8–U	2	1	9.00	BLACK
K32E18	J32–M	3	J8–M	2	1	9.00	BLACK
X9P18C	J32–A	3	TB104–1	4	1	8.00	BLACK
X12R18N	J32–B	3	TB104–3	4	1	7.75	BLACK
P50AA18	J32–E	3	TB104–5	4	1	7.50	RED
P200N18	J32–K	3	TB104–7	4	1	6.75	RED
PSSYY18	K32–D	3	TB104–6	4	1	7.75	RED
PSSRR18	J32–Z	3	E2	6	1	11.00	RED
L93F18	J32–P	3	K16–1	4	1	12.00	BLACK
X15J18	J32–R	3	K16–2	4	1	12.50	BLACK
P57J1B	J32–L	3	K16–8	4	1	12.50	RED
K33E18	J32–N	3	TB106–2	4	1	10.25	BLACK
K34E18	J32–T	3	TB106–4	4	1	950	BLACK
P60C18	J32–H	3	K11–7	4	1	12.50	RED
P204C18	J32–F	3	K11–3	4	1	11.50	RED
P210D18	J32–V	3	K12–5	4	1	9.50	RED
P59A18	K12–4	4	K16–7	4	1	3.00	RED
P71A18	K12–3	4	K11–8	4	1	6.75	RED
P200P18	K12–6	4	TB104–7	4	1	13.50	RED
P200R18	K11–4	4	TB104–7	4	1	15.00	RED
X9F18C	K11–1	4	TB104–1	4	1	15.75	BLACK
X12EE18	K11–2	4	TB104–3	4	1	16.50	BLACK
X9E18C	K12–1	4	TB104–1	4	1	16.25	BLACK
X12FF18N	K12–2	4	TB104–3	4	1	16.00	BLACK
P50AB18	K16–3	4	TB104–5	4	1	17.00	RED
P55XD18	K16–4	4	TB104–6	4	1	17.50	RED
X9S18C	J8–A	2	TB104–2	4	1	7.50	BLACK
X12018N	J5–B	2	TB104–4	4	1	7.50	BLACK
P55S18	J8–D	2	TB104–6	4	1	8.50	RED
K103A18	J8–N	2	TB106–1	4	1	9.00	BLACK
K104A18	J8–T	2	TB106–3	4	1	8.00	BLACK
K108A18	J8–P	2	TB106–5	4	1	7.50	BLACK
K109A18	J8–R	2	TB106–6	4	1	7.00	BLACK
K105A18	J8–E	2	R28–R	6	1	5.50	BLACK
K106A18	J8–H	2	R28–M	6	1	6.50	BLACK
K107A18	J8–F	2	R28–L	6	1	6.75	BLACK
K114A18	S10–3	4	J8–K	2	1	6.85	BLACK
K115A18	S10–4	4	J8–L	2	1	6.50	BLACK
K144A18	S10–1	4	K12–7	4	1	8.00	BLACK
K145A18	S10–2	4	K12–8	4	1	8.25	BLACK

FIND NO.	SYM	CODE IDENT	DWG SIZE	PART OR IDENTIFYING NO.	QTY REQD	NOMENCLATURE OR DESCRIPTION	SPEC	MATERIAL
1				MS086/2–18–9	AR	WIRE ELECTRIC 18 AWG	MIL–W–5086/2	
2				MS3102R24–28S	1	CONNECTOR ELECTRIC, J8		
3				MS3102R24–28P	1	CONNECTOR ELECTRIC, J32		
4				MS25036–102	46	TERMINAL LUG NO. 6 STUD, 18 AWG		
5						(NOT USED)		
6				MS25036–149	4	TERMINAL LUG NO. 8 STUD, 18 AWG		
7				MS3387–5–9	AR	STRAP, CABLE, ADJUSTABLE		
8								
9				M23053/5–105–0	281/2"	INSULATION SLEEVING	MIL–1–23053/5	

NOTES:

1. ALL SOLDERED CONNECTIONS SHALL BE IN ACCORDANCE WITH MIL-STD-454, REQUIREMENT 5.
2. CUT INSULATION SLEEVING (FIND #9) INTO 38 PIECES, .750 INCHES LONG AND INSTALL OVER WIRES AND PINS, AFTER SOLDERING, TO THE CONNECTORS (FIND #2 AND #3). THEN APPLY HEAT OF 400°FOR 3-5 SEC. FOR PROPER SHRINKAGE.
3. INSTALL STRAPS, FIND NO. 7 AT 3.0 MAX INTERVALS AND AT EACH CABLE BREAK-OUT.
4. WIRE MARKING TO BE IN ACCORD–ANCE WITH MIL-W-5088 EXCEPT THAT LENGTH BETWEEN GROUPS OF NUMBERS SHALL NOT EXCEED 6 INCHES.
5. CRIMPED TERMINALS SHALL MEET THE PERFORMANCE REQUIREMENTS OF MIL-T–7928.
6. INTERPRET DRAWING PER MIL-STD-1OO.
7. REFERENCES
   a) FOR WIRING DIAGRAM, SEE DRAWING 72–2205.
   b) FOR SCHEMATIC DIAGRAM, SEE DRAWING 72–2200 AND 72-2269.

Figure 3-128. 50/60 Hz Precise Relay Assembly Wiring Harness, Drawing No. 72-2242 (Sheet 1 of 2)

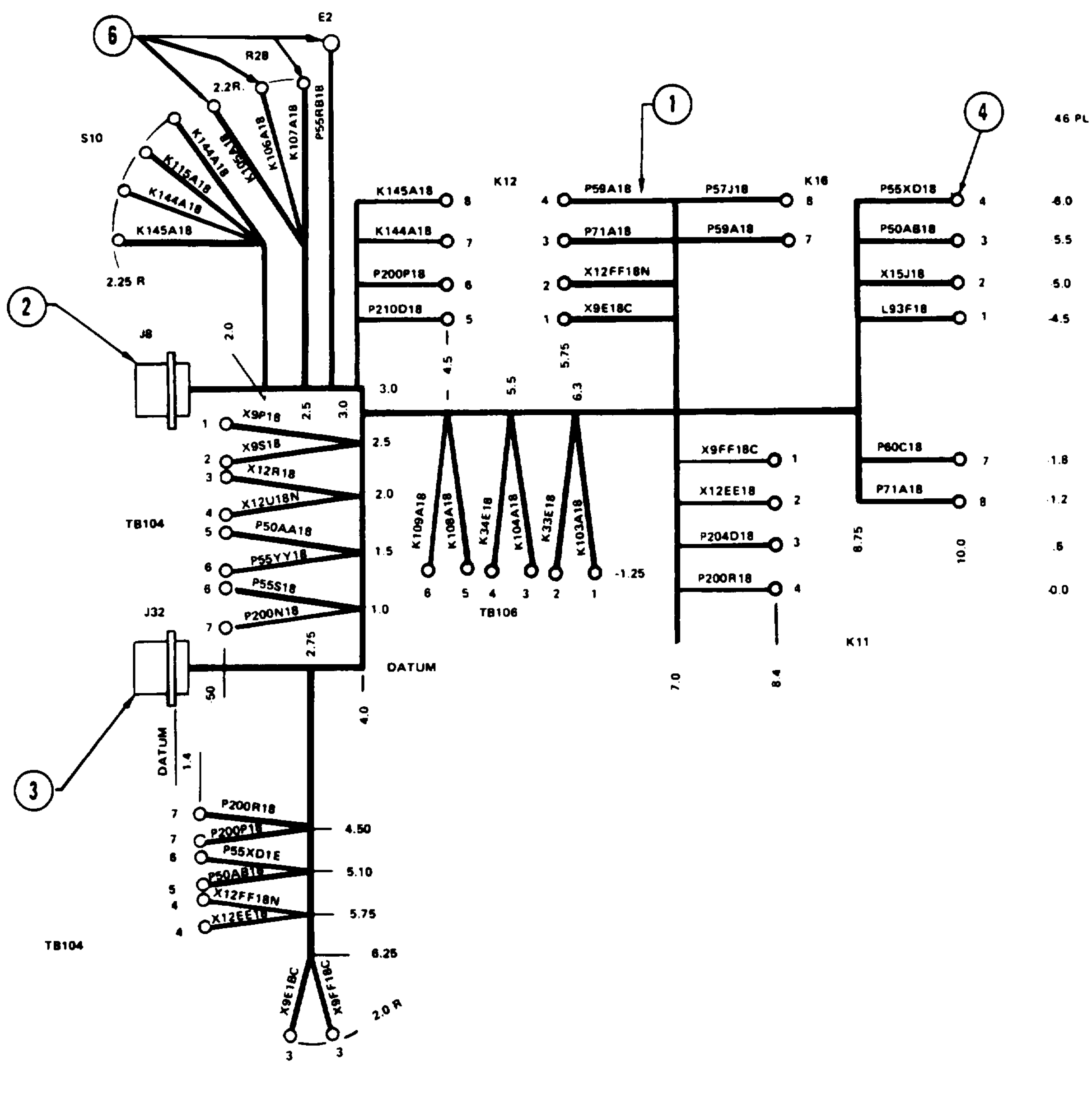


Figure 3-128. 50/60 Hz Precise Relay Assembly Wiring Harness, Drawing No. 72-2242 (Sheet 2 of 2)

WIRE MARKING	FROM	TERMINATION			WIRE FIND NO	WIRE LENGTH REF.	WIRE MARKING COLOR
		FIND NO REF.	TO	FIND NO REF.			
P81E18	J32–C	3	J8–C	2	1	8.50	RED
K110B18	J32–G	3	J8–G	2	1	8.50	BLACK
K111B18	J32–J	3	J8–J	2	1	8.50	BLACK
K102L18	J32–S	3	J8–S	2	1	9.00	BLACK
K101L18	J32–U	3	J8–U	2	1	9.00	BLACK
K32E18	J32–M	3	J8–M	2	1	9.00	BLACK
X9P18C	J32–A	3	TB104–1	4	1	8.00	BLACK
X12R18N	J32–B	3	TB104–3	4	1	7.75	BLACK
P50AA18	J32–E	3	TB104–5	4	1	7.50	RED
P200N18	J32–K	3	TN104–7	4	1	8.75	RED
P55YY18	J32–D	3	TB104–6	4	1	7.75	RED
P55RR18	J32–Z	3	E2	6	1	11.00	RED
L93F18	J32–P	3	K16–1	4	1	12.00	BLACK
X15J18	J32–R	3	K16–2	4	1	12.50	BLACK
P57J18	J32–L	3	K16–8	4	1	12.50	RED
K33E18	J32–N	3	TB106–2	4	1	10.25	BLACK
K34E18	J32–T	3	TB106–4	4	1	9.50	BLACK
P60C18	J32–H	3	K11–7	4	1	12.50	RED
P204D18	J32–F	3	K11–3	4	1	11.50	RED
P210D18	J32–V	3	K12–5	4	1	9.50	RED
P59A18	K12–4	4	K16–7	4	1	3.00	RED
P71A18	K12–3	4	K11–8	4	1	6.75	RED
P200P18	K12–6	4	TB104–7	4	1	13.50	RED
P200R18	K11–4	4	TB104–7	4	1	15.00	RED
X9FF18C	K11–1	4	TB104–1	4	1	15.75	BLACK
X12EEJ8N	K11–2	4	TB104–3	4	1	16.50	BLACK
X9E1BC	K12–1	4	TB104–2	4	1	16.25	BLACK
X12FF18N	K12–2	4	TB104–4	4	1	16.00	BLACK
P50AB18	K16–3	4	TB104–5	4	1	17.00	RED
P55XD18	K16–4	4	TB104–6	4	1	17.50	RED
X9S18C	J8–A	2	TB104–2	4	1	7.50	BLACK
X12U18N	J8–B	2	TB104–4	4	1	7.50	BLACK
P55S18	J8–D	2	TB104–6	4	1	8.50	RED
K103A18	J8–N	2	TB106–1	4	1	9.00	BLACK
K104A18	J8–T	2	TB106–3	4	1	8.00	BLACK
K108A18	J8–P	2	TB106–5	4	1	7.50	BLACK
K109A18	J8–R	2	TB106–6	4	1	7.00	BLACK
K105A18	J8–E	2	R28–R	6	1	5.50	BLACK
K106A18	J8–N	2	R28–N	6	1	6.50	BLACK
K107A18	J8–F	2	R28–L	6	1	5.75	BLACK

FIND NO.	SYM	CODE IDENT	DWG SIZE	PART OR IDENTIFYING NO.	QTY REQD	NOMENCLATURE OR DESCRIPTION	SPEC	MATERIAL
1				M5086/2–18–9	AR	WIRE ELECTRIC 18 AWG	MIL–W–5086/2	
2				MS310R24–28S	1	CONNECTOR– ELECTRIC, J8		
3				MS3102R24–28P	1	CONNECTOR ELECTRIC, J32		
4				MS25036–102	40	TERMINAL LUG NO. 6 STUD, 18 AWG		
5						(NOT USED)		
6				MS25036–149	4	TERMINAL LUG NO. 8 STUD, 18 AWG		
7				MS3367–5–9	AR	STRAP, CABLE, ADJUSTABLE		
8						(NOT USED)		
9				.133ID FORM Ua	AR	INSULATION, TUBING TYPE F	MIL–I–631	

NOTES:

1. ALL SOLDERED CONNECTIONS SHALL BE IN ACCORDANCE WITH MIL-STD-454, REQUIREMENT 5.
2. AFTER SOLDERING, INSTALL INSULATION SLEEVING, FIND NO. 9, .5 LONG, OVER EACH CONTACT OF CONNECTOR FIND NO. 2 AND 3.
3. INSTALL STRAPS, FIND NO. 7 AT3.0 MAX INTERVALS AND AT EACH CABLE BREAK-OUT.
4. WIRE MARKING TO BE IN ACCORDANCE WITH MIL–W-5088 EXCEPT THAT LENGTH BETWEEN GROUPS OF NUMBERS SHALL NOT EXCEED 6 INCHES.
5. CRIMPED TERMINALS SHALL MEET THE PERFORMANCE REQUIREMENTS OF MIL–T-7928.
6. INTERPRET DRAWING PER MIL-STD-100.
7. REFERENCES
   a) FOR WIRING DIAGRAM, SEE DRAWING 72-2205.
   b) FOR SCHEMATIC DIAGRAM, SEE DRAWING 72-2200 AND 72–2269.

Figure 3-129. 400Hz Precise Relay Assembly Wiring Harness, Drawing No. 72–2260 (Sheet 1 of 2)

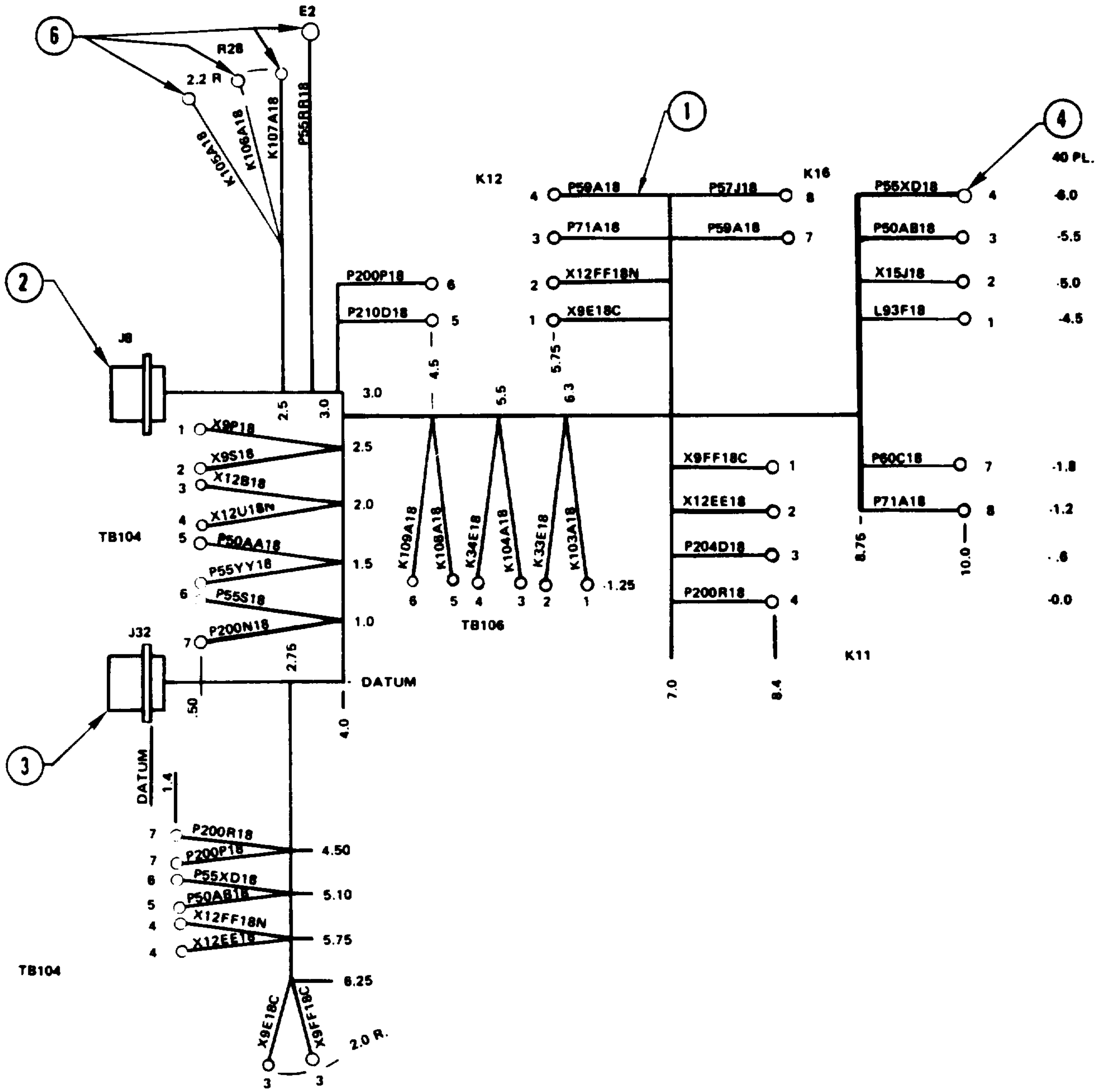


Figure 3-129. 400Hz Precise Relay Assembly Wiring Harness, Drawing No. 72-2260 (Sheet 2 of 2)

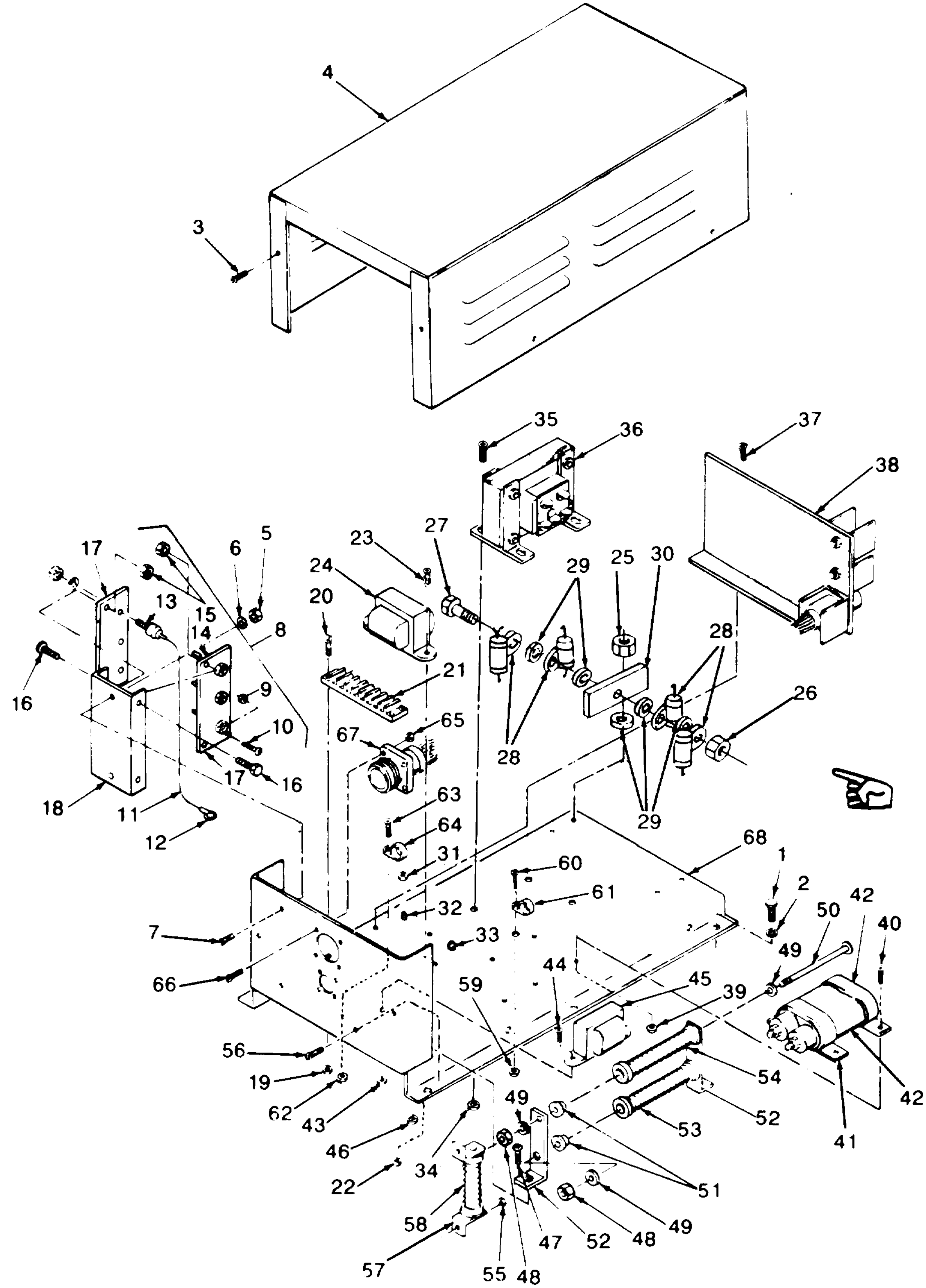


Figure 3–130. Static Exciter and Voltage Regulator Assembly, Exploded View (Sheet 1-3)

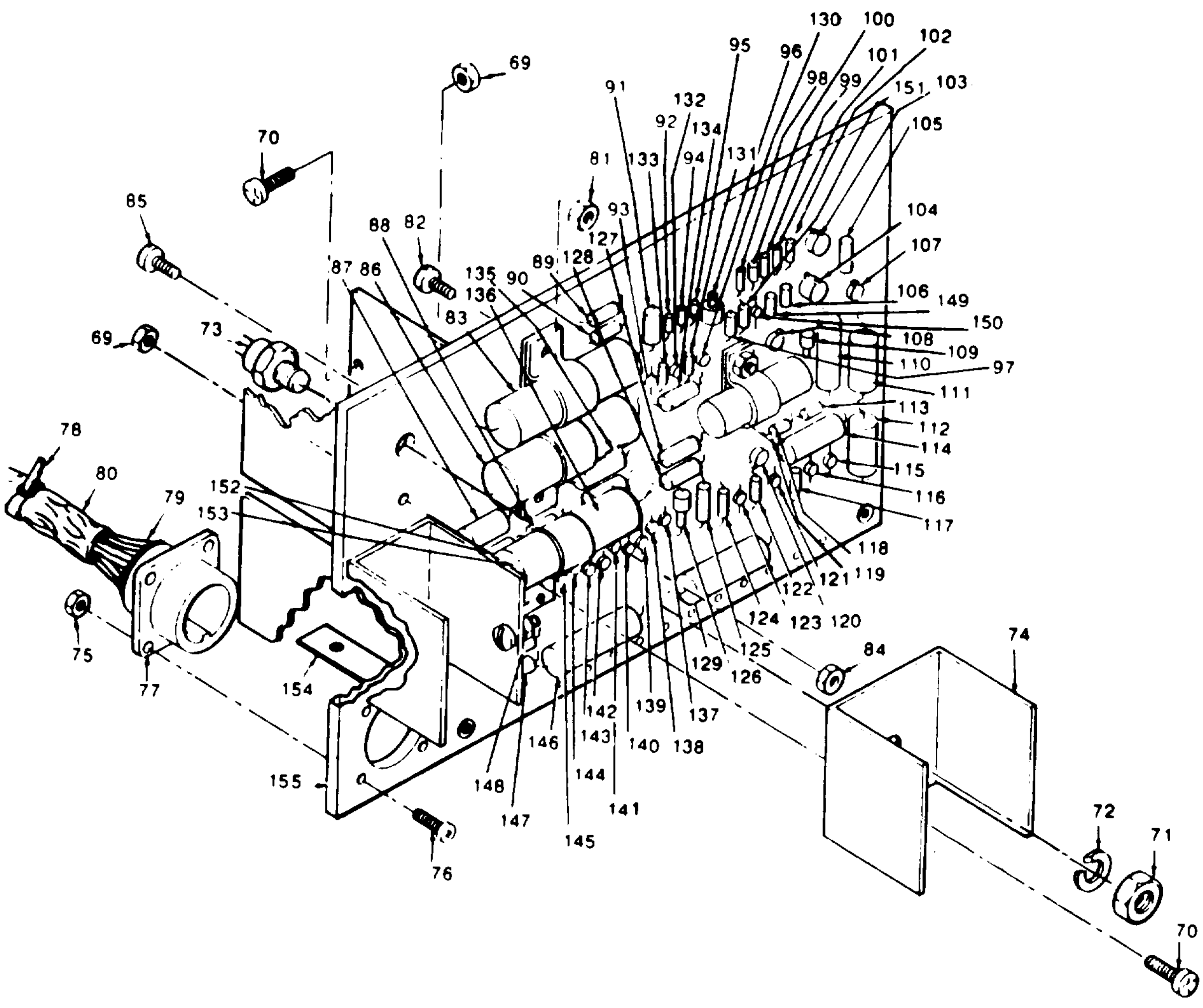


Figure 3-130. Static Exciter and Voltage Regulator Assembly, Exploded View (Sheet 2 of 3)

1. Screw
2. Lockwasher
3. Screw
4. Chassis cover
5. Nut & captive washer assy
6. Flat washer
7. Screw
8. Heat sink assy
9. Nut & captive washer assy
10. Screw
11. Wire
12. Terminal lug
13. Semiconductor
14. Semiconductor
15. Nut & captive washer assy
16. Screw
17. Heat sink
18. Heat sink support
19. Nut & captive washer assy
20. Screw
21. Terminal board
22. Nut & captive washer assy
23. Screw
24. Transformer
25. Nut
26. Nut
27. Screw
28. Capacitor
29. Lockwasher
30. Bracket
31. Nut & captive washer assy
32. Terminal
33. Nut & captive washer assy
34. Nut & captive washer assy
35. Screw
36. Transformer
37. Screw
38. Voltage regulator assy
39. Nut & captive washer assy
40. Screw
41. Mounting bracket
42. Capacitor C2
43. Nut & captive washer assy
44. Screw
45. Transformer
46. Nut & captive washer assy
47. Screw
48. Nut & captive washer assy
49. Washer
50. Screw
51. Mica washer
52. Mounting bracket
53. Resistor R1
54. Resistor R2
55. Nut & captive washer assy
56. Screw
57. Resistor bracket
58. Resistor R3
59. Nut & captive washer assy
60. Screw
61. Cable clamp
62. Nut & captive washer assy
63. Screw
64. Cable clamp
65. Nut & captive washer assy
66. Screw
67. Wiring harness
68. Chassis
69. Nut & captive washer assy
70. Screw
71. Nut
72. Lockwasher
73. Diode CR1
74. Heat sink
75. Nut & captive washer assy
76. Screw
77. Wiring harness
78. Tie down strap wire
79. Wire
80. Shrink tubing
81. Nut & captive washer assy
82. Screw
83. Capacitor C14
84. Nut & captive washer assy
85. Screw
86. Capacitor C13
87. Resistor R24
88. Resistor R16
89. Resistor R21
90. Resistor R28
91. Capacitor C16
92. Resistor R31
93. Diode CR11
94. Resistor R30
95. Resistor R11
96. Zener diode
97. Resistor R6
98. Resistor R10
99. Capacitor C6
100. Capacitor C4
101. Resistor R12
102. Capacitor C3
103. Transistor
104. Integrated circuit
105. Resistor R14
106. Resistor
107. Transistor
108. Transistor
109. Zener diode
110. Capacitor C8
111. Resistor R5
112. Resistor A4
113. Resistor R23 (400 Hz only)
114. Capacitor C7 (400 Hz only)
115. Diode
116. Diode
117. Resistor R18
118. Resistor R22 (400 Hz only)
119. Capacitor C15
120. Transistor
121. Diode
122. Resistor R19
123. Diode
124. Resistor R20
125. Capacitor C5 (400 Hz only)
126. Zener Diode
127. Resistor R9 (400 Hz only)
128. Resistor R29
129. Resistor R25
130. Diode
131. Resistor R33
132. Diode
133. Resistor R15
134. Resistor R32
135. Resistor R17
136. Capacitor C9
137. Diode
138. Diode
139. Diode
140. Diode
141. Diode
142. Diode
143. Diode
144. Diode
145. Diode
146. Capacitor C11
147. Resistor R26
148. Resistor R27
149. Resistor R13
150. Diode
151. Resistor R8
152. Capacitor C10 (50/60 Hz only)
153. Capacitor C12 (50/60 HZ only)
154. Mounting bracket
155. Printed circuit board

Figure 3-130. Static Exciter and Voltage Regulator Assembly, Exploded View (Sheet 3 of 3)

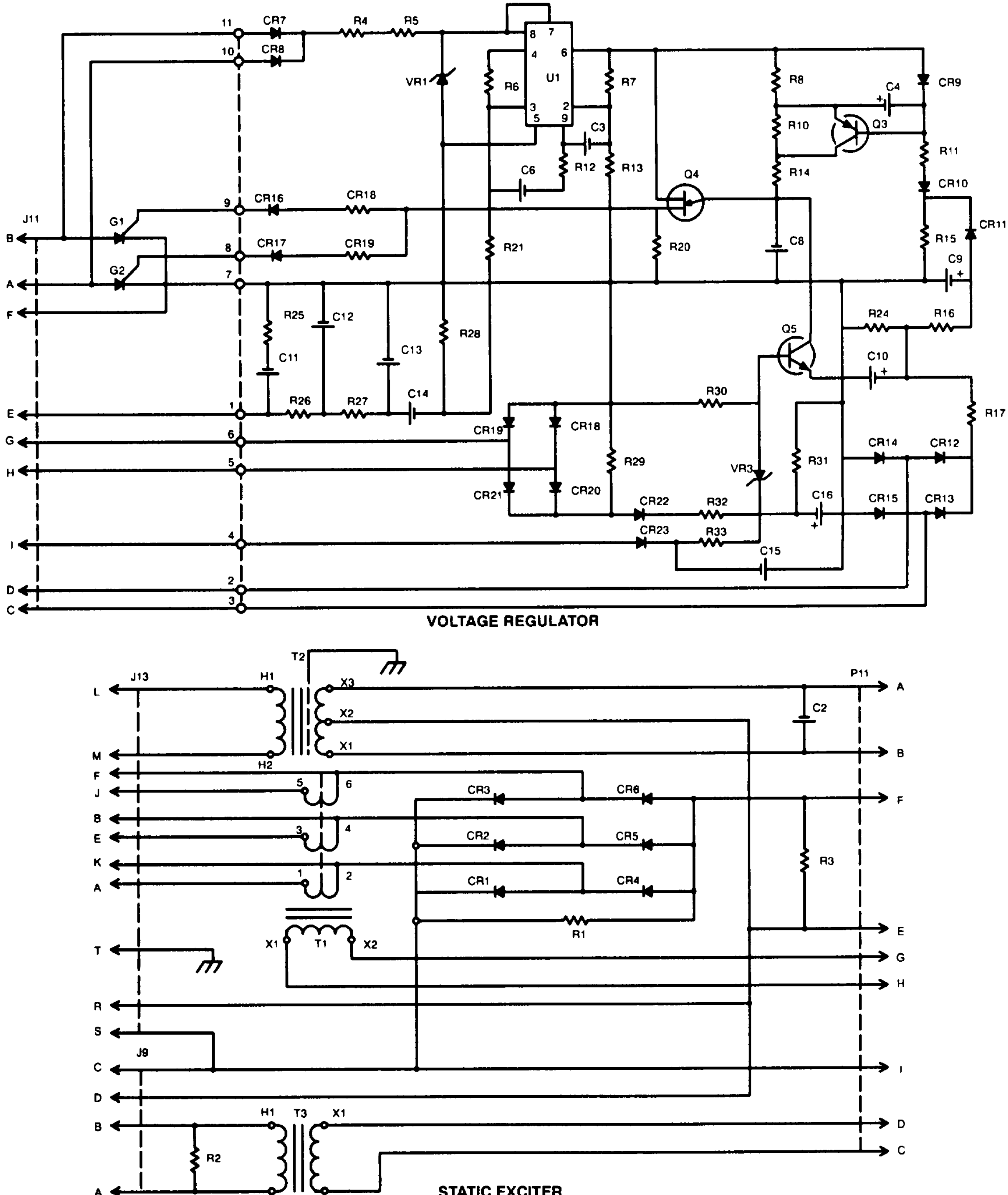


Figure 3-131. 50/60 Hz Static Exciter and Voltage Regulator Schematic Diagram, Drawing No. 72-2629

(b) One direction shall give an indication of less than 100 ohms. The other direction shall give an indication of one megohm or more. There shall be no indication of discontinuity in either direction.

(c) Replace defective semiconductors.

(5) Inspect terminal board assembly for cracks, burns, and corroded terminals. Replace defective terminal board assembly.

(6) Inspect transformers for cracks, corrosion, and evidence of shorting or overheating. Check continuity of coils using an ohmmeter. There shall be no sign of open circuit.

(7) Replace defective transformers.

(8) Inspect voltage regulator assembly for burned or damaged components.

(9) Electrically check voltage regulator assembly components using figure 3-131 or 3-132 as a guide. Refer to table 3–7 for capacitance and resistance value of components.

(10) If any voltage regulator components must be replaced or encapsulating coating repaired or replaced, refer to Appendix A references for detailed procedures. Repair/replace encapsulation by applying 0.020 inch (min) coating of polyurethane resin (scotchcast 221, Minnesota Mining and Mfg. Co. or equal).

(11) Inspect wiring harness for damaged connectors and terminals, burns, broken wires, and other damage.

(12) Check individual wires for continuity using figure 3–133 as a guide.

(13) If the wiring harness has sustained damage and requires repair or rebuild, refer to figure 3-133 for layout, identification and material requirements and Appendix A references for detailed soldering and replacement procedures.

e. Assembly.

(1) Position and resolder wiring for resistors R24 (87), R16 (88), R21 (89), R28 (90), R31 (92), R30 (94), R11 (95), R6 (97), R10 (98), R12 (101), R14 (105), R34 (106), R5 (111), R4 (112), R23 (113), R18 (117), R22 (118), R19 (122), R20 (124), R9 (127), R29 (128), R25 (129), R33 (131), R15 (133), R32 (134), R17 (135), R26 (147), R27 (148), R13 (149), R8 (151).

(2) Position and resolder wiring for capacitors C16 (91), C4 (100), C6 (99), C3 (102), C8 (110), C7 (114), C15 (119), C5 (125), C9 (136), C11 (146), C10 (152), C12 (153).

(3) Position and resolder wiring for diodes CR11 (93), and diodes (96), (109), (115), (116), (121), (123), (126), (130), (132), (137 thru 145), and (150).

(4) Position and resolder wiring for transistors (103), (107), (108), (120).

(5) Position and resolder wiring for integrated circuit (104).

(6) Install capacitor C13 (86), screw (85), nut and captive washer assembly (84), capacitor C14 (83), screw (82) and nut captive washer assembly (81).

(7) Install shrink tubing (80), wire (79), wire tiedown strap (78), wiring harness (77), screw (76) and nut and captive washer assembly (75).

(8) Install heat sink (74), diode CR1 (73), lockwasher (72), nut (71), screws (70), nut and captive washer assembly (69).

(9) Install wiring harness (67), screw (66), and nut and captive washer assembly (65).

(10) Install cable clamp (64), screw (63), and nut captive washer assembly (62).

(11) Install cable clamp (61), screw (60), and nut and captive washer assembly (59).

(12) Install resistor R3 (58), mounting bracket (57), screw (56), and nut and captive washer assembly (55).

(13) Install resistor R2 and R1 (54 and 53), mounting bracket (52), mica washer (51), screw (50), washers (49), nut and captive washer assembly (48), screw (47), nut and captive washer assembly (46).

(14) Install transformer (45), screw (44), and nut and captive washer assembly (43).

(15) Install capacitor C2 (42), mounting bracket (41), screw (40), and nut and captive washer assembly (39).

(16) Install voltage regulator assembly (38), and screw (37) on chassis (68).

(17) Install transformer (36), screw (35), and nut and captive washer assembly (34).

(18) Install terminals (32), and nut and captive washer assemblies (33 and 31).

(19) Install bracket (30), Iockwasher (29), capacitor (28), screw (27), and nuts (26 and 25).

(20) Install transformer (24), screw (23), and nut and captive washer assembly (22).

(21) Install terminal board (21), screw (20), and nut and captive washer assembly (19).

(22) Install heat sink support (18), heat sink (17), screws (16), and nut and captive washer assembly (15).

(23) Install semiconductor (14), semiconductor, terminal lug (12) and wire (11).

(24) Install screw (10), and nut and captive washer assembly (9).

(25) Install heat sink assembly (8), and secure with screw (7), flat washer (6) and nut and captive washer assembly (5).

f. Testing.

(1) Perform sensing circuit bench test as follows:

NOTE

The chassis cover (4, figure 3-130) must be removed to perform the bench test.

(a) Connect static exciter and voltage regulator assembly into test circuit shown in figure 3-134.

(b) Adjust power source until V1 shows 95 Vac (any frequency between 50 and 400 Hz).

(c) Check for 22 Vdc across R15 (connect voltmeter V2, positive side to cathode of CR11, and negative side to heat sink where CR4-CR6 are mounted).

(2) Conduct power circuit bench test as follows:

(a) Install static exciter and voltage regulator assembly into test circuit shown in figure 3-135.

(b) Adjust power source to 208 Vac at the rated frequency for the unit as indicated on voltmeter V1.

(c) For 400 Hz units only apply 50-75 Vac, 400 Hz to terminals A and B of connector J9.

(d) Voltmeter V2 should indicate 48 Vdc.

(3) Conduct boost circuit bench test as follows:

(a) With chassis cover (4, figure 3-130) removed, connect positive lead of voltmeter to heat sink where CR1-CR3 are mounted. Connect negative lead to heat sink where CR4-CR6 are mounted. (See item 17, figure 3–130).

(b) Apply 12 Vac (any frequency between 50 and 400 Hz) to pins A and B of connector J13.

(c) Voltmeter connected across heat sinks should indicate 9.3 Vdc.

(d) Remove 12 Vac from pins A and B and connect to E and F, then to J and K. In each case, voltmeter should indicate 9.3 Vdc.

(4) If the requirements of any test are not met, check components using figure 3-131 or 3-132 and table 3-8 as a guide to locate the malfunction. Correct before installing the static exciter and voltage regulator assembly.

g. Installation.

(1) Position static exciter and voltage regulator to install Iockwasher (2, figure 3-130) and screws (1).

(2) Connect electrical connectors to static exicter and voltage regulator.

3-93. RELAY TABLE COMPONENTS ADJUSTMENTS.

a. General. After maintenance has been performed on any of the relay table components, the appropriate adjustments shall be performed.

b. Voltage Adjustment.

(1) Position voltage adjustment rheostat R2 on generator set control cubicle to the approximate midpoint.

(2) Refer to the Operator and Unit Maintenance Manual and start the generator set.

(3) Adjust voltage rheostat R2 to obtain generator assembly rated voltage at generator set load terminal board.

c. Paralleling Adjustments.

(1) Refer to the Operator and Unit Maintenance Manual and connect a rated load to the generator set load terminal board.

(2) Start the generator set and operate at full rated load.

(3) Install the shorting plug in the paralleling receptacle.

(4) Place the operations switch on the generator set control cubicle in the PARALLEL position.

(5) Adjust reactive current adjust potentiometer R29 of the special relay assembly to provide a special droop of 3 percent.

(6) Adjust the load sharing adjust rheostat (R28) of the precise relay assembly until 4 to 6 VDC appear across pins A and B of the paralleling receptacle. Insure that the positive lead of the meter is connected to pin A. Repeat same procedure for all other generator sets to be paralleled. Voltage readings must be identical on all generator sets to be paralleled to insure load sharing. Failure to make this adjustment will result in load rejection and/or safety system shutdown.

NOTE

Step (6) pertains to precise generator sets only.

(7) Refer to the Operator and Unit Maintenance Manual and shut down the generator set.

Table 3-8. STATIC EXCITER AND VOLTAGE REGULATOR RESISTOR AND CAPACITOR VALUES

COMPONENT	VALUES 50/60 Hz	400 Hz
Resistor R1	10 ohm, 55 watt	10 ohm, 55 watt
Resistor R2	510 ohm, 55 watt	510 ohm, 55 watt
Capacitor C2	20 MFD, 400 volt	5 MFD, 400 volt
Resistor R3	510 ohm, 26 watt	510 ohm, 26 watt
Capacitor C14	2.2 MFD, 200 volt	2.2 MFD, 200 volt
Capacitor C13	3.3 MFD, 200 volt	3.3 MFD, 200 volt
Resistor R24	2.4Kohm, 2 watt	2.4K ohm, 2 watt
Resistor R16	15.K ohm 1/8 watt	1.5K ohm, 1/8 watt
Resistor R21	470K ohm 1/4 watt	470K ohm, 1/4 watt
Resistor R28	47K ohm, 1/4 watt	47K ohm, 1/4 watt
Capacitor C16	22 MFD, 15 volt	22 MFD, 15 volt
Resistor R31	3.9K ohm, 1/4 watt	3.9K ohm, 1/4 watt
Resistor R30	33K ohm, 1/4 watt	33K ohm, 1/4 watt
Resistor R11	4.99K ohm, 1/8 watt	4.99K ohm, 1/8 watt
Resistor R6	32.4K ohm, 1/8 watt	32.4K ohm, 1/8 watt
Resistor R10	20K ohm, 1/8 watt	30K ohm, 1/8 watt
Capacitor C4	.68 MFD, 50 volt	
Capacitor C6	0.22 MFD, 50 volt	0.22 MFD, 50 volt
Resistor R12	2.2M ohm, 1/4 watt	2.2M ohm, 1/4 watt
Capacitor C3	0.0001 MFD, 200 Volt	0.0001 mfd, 200 volt
Resistor R14	470 ohm, 1/2 watt	470 ohm, 1/2 watt
Resistor R7	49.9K ohm, 1/8 watt	49.9K ohm, 1/8 watt
Capacitor C8	0.33 MFD, 50 volt	0.1 mfd, 50 volt
Resistor R5	750 ohm, 2 watt	750 ohm, 2 watt
Resistor R4	750 ohm, 2 watt	750 ohm, 2 watt
Resistor R23		100 ohm, 1/4 watt
Capacitor C7		0.047 mfd, 50 volt
Resistor R18	10 ohm, 1/4 watt	10 ohm, 1/4 watt
Resistor R22		2.2K ohm, 1/4 watt
Capacitor C15	2.2 MFD, 200 volt	2.2 mfd, 200 volt
Resistor R19	10 ohm, 1/4 watt	10 ohm, 1/4 watt
Resistor R20	39 ohm, 1/4 watt	39 ohm, 1/4 watt
Capacitor C5		0.10 mfd, 20 volt
Resistor R9		10K ohm, 1 watt
Resistor R29	1K ohm, 1 watt	1K ohm, 1 watt
Resistor R25	150 ohm, 2 watt	150 ohm, 2 watt
Resistor R33	33K ohm, 1/4 watt	33K ohm, 1/4 watt
Resistor R15	49.9K ohm, 1/8 watt	49.9K ohm, 1/8 watt
Resistor R32	2.7K ohm, 1 watt	2.7K ohm, 1 watt
Resistor R17	5.1 K ohm, 2 watt	5.1 K ohm, 2 watt
Capacitor C9	4.7 MFD, 50 volt	4.7 mfd, 50 volt
Capacitor C11	0.1 MFD, 200 volt	0.1 mfd, 200 volt
Resistor R26	18K ohm, 1 watt	5.1 K ohm, 1 watt
Resistor R27	10K ohm, 1 watt	10K ohm, 1 watt
Resistor R13	20K ohm, 1/8 watt	20K ohm, 1/8 watt
Resistor R8	100 ohm, 1/4 watt	100 ohm, 1/4 watt
Capacitor C10	4.7 MFD, 50 volt	
Capacitor C12	3.3 MFD, 200 volt	
Capacitor C3	.01 MFD, 500 Volt AC/DC	
Capacitor C4	.01 MFD, 500 Volt AC/DC	
Capacitor C5	.01 MFD, 500 Volt AC/DC	
Capacitor C6	.01 MFD, 500 Volt AC/DC	

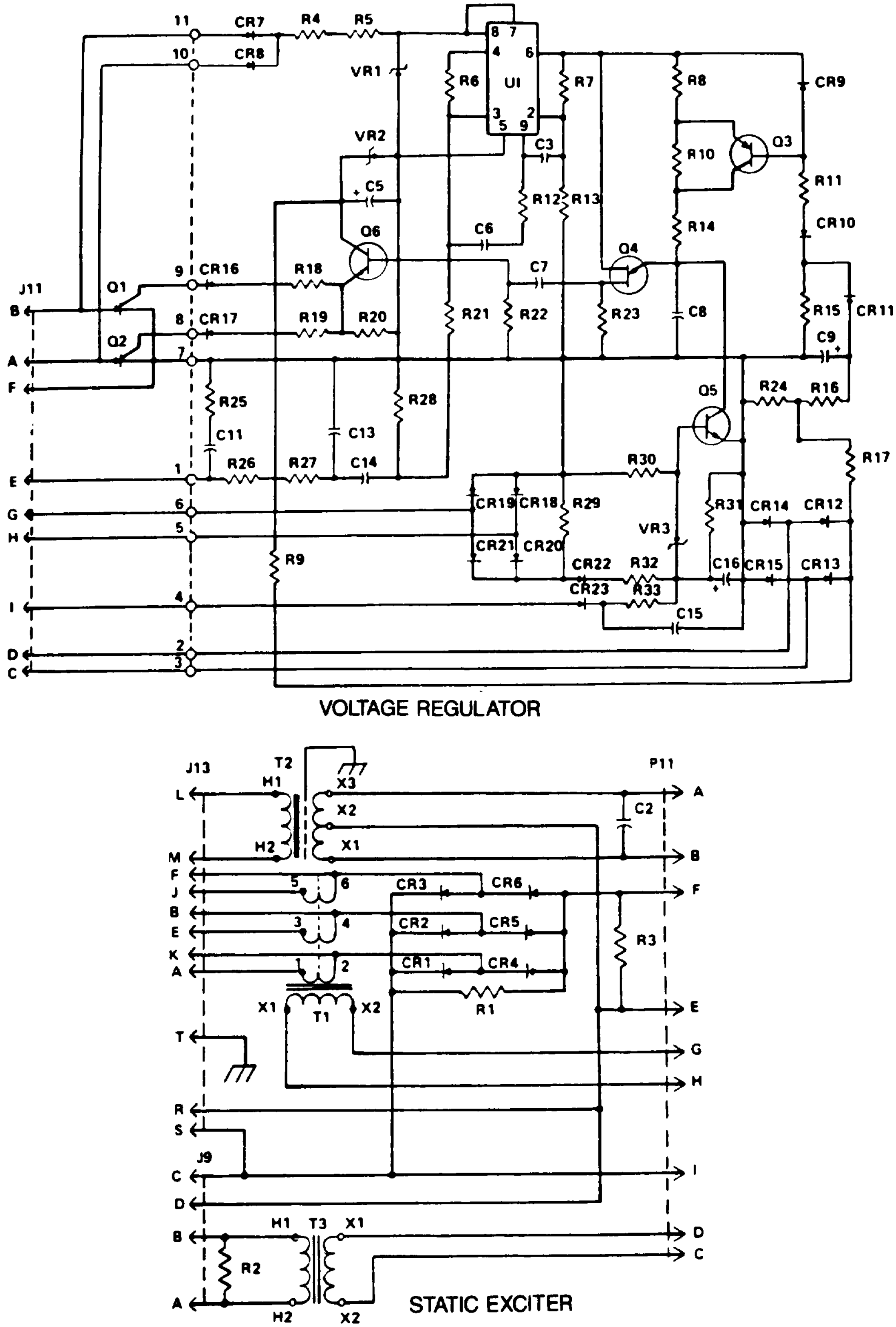


Figure 3–132. 400 Hz Static Exciter and Voltage Schematic Diagram, Drawing No. 72-2630

WIRE NO.	FROM	TERMINATION FIND NO REF.	TO	FIND NO REF.	WIRE FIND NO.	WIRE LENGTH REF.
X12KK18	T2–H3		C3	10	6	4.50
X9Z16	T2–H1		C4	10	6	4.50
X197J18	T3–H1		C5	10	6	4.50
X91G18	T2–H2		C8	10	6	4.50
X1B18	J13–A	3	TB1–8	4	6	12.75
X2B18	J13–B	3	TB1–4	4	6	11.50
X3B18	J13–E	3	TB1–7	4	8	12.50
X4B18	J13–F	3	TB1–3	4	6	10.75
X5B18	J13–J	3	TB1–6	4	6	12.25
X9W18	J13–L	3	T2–H1		6	21.25
X10B18	J13–K	3	TB1–5	4	6	11.75
X12JJ18	J13–M	3	T2–H2		6	22.50
X24A18	P11–C	2	T3–X2		6	17.75
X25A16	P11–D	2	T3–X1		6	17.25
X27A16	P11–H	2	T1–X1		6	19.00
X28A16	P11–G	2	T1–X2		6	16.00
X91E16	J9–A	1	R2–2		6	14.00
X91F18	R2–2		T3–H2		6	5.00
X197H18	J9–B	1	R2–1		6	10.50
X197G18	R2–1		T3–H1		6	4.00
D11C18	J9–C	1	TB1–1	4	6	7.00
D11D18	P11–1	2	TB1–1	4	6	14.75
D11E18	TB1–1	4	R1–1		6	9.00
D11F18	HS2	4	R1–1		6	10.50
D11G18	J13–S	3	TB1–1	4	6	10.50
D12C18	J9–D	1	TB1–2	4	6	7.25
D12D18	TB1–2	4	T2–X2		6	12.00
D12E18	P11–E	2	T2–X2		6	15.00
D12F18	TB1–2	4	R3–1		6	12.25
D12G18	J13–R	3	TB1–2	4	6	10.50
P3A18	HS1	4	R3–2		6	7.50
P3B18	R3–2		R1–2		6	11.50
P3C18	P11–F	2	R1–2		6	17.25
P4A18	C2–1	5	T2–X3		6	8.25
P4B18	P11–B	2	C2–1	5	6	10.00
P5A18	C2–2	5	T2–X3		6	9.50
P5B18	P11–1	2	C2–2	5	6	10.00
P55BB18	J13–T	3	E2	5	6	14.75

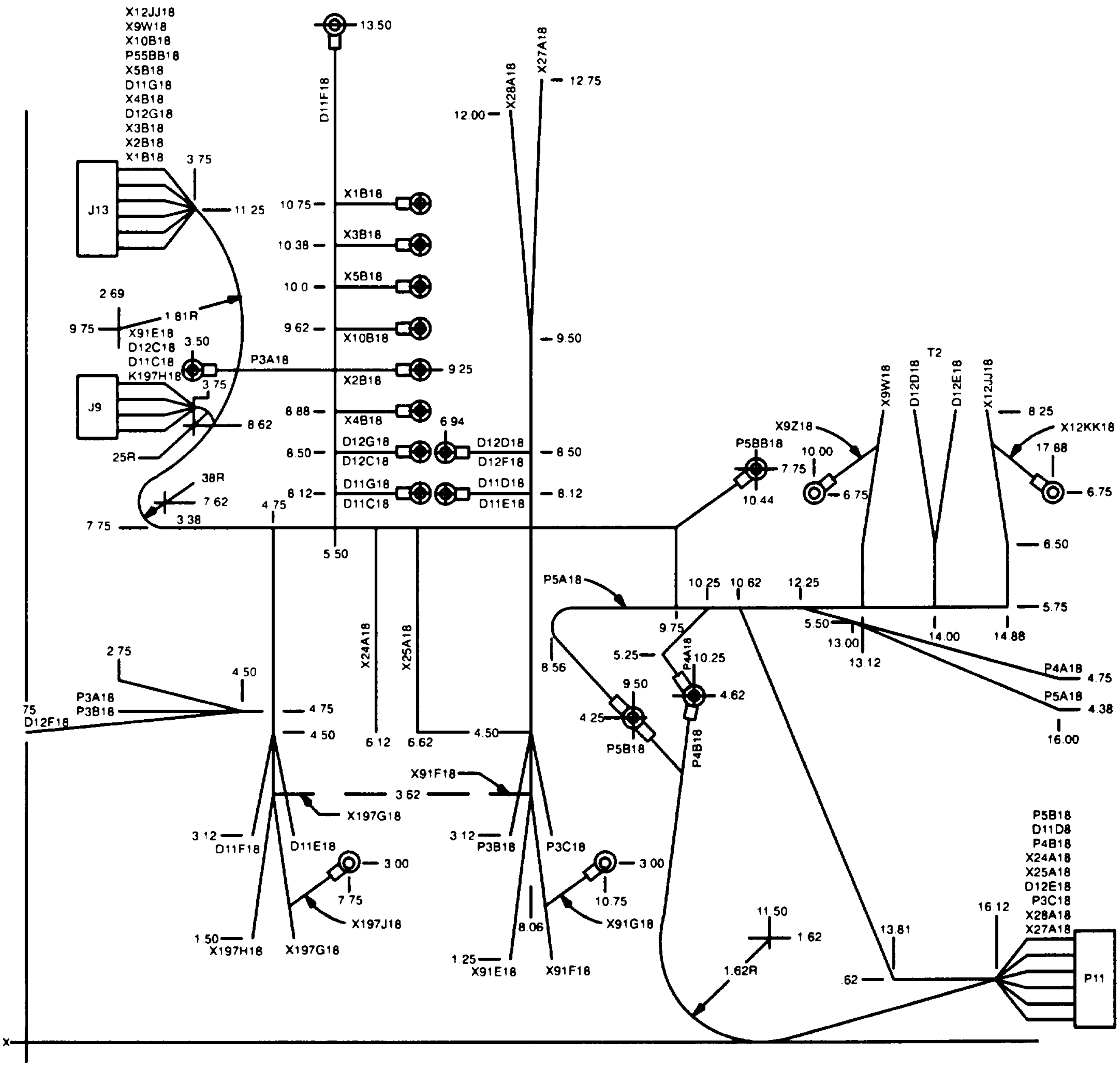
FIND NO.	SYM	CODE IDENT	DWG SIZE	PART OR IDENTIFYING NO.	QTY REQD	NOMENCLATURE OR DESCRIPTION	SPEC	MATERIAL
1				MS3102R14S–6P	1	CONNECTOR J9	MIL–C–5015	
2				MS3106R18–1P	1	CONNECTOR J11	MIL–C–5015	
3				MS3102R22–14P	1	CONNECTOR J13	MIL–C–5015	
4				MS25036–102	16	LUG TERMINAL NO. 6		
5				MS15036–150	5	LUG TERMINAL NO. 1/4		
6				M5086/2–18–9	AR	WIRE, NO. 18 AWG, WHITE	MIL–W–5086/2	
7				M23053/5–105–0	18"	INSULATION, SLEEVING	MIL–I–23053/5	
8				MS25251–16	11	PLUG, END SEAL	MIL–C–50–15	
9				MS3367–4–9	AR	STRAP, ADJUSTABLE	MIL–S–23190	
10				MS25036–149		LUG TERMINAL NO. 8		

NOTES:

1. ALL SOLDERED CONNECTIONS SHALL BE IN ACCORDANCE WITH MIL-STD-454, REQUIREMENT 5.
2. CUT INSULATION SLEEVING, FIND NO. 7, INTO 24 PIECES, .750 INCHES LONG AND INSTALL OVER WIRES AND PINS, AFTER SOLDERING, TO THE CONNECTORS, FIND NOS. 3,2, AND 1. THEN APPLY HEAT OF 400° F FOR 3-5 SEC. FOR PROPER SHRINKAGE.
3. INSTALL STRAPS, FIND NO. 9, AT APPROXIMATELY 2.5 INTERVALS AND AT EACH WIRE BREAKOUT.
4. WIRE MARKING TO BE IN ACCORDANCE WITH MIL-W-5088 EXCEPT THAT LENGTH BETWEEN GROUPS OF NUMBERS SHALL NOT EXCEED 6 INCHES.
5. INTERPRET DRAWING PER MIL-STD-100.
6. CRIMPED TERMINAL SHALL MEET THE PERFORMANCE REQUIREMENTS OF MIL-T-7928.
7. INSTALL END SEAL PLUGS, FIND NO. 8, IN UNUSED HOLES OF CONNECTORS, FIND NOS. 1,2, AND 3.
8. REF: CONNECTION DIAGRAM 72-2631
   SCHEMATIC DIAGRAM 72-2630
   AND 72-2629
9. ALL WIRES WITHOUT TERMINAL LUGS SHALL BE STRIPPED .25 FROM THE END AND TINNED IN ACCORDANCE WITH MIL-STD-454, REQUIREMENT 5.

A. Static Exciter Wiring Harness (Sheet 1 of 2)

Figure 3-133. Static Exciter Wiring Harness, Dwg. No. 72–2628, Voltage Regulator Wiring Harness, Dwg. No. 72–2627, and Static Exciter Connection Wiring Diagram, Dwg. No. 2-2631 (Sheet 1 of 4)



B. Static Exciter Wiring (Sheet 2 of 2)

Figure 3-133. Static Exciter Wiring Harness, Dwg. No. 72-2628, Voltage Regulator Wiring Harness, Dwg. No. 72-2627, and Static Exciter Connection Wiring Diagram, Dwg. No. 72-2631 (Sheet 2 of 4)

WIRE MARKING	FROM	TERMINATION FIND NO REF.	TO	FIND NO REF.	WIRE FIND NO	WIRE LENGTH REF.
P5D18	Q2-A	2	PCB-10	-	3	12.75
P6A18	Q2-G	-	PCB-8	-		12.00
P3F18	Q2-C	-	PCB-7	-		11.50
P3E18	Q1-C	-	Q2-C	-		4.75
P4D18	Q1-A	2	PCB-11	-		11.12
P7A18	A1-G	-	PCB-9	-		10.62
D11H18	J11-I	1	PCB-4	-		6.50
X27B18	J11-H		PCB-5	-		7.12
X28B18	J11-G		PCB-6	-		7.50
P3D18	J11-F		Q1-C	-		4.00
D12H18	J11-E		PCB-1	-		5.50
X25B18	J11-D		PCB-2	-		5.75
X24B18	J11-C		PCB-3	-		6.18
P4C18	J11-B		Q1-A	2		4.50
P5C18	J11-A	1	Q2-A	2	3	6.62

FIND NO.	SYM	CODE IDENT	DWG SIZE	PART OR IDENTIFYING NO.	QTY REQD	NOMENCLATURE OR DESCRIPTION	SPEC	MATERIAL
1				MS3106R18-1S	1	CONNECTOR (J11)		
2				MS25036-102	4	LUG TERMINAL NO. 6 STUD SIZE		
3				M5086/2-18-9	AR	WIRE, ELECT 18 AWG	MIL-W-5086/2	
4				MS3367-4-9	AR	STRAP, TIEDOWN ADJ.		
5				M23053/5-105-0	6.75"	INSULATION SLEEVING	MIL-I-23053/5	

NOTES:

1. ALL SOLDERED CONNECTIONS SHALL BE IN ACCORDANCE WITH MIL-STD-454, REQUIREMENT 5.
2. CUT INSULATION SLEEVING, FIND NO. 5, INTO 9 PIECES, .750 INCHES LONG AND INSTALL OVER WIRES AND PINS. AFTER SOLDERING, TO THE CONNECTOR, FIND NO. 1. THEN APPLY HEAT OF 400°F FOR 3-5 SEC. FOR PROPER SHRINKAGE.
3. INSTALL STRAPS, FIND NO. 4, AT 3.00 MAX INTERVALS AND AT EACH CABLE BREAK-OUT.
4. WIRE MARKING TO BE IN ACCORDANCE WITH MIL-W-5088 EXCEPT THAT LENGTH BETWEEN GROUPS OF NUMBERS SHALL NOT EXCEED 6 INCHES.
5. CRIMPED TERMINALS SHALL MEET THE PERFORMANCE REQUIREMENTS OF MIL-T-7928.
6. REFERENCES:
   A. CONNECTION DIAGRAM: SEE 72-2631.
   B. SCHEMATIC DIAGRAM: 72-2629, FOR 50/60 Hz.
   72-2630, FOR 400Hz

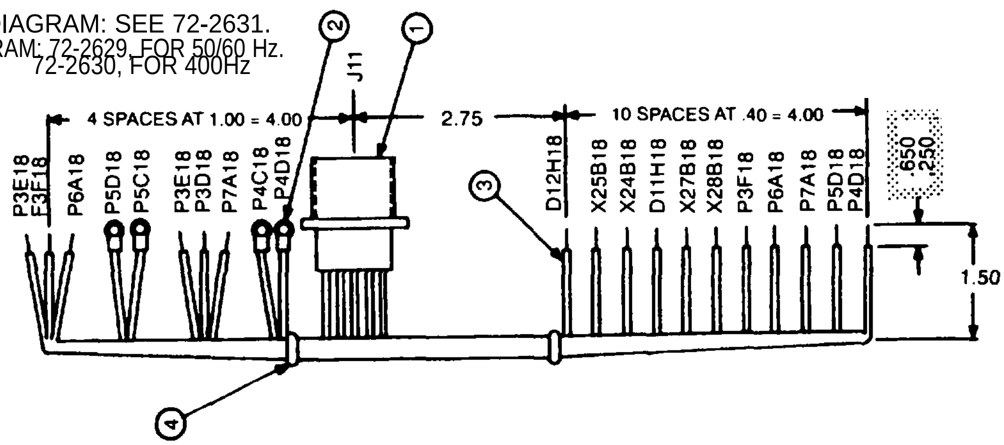
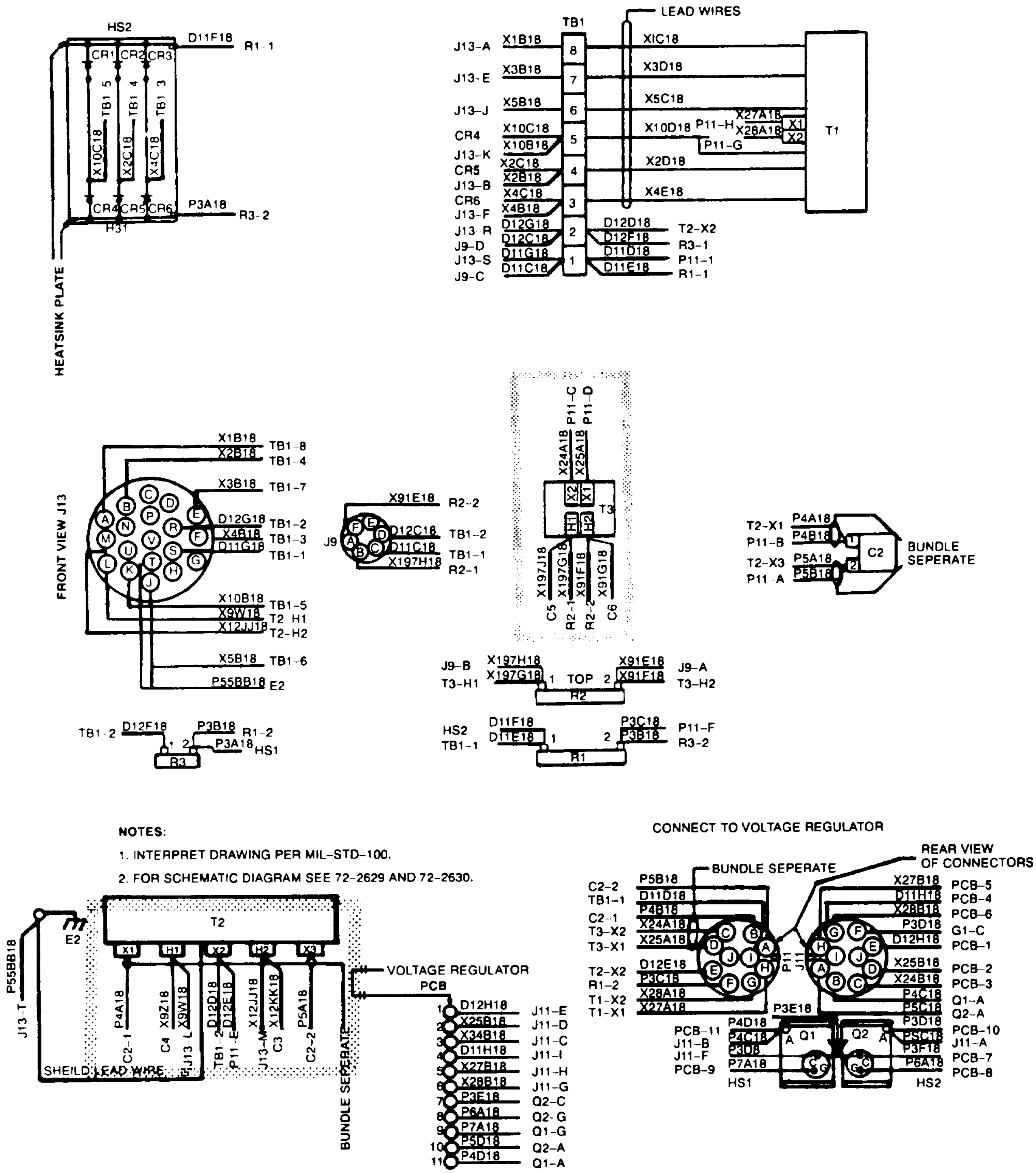
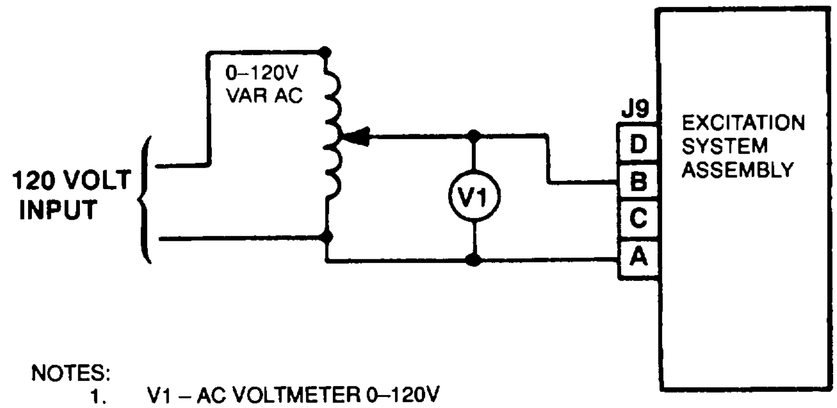


Figure 3-133. Static Exciter Wiring Harness, Dwg. No. 72-2628, Voltage Regulator Wiring Harness, Dwg. No. 72-2627, and Static Exciter Connection Wiring Diagram, Dwg. No. 2-2631 (Sheet 3 of 4)



(Landscape)
D. Static Exciter Connection Wiring Diagram

Figure 3–133. Static Exciter Wiring Harness, Dwg. No. 72–2628, Voltage Regulator Wiring Harness, Dwg. No. 72-2627, and Static Exciter Connection Wiring Diagram, Dwg, No. 72-2631 (Sheet 4 of 4)



NOTES:
1. V1 – AC VOLTMETER 0–120V
2. 120V INPUT:
MODE I SETS: 50/60 Hz
MODE II SETS: 400 Hz

Figure 3–134. Static Exciter and Voltage Regulator Assembly Sensing Circuit Bench Test

NOTES:
1. V1 – AC VOLTMETER 0–250V
2. V2 – DC VOLTMETER 0–50V
3. 208V INPUT:
MODE I SETS: 50/60 Hz
MODE II SETS: 400 Hz

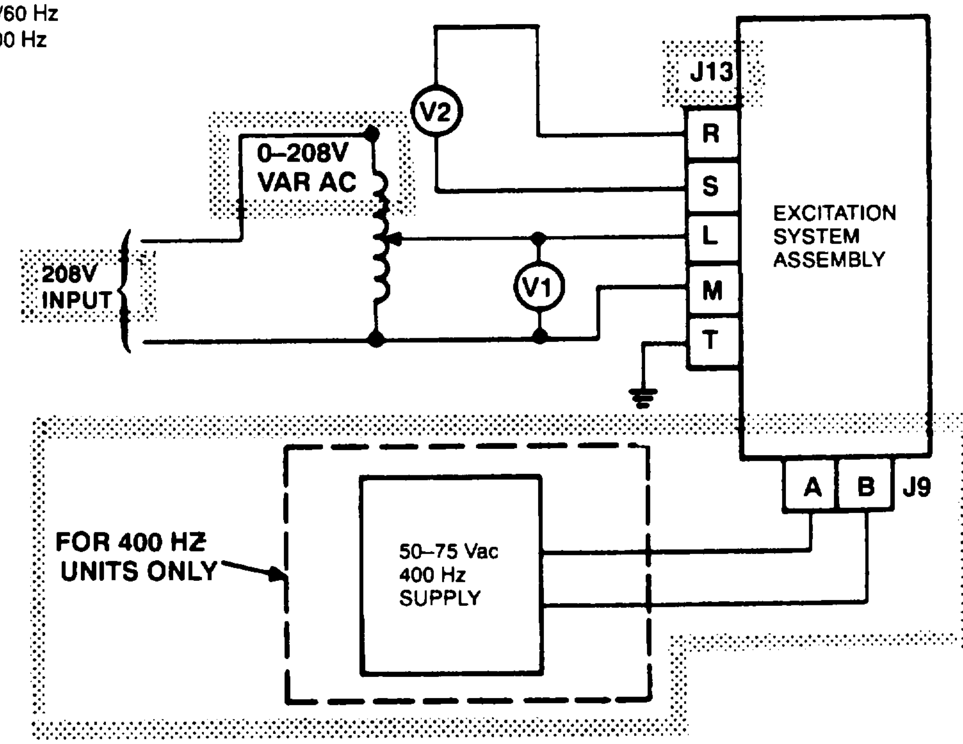


Figure 3–135. Static Exciter and Voltage Regulator Assembly Power Circuit Bench Test

Section XIII. MAINTENANCE OF GENERATOR ASSEMBLIES

3-94. GENERAL.

This section contains maintenance procedures for the generator assemblies. There are two types of generators used in the generator set. The 50/60 Hz generator is used in both the 50/60 Hz utility, and 50/60 Hz precise generator sets. The 400 Hz generator is used only in the 400 Hz precise generator set. Both generators are drip-proof, rotating-field, synchronous, brushless, fan cooled units. Mounting for the generator is provided by the generator feet bolted to the skid base and the housing bolted to the engine flywheel housing. Rotational power is provided by the blower and coupling assembly which is bolted to the generator rotor shaft and the engine flywheel.

3-95. GENERATOR MAINTENANCE INSTRUCTIONS.

a. Removal. Refer to paragraph 2–7a. for generator removal procedure.

b. Disassembly

(1) Disassemble generator by following the ascending sequence of index numbers assigned to figure 3-136 only as required to replace damaged or defective components.

(2) Remove screw (1, figure 3-136) and Iockwashers (2) to remove drip cover (3).

(3) Remove screws (4) and Iockwashers (5) to remove screen guard (6).

(4) Remove screws (7) and Iockwashers (8) to remove lead block assembly (9) and gasket (10).

NOTE

Tag electrical leads to insure proper positioning at installation. loosen clamping screws to relieve tension on the leads.

(5) Remove screws (11) and Iockwashers (12) to remove screen guard (13).

(6) Remove screws (14) and Iockwashers (15) to remove cover plate (16).

(7) Remove plug (17), screw (18) and Iockwasher (19).

(8) Remove screws (18) and Iockwashers (21). Using a suitable puller, remove bearing housing (22).

(9) Thread five turns of screw (18) into rotor shaft and, using a suitable puller, remove bearing (23).

(10) Support bearing on the head of a suitable press and press out adapter (24).

(11) Remove the lifting eye bolt from the generator stator.

(12) Cut a sufficient length of 1/2 inch bar stock steel to fit across the diameter of the coupling disc end of the generator assembly.

WARNING

Drilling operations create metal chips which may enter the eye. Wearing of goggles is required. Failure to observe this warning could result in servere personal injury or death.

(13) Center punch and drill a 1-inch hole through the center of the bar stock.

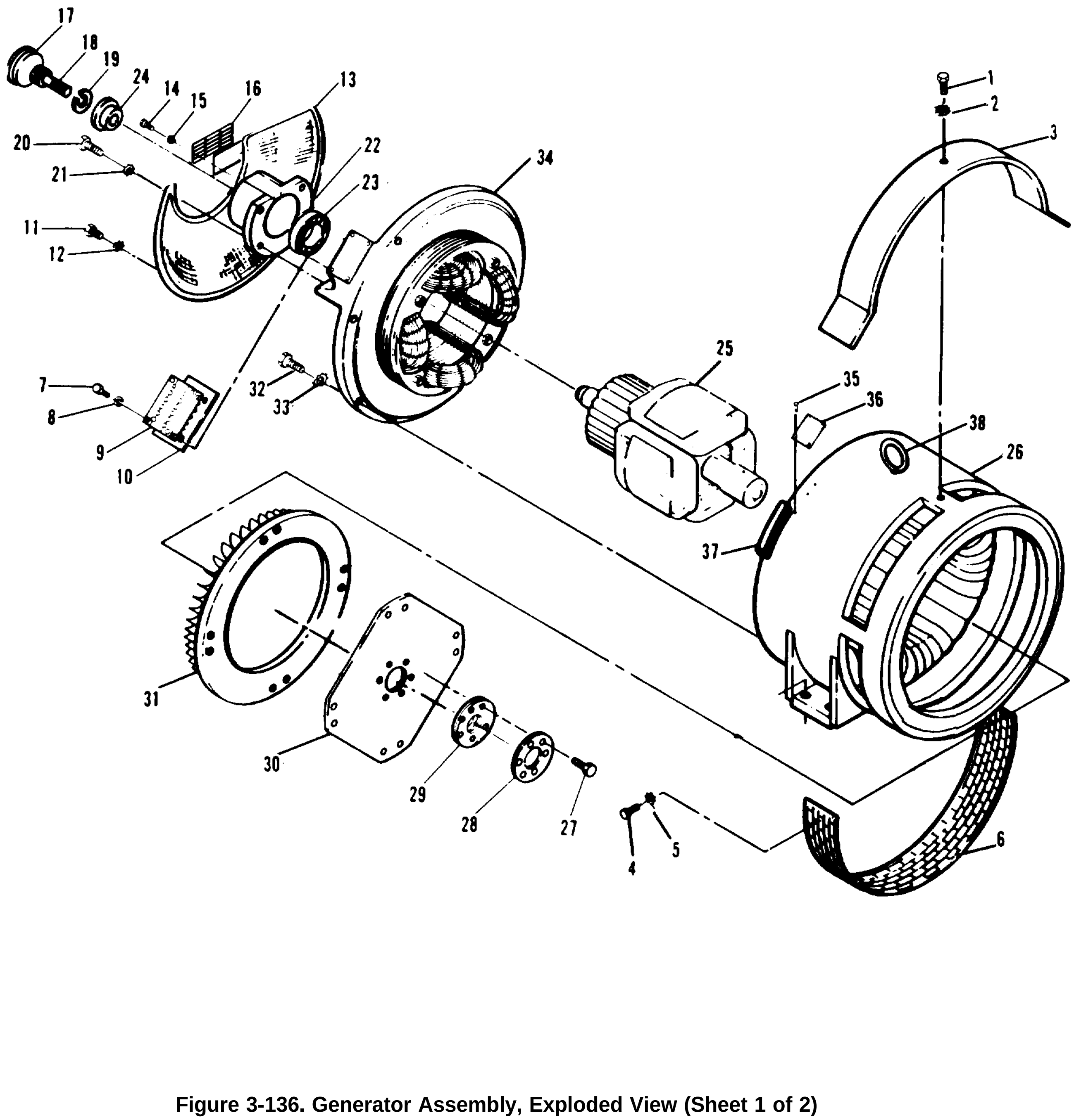


Figure 3-136. Generator Assembly, Exploded View (Sheet 1 of 2)

1. Screw
2. Lockwasher
3. Drip cover
4. Screw
5. Lockwasher
6. Screen guard
7. Screw
8. Lockwasher
9. Lead block assy
10. Gasket
11. Screw
12. Lockwasher
13. Screen Guard
14. Screw
15. Lockwasher
16. Cover plate
17. Plug
18. Screw
19. Lockwasher
20. Screw
21. Lockwasher
22. Bearing housing
23. Bearing
24. Adapter
25. Rotor and balance assy
26. Stator assy
27. Screw
28. Lock plate
29. Pressure plate
30. Coupling disc
31. Blower
32. Screw
33. Lockwasher
34. End bell assembly
35. Screw
36. Data plate
37. Gasket
38. Lifting eye

Figure 3-136. Generator Assembly, Exploded View (Sheet 2 of 2)

(14) Secure the bar stock to the rotor assembly using the generator lifting eye (see figure 3-137).

(15) Locate and center punch a hole at each end of the bar stock in line with the generator housing mounting holes.

(16) Remove the generator lifting eye and the steel bar.

(17) Drill a 5/8 inch hole at each center punched position.

(18) Secure the steel bar to the stator (generator housing) with two of the screws used to secure the generator to the engine flywheel housing.

(19) Install the generator lifting eye bolt.

(20) Using a suitable lifting device, lift the generator by the eye bolt and stand it on its end bell.

NOTE

Use block as necessary to hold the generator in the upright position.

NOTE

If the alternator assembly is to be sent to higher level, the rotor assembly must be secured in the stator assembly to prevent damage while in transit. The bar stock steel illustrated in figure 3-137 can be used for this purpose.

(21) Remove the two screws securing the steel bar to the stator.

CAUTION

Use extreme care when lifting rotor and balance assembly from the stator assembly. Failure to observe this caution could result damage to the equipment.

(22) Using a suitable lifting device, remove rotor and balance assembly (25, figure 3-136) from stator assembly (26) and position on a support.

(23) Remove lifting eye bolt and steel bar.

NOTE

If a steel bar is not available, carefully stand generator on end and remove rotor.

(24) Remove screws (27) to remove lock plate (28), pressure plate (29), coupling disc (30), blower wheel (31) from rotor and balance assembly (25).

(25) Remove screws (32) and lockwashers (33) to remove end bell assembly (34) from stator (26).

NOTE

Feed leads to stator through end bell as it is removed.

(26) Do not remove screws (35) or data plate (36) unless damage is present.

(27) Remove gasket (37).

(28) If inspection reveals damage to end bell assembly, remove screws and lockwashers to remove exciter stator from end bell (figure 3-138).

(29) If inspection reveals damage to rotor and balance assembly, disassemble as follows:

NOTE

Disassembly of the 400 Hz and the 50/60 Hz generator rotor and balance assembly are identical as shown in figure 3–139, even though only the 50/60 Hz rotor is shown.

(a) Remove screws (1, figure 3-139) and lockwashers (2) to disconnect electrical leads (3) and lug (4).

(b) Remove screws (5), flat washers (6) and cable clamps (7).

(c) Remove screws (8) and balance weights (9).

NOTE

Balance weights are tach welded in position. Use a chisel to break them loose.

(d) Remove screws (10) and lockwashers (11) to remove exciter rotor (12).

(e) Do not remove diodes (13) unless inspection reveals damage.

(f) Remove screws (14) and balance weights (15).

NOTE

Balance weights are tach welded in position. Use a chisel to break them loose.

(g) Place rotor assembly in an oven and bake at 356°F (180°C) for 3.0 to 3.5 hours.

WARNING

Wear heat resistant gloves when handling heated rotor assembly. Failure to observe this warning could result in servere personal injury or death.

CAUTION

Do not allow press to exert pressure on rotor core winding as damage may result. Failure to observe this caution could result in equipment damage.

(h) Remove rotor assembly from oven and press shaft (16) and key (17) from rotor core (18).

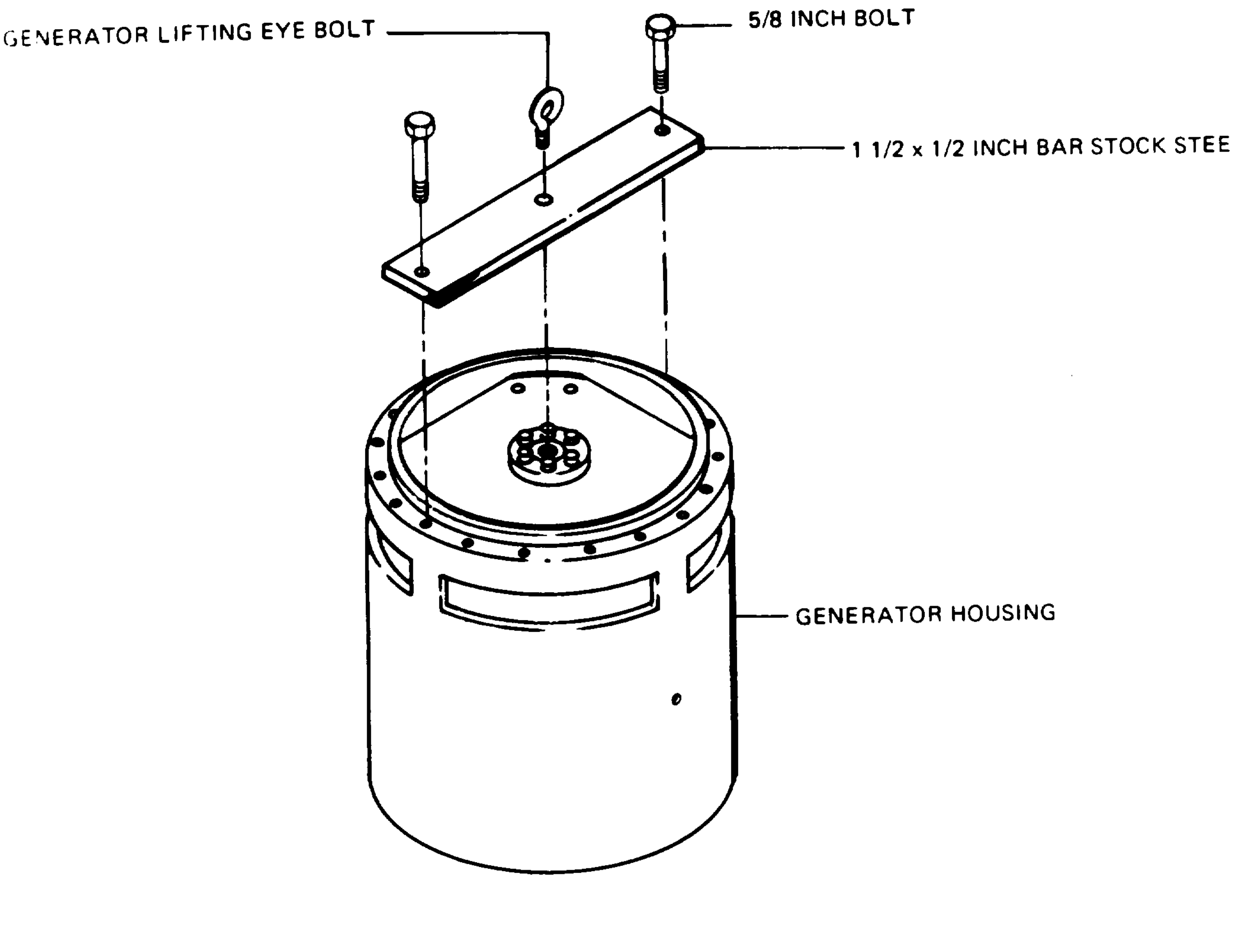


Figure 3-137. Securing Generator Rotor to Stator

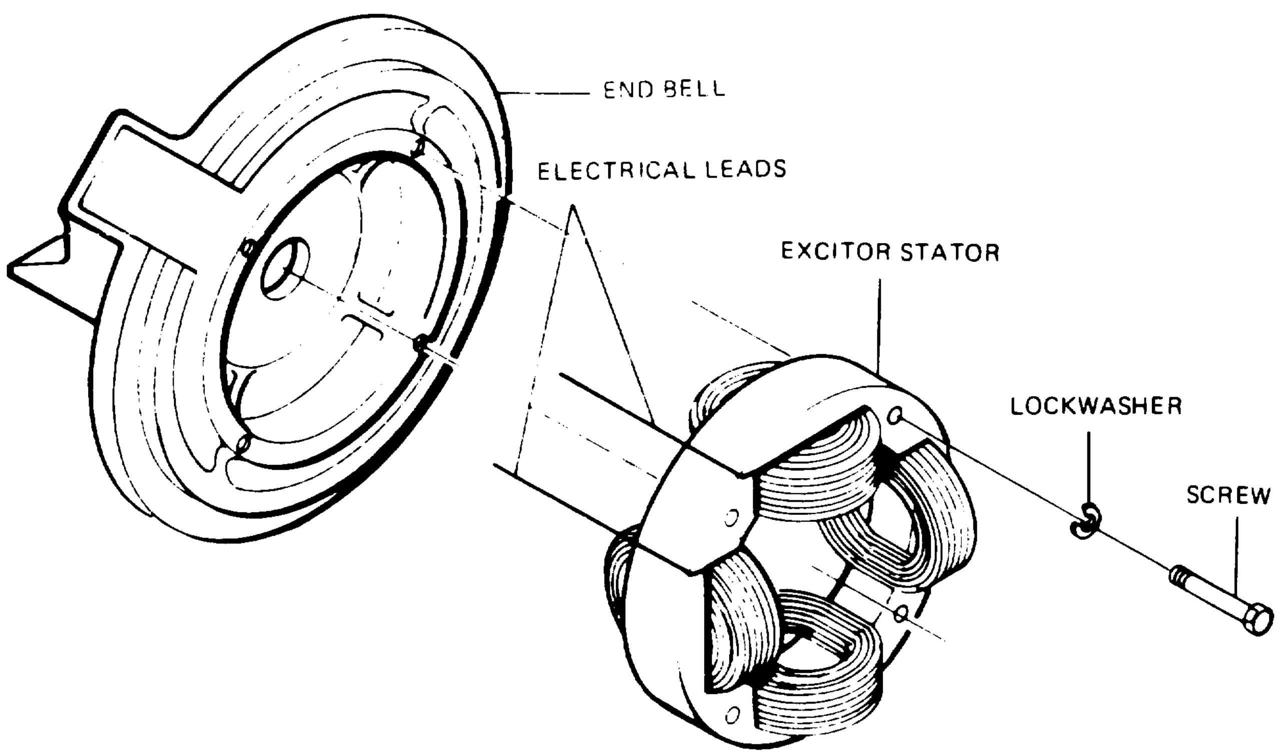
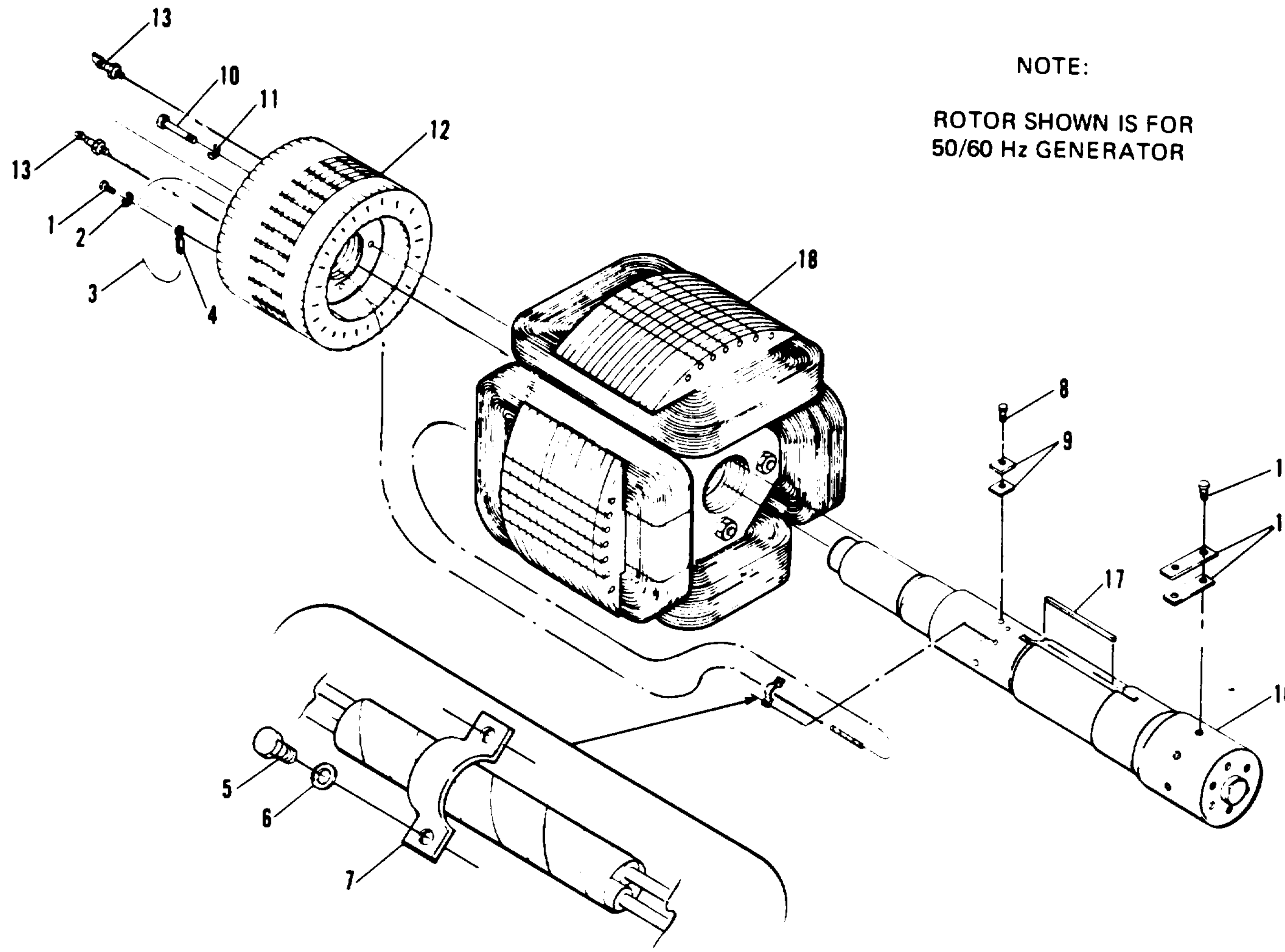


Figure 3-138. End Bell Assembly, Exploded View



1. Screw
2. Lockwasher
3. Electrical lead
4. Lug
5. Screw
6. Flat washer
7. Cable clamp
8. Screw
9. Balance weights
10. Screw
11. Lockwasher
12. Exciter rotor
13. Diode
14. Screw
15. Balance weight
16. Rotor shaft
17. Key
18. Rotor core

Figure 3-139. Generator Rotor and Balance Assembly, Exploded View (Sheet 1 of 2)

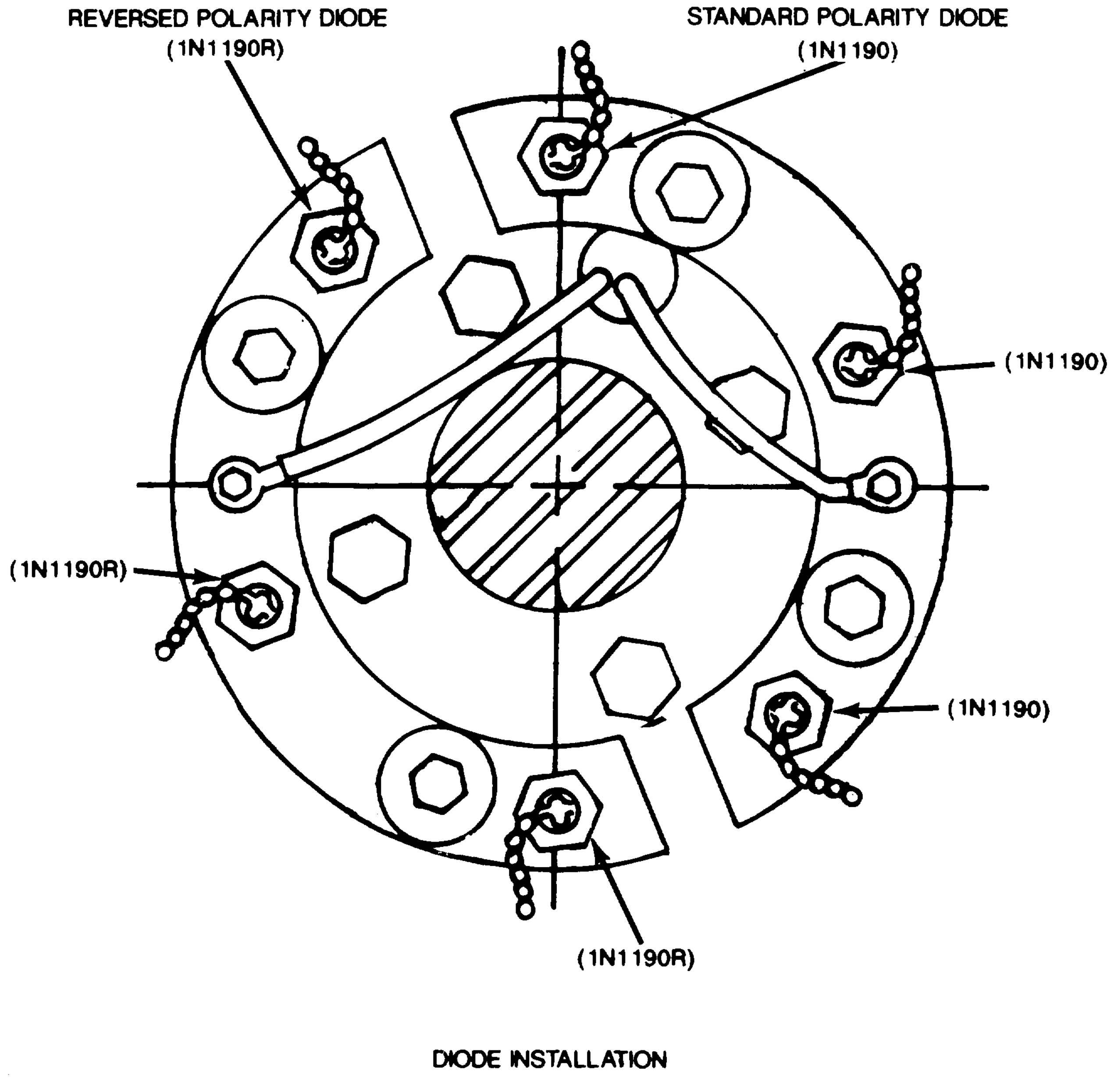


Figure 3-139. Generator Rotor and Balance Assembly, Exploded View (Sheet 2 of 2)

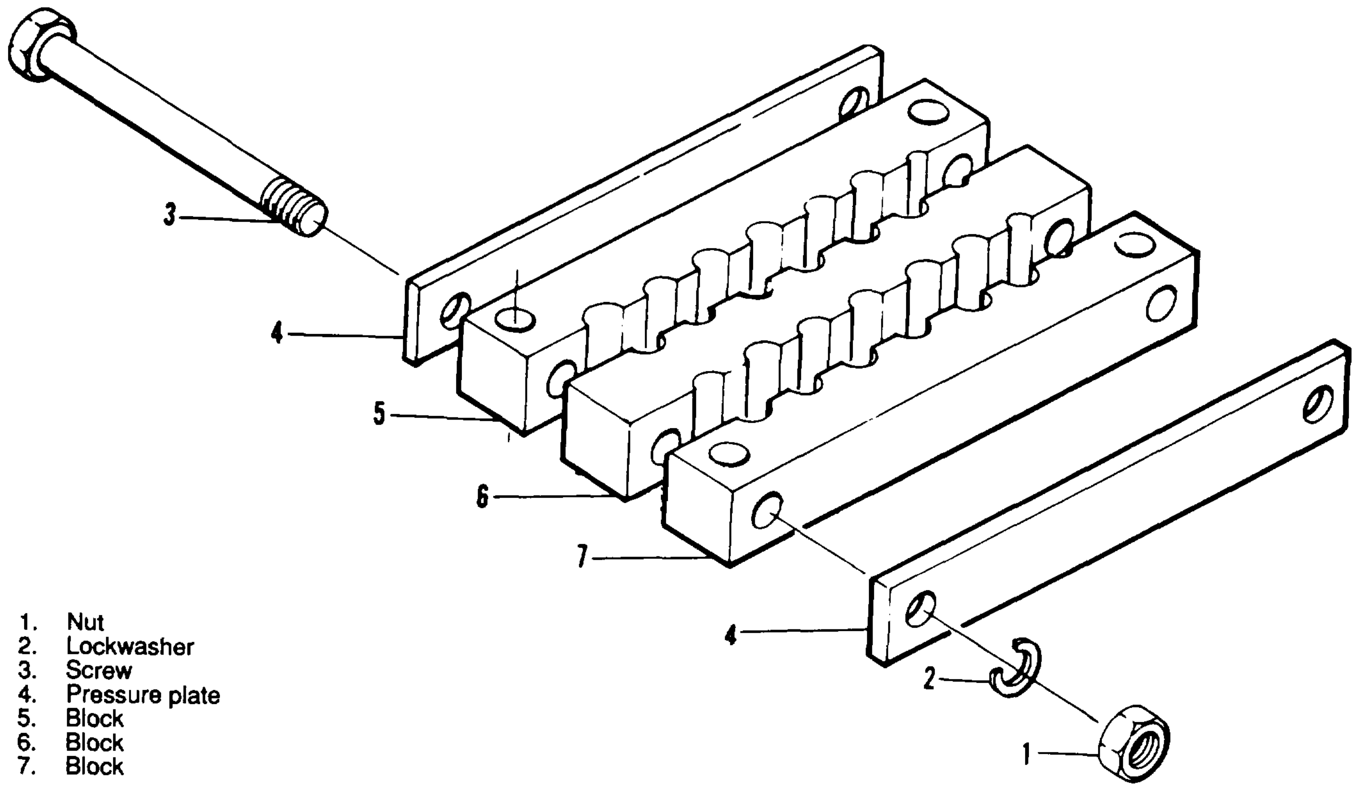


Figure 3–140. Lead Block Assembly, Exploded View

(30) If inspection reveals damage to the lead block assembly, disassemble as follows:

(a) Remove nuts (1, figure 3-140), lockwashers (2) and screws (3).

(b) Separate pressure plates (4) and blocks (5, 6, and 7).

(31) If inspection reveals damage to stator assembly, disassemble as follows:

(a) Remove screws (1, figure 3–141) and lockwashers (2) to remove ring (3). (400 Hz generator sets only.)

(b) Remove screws (4) and lockwashers (5) to remove lead bushing (6).

(c) Unscrew eye bolt (7) from frame assembly (8).

NOTE

Do not attempt to disassemble frame assembly.

c. Cleaning, Inspection, and Repair.

WARNING

Use solvent in a well ventilated area. Avoid inhaling solvent fumes. Do not allow solvent to come into contact with the skin. Failure to observe this warning could result in servere personal injury or death.

(1) Clean all generator parts using an approved solvent. Do not dip parts into solvent.

1. Screw (400 Hz only)
2. Lockwasher (400 Hz only)
3. Ring (400 Hz only)
4. Screw
5. Lockwasher
6. Lead bushing
7. Eye bolt
8. Frame assembly

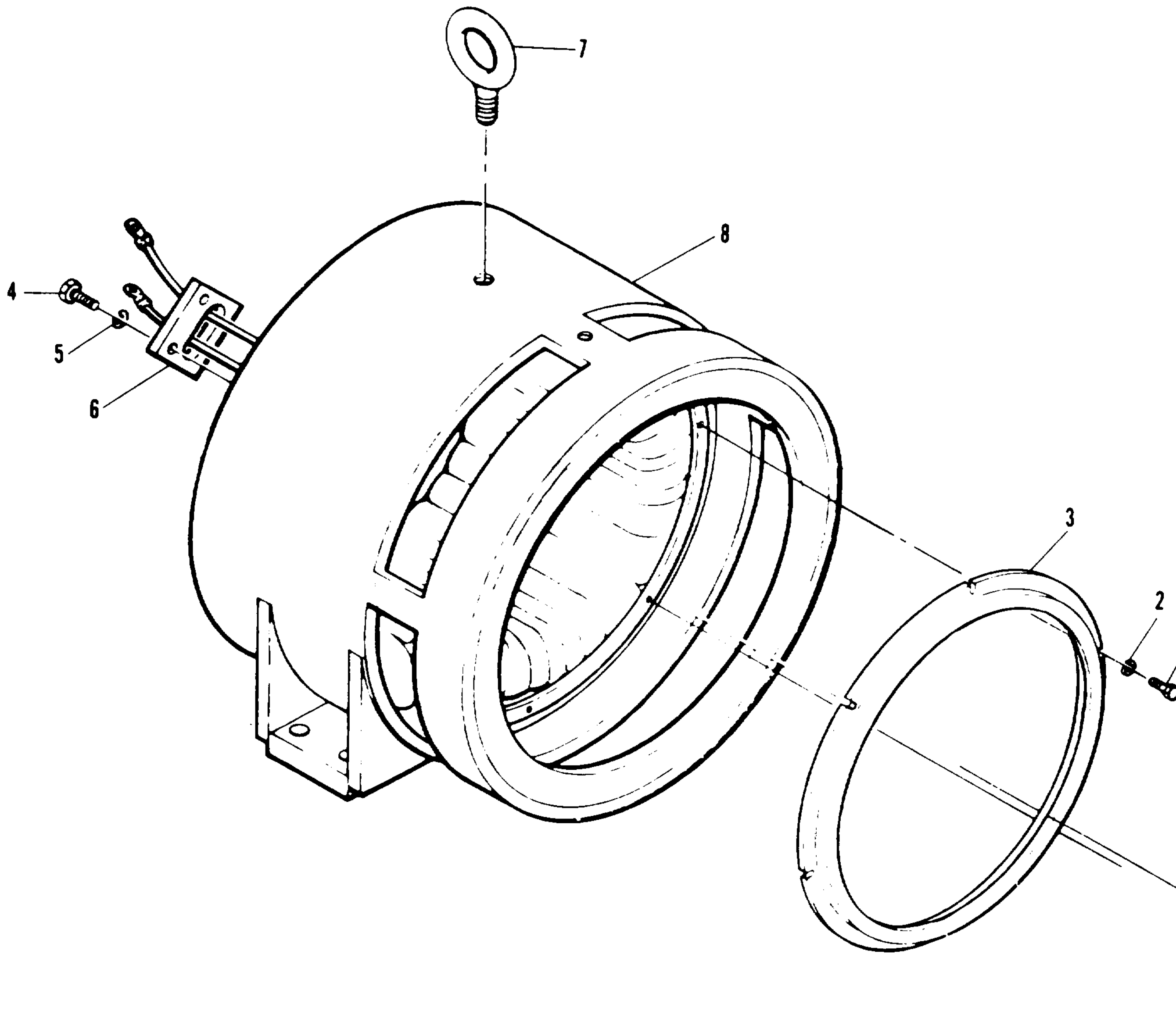


Figure 3-141. Generator Stator Assembly, Exploded View

(2) Ultra sonic cleaning may be used if available. Consult manufacturer's recommendations for cleaning solutions and procedures to be used.

(3) After cleaning, dry rotor and balance assembly, stator assembly, and exciter stator by baking in an oven at 200°F (93°C) for approximately 3 hours. After drying, apply a light coating of oil (Military Specification MIL-I-9870) or corrosion preventive compound (Military Specification MIL-C–4339) to all ferrous-metal surfaces to prevent rusting.

(4) Dry all other parts with a clean, lint-free cloth.

(5) Inspect all electrical leads for a damaged or deteriorated insulation and evidence of shorting. Check each electrical lead for continuity.

(6) Inspect blower and coupling disc for wear, cracks, breaks, or other damage.

(7) Inspect bearing kit for cracked or damaged housing. Check bearing for wear, pitting, and corrosion. Check bearing adapter for wear and corrosion.

(8) Measure inside diameter of bearing housing. Diameter shall be 3.19492 to 3.19502 inches.

(9) Measure outer diameter of bearing adapter. Diameter shall be 1.3780 to 1.3784 inches.

(10) Inspect rotor shaft for discoloration or other evidence of overheating. If it is suspected that rotor shaft is weakened, disassemble rotor assembly (paragraph b. (19) above) and perform magnetic particle inspection in accordance with Military Specification MIL-I-6868.

(11) Inspect rotor and exciter cores for evidence of shorting and overheating. Check windings for physical damage.

(12) Inspect rectifiers for evidence of shorting and overheating.

(13) Inspect end bell assembly for cracks, corrosion, and other damage. Inspect exciter stator for evidence of shorting and overheating. Check windings for physical damage.

(14) Inspect lead block assembly for cracks, corrosion, and other damage.

(15) Inspect stator assembly for cracks, corrosion, and other damage. Check windings for evidence of shorting or other physical damage.

WARNING

When making electrical checks, take precautions to avoid accidental contact with conductors carrying high voltage. Make certain that test leads are properly connected. Failure to observe this warning could result in servere personal injury or death.

CAUTION

Make sure that component being tested is electrically isolated from all other components. Failure to observe this caution could result in damage to the equipment.

(16) Using tester, ground check rotor core by applying 300 Vac at 60 Hz RMS for 1 second between heat sink and rotor shaft. There shall be no evidence of dielectric breakdown.

(17) Using a double bridge, measure resistance of rotor core. Resistance shall be 0.2154 to 0.2486 ohms at 77°F (25°C).

(18) Install rotor and balance assembly and dymetric balance machine and check for static and dynamic balance. Unbalance shall not exceed 0.5 inch-ounce in either balance plane. Balance rotor and balance assembly as outlined in step (25) below.

(19) Install blower and coupling disc assembly on a dymetric balance machine and check both static and dynamic balance. Unbalance shall not exceed 0.5 inch-ounce in either plane. Balance blower and coupling disc assembly as outlined in step (26) below.

(20) Use a double bridge to measure resistance of each phase of exciter rotor. Resistance of each phase shall be 0.1473 to 0.1627 ohm at 77°F (25°C). Difference between phase reading shall not exceed 2 percent.

(21) Using 374 megger, ground test exciter by applying 300 Vac at 60 Hz RMS for 1 second between one terminal and ground (frame). There shall be no evidence of dielectric breakdown.

(22) Using a double bridge measure resistance between terminals of exciter stator, Resistance shall be 4.50 to 5.50 ohms at 77°F (25°C).

(23) Using 374 megger tester, ground test stator assembly by applying 750 Vac at 60 Hz RMS for one second between all leads (tied together) and the frame. Apply 500 Vac at 60 Hz RMS for one second between phases with neutral open. There shall be no indication of dielectric breakdown in either test.

(24) Use semiconductor test set to test rectifiers for inverse current leakage at peak recurrent voltage of 600 volts. Leakage shall not exceed 20.0 milliamperes at 77°F (25°C). Check forward voltage drop. Voltage drop shall not exceed 1.2 volts at 77°F (25°C).

(25) If rotor and balance assembly is out of balance, add or subtract balance weights until remaining unbalance in both balance planes does not exceed 0.5 ounce-inch. Once rotor and balance assembly is balanced, tach weld balance weights and attaching screw.

(26) If blower and coupling disc assembly is out of balance, correct by machining material from inner diameter of blower as required. Remaining unbalance shall not exceed 0.5 inch-ounce in both balance plans.

(27) If damage to the stator windings is discovered during inspection and test, rewind using figure 3-142 (figure 3-143 for 400 Hz) as a guide.

(28) After rewinding, vacuum impregnate the stator assembly as follows:

(a) Place wound stator in an oven at 300°F (-0, +15°F (149°C) for 120 ± 10 minutes.

(b) Transfer stator to vacuum tank.

NOTE

Do not allow temperature of stator to drop below 125°F.

(c) Evacuate tank to a maximum of 50 mm Hg absolute and hold for 10 minutes (minimum).

(d) Without breaking the vacuum, introduce varnish (Military Specification MIL-I-24092, Type M, Class 155) to a sufficient depth to completely cover the stator. Hold vacuum for 5 minutes (minimum).

(e) Break vacuum and hold at atmospheric pressure for 5 minutes (minimum).

(f) Return varnish to storage tank and allow the stator to drain.

(g) Place the impregnated stator in an oven at 300°F, -0°F, +15°F, (149°C) for 120 ± 10 minutes.

(29) If damage to rotor core windings is discovered at inspection and test, rewind in accordance with figure 3-144 (figure 3–145 for 400 Hz).

(30) Impregnate the wound rotor as follows:

(a) Mark all fit surfaces to prevent the resin from adhering.

(b) Preheat the wound core for 2 hours (minimum) at 302°F (150°C) (minimum).

(c) Allow the core to cool in ambient surroundings to 104°F (40°C) (maximum).

(d) Place the core in the vacuum tank and evacuate to 1 to 5 mm Hg and hold for 15 minutes.

(e) Without breaking the vacuum, admit the resin into the tank to a sufficient depth to cover the core. Hold the vacuum for a minimum of 5 minutes.

(f) Break the vacuum and pressurize the tank to 85 to 90 psig. Hold for a minimum of 30 minutes.

(g) Reduce the pressure to zero, then increase as necessary to remove the resin from the tank.

(h) Drain the core for a minimum of 30 minutes.

(i) Place the core in an oven and heat to a temperature of 302°F (150°C). Cure at this temperature for a minimum of 16 hours.

(31) It damage to the exciter stator is discovered at inspection and test, rewind in accordance with figure 3-146.

(32) Vacuum impregnate bobbins in accordance with stop (28) above prior to installing on laminations.

(33) If damage to the exciter rotor is noted at inspection and test, rewind in accordance with figure 3-147.

(34) After winding the rotor, vacuum pressure impregnate as directed in step (30) above.

(35) Replace all worn or damaged parts and parts which fail to meet inspection requirements.

d. Assembly.

(1) Assemble stator assembly as follows:

(a) Screw eye bolt (4, figure 3-141) into frame assembly (5).

(b) Install lead bushing (3) and secure with Iockwashers (2) and screws (1). Torque screws to 17 Ibs-ft.

(2) Assemble lead block assembly as follows:

(a) Assemble blocks (5 and 6, figure 3-140) and pressure plates (4).

(b) Install with screws (3), Iockwashers (2) and nuts (1). Do not tighten.

(3) Assemble rotor and balance assembly as follows:

(a) Heat rotor core (18, figure 3-139) in an oven for 3.0 to 3.5 hours at 356.0°F (180.0°C).

(b) Install key (17) into slot of rotor shaft (16).

WARNING

Wear heat resistant gloves when handling heated rotor. Serious burns may result from failure to observe this warning.

NOTES:

1 STATOR NOT WOUND, FIND NO. 3, SHALL BE CLEAN BEFORE WINDING.
2. ALL LEADS, FIND NO. 2, SHALL BE CLEARLY LABELED BEFORE IMPREGNATION AND ALL HOLES SHALL BE PROTECTED.
3. INSTALL SLEEVING, FIND NO. 1, OVER LEADS FROM WHERE THEY EMERGE FROM WINDINGS TO THE POINT REFERENCED IN NOTE 6. SECURE WITH 1 LAYER OF TAPE, FIND NO. 8.
4. TAPE ALL SPLICES WITH 2 LAYERS OF TAPE, FIND NO. 8, TIE ALL SPLICES AND LEADS TO TURNS IN WINDINGS AT 4 INCH INTERVALS USING CORD, FIND NO. 9. TIE SHALL BE SUFFICIENTLY STRONG TO HOLD LEADS SECURE.
5. PLACE A SHEET OF INSULATION, FIND NO. 11, BETWEEN EACH PHASE BEFORE TYING AS SPECIFIED IN NOTE 4.
6. LENGTH E, IN TABLE 1, IS MEASURED FROM POINT REFERENCED IN DETAIL A, SH 2, Z B–4.
7. SOLDERING SHALL BE IN ACCORDANCE WITH MIL–STD–454, REQUIREMENT 5.
8. VACUUM–PRESSURE IMPREGNATE AND DIP IN ACCORDANCE WITH 72–2488.
9. INTERPRET DRAWING PER MIL–STD–100.
10.. CRIMPED CONNECTIONS, FIND NO. 12, SHALL MEET THE PERFORMANCE REQUIREMENTS OF MIL–T–7928.
11. WIRE MARKING TO BE IN ACCORDANCE WITH MIL–W–5088 EXCEPT THAT LENGTH BETWEEN GROUPS OF NUMBERS SHALL NOT EXCEED 6 INCHES.
12. IF PROCURED AS A REPAIR PART, THE ITEM SHALL BE TREATED AND PAINTED IN ACCORDANCE WITH MIL–7–704, TYPE A SEMI–GLOSS, COLOR X24087. PROTECT ALL HOLES TO PREVENT OVERSPRAY.
13. PHASE INSULATION, FIND NO. 11, SHALL BE OF SUFFICIENT SIZE TO COMPLETELY INSULATE THE PHASES FROM EACH OTHER.
14. GROUND INSULATION: GREATER THAN 1000 KEGOHMS.
HIGH POTENTIAL: 2000 VOLTS.

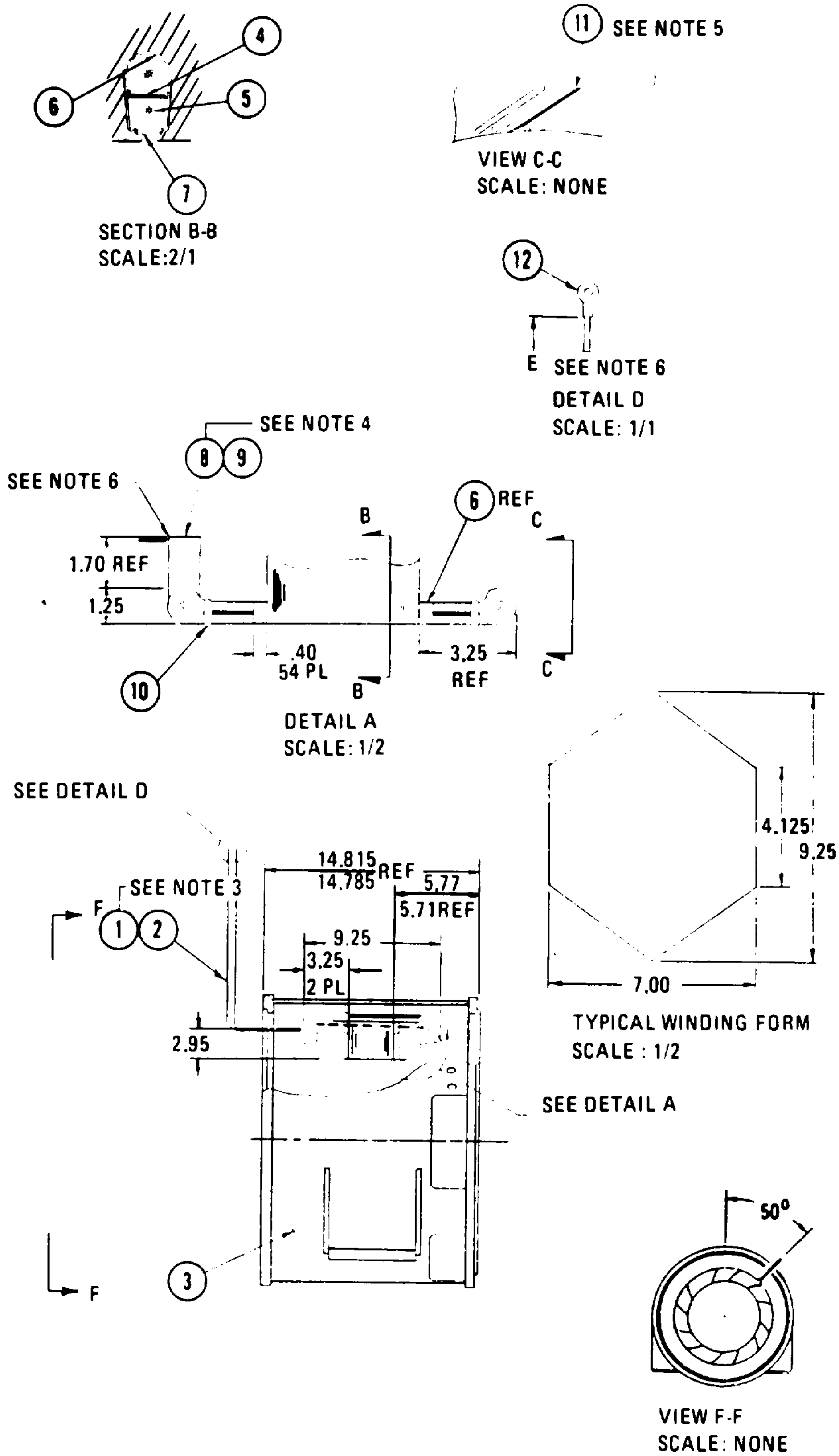
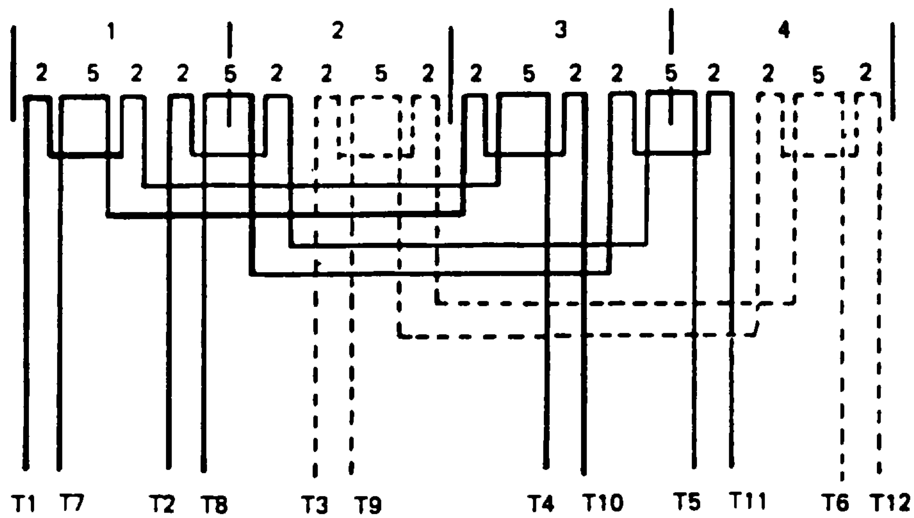


Figure 3–142. 50/60 Hz Generator Stator Winding Procedures
(Sheet 1 of 2)



1. Insulation, sleeving
2. Wire
3. Stator assy (not wound)
4. Liner, slot
5. Wire
6. Separator
7. Liner, slot end
8. Insulation tape
9. Cord
10. Insulation tape
11. Insulation, tape
12. Terminal lug

CONNECTION DIAGRAM

WINDING DATA	
TYPE OF WINDING	3 PHASE
NO OF SLOTS AND COILS	54
NO OF COILS PER GROUP	12 GROUPS OF 2; 6 GROUPS OF 5
TURNS PER COIL	7
CONDUCTOR	3 OF NO. 16 RND
CONNECTION	SEE CONNECTION DIAGRAM
SPACING	1–12

Figure 3-142. 50/60 Hz Generator Stator Winding Procedures (Sheet 2 of 2)

NOTES:

1. STATOR NOT WOUND, FIND NO. 3, SHALL BE CLEAN BEFORE WINDING.
2. ALL LEADS, FIND NO. 1, SHALL BE CLEARLY LABELED AND ALL HOLES SHALL BE PROTECTED BEFORE IMPREGNATION.
3. SOLDERING SHALL BE IN ACCORDANCE WITH MIL-STD-454, REQUIREMENT 5.
4. WRAP ALL SPLICES WITH A MINIMUM OF TWO LAYERS OF TAPE, FIND NO. 8.
5. INSTALL PHASE INSULATION, FIND NO. 11, BETWEEN EACH PHASE.
6. INTERPRET DRAWING PER MIL-STD-100.
7. TIE THE SPLICED LEADS TOGETHER AS NECESSARY TO FIRMLY SECURE THEM FROM INTERFERING WITH GENERATOR ROTOR USING CORD, FIND NO. 9, AT FOUR INCH INTERVALS.
8. VACUUM-PRESSURE IMPREGNATE AND DIP IN ACCORDANCE WITH 72-2488.
9. LENGTH E IS MEASURED FROM THE POINT IN NOTE 10.
10. INSTALL SLEEVING, FIND NO. 1, OVER LEADS FROM WHERE THEY EMERGE FROM WINDINGS TO THE POINT REFERENCED IN DETAIL A: SH 2, B-4.
11. CRIMPED CONNECTIONS, FIND NO. 1, SHALL MEET THE PERFORMANCE REQUIREMENTS OF MIL-T-7928.
12. WIRE MARKING TO BE IN ACCORDANCE WITH MIL-W-5088 EXCEPT THAT LENGTH BETWEEN GROUPS OF NUMBERS SHALL NOT EXCEED 6 INCHES.
13. IF PROCURED AS A REPAIR PART, THE ITEM SHALL BE TREATED AND PAINTED IN ACCORDANCE WITH MIL-T-704, TYPE A SEMI-GLOSS, COLOR X24087. PROTECT ALL HOLES TO PREVENT OVERSPRAY.
14. INSULATION, FIND NO. 11 SHALL BE OF SUFFICIENT SIZE TO COMPLETELY INSULATE THE PHASES FROM EACH OTHER.
15. GROUND INSULATION: GREATER THAN 1000 MEGOHMS.
    HIGH POTENTIAL: 2000 VOLTS

TABLE 1

LEAD	DIM E	LUG (REF)
T1	77.25	MS25036-114
T2	67.38	MS25036-114
T3	67.38	MS25036-114
T4	37.25	MS25036-114
T5	45.00	MS25036-114
T6	37.25	MS25036-114
T7	77.25	MS25036-114
T8	67.38	MS25036-114
T9	67.38	MS25036-114
T10	37.25	MS25036-114
T11	45.50	MS25036-114
T12	37.25	MS25036-114

1. Wire
2. Insulation sleeving
3. Stator assy (not wound)
4. Liner, slot
5. Wire
6. Separator
7. Liner, slot end
8. Cord
9. Insulation tape
10. Insulation tape
11. Insulation phase
12. Terminal lug

Figure 3-143. 400 Hz Generator Stator Winding Procedures (Sheet 1 of 3)

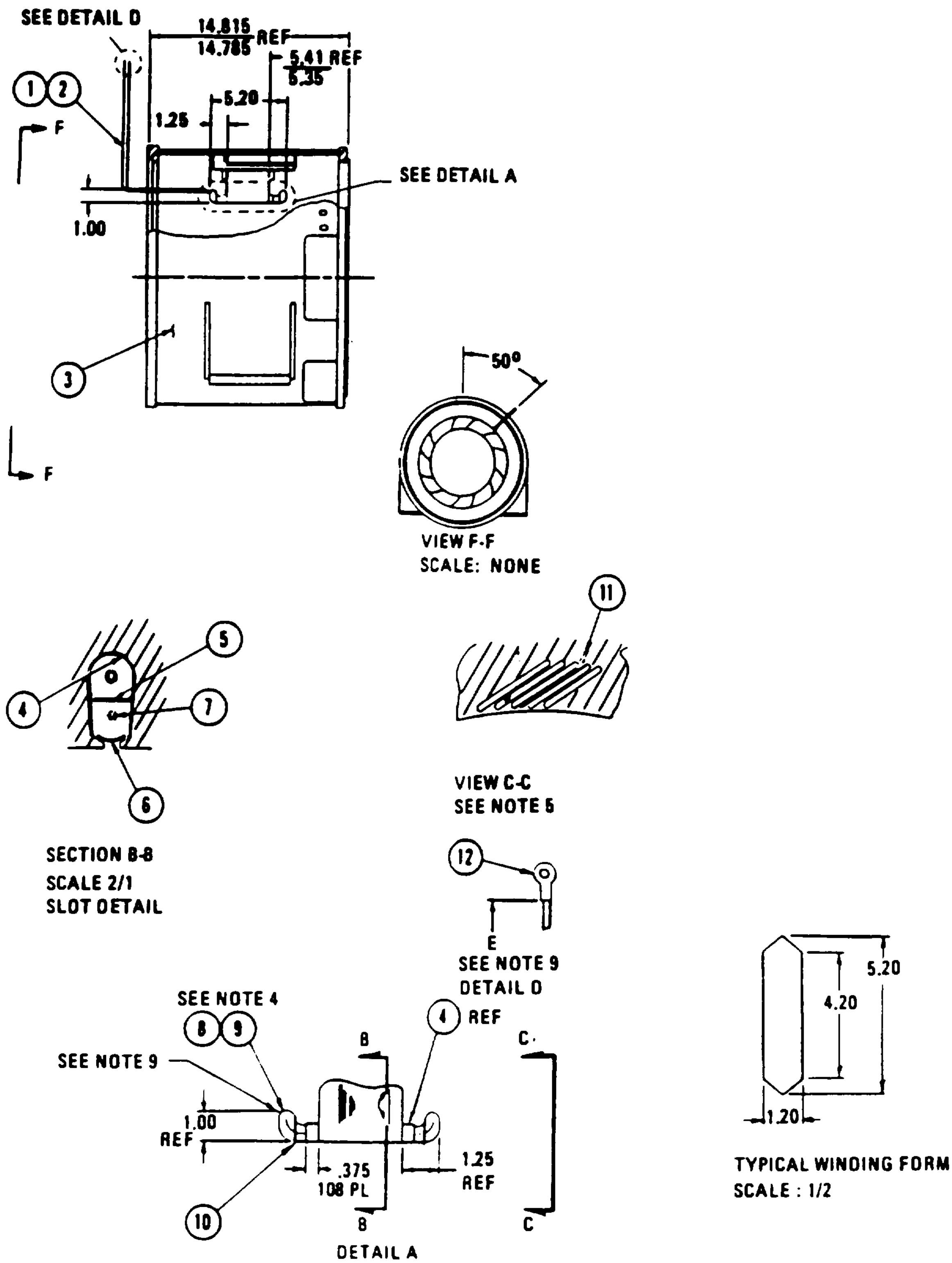
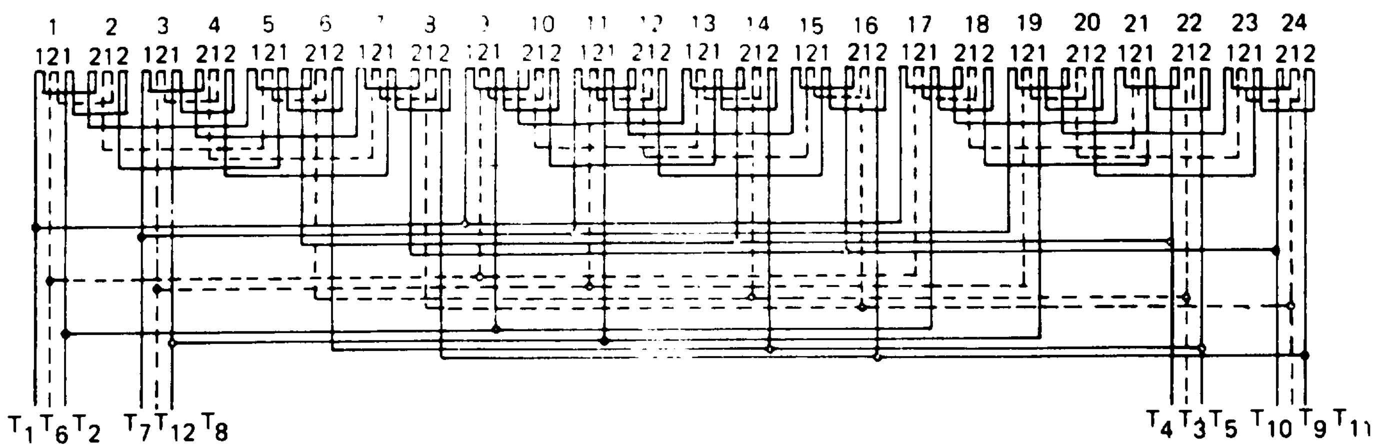


Figure 3-143. 400 Hz Generator Stator Winding Procedures (Sheet 2 of 3)

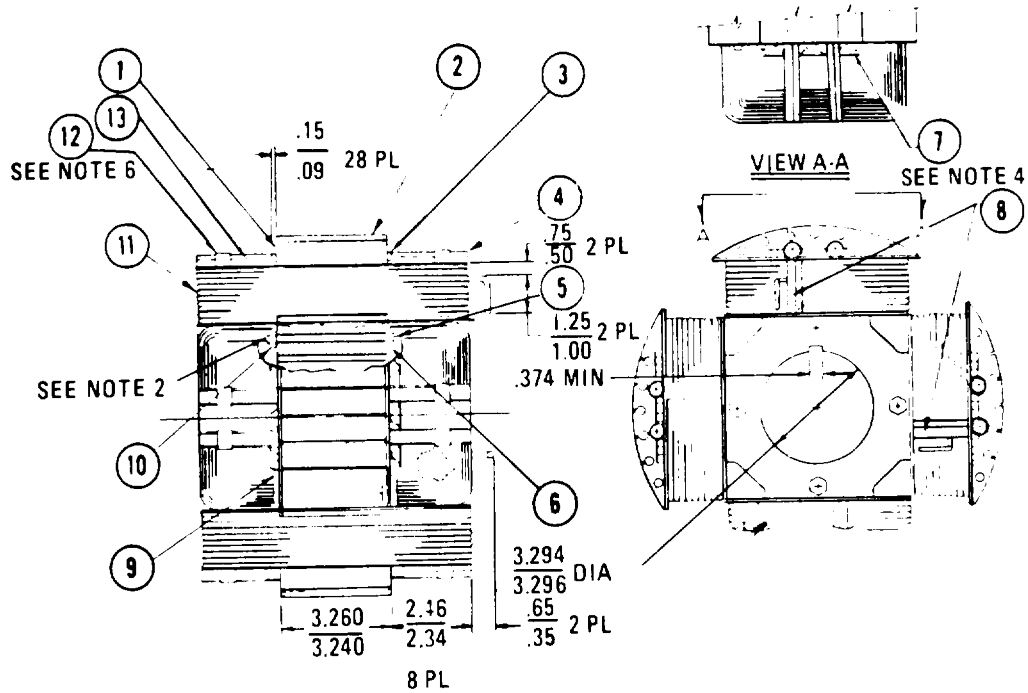


CONNECTION DIAGRAM

WINDING DATA	
TYPE OF WINDING	3 PHASE
NO. OF SLOTS AND COILS	108
NO. OF COILS PER GROUP	36 GROUPS OF 1 36 GROUPS OF 2
TURNS PER COIL	8
CONDUCTOR	1 OF NO. 16 RD.
SPAN	1–4
CONNECTION	SEE CONN. DIAGRAM

Figure 3-143. 400 Hz Generator Stator Winding Procedures (Sheet 3 of 3)

1. Lamination, core
2. Lamination, core
3. Rod, cage
4. Rod, retainer
5. Screw, cap
6. Washer, lock
7. Spacer, coil
8. Tape, glass
9. Insulation
10. Locknut
11. Wire
12. Tape, glass
13. Slot, liner

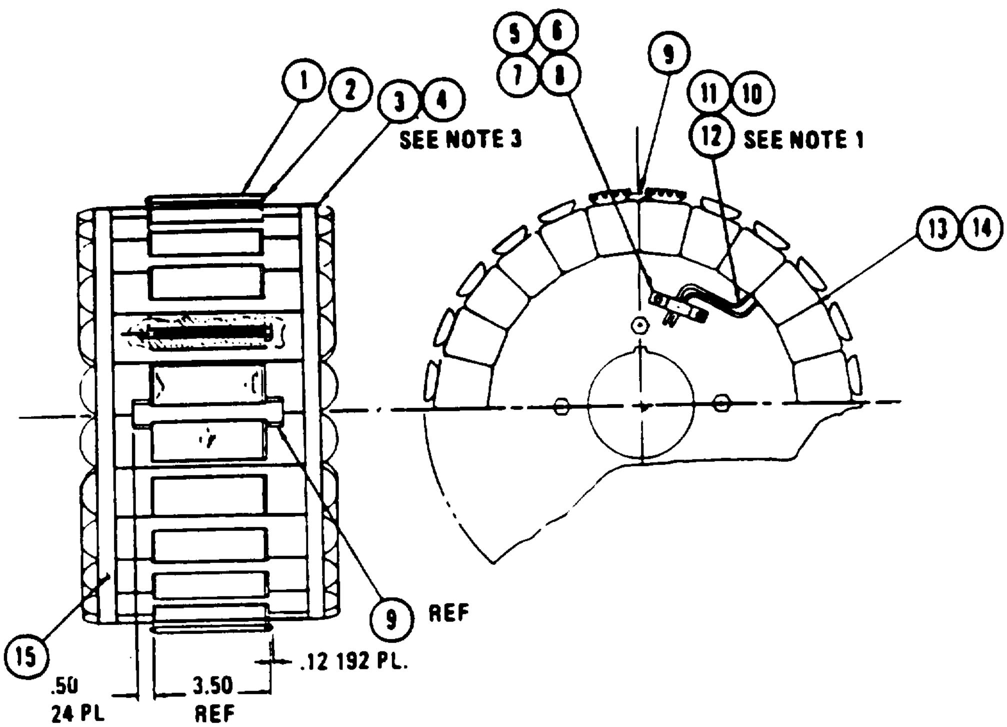


1. INTERPRET DRAWING PER MIL-STD-100.
2. STACK LAMINATIONS, FIND NOS. 1 AND 2, ON I.D. UNDER 2.5 ± 10% TONS.
3. BRAZE CAGE ROD, FIND NO. 3, TO LAMINATIONS, FIND NO. 1, IN ACCORDANCE WITH MIL–B-7883. TYPE 1, GRADE B, BRAZING FLUX SHALL BE IN ACCORDANCE WITH AWS TYPE 3A.
4. ONE COIL SPACER SHALL BE USED AT EACH OF EIGHT PLACES.
5. APPLY 4 LAYERS OF TAPE, FIND NO. 8, TO SECURE CABLE STUDS.
6. APPLY 2 1/2 LAYERS OF TAPE, FIND NO. 12, TO ROD, FIND NO. 4.
7. VACUUM–PRESSURE IMPREGNATE IN ACCORDANCE WITH 72–2487.
8. CLEAN CABLE STUDS AFTER IMPREGNATION.
9. TORQUE CAP SCREWS, FIND NO. 5, TO 17–FT–LB ± 10% WHILE THE LAMINATIONS ARE UNDER PRESSURE.
10. GROUND INSULATION: GREATER THAN 200 MEGOHMS.
    HIGH POTENTIAL: 1500 VOLTS.

Figure 3-144. 50/60 Hz Generator, Rewinding Procedures

NOTES:

1. LOCATE HEAD STUD AS SHOWN, 45° ± 5° FROM ROTOR RETWIST.
2. SOLDERING SHALL BE IN ACCORDANCE WITH MIL-STD-454, REQUIREMENT 5.
3. BAND COIL EXTENSIONS AT EACH BEND WITH TAPE, FIND NO. 4.
4. BAND OUTSIDE CIRCUMFERENCE OF WINDING WITH 9 LAYERS OF TAPE, FIND NO. 16, AS SHOWN, UNDER 33 LBS ± 10°.
5. VACUUM-PRESSURE IMPREGNATE IN ACCORDANCE WITH 72-2487.
6. INTERPRET DRAWING PER MIL-STD-100.



1. Core assembly
2. Rod, cage
3. Wire
4. Tape, glass
5. Clamp, lead
6. Insulation, lead clamp
7. Felt, insulation
8. Washer, lock
9. Wedge, slot
10. Wire
11. Insulation sleeving
12. Tape, insulation
13. Liner, slot
14. Separator
15. Tape, insulation

Figure 3-145. 400 Hz Generator Rotor Winding Procedures

CAUTION

Do not use press which contacts core windings. Press only on core laminations. Failure to observe this caution could result in damage to the equipment.

(c) Remove heated rotor core from oven and press onto rotor shaft until firmly seated against shoulder. Do not allow key to project more than 0.12 inch on either side of rotor.

(d) Insure exciter rotor is positioned so that lead holes are equal distant on each side of lead slot in rotor shaft.

(e) Feed field leads from generator field (18) through exciter rotor (12).

(f) Mount exciter rotor (12) onto rotor shaft and secure with Iockwashers (11) and screws (10). Torque screws to 60 pounds-inch.

NOTE

Remove only one diode at a time (Figure 3-139 sheet 2 of 2).

(g) Install rectifiers (13) and torque to 28 pounds-inch. Connect leads to rectifiers and solder in accordance with established procedures.

(h) install cable clamps (7), Iockwashers (6), and screws (5).

(i) Connect electrical leads (3) and secure with Iockwashers (2) and screws(1).

(j) Install lug (4) on electrical lead (3).

(k) Temporarily install balance weights (15 and 9) and screws (14 and 8).

(l) Balance rotor and balance assembly (paragraph c. (25) above).

(m) Remove screws, Iockwashers, and weights.

(n) Coat screws with Loctite, Grade C (no known government specification) and allow to dry.

(o) Install balance weights, Iockwashers, and screws. Torque screws to 31 lb-ft.

(p) Tach weld screws and single hole weights to prevent movement.

(q) Install blower wheel (31, figure 3–136), coupling disc (30, figure 3–136), pressure plate (29), lock plate (28) with screws (27).

(r) Torque screw to 75 Ibs–ft and bend lock tab of lock plate (28) against flat of screw.

(s) Using 5/8 in. bolts and nuts, temporarily fasten coupling disc to blower.

(4) Assemble end bell assembly as follows:

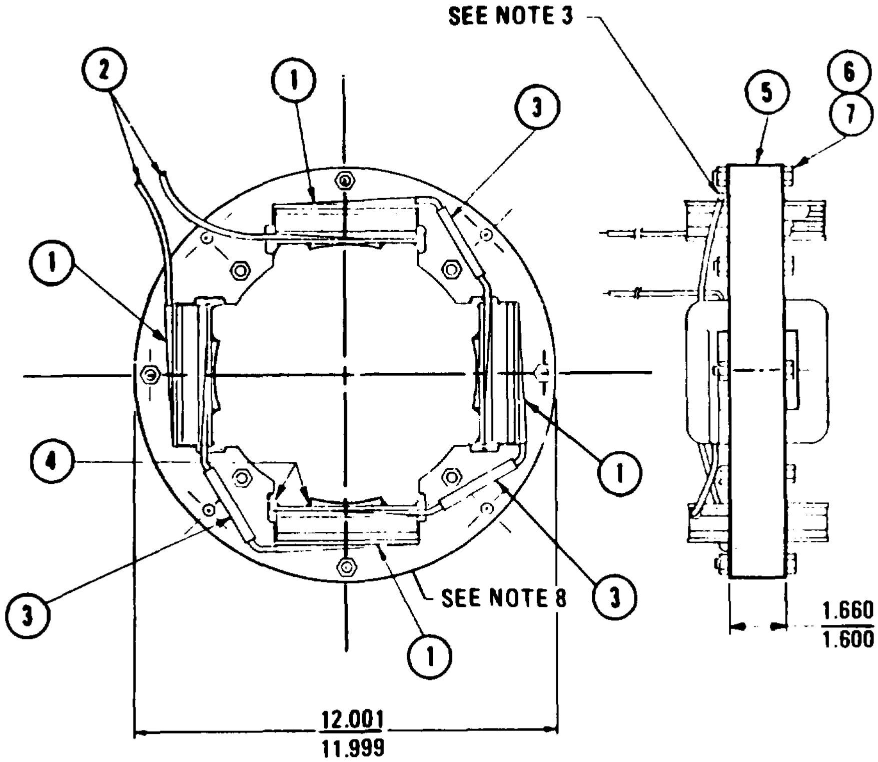
(a) Assemble exciter stator (figure 3-138) to end bell. Insuring electrical leads are lined with lead opening.

(b) Secure with Iockwashers and screws.

(5) Assemble generator assembly as follows:

(a) Secure end bell assembly (34, figure 3-136) to stator (26) using Iockwashers (33) and screws (32). Torque screws to 31 ft-lbs.

(b) Feed electrical leads through gasket (10) and insert them through loosely assembled lead block (9).



NOTES:

1. INTERPRET DRAWING PER MIL-STD-100.
2. SOLDERING SHALL BE IN ACCORDANCE WITH MIL-STD-454. REQUIREMENTS.
3. STACK LAMINATIONS, FIND NO .5, UNDER 3 TONS ± 10%.
4. TORQUE CAP SCREWS, FIND NO. 6, TO 16+1 FT-LBS, WHILE LAMINATIONS ARE UNDER PRESSURE.
5. AFTER ASSEMBLY, SPRAY WITH ONE COAT OF VARNISH IN ACCORDANCE WITH MIL-V-173.
6. SLEEVING, FIND NO. 3, SHALL BE SUFFICIENT TO COVERED SOLDERED CONNECTIONS.
7. MARK:
   30554-72-2430
   MFG: (CODE IDENT NO.)
   IN ACCORDANCE WITH MIL-M-13231 , GROUP 1,2, OR 3 CHARACTERS SHALL BE .12 MIN. HIGH AND LOCATED AS SHOWN.
8. GROUND INSULATION: GREATER THAN 1000 MEGOHMS. HIGH POTENTIAL: 1500 VOLTS.
9. WIND BOBBIN, FIND NO. 8, WITH 200 TURNS OF WIRE, FIND NO. 9.
10. APPLY A MINIMUM OF 2 LAYERS OF TAPE, FIND NO. 10, WITH OVERLAPPING.
11. OUTSIDE SURFACE OF WINDINGS SHALL BE LESS THAN OUTSIDE FLANGES OF BOBBIN.
12. BENCH TEST RESISTANCE: .61 OHMS.

1. Bobbin, wound
2. Wire
3. Insulation sleeving
4. Insulating compound
5. Lamination, stator
6. Screw, cap
7. Nut, self-locking
8. Bobbin (not wound)
9. Wire
10. Yard, cord

Figure 3-146. Generator Exciter Stator Winding Procedures
(Sheet 1 of 2)

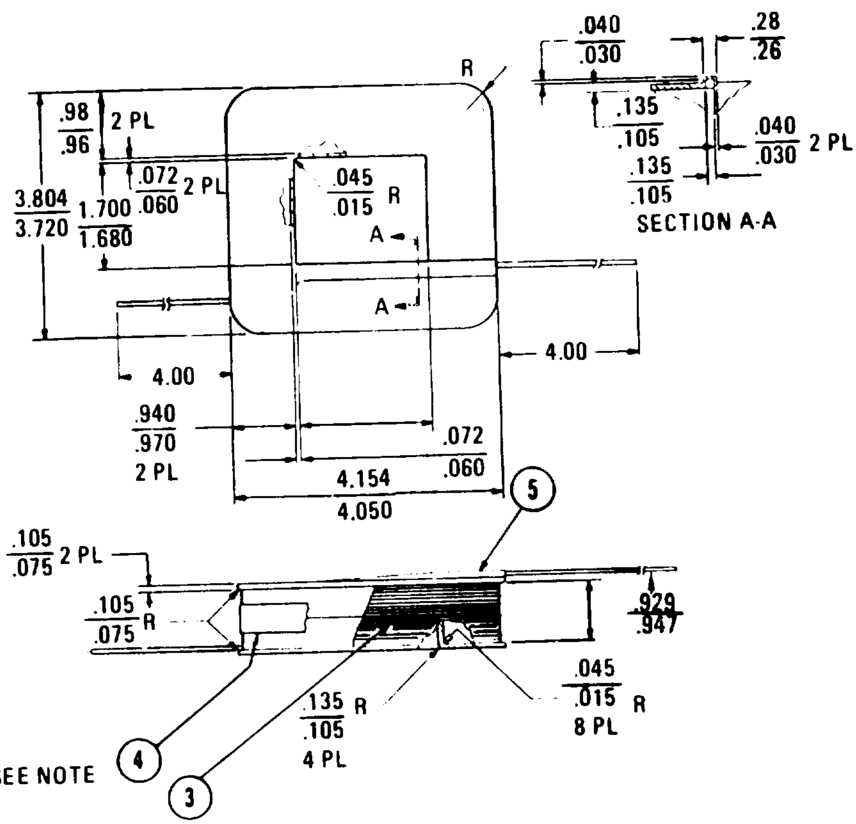
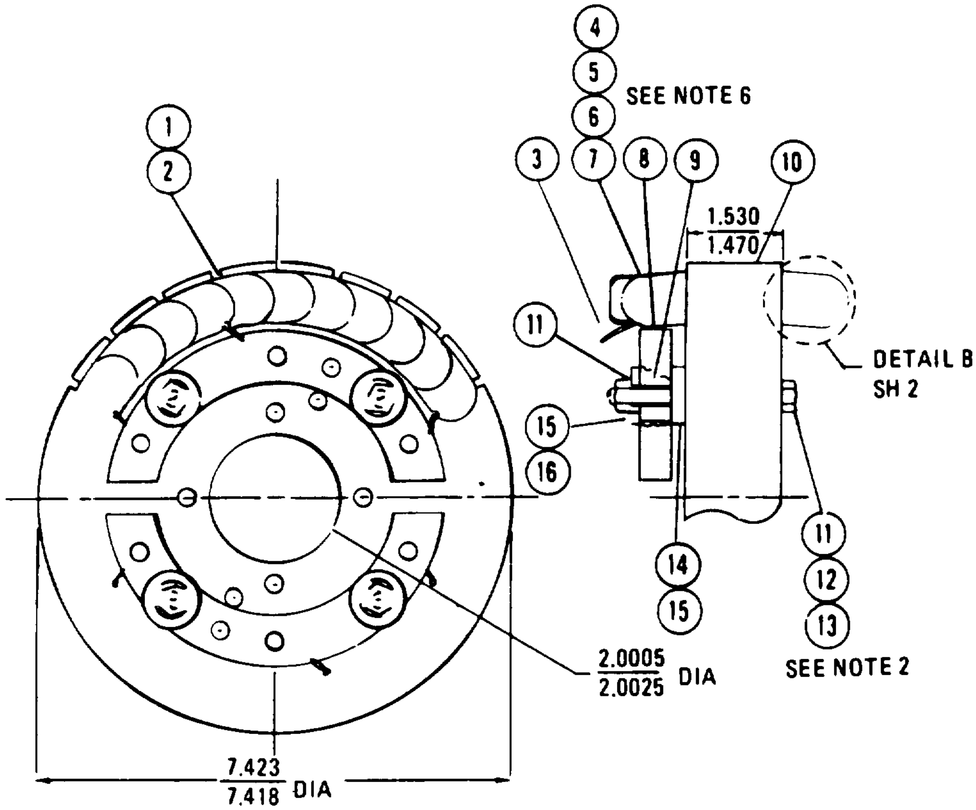


Figure 3-146. Generator Exciter Stator Winding Procedures (Sheet 2 of 2)

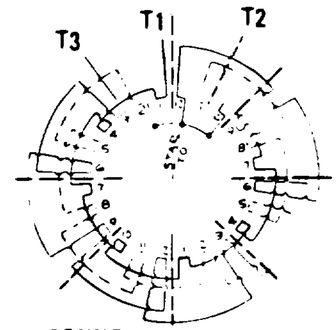


NOTES:

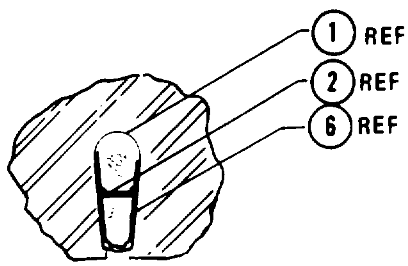
1. STACK LAMINATIONS, FIND NO. 9, ON I.D. UNDER 2+10% TONS.
2. TORQUE CAP SCREWS, FIND NO. 11, TO 60 INCH LBS MAX., WHILE CORE IS UNDER PRESSURE.
3. SOLDER LEADS, FIND NO. 3 TO WINDINGS, FIND NO. 5 AND TAPE CONNECTIONS WITH FIND NO. 6. INSTALL SLEEVING 4, OVER LEADS, AND TIE LEAD TO NEAREST TURN IN WINDING USING CORD 7, TIE SHALL BE SUFFICIENTLY STRONG TO SECURE LEAD.
4. INTERPRET DRAWING PER MIL–STD–100.
5. SOLDERING SHALL BE IN ACCORDANCE WITH MIL–STD–454, REQUIREMENT 5.
6. AFTER WINDING STACKED AND BOLTED LAMINATIONS, FIND NO. 9, VACUUM PRESSURE IMPREGNATE. PROTECT ALL HOLES DURING TREATMENT.
7. GROUND INSULATION GREATER THAN 200 MEGOHMS...
HIGH POTENTIAL: 500 VOLTS.

1. Liner, slot
2. Separator
3. Wire
4. Sleeving
5. Wire
6. Tape, glass
7. Cord
8. Heat sink
9. Insulator, bushing
10. Lamination
11. Screw, cap
12. Washer, flat
13. Nut, self–locking
14. Washer, insulating
15. Thermopoxy compound
16. Washer, insulating

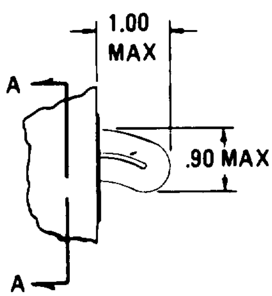
Figure 3-147. Generator Exciter Rotor Winding Procedures (Sheet 1 of 2)



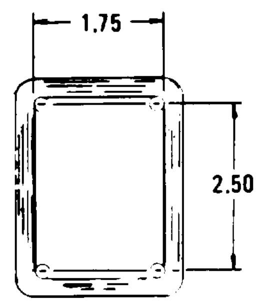
CONNECTION DIAGRAM



SECTION A-A
(SCALE 1/1)



DETAIL B



TYP WINDING FORM
(SCALE 1/1)

WINDING DATA	
TYPE OF WINDING	3 PHASE
NO. OF SLOT AND COILS 24	
NO. OF COILS PER GROUP	24 GROUPS OF 1
TURNS PER COIL	8
CONDUCTORS	3 OF NO 18 PND
SPAN	1–3
CONNECTION	SEE CONN. DIA.

Figure 3-147. Generator Exciter Rotor Winding Procedures (Sheet 2 of 2)

(c) Pull all slack from the leads and tighten the clamping screws of lead block.

(d) Secure lead block and gasket to end bell assembly using lockwashers (8) and

(e) Using a suitable lifting device stand the stator assembly on the end bell

NOTE

Use blocking as necessary to maintain stator in the vertical position.

(f) Remove the lifting eye bolt from the stator and install it in the coupling disc end.

CAUTION

Use extreme care when installing rotor to avoid damage to the generator wind Failure to observe this caution could result in equipment damage.

(g) Using a suitable lifting device, install the rotor (25) into the stator (26).

(h) Temporarily secure rotor to stator as in disassembly (see figure 3-137).

(i) Carefully set the stator on its mounting feet.

(j) Press new bearing (23) onto adapter (24).

(k) Install bearing and adapter and secure with a flat washer and screw (18).

(l) Remove screw and replace flat washer with lockwasher (19). Torque screw;

(m) Install bearing housing (22) and secure with lockwashers (21) and screws (2) 31 ft-lbs.

NOTE

Center bearing housing in end bell prior to torquing screws.

(n) Install screen guard (13) and secure with lockwashers (12) and screws (11).

(o) Install cover (16) and secure with lockwashers (15) and screws (14).

(p) Install cover (17) into bearing housing.

(q) Install screen guard (6) and secure with lockwashers (5) and screws (4).

(r) Install drip cover (3) and secure with lockwashers (2) and screws (1).

(s) Remove steel bar securing rotor to stator and install lifting eye bolt on generator.

e. Testing. Perform winding resistance test, high potential test, and insulation resistant equipment and procedures specified in Military Standard MIL-STD-705.

f. Installation. Refer to paragraph 2-7c for generator installation procedures.

3-96.1. The field flash circuit consists of the following components:

Speedswitch	Exciter
K5 Relay (located on A5 board)	Field Windings
Current Limiting Resistor	Associated Wiring

a. Testing Exciter Stator (On Equipment Test). Locate and disconnect exciter stator winding resistance using ohmmeter. On the 15 kW and 30 kW generator sets, leads F1 and F2 are located on the terminal board near the static exciter/voltage regulator control box. Check across leads F1 and F2 for resistance. A normal resistance reading of 1 to 4 ohms should be found. If the resistance of the exciter winding is not as specified, refer to the applicable section of the TM for replacement/repair of the exciter stator winding.

b. Equipment Test of Field Flash Circuit Assuming the exciter stator winding resistance is correct (within 1 to 4 ohms) Connect a DC voltmeter (0 to 30 volts) to the two wires that are disconnected from the exciter stator windings. NOTE : **DO NOT** reconnect the wires to leads F1 and F2 at this time.

c. Remove Connector P37 from speed switch. Place a jumper between pins A and C on P37. Momentarily, approximately 10 to 15 seconds, place the START-STOP-RUN switch in the START position and observe the DC voltmeter. If the voltmeter indicates approximately 24 volts, the probable cause of the field flash is the speed switch. If a DC voltmeter is not available, proceed to step d.

d. Remove Connector P3 from the speed switch. Place a jumper between pins A and C of socket J3 on the special relay box for approximately 24 volts DC. If a DC voltage is not present, the problem may be the wiring between the speed switch and the special relay box, the K5 relay, or current limiting resistor (R35) inside the special relay box (15kW and 30 kW generator sets only). If a DC voltage is present, replace Connector P3 on socket J3 and proceed to the next step.

e. Remove Connector P9 from the static exciter/voltage regulator control box. Momentarily, hold the START-STOP-RUN switch in the START position and check between pins C and D of P9 for approximately 24 volts DC. If a DC voltage is not present, the problem may be the wiring between the special relay box and the static exciter/voltage regulator control box. If a DC voltage is present, replace Connector P9 on-socket J9 and' proceed to the next step.

f. Remove Connector P13 from the static exciter/voltage regulator control box. Momentarily, hold the START-STOP-RUN switch in the START position and check between pins S and R of J13 on the control box for approximately 24 volts DC. If a DC voltage is not present, the problem may be any one of the following items within the control box:

(1) Broken wire within the control box.

(2) Current limiting resistor R219 sets.

(3) Current limiting resistor R17 sets.

g. Reconnect the wires previously removed from the exciter field winding, F1 and F2.

Section XIV. MAINTENANCE OF ELECTROMAGNETIC INTERFERENCE SUPPRESSION COMPONENTS

3-96. TESTNG FOR ELECTROMAGNETIC INTERFERENCE.

If electromagnetic interference is suspected, unit shall be tested in accordance with MIL-STD-461.

3-97. REPLACEMENT OF INTERFERENCE SUPPRESSION COMPONENTS.

a. Refer to the Operator and Unit Maintenance Manual to replace fuel transfer pumps.

b. To replace capacitors at load terminal:

(1) Remove screws (1, figure 3–148) and disconnect and tag electrical leads.

(2) Remove nuts (2), screws (3), capacitors (4) and lockwashers (5) from bracket (6).

(3) Reassemble in reverse order using new capacitors,

c. Refer to figure 3-130 to replace capacitors in static exciter.

1. Screw
2. Nut
3. Screw
4. Capacitor
5. Lockwasher
6. Bracket

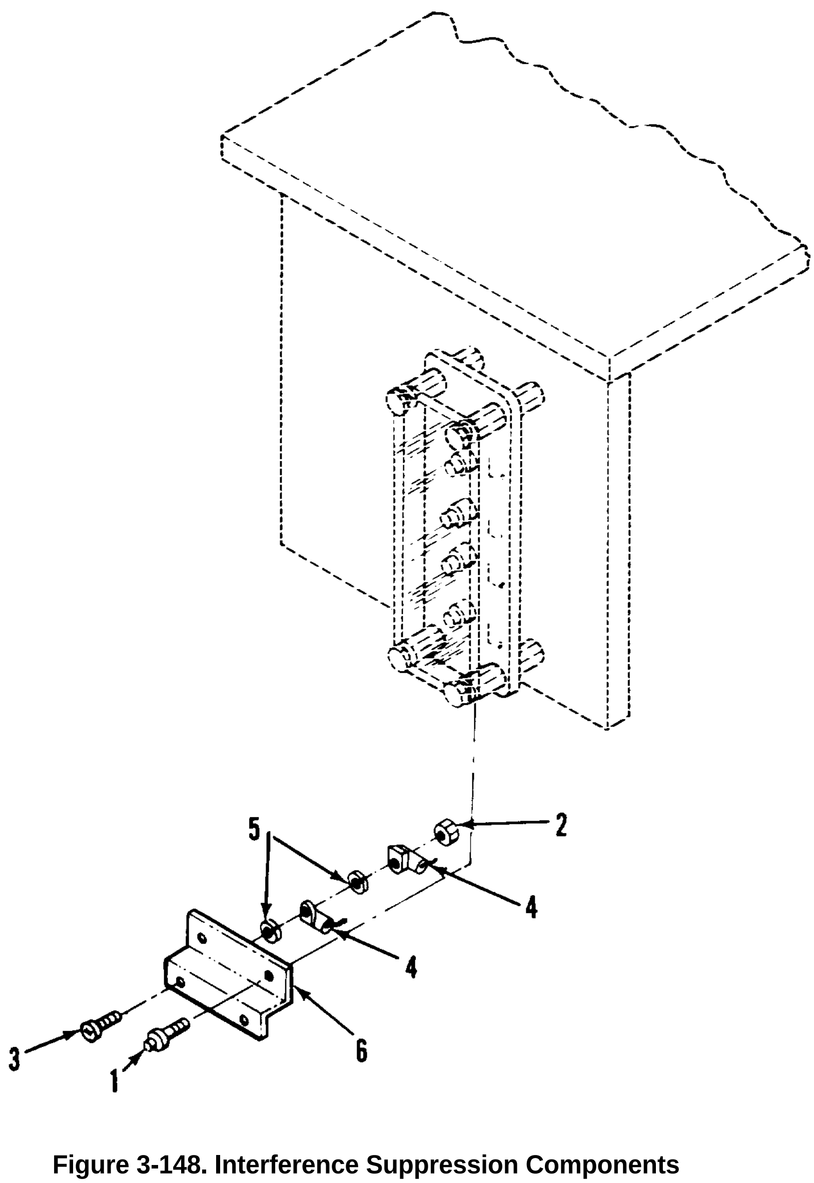


Figure 3-148. Interference Suppression Components

c. Cleaning. Inspection. and Repair

WARNING

Solvent, Dry Cleaning P-D-680, Type II is flammable and moderately toxic to skin, eyes and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate. Failure to observer this warning could cause severe personal injury or death.

WARNING

Compressed air used for cleaning and drying purposes can create airborne particles that may enter the eyes. Pressure shall not exceed 30 psig and use only with adequate chip guards and chipping goggles. Failure to observer this warning could cause severe personal injury or death.

(1) Clean all parts in dry cleaning solvent (Federal Specification P-D-680) and dry thoroughly with filtered compressed air.

(2) Scrape carbon deposits from valves and Cylinder head.

(3) Visually inspect rocker arms for cracks, corrosion, and excessive wear. Check that oil holes are open.

(4) Inspect rocker arm shafts for cracks, deep wear patterns, nicks, and burrs. Remove minor nicks and burrs with oil soaked crocus cloth. Clean polished shaft in dry cleaning solvent to remove abrasive particles.

(5) Inspect blocks for cracks, nicks, burrs, and excessive wear. Remove nicks and burrs from outer surfaces with fine abrasive paper or stone.

(6) Inspect springs for cracks, breaks, chaffing and distortion.

(7) Inspect push rods for cracks, bends, excessive wear, nicks and scratches. Polish push rods with crocus cloth to remove minor defects.

(8) Inspect valve guides for excessive wear. Bore diameter of exhaust valve guide shall be 0.3750 to 0.3790 inch. Bore diameter of intake valve guide shall be 0.3740 to 0. 3780 inch.

(9) Replace worn valve guides as follows:

(a) Use a 5/8 inch drift with a 3/8 inch pilot and drive out valve guides.

(b) Drive replacement valve guides to a depth of 1.3700 to 1.3800 inches blow Cylinder head deck

(c) Ream bore diameter of intake valve guides to 0.3740 to 0.3750 inch.

(d) Ream bore diameter of exhaust valve guides to 0.3750 to 0.3760 inch.

(10) Inspect valve springs for cracks, breaks, and distortion. Using a spring tester, compress spring to a length of 1.0820 inches. Test load shall be 163 to 180 pounds.

(11) Inspect Cylinder head for cracks, breaks, and broken studs. Remove broken studs by center punching, drilling, and using an easy out.

(12) Check Cylinder head for warping using a straight edge and feeler gauge. Check lengthwise and between each Cylinder crosswise. Warpage shall not exceed 0.003 inch laterally and 0.005 inch longitudinally. Cylinder head may be milled to remove minor warpage.

c. Cleaning, Inspection, and Repair.

WARNING

Solvent, Dry Cleaning P-D-680, Type II is flammable and moderately toxic to skin, eyes and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate. Failure to observe this warning could result in servere personal injury or death.

(1) Clean relay table parts in dry cleaning solvent (Federal specification P-D-680) and dry thoroughly.

(2) Inspect relay table for breaks, cracks, and other damage.

(3) Check ail parts for defective paint.

(4) Check all threads for crossing, stripping, and peening.

(5) Repair cracks, breaks, and defective welds by welding.

(6) Replace any parts damaged beyond repair.

(7) Remove defective paint and corrosion. Treat and paint in accordance with service requirements.

d. Installation.

(1) Position left side relay table (31, figure 3–149), to install screw (30), flatwasher (29), Iockwasher (28) and nut (27).

(2) Position rear housing (24), to install screw (23), flatwasher (22), Iockwasher (21) and nut (20).

(3) Position right side relay table (26), to install screw (19),flatwasher(18), Iockwasher (17) and nut (16).

(4) Install fuel line (15).

(5) Position spacer (14), to install flatwasher (13), Iockwasher (12), and screw (11).

(6) Position top relay table (25), to install flatwasher (10), Iockwasher (9), and screw (8).

(7) Install terminal block (7), and screws (6 and 5).

(8) Install nut (4), clamp (3), Iockwasher (2) and screw (1).

(9) Refer to the Operator and Unit Maintenance Manual and install housing assembly doors, covers, and panels.

e. Installation for KZ00001 and up serial numbers

(1) Position top relay table (21, figure 3-1 50) to install screws (32), flatwashers (31), Iockwashers (30) and nut (29).

(2) Install grommet (28).

(3) Position Ieft side relay table (27), screw (26), flatwasher (25), Iockwasher (24) and nut (23).

(4) Install rear housing (20), screw (19), flatwasher (18), lockwasher (17) and bolt (16).

(5) Position right side relay table (22), to install screws (15), flatwasher (14), Iockwasher (13) and nut (12).

(6) Install fuel line (11).

(7) Install flatwasher (10), lockwasher (9), and screw (8).

(8) Install terminal block (7), screw (6) and screw (5).

(9) Install nut (4), clamp (3), lockwasher (2) and screw (1).

Section XVI. MAINTENANCE OF LIFTING FRAME

3-100. GENERAL

The lifting frame is securely attached to the skid base. It is equipped with lifting clevises at the top of each side for lifting equipment attachment. In addition, the lifting frame provides support for the center of the housing assembly and serves as a mounting point for the hydraulic sump and the day tank assembly. During generator assembly removal, the lifting frame provides support for the rear of the engine assembly.

3-101. LIFTING FRAME MAINTENANCE.

a. Removal.

(1) Remove housing assembly doors and panels as required for lifting frame removal (paragraph 3-99).

(2) Remove hydraulic sump (paragraph 3-41).

(3) Remove fuel lines and fittings (paragraph 3-24) and day tank assembly (paragraph 3-20).

(4) Remove main fuel tank filler neck (paragraph 3-16).

(5) Remove nut (1, figure 3-151), lockwasher (2), screw (3), and flat washer (4).

(6) Remove nut (5), lockwasher (6), spacer (7), screw (8) and flatwasher (9).

(7) Remove nut (10), lockwasher (11), screw (12), flatwasher (13), top support (15) and right support (16).

(8) Remove nut (17), lockwasher (18), screw (19), flat washer (20) and bracket (21).

(9) Remove clevis assembly (22).

(10) Remove nut (28), lockwasher (29), hex nut (30), screw (31) and flat washer (32).

NOTE

It is not necessary to completely disassemble the lifting frame to replace a single part Only those parts requiring repair or replacement need be removed.

b. Cleaning, Inspection, and Repair.

WARNING

Solvent, Dry Cleaning P-D-680, Type II is flammable and moderately toxic to skin, eyes and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate. Failure to observe this warning could result in servere personal injury or death.

(1) Clean all parts in dry cleaning solvent (Federal Specification P-D-680) and dry thoroughly.

(2) Inspect supports, lifting clevises and brackets for cracks, corrosion, breaks, defective paint, and other damage.

(3) Inspect lifting clevises, brackets, and pins for excessive wear.

(4) Check all threads for crossing, stripping, and other damage.

(5) Repair cracks and breaks in supports by welding.

(6) Remove corrosion and defective paint. Treat and paint in accordance with service requirements.

(7) Replace all parts worn or damaged beyond repair.

c. Installation.

(1) Install the housing assembly doors, covers, and panels, the hydraulic sump, the fuel lines and fittings, the day tank assembly, and the main fuel tank filler neck removed in steps a. (1) through (4) above.

(2) Install flatwasher (32, figure 3-151), screw (31), hex nut (30), lockwasher (29), and nut (28).

(3) Install clevis assembly (22).

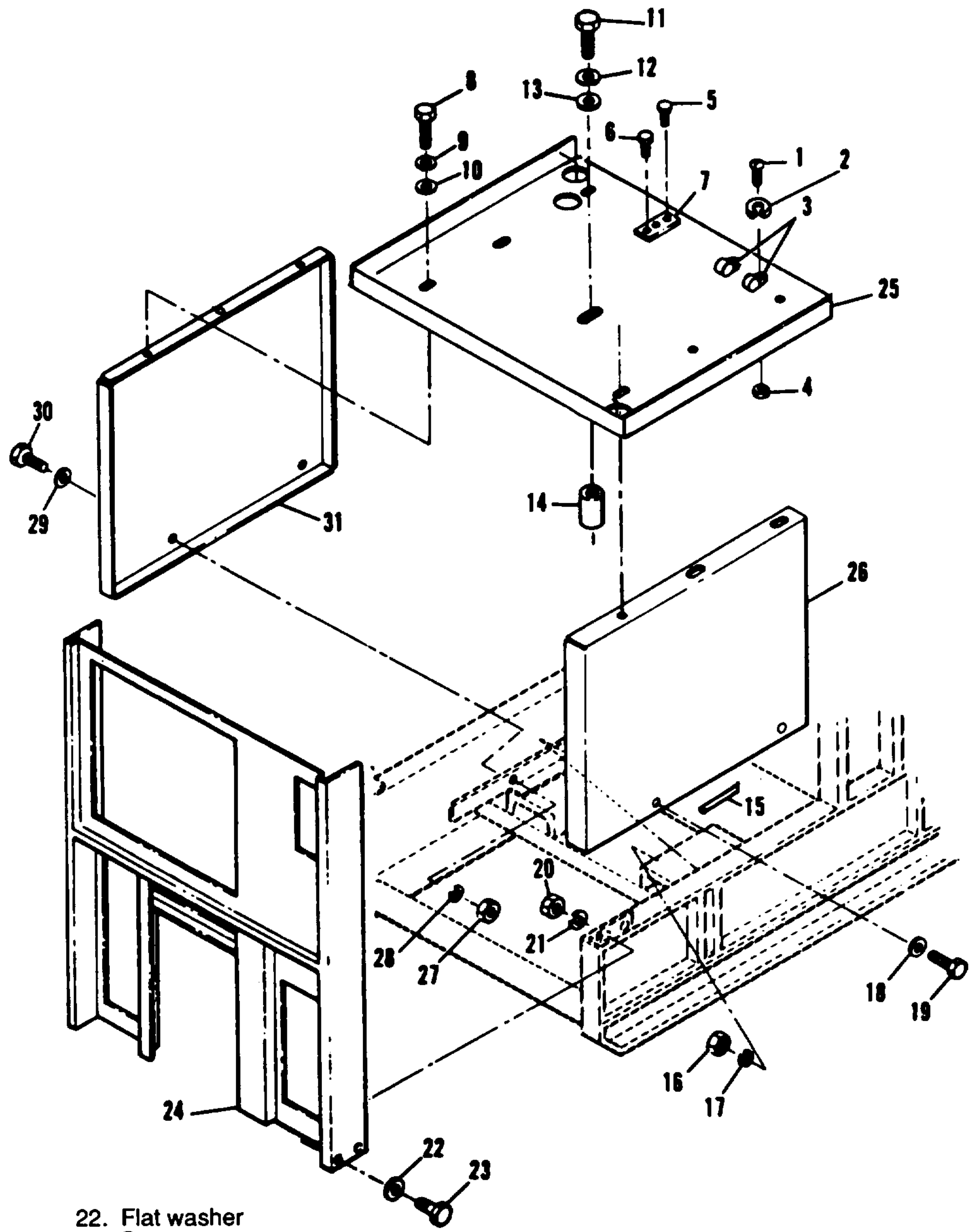
(4) Install bracket (21), flatwasher (20), screw (19), lockwasher (18) and nut (17).

(5) Install right support (16), top support (15), with flatwashers (13), screws (12), lockwasher (11) and nut (10).

(6) Install flatwasher (9), screw (8), spacer (7), lockwasher (6), and nut (5).

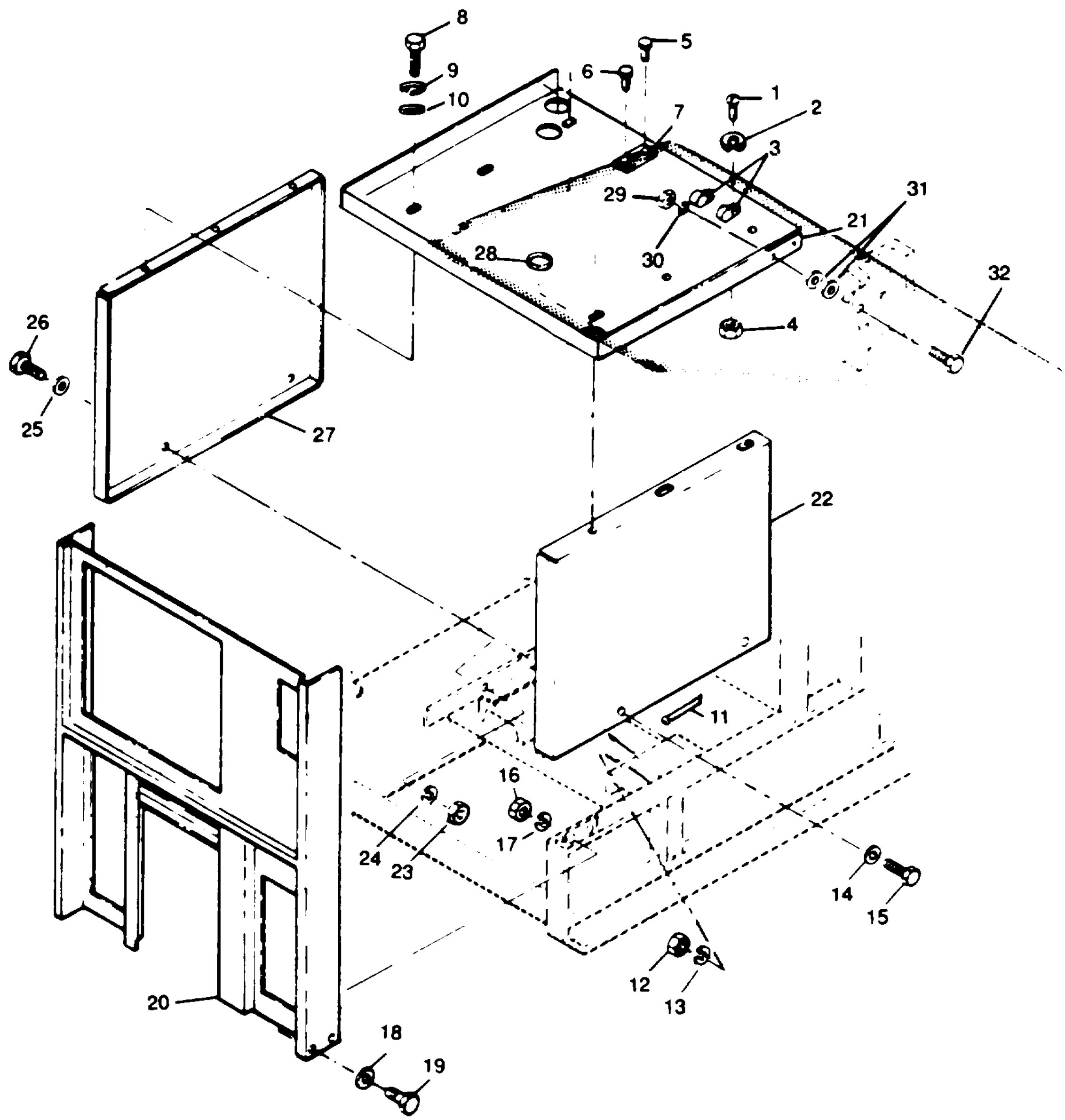
(7) Install flatwasher (4), screw (3), lockwasher (2), and nut (1).

1. Screw
2. Lockwasher
3. Clamp
4. Nut
5. Screw
6. Screw
7. Terminal block
8. Screw
9. Lockwasher
10. Flat washer



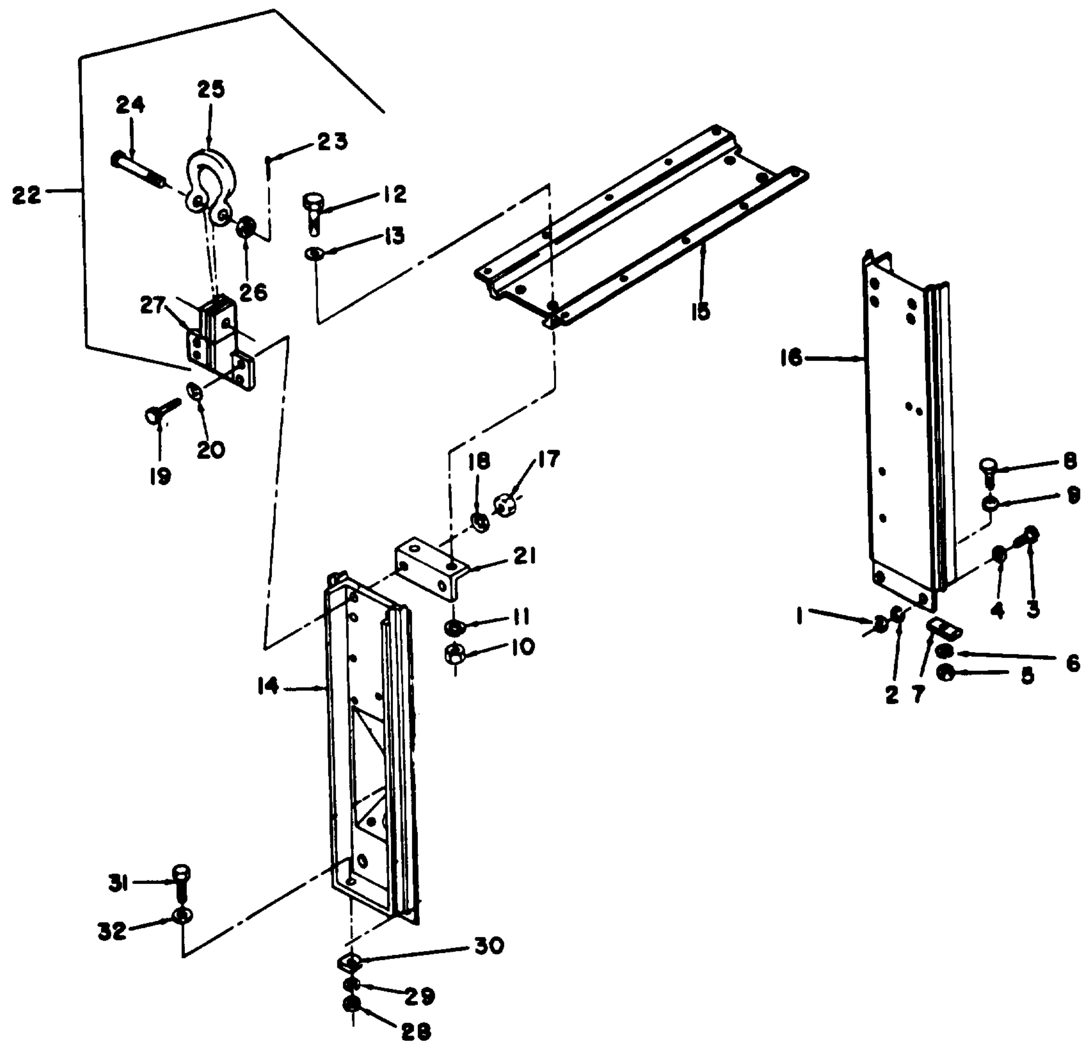
11. Screw
12. Lockwasher
13. Flat washer
14. Spacer
15. Fuel line
16. Nut
17. Lockwasher
18. Flat washer
19. Screw
20. Nut
21. Lockwasher
22. Flat washer
23. Screw
24. Rear housing
25. Top relay table
26. Right side relay table
27. Nut
28. Lockwasher
29. Flat washer
30. Screw
31. Left side relay table

Figure 3-149. Relay Table Assembly, Exploded View



1.	Screw	11.	Fuel line	22.	Right side relay table
2.	Lockwasher	12.	Nut	23.	Nut
3.	Clamp	13.	Lockwasher	24.	Lockwasher
4.	Nut	14.	Flat washer	25.	Flat washer
5.	Screw	15.	Screw	26.	Screw
6.	Screw	16.	Nut	27.	Left side relay table
7.	Terminal block	17.	Lockwasher	28.	Grommet
8.	Screw	18.	Flat washer	29.	Nut
9.	Lockwasher	19.	Screw	30.	Lockwasher
10.	Flat washer	20.	Rear housing	31.	Flat washers
		21.	Top relay table	32.	Screw

Figure 3-150. Relay Table Assembly, Exploded View effective on generator sets serial numbers KZ00001 and up



1. Nut	12. Screw	23. Cotter pin
2. Lockwasher	13. Flatwasher	24. Bolt
3. Screw	14. Left support	25. Lifting Clevis
4. Flatwasher	15. Top support	26. Nut
5. Nut	16. Right support	27. Clevis Bracket
6. Lockwasher	17. Nut	28. Nut
7. Spacer	18. Lockwasher	29. Lockwasher
8. Screw	19. Screw	30. Hex nut
9. Flatwasher	20. Flatwasher	31. Screw
10. Nut	21. Bracket	32. Flatwasher
11. Lockwasher	22. Clevis assembly	

Figure 3-151. Lifting Frame, Exploded View

Section XVII. MAINTENANCE OF SKID BASE ASSEMBLY

3-102. GENERAL

The skid base assembly provides the mounting points for the engine assembly, the generator assembly, and the enclosure assembly. It contains the main fuel tank and the tool box. The generator set ground point is also contained in the skid base assembly. The skid base is also drilled to accept attachment of the wheel mounting kit. A metal sheet near the bottom of the skid base prevents the entry of debris. Drain holes are provided to prevent the accumulation of spilled liquids on the sheet.

3-103. SKID BASE ASSEMBLY MAINTENANCE.

a. Removal.

(1) Refer to the Operator and Unit Maintenance Manual and remove the housing assembly.

(2) Remove the relatable assembly (paragraph 3-99).

(3) Remove engine assembly (paragraph 2-6).

(4) Remove generator assembly (paragraph 2-7).

(5) Remove main fuel tank (paragraph 3-16).

(6) Remove the lifting frame (paragraph 3-101).

b. Disassembly.

NOTE

It is not necessary to completely disassemble the skid base assembly to replace a single part. Only those parts requiring repair or replacement need be removed.

(1) Remove self-locking nut (1, figure 3-152), flatwasher (2), nut (3) and ground terminal stud (4).

(2) Remove nut (5), lockwasher (6), screw (7) and tool box (8).

(3) Remove screw (9), lockwasher (10), panel blank (11) from skid base (12).

c. Cleaning, Inspection, and Repair.

(1) Clean all parts with dry cleaning solvent (Federal Specification P-D-680) and dry thoroughly. If necessary, use a stiff bristle brush to remove caked deposits.

(2) Visually inspect skid base for cracks, corrosion, defective paint and defective welds.

(3) Inspect tool box for cracks, corrosion, damaged latch and hinge, and defective paint. Replace tool box if damaged beyond repair.

(4) Inspect ground terminal stud for burns, corrosion, damaged threads or other damage. Replace if defects are noted.

(5) Repair cracks and defective welds in skid base by welding. File repairs to provide a smooth finish.

(6) Remove corrosion and defective paint. Treat and repaint in accordance with service requirements.

NOTE

Clean paint from ground terminal stud mounting to provide effective ground.

d. Assembly.

(1) Position skid base (12, figure 3-152) to install panel blank (11), lockwasher (10) and screw (9).

(2) Install tool box (8), screw (7), lockwasher (6), and nut (5).

(3) Install ground terminal stud (4), nut (3), flatwasher (2) and self-locking nut (1).

e. Installation.

(1) Install the lifting frame (paragraph 3-101).

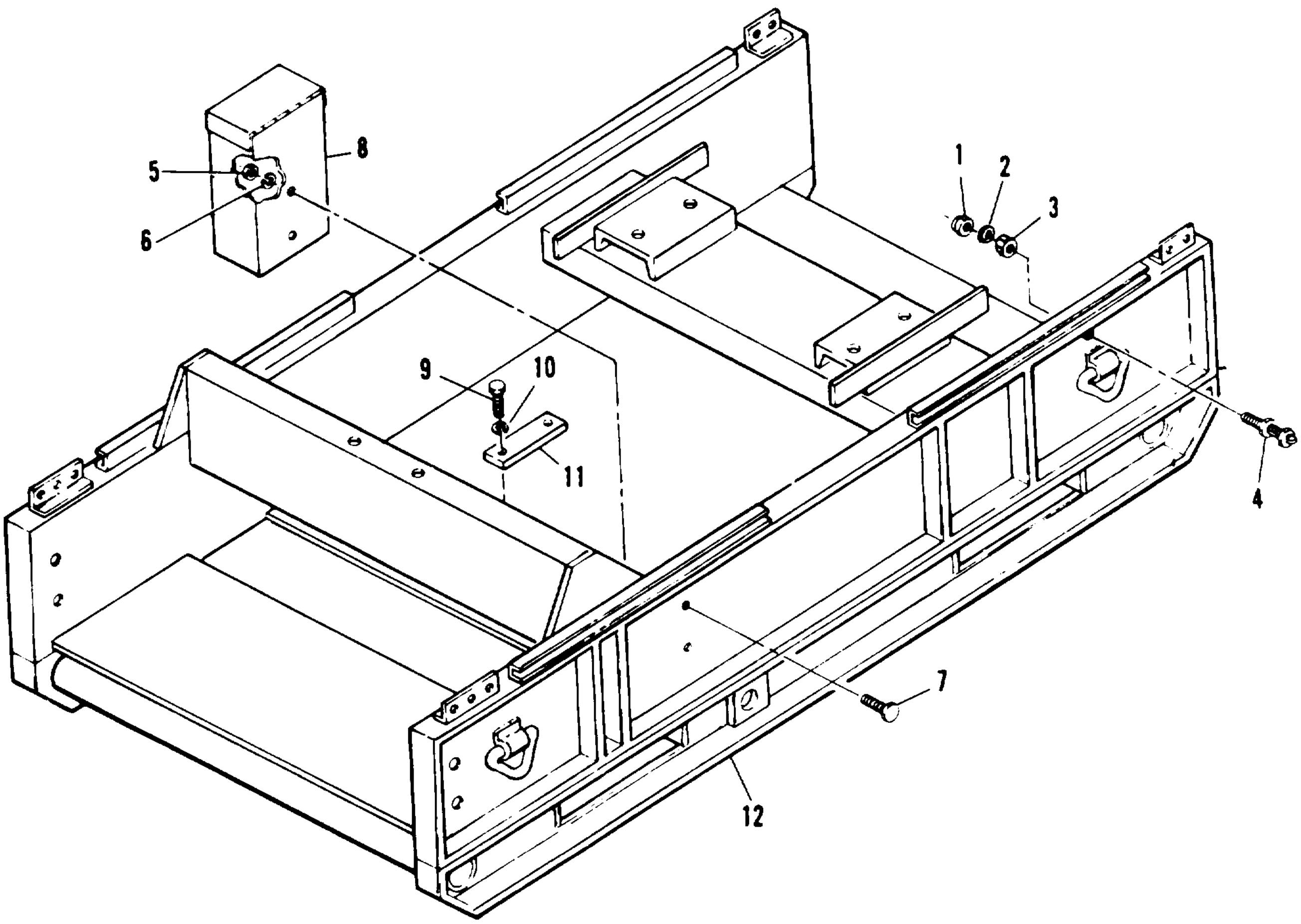
(2) Install main fuel tank (paragraph 3-16).

(3) Install generator assembly (paragraph 2-7).

(4) Install engine assembly (paragraph 2-6).

(5) Install the relay table assembly (paragraph 3-99).

(6) Refer to the Operator and Unit Maintenance Manual and Install the housing assembly.



1. Self–locking nut
2. Flat washer
3. Nut
4. Ground terminal stud
5. Nut
6. Lockwasher
7. Screw
8. Tool box
9. Screw
10. Lockwasher
11. Panel blank
12. Skid base

Figure 3-152. Skid Base Assembly, Exploded View

CHAPTER 4

GENERATOR SET TESTS AFTER OVERHAUL REPAIR INSTRUCTIONS

Section I. INSPECTION

4-1. GENERAL.

a. The activity performing the repair or overhaul is responsible for the performance of all applicable tests and inspections specified herein. Activities performing maintenance on any portion of the generator set must perform those tests and inspections required by the applicable component or system repair instruction.

b. A thorough inspection of the generator set shall be conducted to insure that workmanship and materials are satisfactory.

c. The inspection shall be conducted each time the generator set is overhauled or rebuilt.

4-2. HOUSING AND FRAME INSPECTION.

a. Check that lifting eyes are installed and firmly secured.

b. Check that drain holes are open to prevent moisture accumulation.

c. Insure that exposed parts are properly treated to resist corrosion.

d. Open and close panel doors, engine area doors, and generator area doors to insure proper installation and freedom of motion.

e. Inspect movable door gasketing to insure that it is weatherproof.

f. Check that all caps and covers are equipped with ties, chains, or other ties to prevent loss.

4-3. ENGINE INSPECTION.

a. Check mounting bolts of all components and accessories to insure that they are firmly secured.

b. Check designation and data plates for legibility.

c. Insure that fuel and hydraulic oil lines are protected from damage due to vibration.

4-4. GENERATOR INSPECTION.

a. Insure that generator leads are properly identified and protected from damage due to vibration.

b. Insure that inspection openings are protected by screening or protective plates.

c. Check that the engine generator screws are firmly secured. See paragraph 1-10v, for proper torque values.

4-5. ELECTRICAL ACCESSORIES INSPECTION.

a. Check all cable and harness assemblies for secure fastenings and protection against chafing and vibration.

b. Insure that all cable and harness connectors are firmly secured in their proper place.

Section II. OPERATING TESTS

4-6. GENERAL.

a. The tests described in this section require generator set operation and provide verification of generator set performance characteristics.

NOTE

All tests shall be conducted with the 240/416 volt connections, unless otherwise specified. All tests that are applicable, will be conducted on both Mode I and Mode II generator sets. Mode I tests shall be conducted at 60 Hz only unless otherwise specified.

b. Unless otherwise specified, all test instrumentation will be in accordance with Military Standardization Handbook MIL-HDBK-705 and Military Standard MIL-STD-705.

c. Temperatures will be measured by means of appropriately located thermocouples and properly calibrated read out devices. Thermocouples will be insulated from contact with other metals, as practical. Temperatures will be recorded in degrees Fahrenheit or Centigrade, depending on the instrument scale, but will be converted to degrees Fahrenheit in all cases. Barometric pressures will be measured by a mercurial barometer which will be corrected for the temperature of the scale, the mercury, for vapor pressure and for the location of the barometer with regard to altitude and latitude. Aneroid barometers will not be used.

d. Operation procedures required in support of the individual tests specified herein shall be performed as in the Operator and Unit Maintenance Manual.

e. All test results for generator set overhaul, shall be logged on the appropriate forms as required.

f. Perform the operating tests as indicated in table 4-1.

4-7. DIRECTION OF ROTATION CONTROLS.

With the generator set running at a rated load, rotate the following controls and verify their proper operation.

a. Frequency Adjust Control. On Class 1 sets clockwise rotation of the frequency adjust control rheostat must cause set frequency to increase as indicated on the frequency meter. On Class 2 sets counterclockwise rotation of manual speed control must increase frequency.

b. Voltage Adjust Control. Clockwise rotation of the voltage adjust control must cause set voltage to increase as indicated on the voltmeter.

c. Governor Paralleling Control (Class 1 Sets Only). Counterclockwise rotation of the governor paralleling control must cause an increase in the signal appearing at the paralleling receptacles.

d. Voltage Regulator Paralleling Control. Clockwise rotation of the voltage regulator paralleling control must cause that set to increase its share of the total reactive Kva.

4-8. REVERSE POWER PROTECTIVE DEVICE TEST

a. Operate two generator sets in parallel at no load, with contractors closed.

b. Lower speed of set being tested until the main contactor opens.

c. Record the value on the kilowatt meter of the other set at the moment the contactor opens. The load contactor of the set under test must open when power flow into the generator exceeds 20 percent of the rated value.

4-9. LOW FUEL PROTECTIVE DEVICE.

a. Disconnect cable to the day tank fuel solenoid valve.

b. Operate generator set at full load.

c. The low fuel protective device must operate when the fuel in the day tank falls to a point at which there is only enough to operate the set at rated load for one minute.

4-10. PARALLEL OPERATION PROVISIONS.

a. For Class 1 (Precise) Sets (REAL POWER):

(1) Remove the shorting plug.

(2) With rated (15 kw) load on the generator set, measure the dc voltage across pins A and 8 of one of the paralleling receptacles (J45, J46 or J47). Adjust R28 (located in the precise relay box) until correct *VDC is indicated. Ensure that correct pin * is positive.

Governor Type	VDC *A–B	Positive *Pin
Electric	2	B
Electric–Hydraulic	4	A

b. For Class 1 (Precise) Sets (Reactive Power):

(1) Remove shorting plug.

(2) With rated (15 kW) load applied at .8 PF, and the operation switch in the parallel position, measure the ac voltage across pins C and D of one of the paralleling receptacles (J45, J46, or J47). Adjust R29 (located on the special relay box) until 6 volts ac is achieved.

c. For Class 2 (Utility) Sets (Real Power), adjust governor droop as follows:

(1) Start and run engine until it reaches operating temperature.

(2) With rated (15 kW) load applied and the engine operating at rated speed, droop may be determined by removing load and noting no-load frequency.

(3) Adjust the knurled knob, located at the rear of the fuel pump, until the difference in frequency between no-load and full load is 3 percent. Note the increase of hertz when load is removed. At 60 Hz, droop should be 1.8 Hz, and at 400 Hz, droop should be 12.0 Hz.

d. For Class 2 (Utility) Sets (Reactive Power):

(1) Start and run engine until it reaches operating temperature.

(2) Install shorting plug

(3) With rated (15 kW) load applied at .8 PF and the generator operating at rated voltage; voltage droop may be determined by removing the load and noting the difference between full-load and no-load voltage.

(4) Adjust R29 (located on the special relay box) until the difference in voltage between no-load and full load is 3 percent. Note the increase of volts when load is removed. At 120 volts, droop should be 3.6 volts.

Table 4-1. OPERATING TESTS

TEST	MIL–STD–705 PROCEDURE	TEST PARAMETER
1. Regulator and governor stability and transient response. (Short Term)	608.1a	See Tables 4–2 and 4–3.
2. Overspeed protection device	505.2a	2400 rpm to 2450 rpm.
3. Phase balance	508.1c	See tables 4–2 and 4–3.
4. Circuit interrupter (short circuit).	512.1c	Instantaneously at 425 ±25 percent of rated current.
5. Circuit interrupter (overload trip).	512.2c	8 ±2 minutes at 130 percent of rated current.
6. Circuit interrupter (undervoltage) (Class 1 sets only).	512.3c	Instantaneously below 48 volts, 6 ±2 seconds at 99 ±4 volts or less.
7. Circuit interrupter (overvoltage)	512.3c	Not more than 1 second after voltage has risen to and remained at any value greater than 153 ±3 volts for not less than 200 milliseconds.
8. Circuit interrupter (Under Frequen–cy Trip).	514.1	60 Hz=55±1 50 Hz=46 ±1 400 Hz=370 ±5
9. Low oil pressure protective device.	515.1a	Trip pressure 17 ±3 psi.
10. Reverse power protective device.		Refer to paragraph 4–8.
11. High coolant temperature protective.	515.2a	Trip temperature + 222 ± 3° F.
12. Low fuel protective device	—	Refer to paragraph 4–9.
13. Regulator range.	511.1c	Test at both 50 Hz and 60 Hz for Mode 1 sets. See tables 4–2 and 4–3.
14. Phase sequence (rotation).	507.1c	L1, L2, L3.
15. Frequency adjustment range.	511.2b	See tables 4–2 and 4–3.
16. Parallel operation provisions.	—	Refer to paragraph 4–10.
17. Malfunction indicator system.	—	Refer to paragraph 4–12.
18. Maximum power. a. 15 KW, 50/60 Hz TP, 24.6 KW b. 15 KW, 400 Hz TP, 29.5 KW c. 15 KW, 50/60 Hz, TU, 24.2 KW	640.4	

CAUTION

Prior to performing any of the operating tests listed in table 4-1, insure that the generator set is serviced with the correct fuel, oil, and coolant as listed on the data plate. Failure to observe this caution could result in damage to the equipment.

Table 4-2. ENGINE GENERATOR SET CLASSIFICATION

CLASS	MODE	COMMON NAME	OUTPUT FREQUENCY	GOVERNING SYSTEM	SPECIAL COMPONENT COMPLEMENT	MODEL
1	I	Tactical Precise	50/60 Hz	Electro-Hydraulic, with backup manual governor	Electric governor control unit, hydraulic actuator, hydraulic pump and sump, precise relay assembly, special relay assembly, tactical relay assembly	MEP103A
2	I	Tactical Utility	50/60 Hz	Mechanical (droop Type)	Tactical relay assembly, special relay assembly	MEP004A
1	II	Tactical Precise	400 Hz	Electro-Hydraulic, with backup manual governor	Electric governor control unit, hydraulic actuator, hydraulic pump and sump, tactical relay assembly, special relay assembly	MEP113A
1	II	Tactical Precise	400 Hz	Electric, with backup manual governor	Electric governor control unit, electric actuator, magnetic pickup, tactical relay assembly, special relay assembly	MEP113A

Table 4-3. ELECTRICAL PERFORMANCE CHARACTERISTIC PARAMETERS AC PRECISE (CLASS 1)

CHARACTERISTIC PARAMETER	VALUE	TEST METHOD MIL-STD-705
a. Voltage characteristics		
1. Regulation (%)	1	608.1
2. Steady-state-stability (variation) (bandwidth %)		
(a) Short term (30 seconds)	1	608.1
(b) Long term (4 hours)	2	608.2
3. Transient performance		
(a) Application of rated load		
(1) Dip (%)		
a. 60 HZ	15	619.2
b. 400 HZ	12	619.2
(2) Recovery (seconds)	0.5	619.2
(b) Rejection of rated load		
(1) Rise (%)		
a. 60 Hz	15	619.2
b. 400 Hz	12	619.2
(2) Recovery (seconds)	0.5	619.2
(c) Application of simulated motor load (twice rated current)		
(1) Dip (%)		
a. 60 Hz	30	619.1
b. 400 Hz	25	619.1
(2) Recovery to 95% of rated voltage (seconds) (See Note 1)	0.7	619.1
4. Waveform		
(a) Maximum deviation factor (%)	5	601.1
(b) Maximum individual harmonic (%)	2	601.4
5. Voltage unbalance with unbalanced load (%) (Note 2)	5	620.2
6. Phase balance voltage (%)	1	508.1
7. Voltage adjustment range		
(a) 50 Hz (120/208 volts)	190 to213 volts	
50 Hz (240/416 volts)	380 to 426 volts	511.1
(b) 60 Hz (120/208 volts)	197 to 240 volts	
60 Hz (240/41 6 volts)	395 to 480 volts	511.1
(c) 400 Hz (120/208 volts)	197 to 229 volts	
400 Hz (240/416 volts)	395 to 458 volts	511.1

Table 4-3. ELECTRICAL PERFORMANCE CHARACTERISTIC PARAMETERS AC PRECISE (CLASS 1) (CONTINUED)

CHARACTERISTIC PARAMETER	VALUE	TEST METHOD MIL-STD-705
b. Frequency characteristics		
1. Regulation (%)	0.25	608.1
2. Steady–state-stability (variation (bandwidth %)		
(a) Short term (30 seconds)	0.5	608.1
(b) Long term (4 hours)	1	608.2
3. Transient performance		
(a) Application of rated load		
(1) Undershoot (%)	1.5	608.1
(2) Recovery (seconds)	1	608.1
(b) Rejection of rated load		
(1) Overshoot (%)	1.5	608.1
(2) Recovery (seconds)	1	608.1
4. Frequency adjustment range (Hz)		
(a) 50 Hz	±2	511.2
(b) 60 Hz	±2	511.2
(c) 400 Hz		+20
	+20–10	511.2

NOTE

1. The voltage shall stabilize at or above this voltage.
2. The generator set connected for three phase output and supplying a single phase, unity Power factor load connected line-to-line, with no other load on the set. The load current to be 25 percent of the rated full load current of the set.

4-11. MALFUNCTION INDICATOR TEST.

a. The malfunction indicator system is electrically isolated and independent of the protection system. Testing of the indicators can be accomplished at the same time that the protective devices are tested in tests 6, 9, 10, 11, 12, 14, 15, 16, 17 and 18 of table 4-1.

b. In the event that one of the indicator circuits does not work, verify that the lamp is functional by operating the test and reset switch on the fault indicator panel.

4-12. PHASE BALANCE TEST VOLTAGE.

a. General. Polyphase electrical equipment may not operate properly or may be damaged if the phase voltages of a polyphase generator differ greatly from each other. Also, large differences between the phase voltages of a polyphase generator may be an indication that the generator set has been improperly manu–factured or damaged.

b. Apparatus. A frequency meter (or tachometer as described and illustrated in MIL–HDBK–705. Method 104, or 109.1 and an rms indicating ac voltmeter having an accuracy of ± 0.1% of the reading shall be required to perform both procedures. A means of separately exciting the generator is required since procedure II is performed.

c. Generator With Separate Excitation.

(1) Preparation for test.

(a) Completely isolate the generator windings (armature coils and field windings).

(b) Connect the frequency meter to one of the armature coils of the generator.

(c) Provide separate excitation for the exciter field.

(2) Test.

(a) Start and operate the generatorat rated frequency and at no load.

(b) Adjust the excitation so that anyone of the coil voltages is at rated value.

(c) Read and record the generator frequency (speed) and the voltage of each armature coil.

d. Generator With Separate Excitation:

(1) Determine from the data obtained in 4-13d. (2) the maximum and minimum armature coil voltages.

(2) The voltage unbalance is the difference between the maximum and minimum armature coil voltages. To express this in percent divide this difference by rated armature coil voltage and multiply by 100.

$$\text{Voltage Unbalance (Coil), in percent} = \frac{V\ max - V\ min}{V\ Rated} \times 100$$

(3) Compare the results of step (2) above with the requirements.

4-13. REGULATOR RANGE TEST

a. General. The voltage adjust device associated with the voltage regulator provided with the generator set must have adjustment capable of varying the regulated voltage throughout the limits and under the various load conditions and temperature ranges without causing the voltage droop of the set to exceed specification limits. The voltage adjust device also must be capable in some cases of providing an operating voltage other than rated voltage for special types of equipment and to compensate for external line drop.

b. Apparatus. Instrumentation for measuring load conditions, ambient temperature, and the generator field (or exciter field) voltage and current shall be as described and illustrated in MIL-HDBK-705.

c. Procedure for Test.

(1) Preparation for test.

(a) Connect the load and field instrumentation in accordance with the applicable figure of MIL-HDBK-705, Method 205.1, Paragraph 205.1.10 for one voltage and frequency.

(2) Test.

(a) Start and operate the generator set and allow the set to stabilize at rated load, rated voltage and rated frequency. During this period record all instrument readings including thermal instrumentation at minimum intervals of 10 minutes. If necessary, adjustments to the load, voltage and frequency may be made to maintain rated load at rated voltage and frequency. Adjustments to the voltage and frequency may be made to maintain rated load at rated voltage and frequency. Adjustments to the voltage and frequency shall be limited to those adjustments available to the operator, specifically adjustments to the voltage or frequency adjust devices. On sets utilizing a droop type speed control system as the prime speed control, the speed and droop portions of the control may be adjusted. No other adjustments to the voltage and frequency control systems shall be made. Adjustments to load, voltage or frequency controls shall be recorded on the data sheet at the time of adjustment. Stabilization shall be considered to have occurred when four consecutive voltage and current readings of the generator (or exciter) field either remain unchanged or have only minor variations about an equilibrium condition with no evident continued increase or decrease in value after the last adjustment to the load, voltage, or frequency has been made.

(b) No further adjustments shall be made to any set control for the remainder of this test except the control panel voltage adjust device.

(c) Record all instrument readings.

(d) Remove load.

(e) Record all instrument readings (after transients have subsided).

(f) Adjust the terminal voltage to the maximum specified value.

(g) Record all instrument readings.

NOTE

At voltages above rated values, the generator will be supplying less than rated current, and at voltages below rated values, the generator will be supplying greater than rated current. Caution should be taken to avoid damage to instrumentation and load banks.

(h) Apply rated load (rated kw at rated power factor).

(i) Record all instrument readings (after transients have subsided).

(j) Remove load and adjust voltage to the maximum attainable value or to a value just prior to actuation of the overvoltage protection device.

NOTE

The output voltage may exceed the rating of connected equipment.

(k) Record all instrument readings (after transients have subsided).

(l) Apply rated load.

(m) Record all instrument readings (after transients have subsided).

(n) Adjust voltage to the minimum specified value at rated load.

(o) Record all instrument readings (after transients have subsided).

(p) Remove load.

(q) Record all instrument readings (after transients have subsided).

(r) Adjust voltage to the minimum attainable value or a value just prior to activation of the undervoltage protection device.

(s) Record all instrument readings (after transients have subsided).

(t) Repeat steps (a) through (s) above for all other voltage connection(s).

d. Sample Calculations. Regulation (droop) is defined for the the purposes of this method as the no-land value minus the rated load value divided by the rated load value the quantity expressed in percent.

% Regulation =

$$\frac{(\text{No–Load Voltage}) - (\text{Rated-Load Voltage})}{(\text{Rated–Load Voltage})} \times 100$$

e. Results. The data sheets shall indicate the voltage regulation as a percent of rated voltage within the specified limits at the minimum and maximum specified voltages and the regulation as a percent of rated voltage at the extremes, the maximum and minimum voltages attainable and the actuation of the protection devices (if applicable). Compare these results with the requirements of table 4-1.

4-14. FREQUENCY AND VOLTAGE REGULATION, STABILITY, AND TRANSIENT RESPONSE TEST (SHORT-TERM).

a. General. The frequency regulation (sometimes referred to as droop) of a generator set is the maximum difference between the no load value of frequency and the value at any load up to and including rated load. This difference is expressed as a percentage of the rated frequency of the generator set. The voltage regulation is expressed similarly except that the rms value of voltage is used.

Frequency stability describes the tendency of the frequency to remain at a constant value. Generally, the instantaneous value of frequency is not constant but varies randomly above and below a mean value. Stability may be described as either short-term or long–term depending upon the length of time that the frequency is observed. Another term, bandwidth, describes the limits of these variations. Bandwidth is expressed as a percentage of the rated frequency of the generator set. Voltage stability is described similarly.

Frequency transient response describes the reaction of the frequency to a sudden change in some condition; such as, a load change on a generator set. This response consists of the amount of excursion beyond the mean of the new operating band, and the recovery time. The recovery time is the interval beginning at the point where the frequency leaves the original prescribed operating band and ending at the point where it enters and remains within the new prescribed operating band. The amount of surge is expressed as a percentage of the rated frequency of the generator set. The recovery time is expressed in seconds. The voltage transient response is described similarly.

b. Apparatus. Instrumentation for measuring load conditions, field voltage and current, and ambient temperature shall be as described and illustrated in MIL-HDBK-705. In addition, recording meter(s) for recording voltage and frequency shall be required.

c. Procedure.

(1) Preparation for test.

(a) Connect the load and field instrumentation in accordance with the applicable figure of MIL-HDBK-705, Method 205.1, paragraphs 205.1.10, for one voltage and frequency. Connect the signal input of the recording meter(s) to the convenience receptacle of the set or to the generator coil which is used as the voltage sensing input to the voltage regulator. (Power the recording meter(s) from the commercial utility.)

(b) Set the recording meter chart speed(s) to a minimum of 5 inches per hour. The following items shall be recorded on both the data sheets and recording chart(s):

1. The date
2. The serial number(s) of the recording meter(s)
3. Generator set identification
4. The recording chart speed(s)
5. The data reading number

(c) Place all instrumentation referred to in paragraph 4-15b. in operation.

(2) Test.

(a) Start and operate the generator set and allow the set to stabilize at rated load, rated voltage and rated frequency. During this period operate the recording meter(s) at a chart speed of not less than 6 inches per hour, and record all instrument readings including thermal instrumentation at minimum intervals of 10 minutes. If necessary, adjustments to the load, voltage and frequency may be made to maintain rated load at rated voltage and frequency. Adjustments to the voltage and frequency shall be limited to those adjustments available to the operator, specifically adjustments to the voltage or frequency adjust devices. On sets utilizing a droop-type speed control droop portions of the control may be adjusted. No other adjustments to the voltage and frequency control systems shall be made. Adjustments to load, voltage or frequency controls shall be recorded on both the data sheet and the recording chart(s) at the time of an adjustment. Stabilization shall be considered to have occurred when four consecutive voltage and current recorded readings of the generator (or exciter) field either remain unchanged or have only minor variations about an equilibrium condition with no evident continued increase or decrease in value after the last adjustment to the load, voltage or frequency has been made.

(b) After stabilization has occurred, drop the load to no load and reapply rated load a number of times (three should be sufficient) to assure that the no load and rated load voltage and frequency values are repeatable and that the frequency and voltage regulation is within the limits specified in the procurement document. If any adjustments are necessary, paragraph (a) above must be repeated. Reapply rated load.

(c) The recording meter chart speed(s) shall be 12 inches per minute throughout the remainder of this test. At each of the following load conditions (one step) operate the set for a minimum of 40 seconds (or the short-term stability period plus the allowable recovery time as specified in the procurement document). During each load condition read and record all instrument readings except thermal instrumentation (for three-phase sets it is not necessary to record line-to-line voltages). Each load condition shall be applied to the generator set in one step at the end of the short-term stability period for the previous load condition. The load conditions are:

1. Rated load
2. No load
3. Rated load
4. No load
5. Rated load
6. No load
7. Rated load
8. No load
9. 3/4 rated load
10. No load
11. 3/4 rated load
12. No load
13. 3/4 rated load
14. No load
15. 1/2 rated load
16. No load
17. 1/2 rated load
18. No load
19. 1/2 rated load
20. No load
21. 1/4 rated load
22. No load
23. 1/4 rated load
24. No load
25. 1/4 rated load
26. No load
27. Rated load
28. No load
29. Rated load
30. No load
31. Rated load
32. No load

(d) Repeat (a) through (c) for all voltage connection(s) and frequency(ies).

d. Results.

(1) Prepare a chart giving for each load change the momentary overshoot or undershoot and the recovery time. For each constant load, give the maximum voltage variation.

(2) Referring to figure 4-1 begin by determining the observed (B) and steady-state (D) voltage bandwidths.

(a) Mark numerically the stabilizations occurring after each load change, starting with the stabilization obtained before the first load change.

(b) Determine the observed voltage bandwidth (B) by marking the maximum trace excursion and minimum trace excursion in the stabilized portion. Draw two lines parallel to the axis of chart movement, one each passing through these maximum and minimum trace excursions respectively.

(c) Draw a line (C) parallel to and equidistant from the edges of the observed voltage bandwidth. Determined in (b) above.

(d) Using the rated voltage of the generator and given requirements of table 4-1, calculate the steady-state voltage bandwidth (D). Draw this steady-state voltage bandwidth as two parallel lines, parallel to and equidistant from the median (C) at the observed voltage bandwidth.

(3) To determine the maximum voltage variation at constant load:

(a) One-half the observed voltage bandwidth (B) is the plus or minus value of voltage deviation at constant load.

(b) Divide each of the values obtained in (a) by the rated voltage of the generator and multiply by 100 to convert to percentage.

(4) To determine the maximum overshoot and undershoot at each load step, and express this as a percentage of its rated voltage, proceed as follows:

(a) From the meter recording charts, determine the maximum amount that the voltage trace goes beyond the line (3) of the observed voltage band following the load change. See figure 4-1 for illustration of overshoot and undershoot.

(b) Divide the result obtained in (a) by rated voltage (as given on the generator nameplate), then multiply by 100 to convert to percentage.

CAUTION

Do not use the constant operating voltage at each load as the divisor in the computation. Use only the rated voltage of the generator. Failure to observe this caution could result in damage to the equipment.

(5) To determine the time required to restore stable voltage conditions after each load change (recovery time):

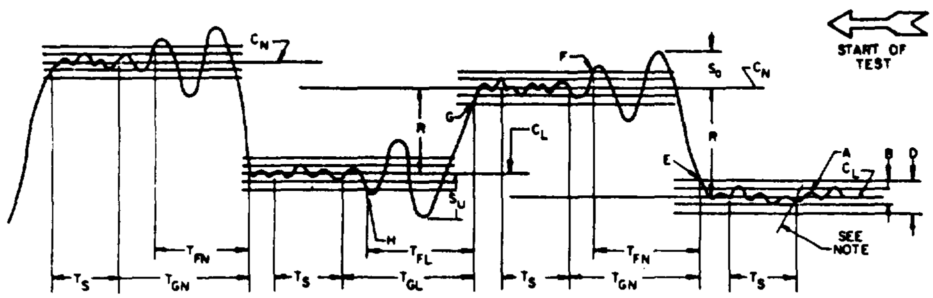
(a) The prescribed steady state voltage bandwidth, extended to the point at which the voltage trace leaves the prescribed steady state band, shall be considered as the time at which the transient conditions begin. The point at which the voltage trace enters and remains within the prescribed band after a load change shall be considered as the point at which stabilization begins.

(b) Measure the distance (in inches) on the chart from the point where the voltage trace leaves the prescribed steady state band to the point where it re-enters and remains within the prescribed voltage band for the next load condition.

(c) Divide this distance by the chart speed (in inches per second). This will give the voltage recovery time, in seconds.

(6) Determine the voltage regulation for all load changes (e. g. rated load to no load, 1/2 rated load to no load to 1/4 load, etc.) as follows:

(a) Using the indicating voltmeter readings subtract the load value of voltage from the no load value for each load change (e. g. step (a) to step (b)). (For voltage regulators utilizing single-phase voltage sensing, the value of voltage in the sensed phase only shall be used in the above calculations. For voltage regulators utilizing multi-phase voltage sensing the average value of the sensed voltage shall be used.)



Trace and definitions apply to either voltage or frequency.

NOTE

Chart marked at start of test.

A Actual instrument trace of function.

B Observed steady–state band (two lines parallel to the axis of chart movement one each passing through the center points of maximum and minimum trace excursion respectively during the short-term stability sample period, TS).

C Mean of observed band.

CL Mean value at selected load.

CN Mean value at no load.

D Prescribed steady-state band.

E Point at which trace initially leaves prescribed load band under condition of decrease in load.

F Point at which trace enters and remains within prescribed no load band.

G Point at which trace initially leaves prescribed no load band.

,H Point at which trace enters and remains within prescribed load band.

R Regulation between any two loads.

S Surge after a load charge.

SO Overshoot

SU Undershoot

TFL Observed recovery time, no load to load.

TFN Observed recovery time, load to no load.

TG Maximum allowable recovery time.

TGL Maximum allowable recovery time, no load to load.

TGN Maximum allowable recovery time, load to no load

TS Prescribed short-term sample time for determining stability.

Figure 4-1. Overshoot and Undershoot Chart Recording

(b) Convert each of the values obtained in (a) above to a percentage of rated voltage by dividing by the rated voltage and multiplying by 100. This is the voltage regulation expressed in percent.

(c) Repeat paragraph 4-15d. (1) above substituting frequency for voltage.

(d) Compare the results tabulated in paragraphs 4-15d. (1) and 4-15d. (6) (c) with the requirements of Table 4-1.

4-15. FREQUENCY ADJUST RANGE TEST

a. General. It is necessary that the frequency of a generator set be adjustable to provide rated frequency at various load conditions as required in certain applications and to synchronize two or more generator sets for parallel operation.

b. Apparatus. Instrumentation for measuring load conditions, field voltage and current, and ambient temperature shall be as described and illustrated in MIL–HDBK-705.

c. Procedure.

(1) Preparation for Test. Connect the load and field instrumentation in accordance with the applicable figure of MIL–HDBK–705, method 205.1, paragraph 205.1.10.

(2) Test.

(a) Start and operate the generator set and allow it to stabilize at rated load, rated voltage and rated frequency.

During this period, readings of the load and field instrumentation shall be recorded at minimum intervals of 10 minutes. If necessary, adjustments to the load, voltage and frequency may be made to maintain rated load at rated voltage and rated frequency. However, adjustments available to the operator, specifically adjustments to voltage and frequency adjust devices. Adjustments to the load, voltage or frequency shall be noted on the stabilization data sheet. Stabilization will be considered to have occurred when four consecutive voltage and current readings of the exciter field either remain unchanged or have only minor variations about an equilibrium condition with no evident continued increase or decrease in value after the last load, voltage or frequency adjustment has been made.

(b) No further adjustments shall be made to any set control for the remainder of this test except for the control panel frequency adjust device.

(c) For each of the conditions in the following steps allow approximately 2 minutes between each adjustment and the subsequent instrument readings.

(d) Adjust the generator set frequency for the specified maximum frequency at rated load. Read and record all instrument readings.

(e) Adjust the generator set frequency for the specified minimum frequency at rated load. Read and record all instrument readings.

(f) Reduce the load to zero.

(9) Adjust the generator set frequency for the maximum attainable frequency. Read and record all instrument readings. If the over frequency or overspeed protection device actuates, read and record all instrument readings just prior to the point of actuation and note on the data sheet that the protection device actuated.

NOTE

This step is not applicable to generator sets having governors that utilize a threaded shaft and lock nut(s) or other mechanical means as a method of operator speed adjustment.

(h) Adjust the generator set frequency for the minimum attainable frequency. Read and record all instrument readings.

NOTE

This step is not applicable to generator sets having governors that utilize a threaded shaft and lock (nuts) or other operator speed alignment.

(i) Repeat 4-16c (1) and 4-16c. (2) (a) through (f) for each frequency.

d. Results. The data sheet shall show the maximum and minimum frequencies attained at rated 109d, the maximum and minimum attainable frequencies at no load and actuation of the protection devices (if applicable). Compare these results with the requirements of table 4-1.

4-16. OVERSPEED PROTECTIVE DEVICE TEST

a. General. To assure that adequate protection is afforded the generator set against overspeeding, the overspeed protective device must operate properly.

b. Apparatus. A frequency meter or tachometer as described and illustrated in MIL-HDBK–705, Methods 104.1 or 109.1 shall be required.

c. Procedure.

(1) Preparation for Test. Connect the frequency meter in accordance with the applicable figure of MIL-HDBK-705, Method 205.1, Paragraph 205.1.9 or utilize the tachometer in accordance with the manufacturer's instructions. Electronic governor and throttle stops must be deactivated.

(2) Test.

(a) Start and operate the generator set at rated speed (frequency), rated voltage and no load.

(b) Slowly increase the engine speed until the overspeed protective device actuates. Record the speed of the generator set at this point, and the malfunction indicator light indication.

CAUTION

Do not operate the set in excess of 125 percent of rated speed or as otherwise limited in the procurement document. Failure to observe this caution could result in damage to the equipment.

(c) Attempt to start the set. Record if starting is achieved. If the set did not start, reset the overspeed protective device.

(d) Compare the test results with requirement of table 4-1.

4-17. CIRCUIT INTERRUPTER TEST (SHORT CIRCUIT).

a. General. A circuit interrupter is connected between the generator voltage reconnection system and the generator set output terminals to disconnect the generator output from the load and also to protect the generator from a short circuit. The circuit interrupter is operated from a current sensor external to the interrupter.

b. Apparatus. Instrumentation for measuring load conditions shall be as described and illustrated in MIL–HDBK-705. In addition, a non-inductive shunt, a short-circuiting switch, galvanometers matching networks, an oscillograph as described and illustrated in MIL-HDBK–705, Method 106.1, paragraph 106.1.3 and galvanometers having a flat frequency response (flat within plus or minus five percent) from DC to 3,000 hertz will be required.

c. Procedure.

(1) Preparation for Test.

(a) Connect the load and instrumentation in accordance with the applicable figure of MIL-HDBK-705, Method 205.1, paragraph 205.1.10 for one voltage and frequency.

(b) Connect the shunt, galvanometers matching network, oscillograph, and short-circuiting switch as illustrated in figure 512.1.1.

(2) Test.

(a) Start and operate the generator set at rated voltage, rated frequency and rated load.

(b) Set the oscillograph time marker to a minimum of 0.01 seconds or use a 60 hertz timing trace set the chart speed such that the individual peaks of the current waveform are clearly visible and adjust the peak-to-peak rated current amplitude to a minimum of 0.5 inch for approximately 12 millimeters).

(c) Prior to closing the short-circuiting switch, record a portion of the steady state load for calibration. With the same load conditions record all instrument readings.

(d) With oscillograph still recording the steady state current, close the short-circuiting switch.

CAUTION

If the circuit interrupter fails to operate within the specified time, remove the short circuit to prevent damage. Note the failure to operate on the data sheet. Failure to observe this caution could result in damage to the equipment.

(e) The generator set contains a short-circuit malfunction indicator, check and record its indication.

(f) Repeat steps (a) thru (e) above for each possible short circuit condition (L1-L0,L2-L3,L1-L2-L3 etc.).

(g) Repeat steps (a) through (f) above for both voltage connections if applicable.

d. Results

(1) From the oscillograms taken in 4-18c (2) (d), determine the time between the indicated closure of the short-circuiting switch and the opening of the circuit interrupter. See figure512. 1.-II.

(2) Calculate the short-circuit current using the peak-to-peak amplitudes of the current trace and the steady state ammeter reading prior to application of the short circuit. See figure 512.1-11.

(3) Tabulate the above results and the malfunction indicator indication for each line connection at each voltage connection and compare the results with the requirement in table 4-1.

4-18. CIRCUIT INTERRUPTER TEST (OVERLOAD CURRENT)

a. General. A circuit interrupter is connected between the generator voltage reconnection system and the generator output terminals to disconnect the generator output from the load and to protect the generator from a sustained overload current. The circuit interrupter is operated from a current sensor external to the interrupter.

b. Apparatus. Instrumentation for measuring load conditions and field voltage and current shall be as described and illustrated in MIL-HDBK-705. In addition, a stopwatch or an oscillograph with galvanometers matching network and a non-inductive shunt as described and illustrated in MIL-HDBK-705, Method 106.1, paragraph 106.1.3 and galvanometers having a flat frequency respond (within plus or minus 5%) from dc to 3000 Hz.

c. Procedure.

(1) Preparation for test. Connect the load and field instrumentation in accordance with the applicable figure of MIL–HDBK–705, Method 205.1, paragraph 205.1.10 for one voltage and frequency.

CAUTION

If the circuit interrupter fails to operate within the time specified in table 4-1 at any time during the performance of this method, manually open the circuit interrupter and reduce the load impedance to rated value before reclosing the circuit interrupter. Record on the data sheet the failure of the interrupter to operate and the total elapsed time the overload was on the set. Failure to observe this caution could result in damage to the equipment

(a) Start and operate the generator set at rated voltage, rated frequency and rated load.

(b) Allow the generator set to stabilize at rated load, voltage and frequency. During this period, readings of the load and field instrumentation shall be recorded at minimum intervals of 10 minutes. If necessary, adjustments to the load, voltage and frequency maybe made to maintain rated load at rated voltage and frequency. Adjustment to the load, voltage or frequency shall be noted on the data sheet. Stabilization will be considered to have occurred when four consecutive voltage and current readings of the exciter field either remain unchanged or have only minor variations about an equilibrium condition with no evident continued increase or decrease in value after the last load, voltage or frequency adjustment has been made.

(c) In one step, increase the load current to the overload current value specified in table 4-1 (the increase in current may be accomplished by any practical means, e. g. reactively or using reduced voltage levels).

NOTE

The frequency shall be maintained at rated conditions, the load current shall be kept constant and the load current shall be balanced equally among the phases. Simultaneously with the load current increase, start the stop watch.

(d) Record all load instrumentation and the time, in seconds, required for the circuit interrupter to operate.

(e) The generator set contains an overload malfunction indicator. Check and record its indication.

(f) Allow the generator set to cool at rated load for a minimum of 15 minutes.

(9) Repeat steps (c) thru (f) except that the load current is increased to the overload current value in Phase A only. Phases B and C remain at the rated load current value.

(h) Repeat step (g) except that the load is increased to the overload current value in phase B only. Phases A and C remain at the rated load value of current.

(i) Repeat step (g) except that the load is increased to the overload current value in phase C only. Phases A and B remain at the rated load value of current.

d. Results. The data sheets shall show, as a minimum, whether or not the circuit interrupter operated, the time(s) required for the interrupter to operate, the indication of the malfunction indicator, the overload condition(s) and the stabilization data. Compare the time(s) requirements of table 4-1.

4-19. CIRCUIT INTERRUPTER TEST (OVER VOLTAGE AND UNDER VOLTAGE).

a. General To protect the load from generator malfunction (e. g., overvoltage or undervoltage) a circuit interrupter is connected between the generator voltage reconnection system and the generator output terminals. A voltage sensing circuit operates the circuit interrupter if an overvoltage or undervoltage condition occurs and thus protects the load from a generator malfunction.

b. Apparatus. Instrumentation for measuring voltage and frequency shall be as described and illustrated in MIL–HDBK–705. Resistor(s), galvanometers matching networks, an oscillogram (as described and illustrated in MIL-HDBK-705, Method 106.1, paragraph 106.1.3) and galvanometers having a minimum flat frequency response (flat within plus or minus 5 percent) from DC to 3000 Hertz and the voltage divider transformer network will be required.

c. Procedure I. (Overvoltage).

(1) Preparation for test.

(a) Locate and disconnect the input circuit to the input terminals of the overvoltage protective sensing circuit and connect the apparatus as illustrated in figure 512.3–I for one voltage connection.

(b) Connect the frequency meter to the output terminals of the generator set.

(2) Test.

(a) Start and operate the set at rated frequency and no load.

(b) Close the switch (see figure 512. 3-I) and use resistance, RI to adjust the voltage to the overvoltage value specified in table 4-1. The set has provisions for shutdown upon an overvoltage condition. It will be necessary to temporarily deactivate this provision to permit adjustment of the overvoltage value. This may be done by activation of the “protective bypass” (Battle Short) switch. Do not deactivate the circuit interrupter trip circuitry.

(c) Open the switch, reset the overvoltage circuit and adjust the resistance, R2, until voltmeter No. 2 reads rated voltage.

(d) Repeat (b) and (c) to assure that the specified overvoltage and rated voltage settings are correct.

(e) Set the oscillograph chart speed such that the individual waveform peaks are clearly visible. Set the timing lines to a minimum of 0.01 seconds per line or use a 60 Hertz time trace. Adjust the trace peak-to-peak amplitude to a minimum of one inch (or 25 millimeters).

(f) Read and record both voltmeter readings.

(g) With the oscillograph recording and the circuit interrupter closed, close the switch. (See figure 512.3-l.

(h) Reactivate the shutdown provision if used.

(i) The generator set contains an ovewoltage malfunction indicator; check and record its indication.

(j) Record whether or not the set shuts down.

(k) Open the switch, reset the ovewoltage circuit if necessary, restart the set if required, and close the circuit interrupter.

(1) Repeat steps (e) thru (k) above two additional times.

d. Procedure II (Undervoltage).

(1) Preparation for test.

(a) Locate the input terminals of the undervoltage sensing circuit and connect the apparatus as illustrated in figure 512.3–I.

(b) Repeat step (b) of para. 4-20c. (1) (b).

(2) Test.

(a) Start and operate the set at rated frequency and no load.

(b) Close the switch (see figure 512.3–I) and use the resistance, R1, to adjust the voltage to the rated value.

(c) Open the switch and adjust the resistance, R2, until Voltmeter No. 2 reads the undervoltage value specified in table 4-1. This test shall be repeated for each undervoltage value.

(d) Repeat steps (b) and (c) above to assure that the specified undervoltage and rated voltage settings are correct.

(e) Set the oscillograph chart speed such that the individual waveform peaks are clearly visible. Set the timing lines to a minimum of 0.01 seconds per line or use a 60 Hertz timing trace. With the switch open, adjust the trace peak–to-peak amplitude to a minimum of one inch (or 25 millimeters).

(f) With the set operating and the circuit interrupter and the switch open, read and record both voltmeter readings.

(9) Close the switch and circuit interrupter.

(h) With the oscillograph recording, open the switch.

(i) After allowing sufficient time for the circuit interrupter to operate, check and record the indication of the undervoltage malfunction indicator.

(j) Close the switch and close the circuit interrupter.

(k) Repeat steps (e) thru (j) above two additional times.

(l) Repeat (a) thru (k) for the other undervoltage value specified in para. 4-1.

e. Results.

(1) From the oscillograms made in 4-20c, determine and tabulate the time between the application of the overvoltage and operation of the circuit interrupter for each application of overvoltage.

(2) From the oscillograms made in 4-20d. determine and tabulate the time between the application of the undervoltage and the operation of the circuit interrupter for each application of undervoltage.

(3) Compare these results with the requirements of table 4-1.

4-20. LOW OIL PRESSURE PROTECTIVE DEVICE TEST.

a. General. Since generator sets frequently operate unattended for tong periods, the engine is equipped with a low oil pressure protective device. This device shuts down the engine when the oil pressure drops below the safe limit.

b. Apparatus. The following equipment shall be required to perform this test.

Oil pressure gauge (±1%)
Flexible oil line (or copper tubing)
Regulating valves
Brass fittings.

c. Procedure.

(1) Preparation for test. With the set not operating, remove the protective device tap from the engine block and reconnect as shown in figure 515.1–I with the protective device and oil pressure gauge in approximately the same horizontal plane as the protective device tap located on the engine.

(2) Test.

(a) With the bleeder valve closed and the shut-off valve in the oil pressure line open, start and operate the set at rated speed (use the set instrumentation) and at no load.

(b) Open the bleeder valve slightly to purge air from the system.

(c) Close the bleeder valve and record the oil pressure as indicated on the external gauge.

(d) Almost completely close the shut-off valve.

(e) Slowly open the bleeder valve until the low oil pressure protective device shuts down the engine. Record the reading of the oil pressure gauge at the point of set shutdown (see figure 515.1-II).

(f) Record operation of the malfunction indicator light.

d. Results. Compare the value of shutdown pressure with the requirement of table 4-1.

4-21. OVERTEMPERATURE PROTECTIVE DEVICE TEST

a. General. The overtemperature device must be capable of protecting the engine in the set against overheating for any reason.

b. Apparatus Instrumentation for measuring load conditions and set and ambient temperatures shall be as described and illustrated in MIL-HDBK-705, Method 205.1, Paragraph 205.1.10.

c. Procedure.

(1) Preparation for test.

(a) Connect the load instrumentation in accordance with the applicable figure of MIL-HDBK-705, Method 205.1, Paragraph 205.1.10.

(b) Install a thermocouple to measure the same temperature as seen by the protective device sensor.

(2) Test.

(a) Start ando perate the generator set at rated voitage, rated frequency (speed), and rated load.

(b) Block the cooling air to the generator set by any suitable means.

(c) Continuously monitor the temperature seen by the thermocouple installed in paragraph 4-22c. (1) (b) above. Record the temperature at which the overtemperature protective device actuates. Record the temperature at which the coolant temperature indicator illuminates.

CAUTION

If the engine fails to shutdown when the temperature exceeds the maximum trip value specified in table 4-1, the test shall be immediately discontinued. Failure to observe this caution could result in equipment damage.

d. Results. Compare the results with the requirement of table 4-1.

4-22. PHASE SEQUENCE TEST (ROTATION)

a. General. Unless the phase sequence (rotation) of the load terminals of a three-phase generator set is correct, serious damage or injury could be done to connected equipment and to personnel as a result of reversed motor rotation or excessive current surges.

b. Apparatus. A phase sequence (rotation) indicator as described and illustrated in MIL-HDBK-705, Method 116.1 or a three–phase motor whose direction of operation in relation to phase sequence is known shall be required.

c. Procedure.

(1) Connect the generator set load terminals to the applicable test apparatus for one of the set three–phase voltage connections. Recheck the connections to insure that L1, L2 and L3 of the generator set are connected to L1, L2 and L3 of the test apparatus respectively.

(2) Start and operate the generator set at rated voltage and frequency. The set indicating instruments shall be sufficient indication of output voltage and frequency.

(3) Close the circuit interrupter and determine the direction of phase sequence (rotation) by observing the indicator, or by noting the direction of rotation if a three-phase motor is used. Record results.

(4) Check the phase sequence (rotation) of the power output of each power receptacle on the generator set by connecting the applicable test apparatus to the receptacle and repeating steps (1) thru (3) above.

(5) Repeat steps (a) thru (d) above for all other three-phase voltage output connections of the generator set.

d. Results. The phase sequence (rotation) as indicated by the test shall be checked against the requirements of table 4-1.

4-23. MAXIMUM POWER TEST.

a. General. The maximum power of a generator set is a function of the ambient conditions (temperature and altitude) and the mechanical condition of the engine at any particular time.

b. Apparatus. Instrumentation for measuring load conditions, field voltage and current, pressure and temperatures shall be as described and illustrated in MIL-HDBK-705.

CAUTION

This procedure subjects the generator set to a severe overload which may be damaging if maintained for too long a period of time. Failure to observe this caution could result in equipment damage.

(1) Preparation for test.

(a) Connect the load and instrumentation in accordance with the applicable figure of MIL-HDBK-705, Method 205.1, paragraph 205.1.10 for one voltage and frequency.

(b) Install appropriate thermocouples to measure the following temperatures:

1. Engine coolant (engine outlet and inlet)
2. Exhaust gas(es) (the exhaust manifolds shall be drilled and tapped as close as possible to the combustion chamber(s).
3. Lubricating oil sump.
4. Engine combustion air in (located at the inlet of the intake manifold).

(c) Install appropriate pressure instrumentation to measure the following items:

1. Exhaust pressure (combined exhaust gases in exhaust manifold).
2. Intake air manifold pressure (between air filters and manifold).

(d) Obtain and record the barometric and water vapor pressures (see MIL-HDBK-705, Method 220. 2).

(e) Bypass the set circuit interrupter.

(f) Connect the set to a source of fuel containing a specified fuel required by the procurement document.

(2) Test.

(a) Start and operate the generator set and allow it to stabilize at rated load, rated voltage and rated frequency (speed). During this period, readings of all instruments including thermal instrumentation shall be recorded at minimum intervals of 10 minutes. If necessary, adjustments to the load, voltage and rated frequency. However, adjustments to the voltage and frequency shall be limited to those adjustments available to the operator, specifically adjustments to the voltage or frequency adjust devices. On generator sets utilizing a droop-type speed control system as the prime speed control, the speed and droop portions of the control maybe adjusted. No other adjustments to the voltage and frequency control systems shall be made. Adjustments to the load, voltage or frequency controls shall be recorded on both the data sheet, and recording chart(s). Stabilization will be considered to have occurred when four consecutive voltage and current recordings of the exciter field either remain unchanged or have only minor variations about an equilibrium condition with no evident continued increase or decrease in value after the last adjustment to the load, voltage or frequency has been made.

(b) Perform this test using resistive load only. Remove reactive load after stabilization.

(c) For Class II Sets:

1. Alternately increase the load, voltage and frequency in small increments until the fuel system controls are in the maximum fuel position as permitted by the governor control linkage and the voltage and frequency are within 1 percent of their rated values.

NOTE

Small increments should be taken to avoid passing the maximum power at the rated voltage and frequency point and to avoid racing or bogging the engine.

2. Hold the conditions in step (1) above for two minutes. However, if the voltage and frequency cannot be maintained within 1 percent of their rated values, the load must be adjusted to the point at which the voltage and frequency can be maintained within 1 percent of the rated value for two minutes.

CAUTION

It may be necessary to reduce the load to a value below the rated kilowatt load for a short period of time to prevent serious overheating or damage to the generator set if the conditions can not be readily attained. (Monitor instrumentation.) Failure to observe this caution could result in equipment damage.

3. At the end of the two minute interval record all instrument readings including thermal instrumentation.

4. Reduce the load to approximately rated kilowatt load and allow the generator set to cool for approximately 5 to 10 minutes.

5. Repeat steps (1) through (4) above until three valid sets of maximum power data are obtained.

(d) For Class I Sets:

1. Repeat step (c) above but do not adjust the frequency.

2. Repeat steps (a) through (c) above as applicable for all other voltage connections and frequencies.

(e) Results.

1. Average the three valid power readings. This average is the observed maximum power value.

2. Correct the observed maximum power value to standard conditions using the procedure in MIL–HDBK-705, Method 220.2, paragraph 220.2.3. This is the corrected maximum power value.

3. Compare these results with the requirements of table 4-1.

4-24. UNDER FREQUENCY PROTECTIVE DEVICE TEST

a. General. For generators that power certain types of equipment, it is extremely important that the circuit interrupter open when the frequency fails appreciably below rated value. Severe damage may otherwise result to the powered equipment. To insure that the circuit interrupter will open at or before the critical frequency value, the generators are equipped with an underfrequency protective device. The device on this generator operates electrically. Although the under frequency protective device must be capable of functioning at any voltage throughout the specified voltage operating range, it is necessary only to perform the test at the specified maximum, at rated, and at minimum voltage limits.

b. Apparatus Instrumentation for measuring load conditions shall be as described and illustrated in method 205.1. paragraph 205.1.10 of MILL-HDBK-7050.

c. Procedure.

(1) Preparation for test. Connect a voltmeter and frequency meter to the generator set terminals, ahead of the circuit interrupter, and the remainder of the apparatus as shown in the applicable figure of paragraph 205.1.10 of MIL-HDBK-705.

(2) Test.

(a) Operate the generator at rated speed and voltage, and at no load since the generator is equipped with an electrical-type underfrequency protective device, this test shall be repeated with the voltage adjusted to maximum and minimum voltage for the specified voltage operating range.

(b) With the circuit interrupter closed, slowly decrease the operating speed until the protective device causes the circuit interrupter to open. The electric governor must be deactivated to sufficiently decrease the speed on Class 1, precise sets.

(c) Record the speed.

(d) Repeat the test while rapidly decreasing the operating speed. Again record the speed.

(e) Operate the generator at rated speed and voltage, and at rated load.

(f) Repeat steps (b), (c) and (d).

d. Results. Compare the test value of frequency with that given in table 4-1.

CHAPTER 5
REPAIR INSTRUCTIONS FOR MATERIAL USED IN CONJUNCTION WITH THE GENERATOR SET

Section 1. FUEL BURNING WINTERIZATION KIT

5-1. GENERAL.

The fuel burning winterization kit is used to preheat engine coolant and lubricating oil to facilitate starting at ambient temperatures between –25°F (-31. 7° C) and -65° F (-53. 9° C). It consists of a heater and coolant pump assembly, a heater control assembly, coolant circulating lines and fittings and wiring harness. Fuel for heating the coolant is supplied from the generator set main fuel tank by the fuel transfer pumps. Electrical power for coolant pump operation is supplied from the generator set batteries.

5-2. TROUBLESHOOTING.

Table 5-1 contains a listing 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 numerical listing of probable causes of the malfunction. The corresponding listing of corrective actions contains references to the applicable maintenance paragraph for correcting the cause of each malfunction.

NOTE

Refer to the Operator and Unit Maintenance Manual for troubleshooting information applicable to lower levels of maintenance.

Table 5-1. FUEL BURNING WINTERIZATION KIT TROUBLESHOOTING CHART

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

1. PRESS-TO-TEST LAMP DOES NOT ILLUMINATE

Step 1. Faulty circuit breaker.

Replace circuit breaker (para. 5-3).

Step 2. Open circuit.

Check circuit.

2. SWITCH ON, NOTHING HAPPENS

Step 1. Faulty circuit breaker.

Replace circuit breaker (para. 5-3).

Step 2. Open circuit.

Check circuit.

Table 5-1. FUEL BURNING WINTERIZATION KIT TROUBLESHOOTING CHART (Continued)

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

3. SWITCH ON, HEATER WILL NOT IGNITE; BLOWER OPERATES

Step 1. Defective igniter.

Replace igniter (para. 5-4).

Step 2. Metering orifice clogged.

Clean orifice (para. 5-4).

Step 3. Pressure regulator solenoid closed.

Check regulator valve. Replace if defective (para. 5-4).

4. FAN RUNS WITH SWITCH OFF

Step 1. Broken quartz rod.

Replace rod (para. 5-4).

Step 2. Flame switch out of adjustment.

Adjust flame switch (para 5-4).

5. HEATER STARTS, THEN GOES OUT.

Step 1. Faulty micro switch.

Replace switch (para. 5-4).

Step 2. Overheats, trips limit switch.

Check fuel regulator delivery rate. Adjust as required (para. 5-4).

6. CIRCUIT BREAKER OPENS

Short circuit.

Disconnect basic components, one at a time to isolate short (para. 5-4), then check wiring (para. 5-6).

7. FAILURE TO SHUT OFF

Step 1. Fuel regulator valve stuck open.

Replace valve (para. 5-4).

Step 2. Flame switch stuck open.

Adjust or replace (para 5-4).

Table 5-1. FUEL BURNING WINTERIZATION KIT TROUBLESHOOTING CHART (Continued)

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

8. SURGING COMBUSTION

Fuel regulator operating erratically.

Check fuel rate and replace valve if necessary (para. 5-4).

9. COOLANT PUMP FAILS TO RECIRCULATE LIQUID

Step 1. Faulty coolant pump.

Repair or replace pump (para. 5-4).

Step 2. Clogged coolant line.

Unclog or replace coolant line (para. 5-4).

10. COOLANT PUMP TURNS OVER BUT FAILS TO DELIVER FLUID

Step 1. Pump passages or blade slots plugged with foreign matter.

Repair or replace pump (para. 5-4).

Step 2. Defective motor.

Replace motor (para. 5-4).

11. ERRATIC OR REDUCED OUTPUT

Step 1. Air leak.

Check tubing connections for leaks (para 5-5).

Step 2. Reduced voltage.

Check voltage input to motor (para 5-4).

Step 3. Motor lag, low RPM.

Check motor brushes for excessive wear (para. 5-4).

Step 4. Scored cam ring bore.

Replace the cam ring (para. 5-4).

Step 5. Foreign matter in pump blade slots.

Remove pump from motor; disassemble and clean pump and filter (para 5-4).

Table 5-1. FUEL BURNING WINTERIZATION KIT TROUBLESHOOTING CHART (Continued)

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

12. LEAKAGE

Step 1. Face of steel cage scored or damaged seal O-ring.

Disassemble and inspect seal cage face and O-ring. Refinish or replace as required (para. 5-4).

Step 2. Seal face of adapter scored.

Disassemble and inspect seal face. Refinish or replace the adapter (para 5-4).

13. MOTOR FAILURE

Step 1. Worn brushes.

Remove and replace (para 5-4).

Step 2. Worn bearings. Burned armature.

Remove and replace (para. 5-4). Replace motor (para 5-4).

5-3. HEATER CONTROL ASSEMBLY.

a. Removal. Refer to the Operator and Unit Maintenance Manual for heater control assembly removal instructions.

b Disassembly.

(1) Tag all electrical leads before disconnecting.

(2) Remove screws (1, figure 5-1), and remove panel assembly (9), from housing (21).

(3) Remove nut (2), tooth lockwasher (3), on-off switch (15), and key washer (11).

(4) Remove nut (4), Iockwasher (5), and circuit breaker (16).

(5) Remove lens (6), lamp (7), nut (8), lockwasher (10) and indicator light base (17) from panel (9).

(6) Remove screw (13) from housing (14).

(7) Remove nut (18), screw (19), and connector, from housing (21).

c. Cleaning, Inspection, and Repair.

WARNING

Compressed air used for cleaning and drying purposes can create airborne particles that may enter the eyes. Pressure shall not exceed 30 psig and use only with adequate chip guards and chipping goggles. Failure to observe this warning could result in serious personal injury or death.

WARNING

Solvent, Dry Cleaning P–D-680, Type II is flammable and moderately toxic to skin, eyes and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate. Failure to observe this warning could result in serious personal injury or death.

(1) Clean all electrical parts with filtered compressed air and a soft bristle brush. If necessary, caked deposits may be removed with a clean, lint-free cloth moistened with solvent P-D-680 Type II.

(2) Clean all non-electrical parts with a clean, lint–free cloth moistened with dry cleaning solvent (Federal Specification P-D-680).

(3) Inspect ON-OFF switch for cracked casing, corrosion, and burns or other evidence of shorting.

(4) Place switch in the ON position and check for continuity, using an ohmmeter. Ohmmeter shall indicate continuity. Check for open circuit with switch in the OFF position. Ohmmeter shall indicate open circuit.

(5) Inspect circuit breaker for cracked casing, corrosion, and burns or other indications of shorting.

(6) Using an ohmmeter, check for open circuit across circuit breaker terminals. Ohmmeter shall indicate open circuit. Depress circuit breaker button. Ohmmeter shall indicate continuity.

(7) Inspect indicator light lens for cracked or broken glass, corrosion, and other damage.

(8) Inspect lamp for cracked or broken glass, burned out filament and corrosion.

(9) Check indicator light base for cracks, corrosion, and burns.

(10) Inspect wiring harness for damaged connectors, wires, and terminals. Check individual wires for continuity using figure 5-2 as a guide.

(11) Replace damaged connectors and terminals by unsoldering and removing electrical leads. Install replacement part, make mechanical connection and solder in accordance with established procedure.

(12) Replace defective wires using wire conforming to Military Specification MIL-W-5086, Type II.

(13) Inspect housing for cracks, warping, and corrosion.

(14) Inspect all threads for crossing, stripping, and other damage.

(15) Replace all damaged or defective parts.

d. Assembly.

(1) Install connector (20, figure 5-1), screws (19), nuts (18) on housing (21).

(2) Install screws (13) in housing (14).

(3) Install indicator light base (17), tooth lockwasher (10), nut (8), lamp (7), and lens (6) on panel assembly (9).

(4) Install circuit breaker (16), lockwasher (5) and nut (4).

(5) Install key washer (11), on-off switch (15), tooth lockwasher (3) and nut (2).

(6) Position panel assembly (9), and install screws (1).

e. Installation. Refer to the Operator and Unit Maintenance Manual for fuel burning winterization heater control assembly installation instructions.

1. Screw
2. Nut
3. Tooth lockwasher
4. Nut
5. Tooth lockwasher
6. Lens
7. Lamp
8. Nut
9. Panel
10. Tooth lockwasher
11. Key washer
12. Nut
13. Screw
14. Housing
15. ON–OFF switch
16. Circuit breaker
17. Indicator light base
18. Nut
19. Screw
20. Connector
21. Housing

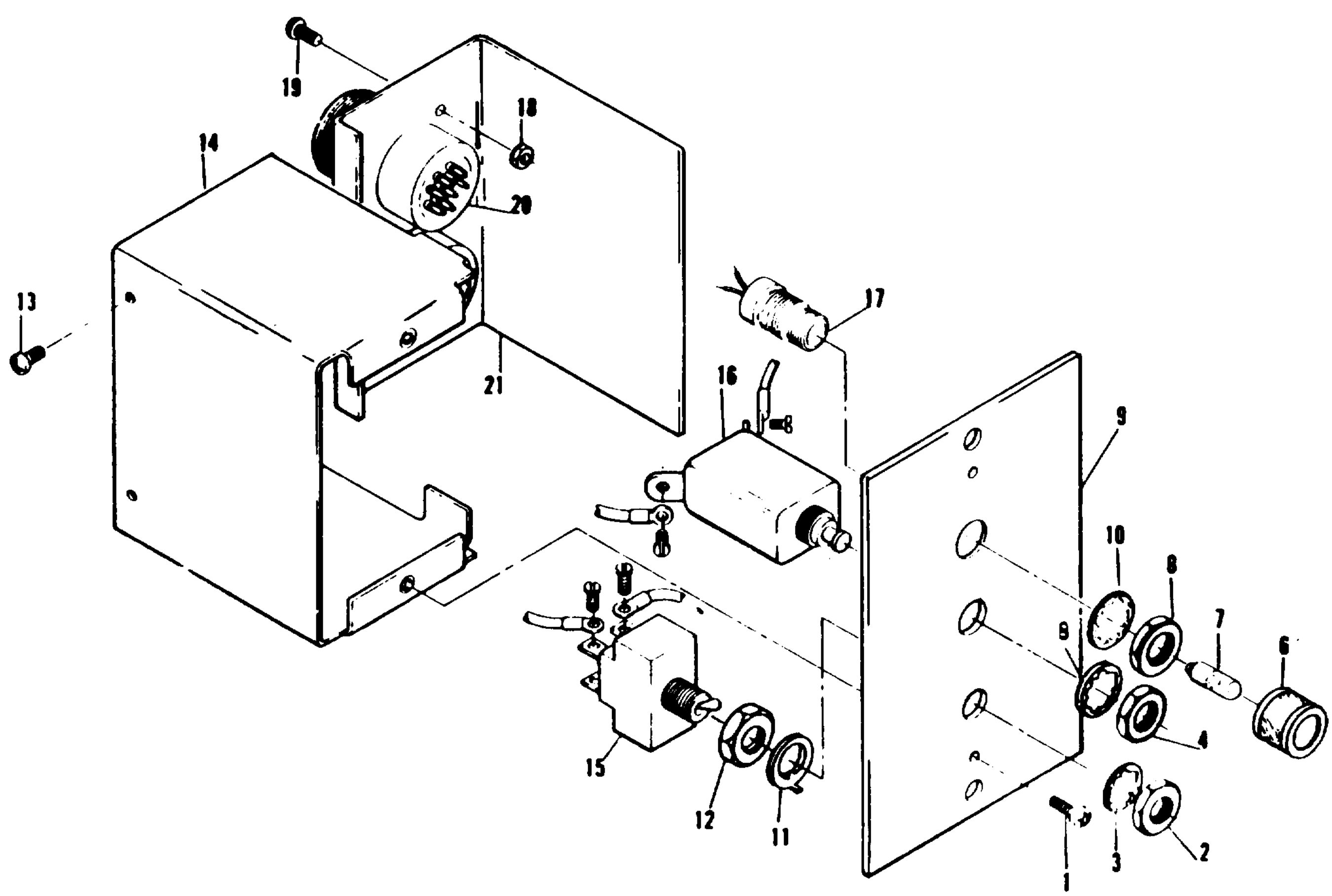
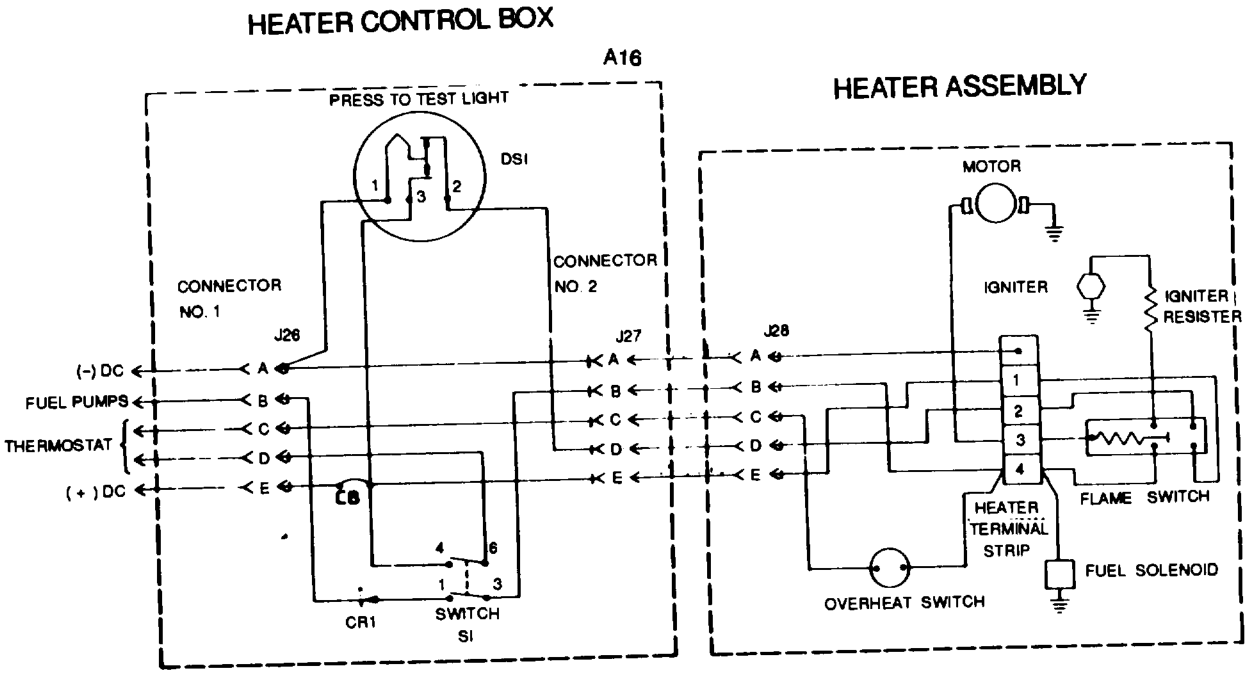


Figure 5-1. Fuel Burning Heater, Control Assembly

NOTES:

1. INTERPRET DRAWING PER DOD-STD-100.
2. CONNECTOR J26 is MS3102 R-18-11P REF
3. CONNECTOR J27 is MS3102 R-18-11S REF



ASSEMBLIES

A16 HEATER CONTROL BOX
A17 FUEL FIRED WINTERIZATION

Figure 5-2. Fuel Burning Heater Control Assembly Wiring Diagram, Drawing 72-2863

5-4. HEATER ASSEMBLY.

a. Removal. Refer to the Operator and Unit Maintenance Manual for heater assembly removal instructions.

NOTE

It is not necessary to completely disassemble the heater assembly to replace a single part. Only those parts requiring repair or replacement need be removed.

b. Disassembly

(1) Tag or otherwise identify electrical leads as they are disconnected to facilitate installation.

(2) Remove cover (1, figure 5-3).

(3) Remove screw (2), and receptacle assembly (3).

(4) Remove screw (4), and terminal board assembly (5).

(5) Remove screw (6), and limit switch (7).

(6) Remove frame assembly (8), adjusting screw (9), spring (10), tension spring (11), and spring pad (12). Carefully remove quartz rod (13), screw (14) and switch (15).

(7) Remove screws (16), and separate assembled heat exchanger (75) and burner casing.

(8) Remove drain plug (17) from heat exchanger.

(9) Remove igniter assembly (18) and gasket (19).

(I0) Remove fuel tube assembly (20), metering orifice (21), metering orifice assembly (22), filter body (23), gasket (24) and sintered filter (25).

(11) Remove screw (26), screw (27), and remove bracket (28), and fuel regulator value assembly (29).

(12) Remove screw (30), setscrews (31 and 32), and fuel preheater (33).

(13) Remove screw (34), screw (35), air inlet cover (36).

(14) Remove clamps (37), and (40), and remove hose (41)

(15) Remove burner casing (38), and casing grommet (39).

(16) Remove plug (42), spring (43), ball (44), elbow (45), and screw (46) from port plate (47).

(17) Conspicuously mark port plate (47, figure 5-3) and cam ring (49) to insure that they will be installed properly.

(18) Remove O-ring (48), cam ring (49), setscrew (50), vane (51), rotor (52), O-ring (53), adapter (54), O-ring (55), seal cage (56), seal washer (57), and spring (58).

(19) Remove setscrew (60) and combustion fan (61).

(20) Remove screws (59), and (63), and remove inlet plate (62) and combustion air inlet (64) from motor (67)

(21) Remove brush cap (65) and brush spring (66) from motor (67).

(22) Remove screw (68), vaporizer retainer (69) and vaporizer (70).

(23) Remove elbow (71), burner assembly (72). Remove burner assembly.

(24) If necessary, remove screw (73), and nameplate (74).

c. Cleaning, Inspection, and Repair.

(1) Clean all electrical parts with filtered compressed air and a soft bristle brush. If necessary, remove caked deposits with an approved cleaning solvent. Do not dip electrical parts in cleaning water.

(2) Clean all non-electrical parts with dry cleaning solvent (Federal Specification P-D-680) and dry thoroughly.

(3) Inspect receptacle assembly for cracks, burned or damaged insulation, loose connections and bent or broken terminals. Check for continuity between wires and terminal pins with an ohmmeter.

(4) Inspect fuel tube for cracks and other damage.

(5) Inspect metering orifice for damaged threads and obstruction at pin holes. Pin hole diameter is 0.012 inch.

(6) Inspect regulator valve for cracks, leaks, or damaged threads.

(7) Check flame switch for distorted or broken springs, loose pivot points, stripped threads, and cracked or damaged insulation. Check flame switch for continuity.

(8) Inspect igniter for a broken coil or shorts. Check resistance. Resistance must be one ohm with igniter cold.

(9) Inspect quartz rod and heat exchanger for damage, warping, or burned condition.

(10) Inspect air inlet cover for dents. Inspect blower casting for damaged blades, cracks, and breaks.

(11) Inspect heater casting for defective threads, or burned or damaged condition.

(12) Inspect sintered filter for clogged or damaged condition.

(13) Inspect motor assembly for damaged threads, burned or frayed leads and worn brushes.

(14) Inspect adapter for damaged or scored face, warping and for motor shaft bore wear. Face of adapter must be parallel within 0.001 inch. Adapter bore diameter must be 0.315 to 0.318 inch. Adapter face must be parallel with rotor side of adapter within 0.001 inch per inch.

(15) Inspect rotor and rotor blades for nicks, scratches and excessive wear.

(16) Inspect seal cage for scored or damaged face and for wear. Remove all imperfections by lapping, or replace seal cage.

(17) Inspect cam ring and port plate for damaged, scored, or warping. Replace defective cam ring or port plate.

(18) Replace all gaskets, seal rings, motor brushes and vaporizer at each overhaul.

(19) Replace all parts that do not meet inspection requirements.

(20) Seal faces of adapter and seal cage maybe dressed to remove minor nicks, scratches or scoring using crocus cloth (Federal Specification P-C-458). Remove only material necessary to clean seal face.

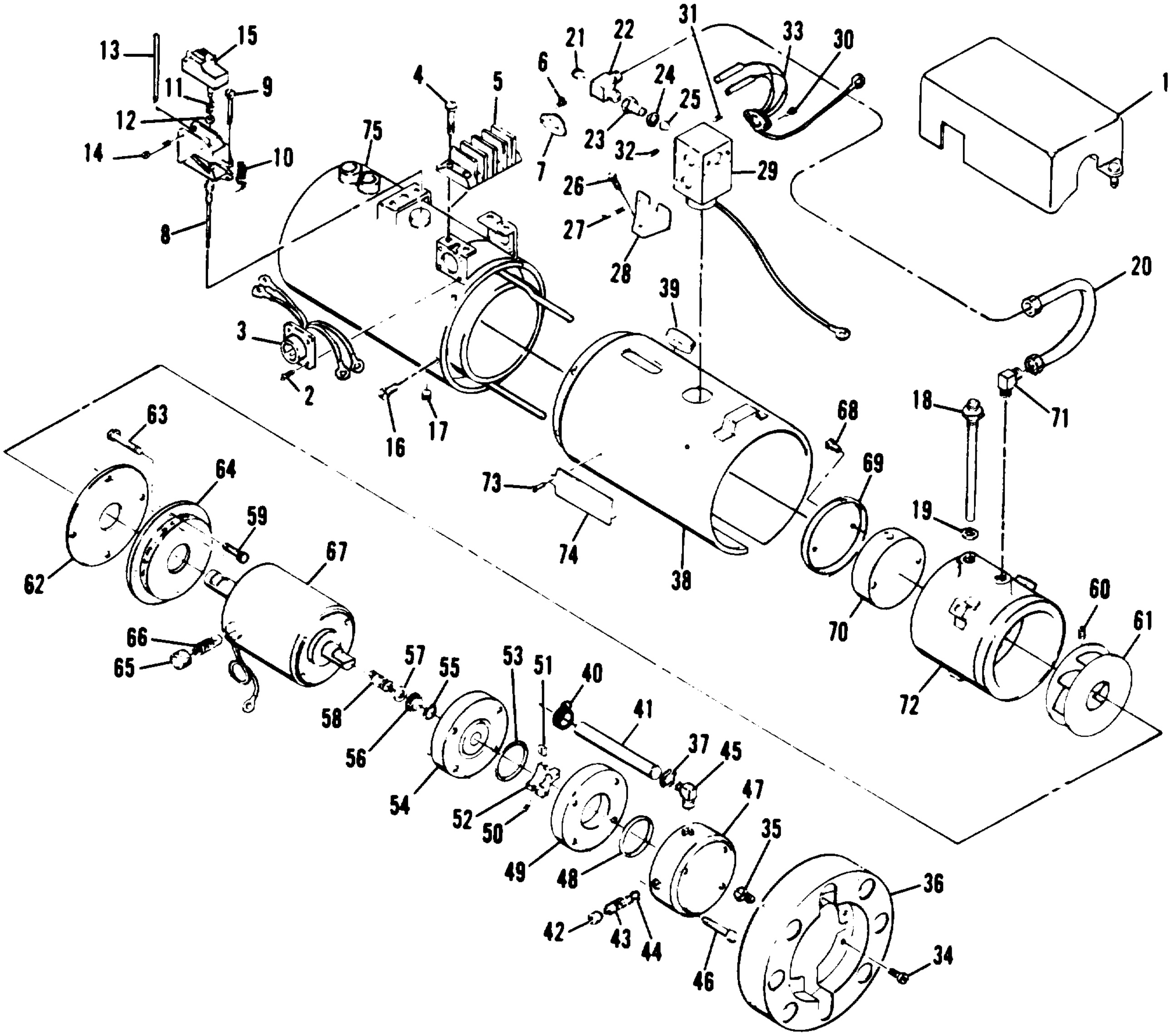


Figure 5-3. Fuel Burning Heater Assembly, Exploded View (Sheet 1 of 2)

1. Cover
2. Screw
3. Receptacle assembly
4. Screw
5. Terminal board assembly
6. Screw
7. Limit switch
8. Frame assembly
9. Adjusting screw
10. Spring
11. Tension spring
12. Spring pad
13. Quartz rod
14. Screw
15. Switch
16. Screw
17. Plug
18. Igniter assembly
19. Gasket
20. Fuel tube assembly
21. Metering orifice plug
22. Metering orifice assembly
23. Filter body
24. Gasket
25. Sintered filter
26. Screw
27. Screw
28. Bracket
29. Fuel regulator valve assembly
30. Screw
31. Setscrew
32. Setscrew
33. Fuel preheater
34. Screw
35. Screw
36. Air inlet cover
37. Clamp
38. Burner casing
39. Casing grommet
40. Clamp
41. Hose
42. Plug
43. Spring
44. Ball
45. Elbow
46. Screw
47. Port plate
48. O–ring
49. Cam ring
50. Setscrew
51. Vane
52. Rotor
53. O–ring
54. Adapter
55. O–ring
56. Seal cage
57. Seal washer
58. Spring
59. Screw
60. Setscrew
61. Combustion fan
62. Inlet plate
63. Screw
64. Combustion air inlet
65. Brush cap
66. Brush spring
67. Motor assembly
68. Screw
69. Vaporizer retainer
70. Vaporizer
71. Elbow
72. Burner assembly
73. Screw
74. Nameplate
75. Heat exchanger

Figure 5-3. Fuel Burning Heater Assembly, Exploded View (Sheet 2 of 2)

d. Assembly. Assemble the fuel burning heater assembly in reverse order of disassembly procedures while observing the following:

(1) Exercise care in replacing quartz rod (13, figure 5-3) as it is easily broken if dropped. After installation, gently move rod up and down to make sure it moves freely in its stainless steel tube. Also make sure at least 1/32 inch extends out of tube when rod is resting on bottom.

(2) Assemble motor assembly (67), combustion air inlet (64), inlet plate (62) and combustion fan (61) before installing burner assembly.

(3) Make sure lead wire from motor assembly is on side of blower opposite nameplate (74) before drawing it through casing grommet (39).

(4) Make sure all wire leads are connected to their respective terminals as tagged during disassembly.

NOTE

Coolant pump cannot be assembled completely and installed as a separate unit. It must be assembled as it is installed on short shaft end of motor. Test motor and pump (paragraph e.(3) before completing heater assembly.

(5) Install seal spring (58) and seal washer (57) over end of motor shaft. Place o-ring (55) in seal cage (56), then install seal cage over end of motor shaft with seal face facing forward.

(6) Install adapter (54) over motor shaft and align holes with tapped holes in motor.

(7) Install pump rotor (52) on motor shaft and temporarily tighten rotor setscrew (50). Place o-ring (53) in groove of adapter (54). Place cam ring in position aligning scribe mark. With motor shaft end play taken up in direction of pump, make certain there is at least 0.002–inch clearance between outer face of cam ring and rotor. Move rotor back and forth as necessary to produce this clearance, then tighten setscrew.

NOTE

Make sure that adapter and cam ring are tightly compressed together when determining 0.002 inch clearance, otherwise a false reading will be obtained.

(8) Install pump vane (51) in rotor slots making sure that grooves in vanes face toward the direction of rotation. Pump rotates counterclockwise when viewing end of port plate (47).

(9) Place o-ring (48) in groove of port plate (47), then position plate against cam ring (49). Align scribe marks and secure with four setscrews (46).

(10) Test heater assembly. Plug threaded ports with caps if pump is not to be assembled in heater immediately.

e. Testing and Adjustment.

(1) Flame Switch Adjustment. Refer to the Operator and Unit Maintenance Manual for flame switch adjustment procedures.

(2) Fuel Regulator Valve Adjustment. Refer to the Operator and Unit Maintenance Manual for fuel regulator valve adjustment procedures.

(3) Coolant Pump Testing. After coolant pump has been overhauled, it shall be tested as follows:

(a) Install pump and motor assembly into test setup shown in figure 5-4.

(b) Turn power switch ON and run-in unit for approximately 15 minutes on 24 volts dc.

(c) Close valve in outlet line. (Make certain the discharge pressure does not exceed a maximum of 30–35 psi when closing this valve.) Open and close valve a few times to check consistency of valve performance.

(d) To check pump for rated flow and pressure, adjust valve in discharge line until a reading of 2 psi is obtained on the pressure gauge. Using a suitable timer, check for rated flow of 80 gph minimum at 2 psi discharge pressure. Amperage draw should not exceed 6 amperes during this test. Observe smoothness of operation of both pump and motor. Seal leakage of 1 cc per hour is maximum when pump is operating at 2 psi discharge.

(e) Turn power supply OFF, then remove motor and pump assembly from test setup.

f. Installation. Refer to the Operator and Unit Maintenance Manual for fuel burning heater installation procedures.

5-5. COOLANT LINES AND FITTINGS.

Refer to the Operator and Unit Maintenance Manual for coolant lines and fittings repair instructions.

5-6. WIRING HARNESS ASSEMBLIES.

a. Refer to the Operator and Unit Maintenance Manual for wiring harness removal, cleaning, and repair instructions.

b. If the wiring harnesses have sustained damage and require repair or rebuild, refer to figure 5-5 or 5-6 as required for layout, identification of material requirements and Appendix A reference for detailed soldering and replacement procedures.

c. Refer to the Operator and Unit Maintenance Manual for wiring harness installation procedures.

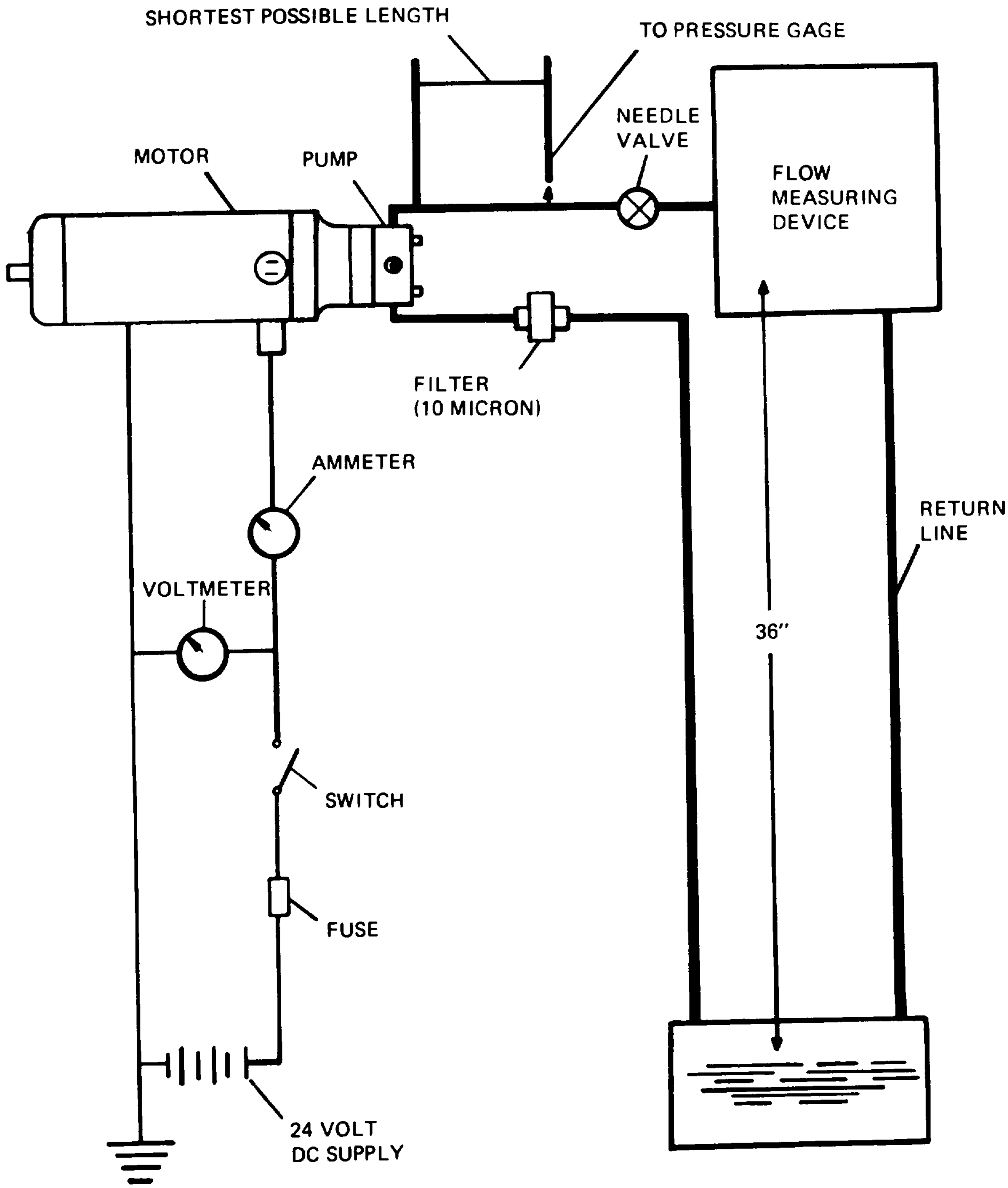
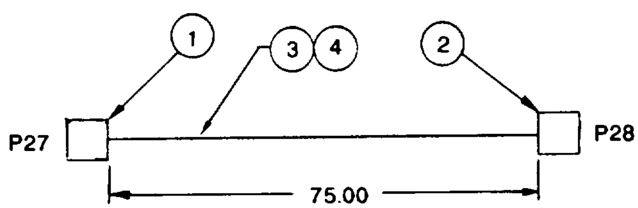


Figure 5-4 Coolant Pump Test Diagram

NOTES:

1. ALL SOLDERED CONNECTIONS SHALL BE IN ACCORDANCE WITH MIL-STD-454, REQUIREMENT 5.
2. INSTALL STRAPS, FIND NO. 5, AT 3.0 MAX 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. INTERPRET DRAWING PER MIL-STD-100.
5. REFERENCES
   a) FOR WIRING DIAGRAM, SEE DRAWING 72-2205.
   b) FOR SCHEMATIC DIAGRAM, SEE DRAWING 72-2200.



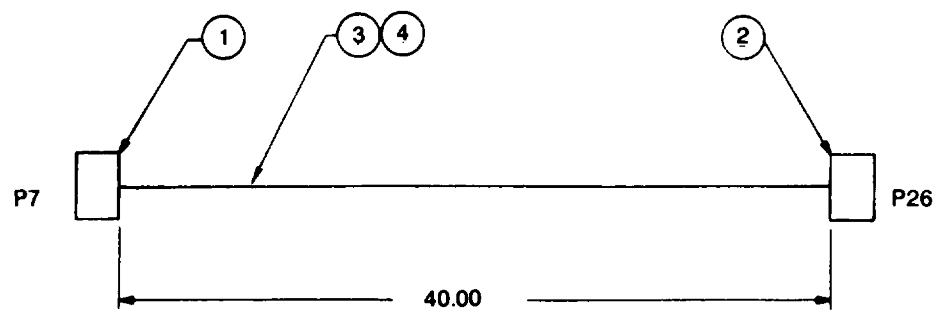
WIRE MARKING	FROM	TERMINATION FIND NO REF.	TERMINATION TO	TERMINATION FIND NO REF.	WIRE FIND NO.	WIRE LENGTH REF.	WIRE MARKING COLOR
P550K16	P27-A	1	P28-A	2	3	76.00	RED
P70816	P27-B	1	P28-B	2	3	76.00	RED
V64G12	P27-C	1	P28-C	2	4	76.00	RED
P82B12	P27-D	1	P28-D	2	4	76.00	RED
P83B12	P27-E	1	P28-E	2	4	76.00	RED

FIND NO.	SYM	CODE IDENT	DWG SIZE	PART OR IDENTIFYING NO.	QTY REQD	NOMENCLATURE OR DESCRIPTION	SPEC	MATERIAL
1				MS3106R18-11P	1	CONNECTOR ELECTRICAL P27		
2				MS3106R18-11S	1	CONNECTOR ELECTRICAL P28		
3				M5085/2-16-9	AR	WIRE ELECTRICAL 16 AWG	MIL-W-5088/2	
4				M5086/2-12-9	AR	WIRE ELECTRICAL 12 AWG	MIL-W-5088/2	
5				MS3367-4-9	AR	STRAP, CABLE ADJUSTABLE		

Figure 5-5. Fuel Burning Winterization Kit Wiring Harness, Drawing No. 72-2856

NOTES:

1. ALL SOLDERED CONNECTIONS SHALL BE IN ACCORDANCE WITH MIL–STD–454, REQUIREMENT.
2. INSTALL STRAPS, FIND NO. 5, AT 3.0 MAX INTERVALS.
3. WIRE MARKING TO BE IN ACCORDANCE WITH MIL-W-5088 EXCEPT THAT LENGTH BETWEEN GROUPS OF NUMBERS SHALL NOT EXCEED 6 INCHES.
4. REFERENCES
   a) FOR WIRING DIAGRAM, SEE DRAWING 72–2205.
   b) FOR SCHEMATIC DIAGRAM, SEE DRAWING 72–2200.
5. INTERPRET DRAWING PER DOD–STD–100.



WIRE MARKING	FROM	TERMINATION FIND NO REF.	TO	FIND NO REF.	WIRE FIND NO.	WIRE LENGTH REF.	WIRE MARKING COLOR
P55E12	P7–A	1	P26–A	2	3	41.50	RED
P51C16	P7–B	1	P26–B	2	4	41.50	RED
V6412	P7–C	1	P26–C	2	3	41.50	RED
V65A12	P7–D	1	P26–D	2	3	41.50	RED
P141G12	P7–E	1	P26–E	2	4	41.50	RED

FIND NO.	SYM	CODE IDENT	DWG SIZE	PART OR IDENTIFYING NO.	QTY REQD	NOMENCLATURE OR DESCRIPTION	SPEC	MATERIAL
1				MS3106R18–11P	1	CONNECTOR PLUG ELECTRICAL P7		
2				MS3106R18–11S	1	CONNECTOR PLUG ELECTRICAL P27		
3				M5086/2–12–9	AR	WIRE ELECTRICAL 12 AWG	MIL–W–5086/2	
4				M5086/2–16–9	AR	WIRE ELECTRICAL 16 AWG	MIL–W–5086/2	
5				MS3367–4–9	AR	STRAP, CABLE ADJUSTABLE		

Figure 5-6. Fuel Burning Winterization Heater Control Assembly to Special Relay Assembly Wiring Harness Drawing No. 72-2875

Section II. ELECTRIC WINTERIZATION KIT

5-7. GENERAL.

The electric winterization kit is used to maintain the engine coolant and lubricating oil at normal operating temperature in situations which require immediate starting of the generator set. It will function effectively down to an ambient temperature of -65°F (–53. 9°C). The kit consists of a heater assembly, a heater control assembly, and interconnecting coolant lines and fittings and wiring harnesses. Power for operation of the kit may be obtained from any 208 to 240 volt, 50/60 Hz or 400 Hz, single phase source.

5-8. TROUBLESHOOTING.

Table 5-2 contains a numerical list of malfunctions which is useful in diagnosing and correcting unsatisfactory operation or failure of the electric winterization kit. Each numbered malfunction is followed by an numerical listing of probable causes of the malfunction. The corresponding listing of corrective actions contains references to the applicable maintenance paragraphs for correcting the cause of the malfunction.

NOTE

Refer to the Operator and Unit Maintenance Manual for troubleshooting information applicable to lower levels of maintenance.

Table 5-2. ELECTRIC WINTERIZATION KIT TROUBLESHOOTING CHART

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

1. HEATER ON INDICATOR LIGHT DOES NOT ILLUMINATE WITH SWITCH IN ON POSITION.

Step 1. Defective fuse.

Replace fuse (para. 5-9).

Step 2. Defective switch.

Replace switch (para. 5-9).

Step 3. Defective circuit breaker.

Replace circuit breaker (para. 5-9).

Step 4. Defective lamp.

Replace lamp (para. 5-9).

Step 5. Defective semi-conductor.

Replace semi-conductors (para. 5-9).

Step 6. Defective transformer.

Replace transformer (para. 5-9).

Table 5-2. ELECTRIC WINTERIZATION KIT TROUBLESHOOTING CHART (Continued)

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

2. POWER ON INDICATOR LIGHT DOES NOT ILLUMINATE WITH SWITCH IN ON POSITION.

Step 1. See Malfunction 1 of this table.

Step 2. Defective thermostat.

Replace thermostat (para. 5-10).

3. HEATER ELEMENT DOES NOT HEAT UP

Step 1. Defective wiring harness.

Replace wiring harness (para. 5-13).

Step 2. Defective heater element.

Replace heater element (para. 5-10).

Step 3. Defective power relay.

Replace power relay (para. 5-9).

4. PUMP DOES NOT CIRCULATE COOLANT

Step 1. Defective fuse.

Replace fuse (para 5-9).

Step 2. Defective switch.

Replace switch (para 5-9).

Step 3. Defective circuit breaker.

Replace circuit breaker (para. 5-9).

Step 4. Defective semi-conductor.

Replace semi-conductors (para 5-9).

Step 5. Defective motor assembly.

Replace motor assembly (para 5-11).

Step 6. Defective pump.

Repair or replace pump (para. 5-11).

5-9. HEATER CONTROL ASSEMBLY.

a. Removal. Refer to the Operator and Unit Maintenance Manual for heater control assembly removal instructions.

b. Disassembly.

NOTE

Disassemble heater control assembly only as required to clean, inspect, test and replace components.

(1) Tag all electrical leads before disconnecting.

(2) Remove screws (1, figure 5-7), Iockwashers (2), and pull the panel (22) away from the Chassis (60), as far as electrical connections will allow.

(3) Remove nut (3), tooth Iockwasher (4), positioning washer (5), nut (6) and switch (7).

(4) Remove nut (8), tooth Iockwasher (9), and circuit breaker (10).

(5) Remove fuseholder (11), fuse (12), nut (13), tooth Iockwasher (14) and fuse holder (15).

(6) Remove lens (16), lamp (17), nut (18), indicator light base (19), nut (20), tooth Iockwasher (21).

(7) Remove screw and captive washer assembly (23) and cover (24).

(8) Remove screw and captive washer assembly (25), nut and captive washer assembly (26), screw and captive washer assemblies (27 and 28) and cushion clamp (29).

(9) Remove nut (30), flat washer (31), tooth Iockwasher (32), and semiconductor (33).

(10) Remove nut (34), flatwasher (35), Iockwasher (36) and semiconductor (37).

(11) Remove nut (38), flat washer (39), shoulder washer (40), screw & captive washer assembly (41), heat sink (42), shoulder washer (43), split grommet (44) and heat sink bracket (45).

(12) Remove screw and captive washer assembly (46), protective cap and chain (47), nut (48), screw and captive washer assembly (49), nut (50), and wiring harness (51).

(13) Remove nut (52), shoulder washer (53), screw (54), power relay (55) and relaly insulator (56).

(14) Remove nut (57), screw and captive washer assembly (58), and transformer (59), from chassis (60).

c. Cleaning. Inspection, and Repair.

WARNING

Compressed air used for cleaning and drying purpcses can create airborne particles that may enter the eyes. Pressure shall not exceed 30 psig and use only with adequate chip guards and chipping goggles. Failure to observe this warning could result in servere personal injury or death.

WARNING

Solvent, Dry Cleaning P-D-680, Type II is flammable and moderately toxic to skin, eyes and respiratory tract. Eyes and skin protection required. Good general ventilation is normally adequate. Failure to observe this warning could result in servere personal injury or death.

(1) Clean all electrical parts with filtered compressed air and a soft bristle brush. If necessary, caked deposits may be removed with a clean, lint-free cloth moistened with solvent P-D-680 Type II. Do not dip electrical parts in cleaning solvent.

(2) Clean non-electrical parts with a clean, lint–free cloth moistened with dry cleaning solvent (P-D-680) and dry thoroughly.

(3) Visually inspect switch for cracked casing, corrosion, and burns or other evidence of shorting. Check switch continuity.

(4) Inspect circuit breaker for cracked casing, corrosion, and burns or other evidence of shorting. Check circuit breaker continuity using an ohmmeter. Replace circuit breaker if defective.

(5) Inspect fuse holder for cracks, corrosion, stripped threads and burns or other evidence of shorting. Replace if defects are noted.

(6) Inspect indicator light for cracked or broken lens, damaged or defective lamp, cracks, corrosion, and burns. Replace any defective parts.

(7) Inspect power relay for cracks, corrosion, and burns or other evidence of shorting. Using an ohmmeter, check power relay coil resistance. Resistance shall be 30-45 ohms at 77°F (25°C). Replace power relay if damaged or defective.

(8) Inspect transformer for corrosion, cracks, and burns or other evidence of overheating.

(9) Using figure 5-8 as a guide, test transformer as follows:

(a) Using an ohmmeter, check resistance of windings. Winding 1-2 shall indicate 6.77 ± 0.677 ohms. Winding 3–5 shall indicate 0.108 ± 0.0108 ohm.

(b) Apply 230 Vac, RMS to winding 1-2 with all secondaries open circuit. Exciting current shall be less than 0.04 amp RMS (0.01 amp RMS for 400 Hz).

(c) Apply 253 Vac RMS to winding 1-2 with all secondaries open circuit. Exciting current shall be less than 0.065 amp RMS (0.016 amp for 400 Hz).

(d) Apply 230 Vac RMS to winding 1-2 with all secondaries open circuit. Voltage across winding 3-4 shall be 14.8 ± 0.148 volts RMS. Voltage across winding 3-5 shall be 29.6+ 0.296 volts RMS.

(e) Replace transformer if damaged or defective.

(10) Use a semiconductor test set to check semiconductors for inverse current leakage at peak recurrent inverse voltage of 600 volts. Leakage shall not exceed 20.0 milliamperes at 77°'F (25°C). Check forward voltage drop. Voltage drop shall not exceed 1.2 volts at 77° F (25° C). Replace defective semiconductors.

(11) Inspect heat sink and bracket for cracks, corrosion and evidence of overheating.

(12) Inspect wiring harness for loose or damaged connector pins, damaged terminals, worn or chaffed insulation, and burned areas indicating shorting. Check individual wires for continuity using figure 5-9 as a guide.

(13) If the wiring harness has sustained damage and requires repair or rebuild refer to figure 5-9 for layout, identification of material requirements and Appendix A references or detailed soldering and replacement procedures.

(14) Inspect chassis and cover for cracks, corrosion, warping and other damage. Replace parts damaged beyond repair.

(15) Inspect hardware for crossed, stripped, and peened threads.

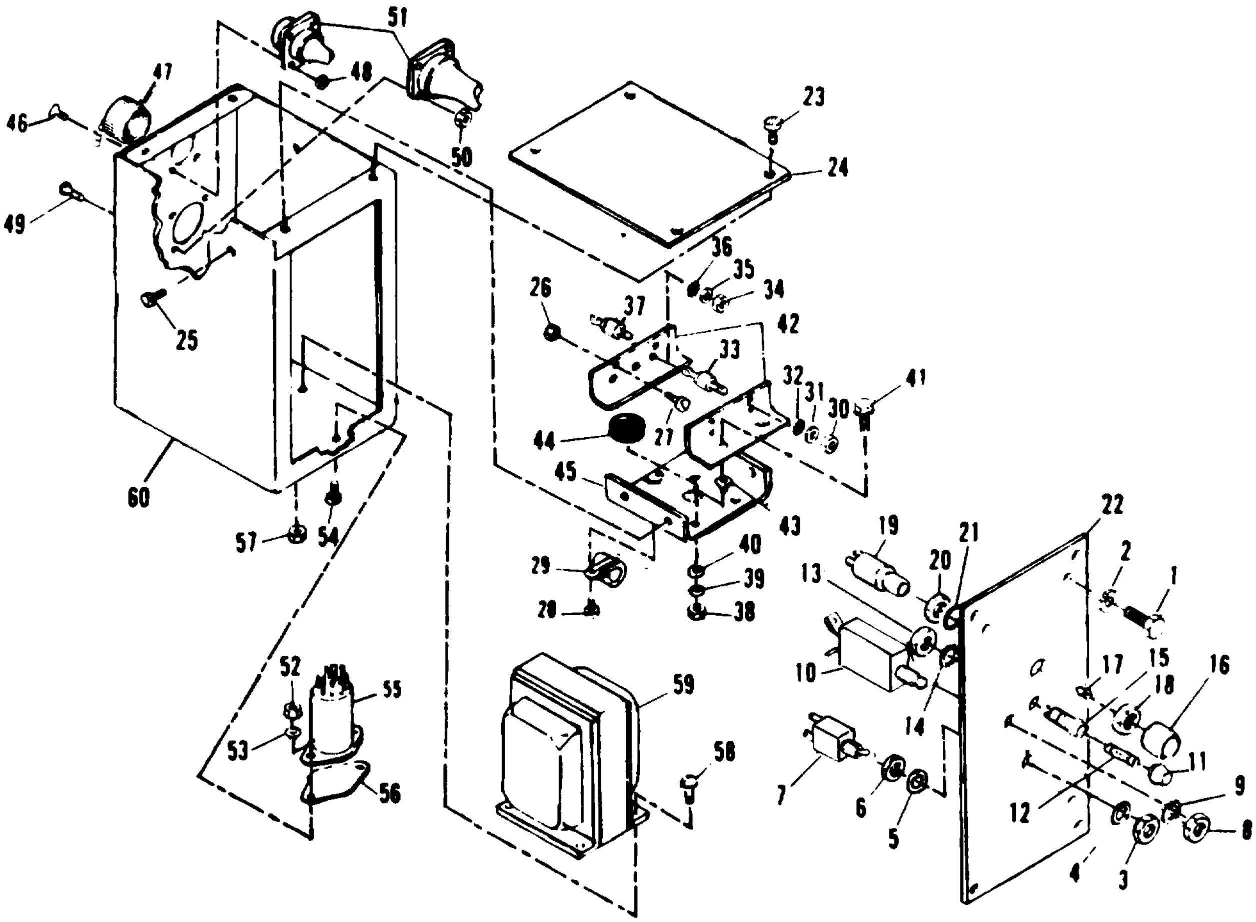


Figure 5-7. Electric Winterization Kit Heater Control Assembly, Exploded View (Sheet 1 of 2)

1. Screw
2. Lockwasher
3. Nut
4. Tooth lockwasher
5. Positioning washer
6. Nut
7. Switch
8. Nut
9. Tooth lockwasher
10. Circuit breaker
11. Fuseholder cap
12. Fuse
13. Nut
14. Tooth lockwasher
15. Fuseholder
16. Lens
17. Lamp
18. Nut
19. Indicator light base
20. Nut
21. Tooth lockwasher
22. Panel
23. Screw & captive washer assembly
24. Cover
25. Screw & captive washer assembly
26. Nut & captive washer assembly
27. Screw & captive washer assembly
28. Screw & captive washer assembly
29. Cushion clamp
30. Nut
31. Flat washer
32. Tooth lockwasher
33. Semiconductor
34. Nut
35. Flat washer
36. Lockwasher
37. Semiconductor
38. Nut
39. Flat washer
40. Shoulder washer
41. Screw & captive washer assembly
42. Heat sink
43. Shoulder washer
44. Split grommet
45. Heat sink bracket
46. Screw & captive washer assembly
47. Protective cap and chain
48. Nut
49. Screw & captive washer assembly
50. Nut
51. Wiring harness
52. Nut
53. Shoulder washer
54. Screw
55. Power relay
56. Relay insulator
57. Nut
58. Screw & captive washer assembly
59. Transformer
60. Chassis

Figure 5-7. Electric Winterization Kit Heater Control Assembly, Exploded View (Sheet 2 of 2)

d. Assembly.

(1) Install transformer (59, figure 5-7), screw and captive washer assembly (58) and nut (57), on chassis (60).

(2) Install relay insulator (56), power relay (55), screw (54), shoulder washer (53) and nut (52).

(3) Position wiring harness (51), and install attaching screw and cpative washer assemblies (46 and 49) and nuts 48 and 50). Install protective cap chain (47).

(4) Install split gormmet (44) in heat sink bracket (45).

(5) Postion heat sink bracket (45) in chassis (60) and install attaching screw and captive washer assembly (25).

(6) Position heat sinks (42) and install shoulder washers (43), screw and captive washer assemblies (41), shoulder washer (40), flat washer (39) and nut (38).

(7) Install semiconductors (37 and 33), Iockwasher (36) and tooth Iockwasher (32), flat washers (35 and 31) and nuts (34 and 30).

(8) Install cushion clamp (29), screw and captive washer assemblies (28 and 27), nut and captive washer assembly (26), and screw and captive washer assembly (25).

(9) Install cover (24) and screw and captive washer assembly (23).

(Io) Install nut (20), tooth Iockwasher (21), indicator light base (19), nut (18), lamp (17) and lens (16) on panel (22).

(11) Install fuseholder (15), tooth Iockwasher (14), nut (13), fuse (12) and fuseholder cap (11).

(12) Install circuit breaker (10), tooth Iockwasher (9), and nut (8) on panel (22).

(13) Install switch (7), nut (6), positioning washer (5), tooth Iockwasher (4) and nut (3) on panel (22).

(14) Install panel (22) on chassis (60) and secure with Iockwashers (2) and screws (1).

(15) Connect electrical leads.

e. Installation. Refer to the Operator and Unit Maintenance Manual for electric winterization kit heater control assembly installation instructions.

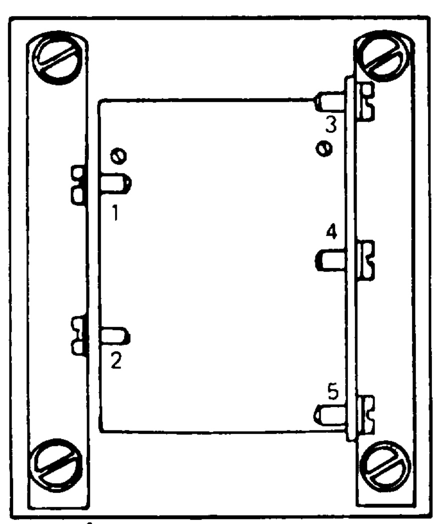
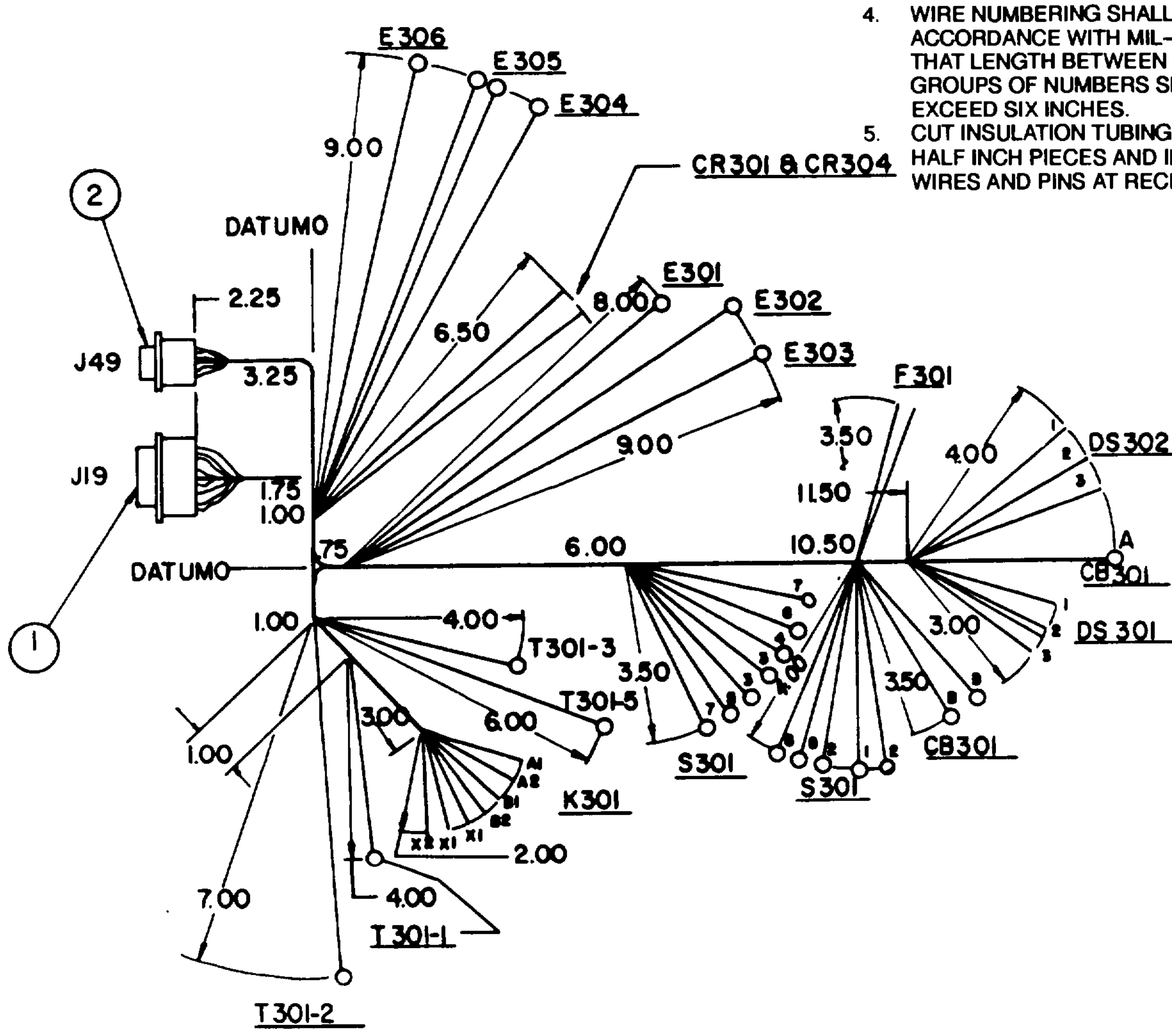


Figure 5-8. Transformer Test Points

WIRE NO.	SIZE REF.	LENGTH REF.	COLOR	FROM	END PREP PREP	TO	END PREP
X9EA12C	12	21.00	BLK MKG	J49-A	SOLDER	CB301–A	(5)
X1OEA16C	16	20.50		CB301-B	(4)	K301–A2	SOLDER
X1OEB16C		7.50		CB301-B	(4)	S301–1	(3)
X11EA16C	16	10.00		J19-L	SOLDER	K301-A1	SOLDER
X12EA12N	12	14.50		J49-B	SOLDER	S301-8	(13)
X13EB16N	16	13.50		J19-B		S301-7	(3)
X14EB16C	16	18.50		J19-M	SOLDER	S301–2	(3)
X14EA16C	16	8.50		S301-2	(3)	F301	SOLDER
X301A16		12.50		T301-3	(4)	CR301	SOLDER
X302A16		14.50		T301–5	(4)	CR304	SOLDER
P90A16		13.50		J19-J	SOLDER	E301	(3)
P90C16		24.50		E302	(3)	DS302-1	SOLDER
P90D16		18.50		E303	(3)	S301–5	(3)
P91A16		12.50		J19 K	SOLDER	E304	(3)
P91C16		13.00		DS302-2	SOLDER	S301-3	(3)
P91D16		25.50		DS301-3	SOLDER	E306	(3)
P91E16		25.50		E305	(3)	DS302-3	SOLDER
P91F16		19.50		E305	(3)	S301–3	(3)
P99B16		20.50		K301–X2	SOLDER	DS301-2	SOLDER
P99A16		12.00	BLK MKG	S301-4	(3)	DS301-2	SOLDER
V64F16		13.50	RED MKG	J19-H	SOLDER	S301-6	(3)
V65F16		10.00	RED MKG	J19-A	SOLDER	K301–X1	SOLDER
V65G16	16	20.50	RED MKG	K301-X1	SOLDER	DS301–1	SOLDER
X13EA16N	16	17.50	BLK MKG	T301-2	(4)	S301-7	(3)
X12EB16N	16	21.50	BLK MKG	K301-B2	SOLDER	S301-8	(3)
X15EA16N	16	11.00	BLK MKG	K301-B1	SOLDER	J19-C	SOLDER
X16EA16C	16	20.50	BLK MKG	F301	SOLDER	T301-1	(4)

Figure 5-9. Electric Winterization Kit Heater Control Assembly, Wiring Harness (Sheet 1 of 2) Drawing No. 70-1233

1. INTERPRET DWG PER MIL-STD-100.
2. ALL WIRES, 6 AND 7, SHALL BE NEATLY LACED INTO HARNESS THROUGH THE USE OF SELF-LOCKING NYLON STRAPS. LACING STRAPS, 8 AND 9, SHALL BE LOCATED AT EACH WIRE BREAKOUT AND AT PERIODIC INTERVALS NOT TO EXCEED THREE INCHES.
3. SOLDERING SHALL BE IN ACCORDANCE WITH REQUIREMENT 5 OF MIL-STD-454.
4. WIRE NUMBERING SHALL BE IN ACCORDANCE WITH MIL-W-5088, EXCEPT THAT LENGTH BETWEEN ADJACENT GROUPS OF NUMBERS SHALL NOT EXCEED SIX INCHES.
5. CUT INSULATION TUBING, 10 AND 11, IN HALF INCH PIECES AND INSTALL AROUND WIRES AND PINS AT RECEPTACLES.



	SYM	CODE IDENT	DWG SIZE	PART OR IDENTIFYING NO.	QTY REQD	NOMENCLATURE OR DESCRIPTION	SPEC	MATERIAL
1					1	CONNECTOR, RECEPTACLE, ELEC		
2					1	CONNECTOR, RECEPTACLE, ELEC		
3					18	TERMINAL, LUG, CRIMP STYLE		
4					6	TERMINAL, LUG, CRIMP STYLE		
5					1	TERMINAL, LUG, CRIMP STYLE		
6					AR	WIRE, AN 16, COLOR WHITE	MIL-W-5086/2	
7					AR	WIRE, AN 12, COLOR WHITE	MIL-W-5086/2	
8					AR	STRAP, CABLE, ADJUSTABLE		
9					AR	STRAP, CABLE, ADJUSTABLE		
10					AR	INSUL, SLEEVING, .125 I.D., BLK	MIL-I-23053/5, CLASS 1	
11					1	INSUL, SLEEVING, .187 I.D., BLK	MIL-I-23053/5, CLASS 1	
13					1	TERMINAL, LUG, CRIMP STYLE		

Figure 5-9. Electric Winterization Kit Heater Control Assembly, Wiring Harness (Sheet 2 of 2) Drawing No. 70-1233

5-10. HEATER ASSEMBLY.

Refer to the Operator and Unit Maintenance Manual for electric winterization kit heater assembly maintenance instructions.

5-11. COOLANT PUMP AND MOTOR ASSEMBLY.

a. Removal. Refer to the Operator and Unit Maintenance Manual for coolant pump and motor assembly removal procedures.

b. Disassembly.

(1) Remove plug (1, figure 5-10), spring (2), and ball (3).

(2) Remove screws (4), port plate (5), O-ring (6), and cam ring (7).

NOTE

Conspicuously mark port plate (5) and cam ring (7) to insure that they will be installed properly during assembly.

(3) Remove setscrew (8), vane (9), rotor (10), and O-ring (11).

(4) Remove adapter (12), O-ring (13), seal cage (14), seal washer (15), and seal spring (16).

(5) Remove cap (17), and brush assembly (18) from motor assembly (19).

c. Cleaning. Inspectlon. and Repair.

WARNING

Solvent, Dry Cleaning P-D-680, Type II is flammable and moderately toxic to skin, eyes and respiratory tract. Eyes and skin protection required. Good general ventilation is normally adequate. Failure to observe this warning could result in servere personal injury or death.

(1) Clean motor assembly with a clean lint-free cloth moistened with solvent P-D-680 Type II.

(2) Wash all parts in dry cleaning solvent (Federal Specification P-D-880) and dry thoroughly.

(3) Inspect and repair pump parts as outlined in paragraph 5-4c. (15) through c. (20).

d. Assemb!y. Assemble coolant pump and motor assembly procedures while observing the following:

(1) Install seal spring (16) and seal washer (15) over end of motor shaft. Place o-ring (13) in seal cage (14), then install seal cage over end of motor shaft with seal face facing forward.

(2) Install adapter (12) over motor shaft and align holes with tapped holes in motor.

(3) Install pump rotor (10) on motor shaft and temporarily tighten rotor setscrew (8). Place cam ring (7) in position aligning scribe marks.

(4) With motor shaft end play taken up in direction of pump, make certain there is at least 0.002 inch clearances between outer face of cam ring and rotor. Loosen setscrew and position rotor if necessary. Remove cam ring.

(5) Install pump vanes (9) into rotor making sure that the grooves in the vane face the direction of rotation.

NOTE

Pump rotates counterclockwise when viewed from the port plate end.

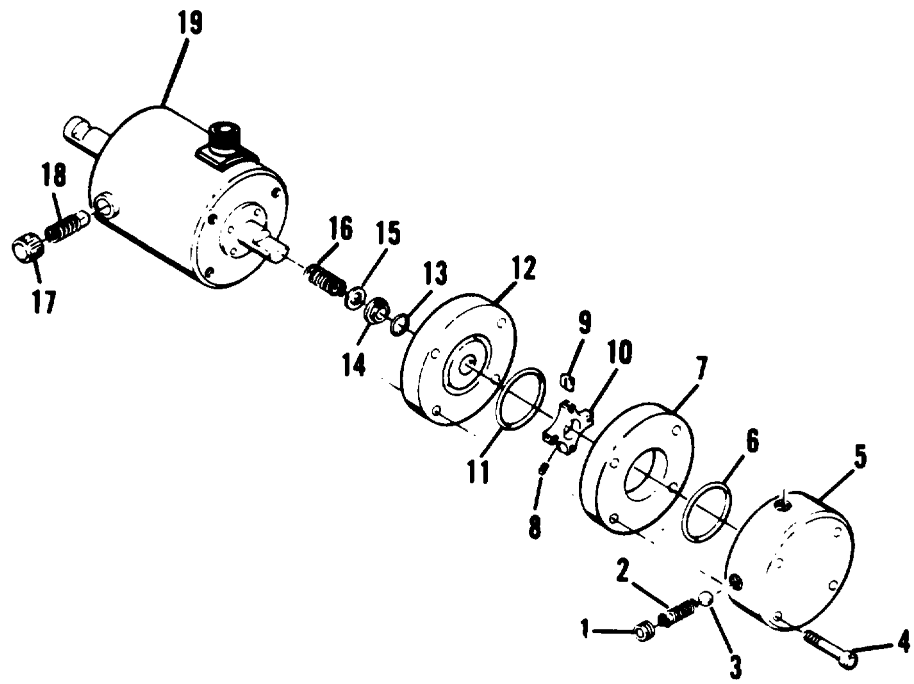
(6) Place o-ring (6) into groove of port plate (5), then position port plate against cam ring (7). Align scribe marks and secure with screws (4).

(7) Install ball (3), spring (2), and plug (1).

e. Testing. Test coolant pump and motor assembly as directed in paragraph 5-4(e) (3).

5-12. COOLANT LINES AND FITTINGS.

Refer to the Operator and Unit Maintenance Manual for electric winterization kit coolant lines and fittings maintenance instructions.



1. Plug
2. Spring
3. Ball
4. Screw
5. Port plate
6. O-ring
7. Cam ring
8. Setscrew
9. Vane
10. Rotor
11. O-ring
12. Adapter
13. O-ring
14. Seal cage
15. Seal washer
16. Spring
17. Cap
18. Brush assembly
19. Motor assembly

Figure 5-10. Coolant Pump and Motor Assembly, Exploded View

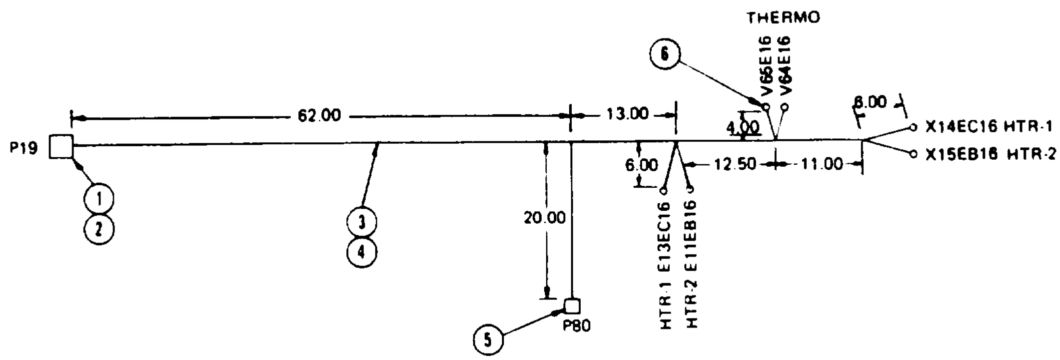
5-13. WIRING HARNESS.

a. Refer to the Operator and Unit Maintenance Manual for wiring harness removal, cleaning, inspection, and repair procedures.

b. If the wiring harness has sustained damage and requires repair or rebuild, refer to figure 5-11 for layout, identification of material requirements and Appendix A reference for detailed soldering and replacement procedures.

c. Refer to Operator and Unit Maintenance Manual for wiring harness installation procedures.

NOTES:
1. ALL SOLDERED CONNECTIONS SHALL BE IN ACCORDANCE WITH MIL–STD–454, REQUIREMENT 5.
2. INSTALL STRAPS, FIND NO. 4, AT 3.0 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.



WIRE MARKING	TERMINATION FROM	FIND NO REF.	TO	FIND NO REF.	WIRE FIND NO.	WIRE LENGTH REF.	WIRE MARKING COLOR
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	HTR1–1	6	3	82.00	BLACK
E11EB16	P19–L	1	HTR1–2	6	3	82.00	BLACK
V64E16	P19–H	1	THERM	6	3	92.50	RED
V65E16	P19–AH	1	THERM	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	SPEC	MATERIAL
1				MS3106R28–9P	1	CONNECTOR, ELECT. P19		
2				MS25251–12	4	PLUG, END SEAL, 12 AWG		
3				M5086/2–16–9	AR	WIRE, ELECT, 16 AWG WHITE	MIL–W–5086/2	
4				MS3367–1–9	AR	STRAP, CABLE, ADJUSTABLE		
5				MS3106R10SL–4S	1	CONNECTOR, ELECT. P80		
6				MS25036–153	6	TERMINAL, LUG		

Figure 5-11. Electric Winterization Kit Wiring Harness, Drawing No. 72-2855

Section III. WHEEL MOUNTING KIT

5-14. GENERAL.

The wheel mounting kit provides added mobility for the generator set. It consists of a front and a rear axle assembly. The front axle assembly is equipped with a tow bar, pintle and safety chains. A lock holds the tow bar in the vertical position when not in use. A mechanical parking brake locks the wheels of the rear axle assembly against rotation. It is actuated by a hand lever located at the right rear of the generator set. The wheel mounting kit provides 8 inches of ground clearance for the generator set.

5-15. WHEEL MOUNTING KIT INSTALLATION AND REMOVAL.

a. Installation

WARNING

Do not use hoisting equipment with maximum capacity less than 5000 pounds. Do not allow generator set to swing while suspended. Failure to observe this warning could result in servere personal injury or death.

WARNING

Do not allow any part of the body to get under the generator set. Serious injury or death may result from failure to observe this warning. Failure to observe this warning could result in servere personal injury or death.

CAUTION

Use a minimum bridle of 5 feet on the hoisting sling to avoid undue side pressure on the lifting frame. Failure to observe this caution could result in equipment damage.

(1) Using suitable hoisting equipment, raise the generator set sufficiently to clear axle assemblies.

(2) Position axle assemblies under generator set.

(3) Lower the generator set until it is just touching axle assemblies.

(4) Install attaching hardware as shown in figure 5-12.

(5) Lower generator set until it is supported on the axle assemblies and remove hoisting equipment.

b. Removal. Remove wheel mounting kit in reverse order of installation procedures.

5-16. WHEELS AND TIRES.

Refer to the Operator and Unit Maintenance Manual for wheels and tires maintenance instructions and alignment procedures.

5-17. WHEEL BEARINGS.

Refer to the Operator and Unit Maintenance Manual for wheel bearing maintenance instructions.

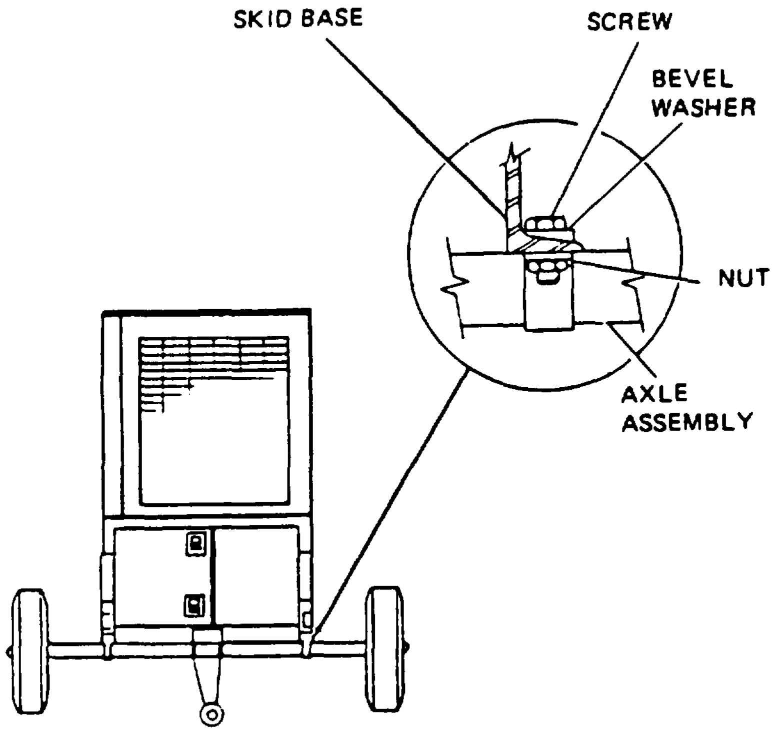


Figure 5-12. Wheel Mounting Kit Installation

5-18. AXLE ASSEMBLIES.

a. Removal. Refer to paragraph 5-15 for axle assembly removal instructions.

b. Disassembly.

NOTE

Disassemble wheel mounting kit only as necessary to replace defective parts.

(1) Refer to the Operator and Unit Maintenance Manual and remove the wheels, tires brakes, and wheel bearings.

(2) Remove nut (1, figure 5-13), rod (2), bolt (3), lockwasher (4), nut (5), spacer (6), cotter pin (7), washer (8), pin (9), hand lever assembly (10), and yoke (11).

(3) Remove cotter pin (12), yoke pin (13), and yoke (14).

(4) Remove nut (15), lockwasher (16), bolt (17), pin (18), level (19), grease fitting (20), and bearing block (21).

(5) Remove nut (22), rod (23), pin (24), and yoke (25).

(6) Remove pin (26), yoke (27), pin (28), lever (29), and cross shaft (30).

(7) Remove nut (31), lockwasher (32), bolt (33), and lever (34).

(8) Remove nut (35), lockwasher (36), bolt (37), backing plate (38) and rear axle (39).

(9) Remove cotter pin (40), nut (41), bolt (42).

(10) Remove cotter pin (46), nut (47), bolt (48), and tie rod end (49), nuts (44 and 45), tube (43) and grease fitting (50).

(11) Remove grease fitting (51), roll pin (52), king pin (53), spindle & knuckle (54).

(12) Remove tie rod end (55), and grease fitting (56).

(13) Remove cotter pin (57), pin (58), spacer washer (59), tow bar assembly (60) and center arm (61).

(14) Remove cotter pin (65), roll pin (62), spring (63), latch (64) hinge pin (66), tow bar (67), front axle (68), safety chain (69), and spindle and knuckle (70).

(15) Remove camshaft (71), hold-down spring (72), return spring (73), brake shoe (74), from brake drum (75).

(16) Remove nuts (76 and 77), lockwashers (78 and 79), screw (80), grease cap (81), cotter pin (82), castellated nut (83), key washer (84), wheel half (85), tire (86), wheel half (87), studs (88), and (89), outer bearing (90), bearing race (91), hub (92), bearing race (93), inner bearing (94), and grease seal (95).

(17) Remove nut (96), lockwasher (97), flatwasher (98), capscrew (99), beveled washer (100).

(18) Remove blind rivet (101) and ID plate (102).

c. Cleaning, Inspection, and Repair

WARNING

Solvent, Dry Cleaning P–D-680, Type II is flammable and moderately toxic to skin, eyes and respiratory tract. Eyes and skin protection required. Good general ventilation is normally adequate. Failure to observe this warning could result in servere personal injury or death.

(1) Clean all parts in dry cleaning solvent (Federal Specification P–D-680) and dry thoroughly.

(2) Inspect axle, tow bar, cross shaft and tube for wear, corrosion, defective paint, and other damage.

(3) Inspect all moving parts for cracks, corrosion, and deep wear patterns. Replace any defective parts.

(4) Inspect safety chains for cracked or broken links. Repair damaged links by welding.

(5) Check all threads for crossing, stripping. and peening.

(6) Replace any damaged or defective parts.

(7) Refer to the Operator and Unit Maintenance Manual for troubleshooting and inspection procedures to determine which parts need replacement.

NOTE

If king pins are excessively worn, perform the following procedures.

(8) Jack the front end of the generator up and place a suitable support under the front axle.

(9) Remove the grease cap (81, figure 5-13), cotter pin (82), castellated nut (83), key washer (84) and remove the wheel, tire, and hub as an assembly.

(10) Remove roll pin (52) and king pin (53).

(11) Install a new king pin and roll pin and install the wheel in reverse order of removal.

(12) Refer to Operator and Unit Maintenance Manual and check wheel alignment.

d. Assembly.

(1) Position ID plate (102, figure 5-13) and secure with rivets (101).

(2) Install beveled washer (100), capscrew (99), flatwasher (98), lockwasher (97) and nut (96).

(3) Install grease seal (95), inner bearing (94), bearing race (93), hub (92), bearing race (91), outer bearing (90), studs (89), and (88), wheel half (87), into tire (86), wheel half (85), key washer (84), castellated nut (83), cotter pin (82), grease cap (81), screw (80), lockwashers (79 and 78), nuts (77 and 76).

(4) Install brake drum (75), brake shoe (74), return spring (73), hold-down spring (72) and camshaft (71).

(5) Install sprindle and knuckle (70), safety chain (69), front axle (68), tow bar (67), hinge pin (66), latch (64), spring (63), roll pin (62) and cotter pin (65).

(6) Install center arm (61), tow bar (60), spacer washer (59), pin (58), cotter pin (57).

(7) Install grease fitting (56), and tie rod end (55).

(8) Install spindle and knuckle (54), king pin (53), roll pin (52), grease fitting (51).

(9) Install grease fitting (50), nuts (44 and 45), tube (43), tie rod end (49), bolt (48), nut (47), and cotter pin (46).

(10) Install bolt (42), nut (41), and cotter pin (40).

(11) Install rear axle (39), backing plate (38), bolt (37), lockwasher (36), and nut (35).

(12) Install lever (34), bolt (33), lockwasher (32) and nut (31).

(13) Install cross shaft (30), lever (29), pin (28), yoke (27), and pin (26).

(14) Install yoke (25), pin (24), rod (23), and nut (22).

(15) Install bearing block (21), grease fitting (20), lever (19), pin (18), bolt (17), lockwasher (16), and nut (15).

(16) Install yoke (14), yoke (13), and cotter pin (12).

(17) Install yoke (11), hand lever assembly (10), pin (9), washer (8), cotter pin (7), spacer (6), nut (5), lockwasher (4), bolt (3), rod (2) and nut (1).

e. Installation. Refer to paragraph 5-15 for wheel mounting kit installation procedures.

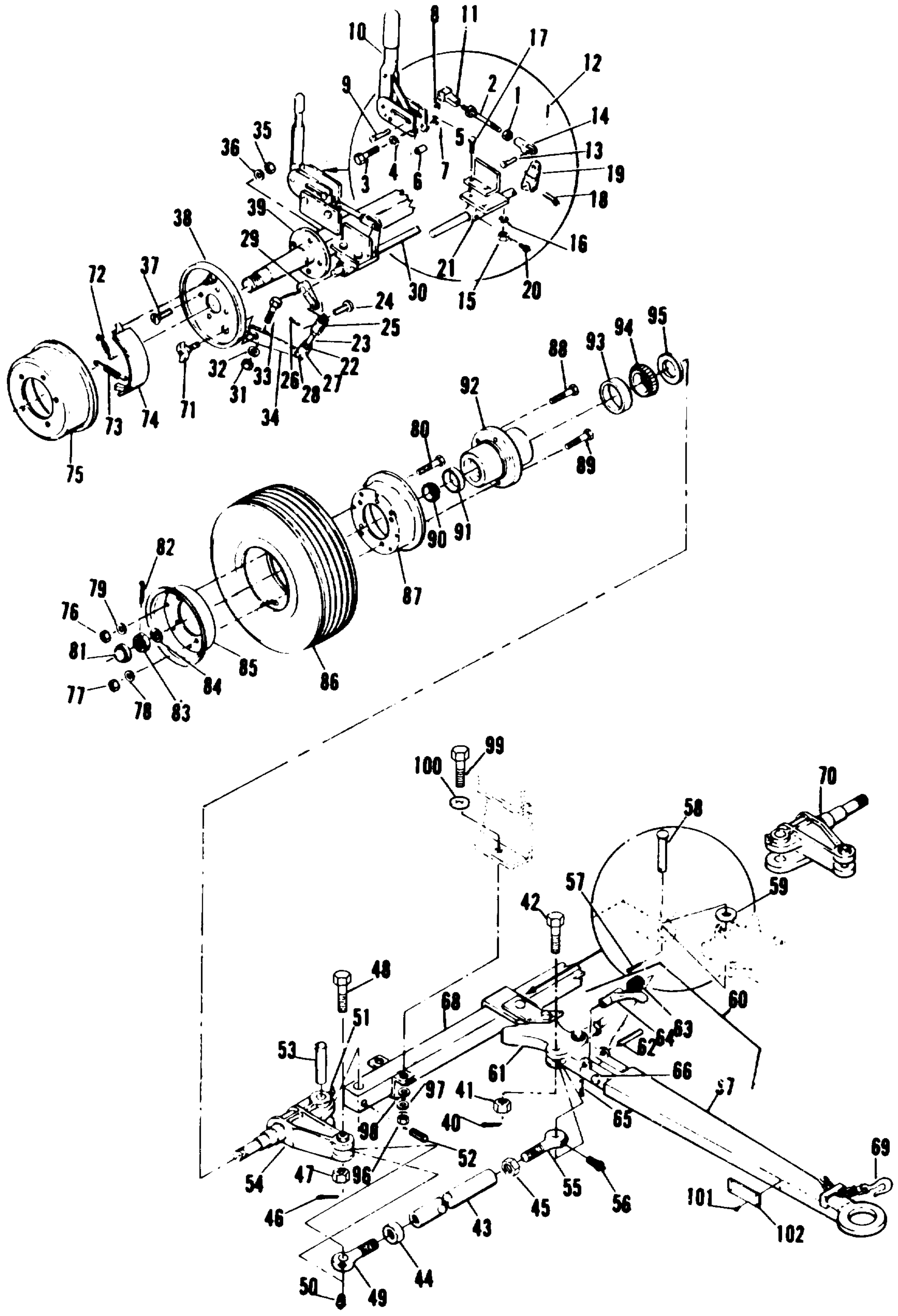


Figure 5-13. Wheel Mounting Kit, Exploded View (Sheet 1 of 2)

1. Nut
2. Rod
3. Bolt
4. Lockwasher
5. Nut
6. Spacer
7. Cotter pin
8. Washer
9. Pin
10. Hand lever assembly
11. Yoke
12. Cotter pin
13. Yoke pin
14. Yoke
15. Nut
16. Lockwasher
17. Bolt
18. Pin
19. Lever
20. Grease fitting
21. Bearing block
22. Nut
23. Rod
24. Pin
25. Yoke
26. Pin
27. Yoke
28. Pin
29. Lever
30. Cross shaft
31. Nut
32. Lockwasher
33. Bolt
34. Lever
35. Nut
36. Lockwasher
37. Bolt
38. Backing plate
39. Rear axle
40. Cotter pin
41. Nut
42. Bolt
43. Tube
44. Nut
45. Nut
46. Cotter pin
47. Nut
48. Bolt
49. Tie rod end
50. Grease fitting
51. Grease fitting
52. Roll pin
53. King pin
54. Spindle & knuckle
55. Tie rod end
56. Grease fitting
57. Cotter pin
58. Pin
59. Spacer washer
60. Tow bar
61. Center arm
62. Roll pin
63. Spring
64. Latch
65. Cotter pin
66. Hinge pin
67. Tow bar
68. Front axle
69. Safety chain
70. Spindle & knuckle
71. Camshaft
72. Hold–down spring
73. Return spring
74. Brake shoe
75. Brake drum
76. Nut
77. Nut
78. Lockwasher
79. Lockwasher
80. Screw
81. Grease cap
82. Cotter pin
83. Castellated nut
84. Key washer
85. Wheel half
86. Tire
87. Wheel half
88. Stud
89. Stud
90. Outer bearing
91. Bearing race
92. Hub
93. Bearing race
94. Inner bearing
95. Grease seal
96. Nut
97. Lockwasher
98. Flat washer
99. Capscrew
100. Beveled washer
101. Blind rivet
102. ID plate

Figure 5-13. Wheel Mounting Kit, Exploded View (Sheet 2 of 2)

Section IV. LOAD BANK

5-19. GENERAL.

The load bank is used to apply up to 50 percent of the generator rated load to prevent carbon buildup in the engine due to light loads. It is a balanced three phase, air cooled, resistive load which maybe operated at either 120/208 or 240/416 volts. Generator load is selected through the load selector switch in increments of 12.5 percent rated generator load.

5-20. CONTROL BOX ASSEMBLY.

a. Removal. Refer to the Operator and Unit Maintenance Manual for control box assembly removal procedures.

b. Disassembly.

(1) Remove load selector switch, circuit breaker, and indicator light as instructed in the Operator and Unit Maintenance Manual.

(2) Remove screw and captive washer assemlby (1, figure 5-14), and backup plate (2).

(3) Remove nut (3), screw & captive washer assembly (4), and branched wiring harness (5).

(4) Remove nut (6), screw & captive washer assembly (7), and branched wiring harness (12).

(5) Remove protective cap (8).

(6) Remove nut (9), and screw & captive washer assembly (10).

(7) Remove protective cap (11).

(8) Remove screw & captive washer (13), and load sensing module (14).

(9) Remove nut (15), tooth Iockwasher (16), mode selector switch (17), and nut (18).

(10) Remove nut (19), screw & captive washer (20), transformer (21), and chassis (22).

c. Cleaning, Inspection, and Repair.

WARNING

Compressed air used for cleaning and drying purposes can create airborne particles that may enter the eyes. Pressure shall not exceed 30 psig and use only with adequate chip guards and chipping goggles. Failure to observe this warning could result in servere personal injury or death.

WARNING

Solvent, Dry Cleaning P–D-680, Type II is flammable and moderately toxic to skin, eyes and respiratory tract. Eyes and skin protection required. Good general ventilation is normally adequate. Failure to observe this warning could result in servere personal injury or death.

(1) Clean all electrical parts with filtered compressed air and a soft bristle brush. If necessary, remove caked deposits with a clean, lint-free cloth moistened with solvent P-D-680 Type Il.

(2) Clean chassis and back plate with dry cleaning solvent (Federal Specification P-D-680) and dry thoroughly.

(3) Inspect load sensing module for cracks, corroded terminals, and burns or other evidence of shorting.

(4) Inspect mode selector switch for cracks, corrosion and other damage. Check switch continuity using an ohmmeter.

(5) Inspect transformer for cracks, corrosion and burns or other evidence of shorting. Using an ohmmeter, check transformer coils for continuity.

(6) Refer to the Operator and Unit Maintenance Manual for wiring harness cleaning, inspection, and repair procedures.

(7) If the wiring harnesses have sustained damage and require repair or rebuild, refer to figures 5-15, 5-16 or 5-17 as required, for layout, identification of material requirements and Appendix A reference for detailed soldering and replacement procedures.

(8) Inspect back plate and chassis for cracks, corrosion, warping and other damage.

(9) Check all hardware for crossed, stripped, and otherwise damaged threads.

(10) Replace all defective parts and parts damaged beyond repair.

d. Assembly.

(1) Install chassis (22, figure 5-14), transformer (21), screw & captive washer (20), and nut (19).

(2) Install nut (18), mode selector switch (17), tooth Iockwasher (16) and nut (15).

(3) Install load sensing module (14), and screw &captive washer (13).

(4) Install protective cap (11).

(5) Install screw & captive washer (10) and nut (9).

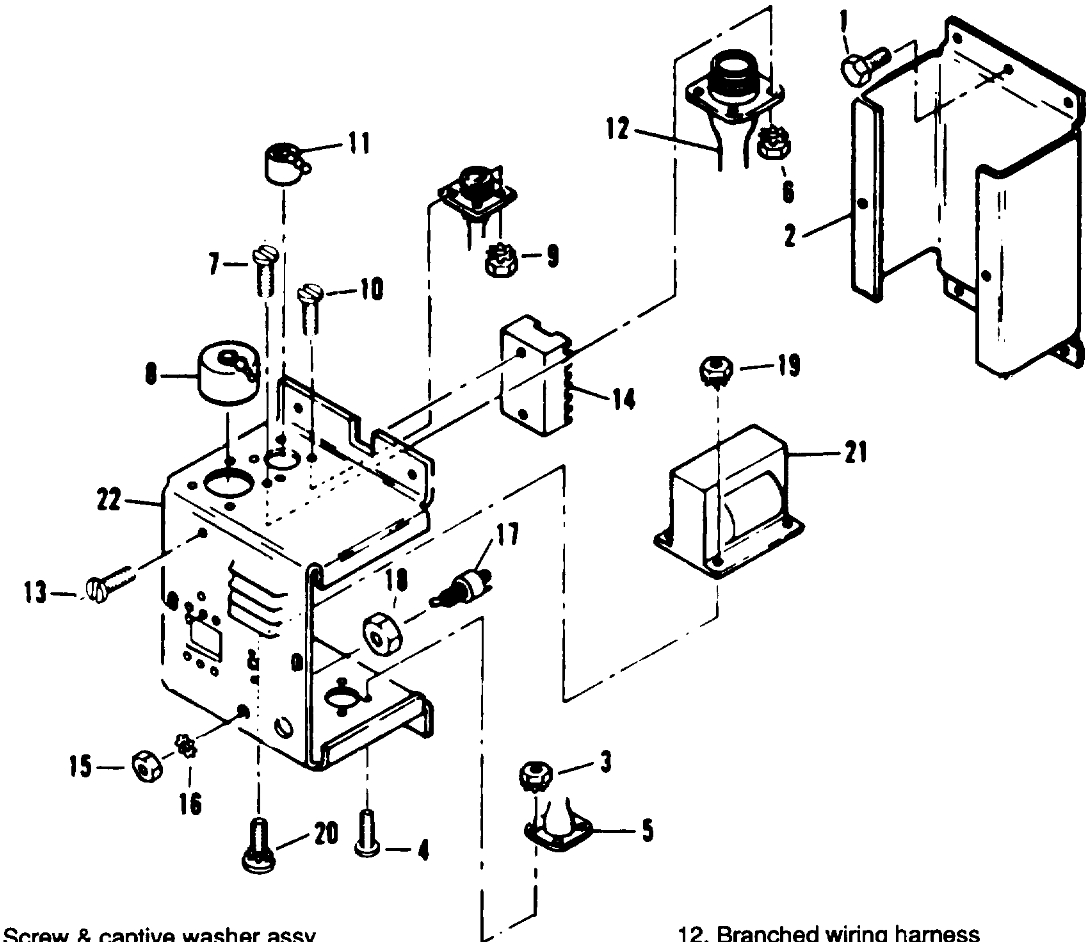
(6) Install protective (8).

(7) Position branched wiring harness (12) to install screw & captive washer assembly (7) and nut (6).

(8) Install branced wiring harness (5), screw & captive washer assembly (4), and nut (3).

(9) Install backup plate (2), screw and captive washer (1).

e. Installation. Refer to the Operator and Unit Maintenance Manual for load bank control box assembly installation procedures.



1. Screw & captive washer assy
2. Backup plate
3. Nut
4. Screw & captive washer assy
5. Branched wiring harness
6. Nut
7. Screw & captive washer assy
8. Protective cap
9. Nut
10. Screw & captive washer assy
11. Protective cap
12. Branched wiring harness
13. Screw & captive washer assy
14. Load sensing module
15. Nut
16. Tooth lockwasher
17. Mode selector switch
18. Nut
19. Nut
20. Screw & captive washer assy
21. Transfomer
22. Chassis

Figure 5-14. Load Bank Control Box Assembly, Exploded View

5-21. LOAD BANK HOUSING.

a. Removal. Refer to the Operator and Unit Maintenance Manual for load bank housing removal instructions.

b. Disassembly.

(1) Remove control box assembly (paragraph 5-20),

(2) Remove heater strips, thermostat and terminal board as outlined in the Operator and Unit Maintenance Manual.

(3) Remove nut (1, figure 5-17), screw and captive washer assembly (2), and protective cap (3).

(4) Remove nut (4), screw and captive washer assembly (5), top load bank wiring harness (7).

(5) Remove split grommet (9), load bank wiring harness (6), and bottom load bank wiring harness (8) from housing assembly (10).

c. Cleaning, Inspection, and Repair.

(1) Clean housing in dry cleaning solvent (Federal Specification P-D-680) and dry with compressed air.

(2) Refer to the Operator and Unit Maintenance Manual for wiring harness cleaning, inspection, and repair procedures.

(3) If the wiring harnesses have sustained damage and require repair or rebuild, refer to figures 5-18, 5-19, or 5-20 as required, for layout, identification of material requirements and Appendix A references for detailed soldering and replacement procedures.

(4) Inspect housing assembly for cracks, breaks, warping and other damage. Replace housing assembly if damaged beyond repair.

d. Assembly.

(1) Position housing assembly (10, figure 5-17), to install bottom load bank wiring harness (8), and load bank wiring harness (6), with grommets (9).

(2) Install top load bank wiring harness (7), screw and captive washer assembly (5), and nut (4).

(3) Install protective cap (3), screw and captive washer assembly (2), and nut (1).

(4) Install heater strips, thermostat and terminal board as outlined in the Operator and Unit Maintenance Manual.

(5) Install control box assembly (paragraph 5-20).

e. Installation. Refer to the Operator and Unit Maintenance Manual for load bank housing installation instructions.

5-22. WIRING HARNESSES.

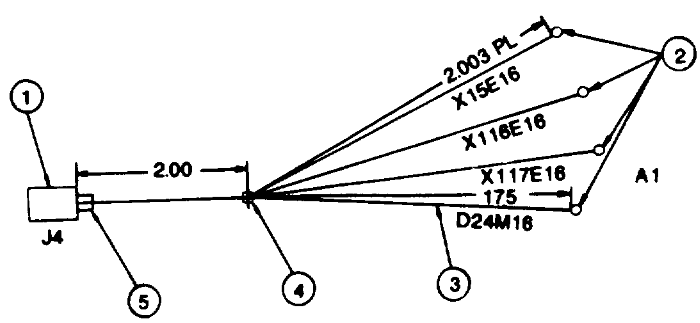
a. Refer to the Operator and Unit Maintenance Manual for wiring harness removal, cleaning, inspection, and repair procedures.

b. If the wiring harness has sustained damage and requires repair or rebuild, refer to figure 5-21 or 5-22 for layout, identification, and material requirements and Appendix A for detailed soldering and replacement procedures.

c. Refer to the Operator and Unit Maintenance Manual for wiring harness installation instructions.

WIRE MARKING	TERMINATION FROM	FIND NO REF.	TO	FIND NO REF.	WIRE FIND NO	WIRE LENGTH REF.	WIRE MARKING COLOR
X115E16	J4–A	1	A1–12	2	3	4.00	BLACK
X116E16	J4–B	1	A1–11	2	3	4.00	BLACK
X117E16	J4–C	1	A1–10	2	3	4.00	BLACK
D24M16	J4–D	1	A1–8	2	3	3.75	BLACK

NOTES:
1. INTERPRET DRAWING PER MIL–STD–100.
2. SOLDERING SHALL BE IN ACCORDANCE WITH MIL–STD–454, REQUIREMENT 5.
3. CRIMPED TERMINALS SHALL MEET THE PERFORMANCE REQUIREMENTS OF MIL–T–7928.
4. WIRE MARKING TO BE IN ACCORDANCE WITH MIL–W–5088 EXCEPT THAT LENGTH BETWEEN GROUPS OF NUMBERS SHALL NOT EXCEED 6.00 INCHES.
5. REFERENCE:
   WIRING DIAGRAM: 72–2826
   SCHEMATIC DIAGRAM: 72–2827
6. INSTALL STRAP, FIND NO. 4, AT EACH CABLE BREAKOUT.
7. INSTALL INSULATION SLEEVING .75 LONG FIND NO. 5, OVER EACH CONDUCTOR AT CONNECTOR FIND NO. 1.



FIND NO.	SYM	CODE IDENT	DWG SIZE	PART OR IDENTIFYING NO.	QTY REQD	NOMENCLATURE OR DESCRIPTION	SPEC	MATERIAL
1				MS3102R18–4P	1	CONNECTOR, RECEPTACLE J4		
2				MS25036–106	4	TERMINAL LUG, NO. 8 STUD, 16 AWG		
3				M5086–2–16	AR	WIRE, ELECTRICAL NO. 16 AWG	MIL–W–5086–2	
4				MS3367–5–9	AR	STRAP, ADJUSTABLE	MIL–S–23190	
5				CLASS 1, .125 ID	AR	INSULATION TUBING, FROM Ua	MIL–I–631	

Figure 5-15. Control Box Assembly Wiring Harness, Drawing No. 72-2868

NOTES:

1. INTERPRET DRAWING PER MIL–STD–100.
2. SOLDERING SHALL BE IN ACCORDANCE WITH MIL–STD–454, REQUIREMENT 5.
3. CRIMPED TERMINALS SHALL MEET THE PERFORMANCE REQUIREMENTS OF MIL–T–7928.
4. STRIP WIRES X13HH16, X123A16, X124A16 AND X69B16, 1/4 INCH AND SOLDER PER NOTE 2.
5. WIRE MARKING TO BE IN ACCORDANCE WITH MIL–W–5088 EXCEPT THAT LENGTH BETWEEN GROUPS OF NUMBERS SHALL NOT EXCEED 6.00 INCHES.
6. REFERENCE:
   WIRING DIAGRAM: 72–2826
   SCHEMATIC DIAGRAM: 72–2827
7. INSTALL STRAPS, FIND NUMBERS 9 AND 10, AT 3.0 INCH INTERVALS AND AT EACH CABLE BREAK–OUT.
8. THE WIRE END OF CONNECTOR J5 SHALL BE SEALED ALONG THE HARNESS WITH FIND NUMBER 11 FOR NOT LESS THAN 1" FROM THE CONNECTOR SHOULDER.
9. INSTALL INSULATION FIND NUMBER 9, OVER EACH CONDUCTOR AT CONNECTOR, FIND NUMBER 1.

WIRE MARKING	FROM	TERMINATION			WIRE FIND NO REF.	WIRE LENGTH REF.	MARKING COLOR
		FIND NO REF.	TO	FIND NO REF.			
X21A8	J3–A	1	CB1–A2	5	7	7.00	BLACK
X22A8	J3–B	1	CB1–B2	5	7	7.00	BLACK
X23A8	J3–C	1	CB1–C2	5	7	7.75	BLACK
X13JJ8	J3–D	1	J5–X	2	7	10.00	BLACK
X51C16	J5–A	2	S1–35	4	6	3.50	BLACK
X50C16	J5–B	2	S1–34	4	6	11.50	BLACK
X49C16	J5–C	2	S1–33	4	6	10.50	BLACK
X48C16	J5–D	2	S1–32	4	6	9.25	BLACK
X47C16	J5–E	2	S1–25	4	6	7.50	BLACK
X46C16	J5–F	2	S1–24	4	6	12.25	BLACK
X45C16	J5–G	2	S1–23	4	6	10.25	BLACK
X44C16	J5–H	2	S1–22	4	6	9.75	BLACK
X43C16	J5–I	2	S1–15	4	6	8.00	BLACK
X42C16	J5–J	2	S1–14	4	6	11.50	BLACK
X41C16	J5–K	2	S1–13	4	6	10.25	BLACK
X40C16	J5–L	2	S1–12	4	6	9.00	BLACK
X60C16	J5–O	2	DS1	3	6	4.00	BLACK
X68C16	J5–S	2	S3–6	3	6	5.50	BLACK
X13HH16	J5–U	2	T1–2		6	4.25	BLACK
X13GG16	J5–V	2	DS1	3	6	4.50	BLACK
X23B16	J5–P	2	CB1–C2	10	6	11.75	BLACK
X11C16	J5–T	2	S3–4	3	6	4.75	BLACK
X120A8	CB1–A1	5	S1–11	5	7	7.75	BLACK
X121A8	CB1–B1	5	S1–21	5	7	7.75	BLACK
X122A8	CB1–C1	5	S1–31	5	7	7.75	BLACK
D24N16	S2	3	A1–8	3	6	12.00	BLACK
P33A16	S2	3	A1–6	3	6	12.00	BLACK
X69B16	S3–5	3	T1–1	–	6	7.00	BLACK
P32A16	CB1–X1	3	A1–3	3	6	10.00	BLACK
P29A16	S3–3	3	A1–1	3	6	9.50	BLACK
P30A16	S3–1	3	A1–9	3	6	11.75	BLACK
X123A16	T1–3	–	A1–4	3	6	11.25	BLACK
X124A16	T1–4	–	A1–5	3	6	11.25	BLACK
P32B16	S3–2	3	A1–3	3	6	11.75	BLACK
P31B16	CB1–X2	3	A1–2	3	6	9.00	BLACK

FIND NO.	SYM	CODE IDENT	DWG SIZE	PART OR IDENTIFYING NO.	QTY REQD	NOMENCLATURE OR DESCRIPTION	SPEC	MATERIAL
1				MS3102R32–17P	1	CONNECTOR RECEPTACLE J3		
2				MS3102R32–6P	1	CONNECTOR RECEPTACLE J5		
3				MS25036–106	21	TERMINAL LUG, NO. 6 STUD, NO. 16 AWG		
4				MS25036–153	12	TERMINAL LUG, NO. 8 STUD, NO. 16 AWG		
5				MS25036–115	9	TERMINAL LUG, NO. 10 STUD, NO. 8 AWG		
6				M5086/2–16–9	AR	WIRE, ELECTRICAL, NO. 16 AWG	MIL–W–5086/2	
7				M5086/2–8–9	AR	WIRE, ELECTRICAL, NO. 8 AWG	MIL–W–5086/2	
8				MS3367–5–9	AR	STRAP, ADJUSTABLE	MIL–S–23910	
12	C		B	CLASS 1, 2.0 ID	2"	INSULATION TUBING	MIL–I–23053	
9				CLASS 1, .5 ID	AR	INSULAT'ON TUBING	MIL–I–23053	
10				MS25036–108	1	TERMINAL LUG, NO. 10 STUD, NO. 16 AWG		
11	C		B	72–2806	AR	SEALING COMPOUND, SILICONE RUBBER		

Figure 5-16. Control Box Assembly Branched Wiring Harness (Sheet 1 of 2), Drawing No. 72-2828

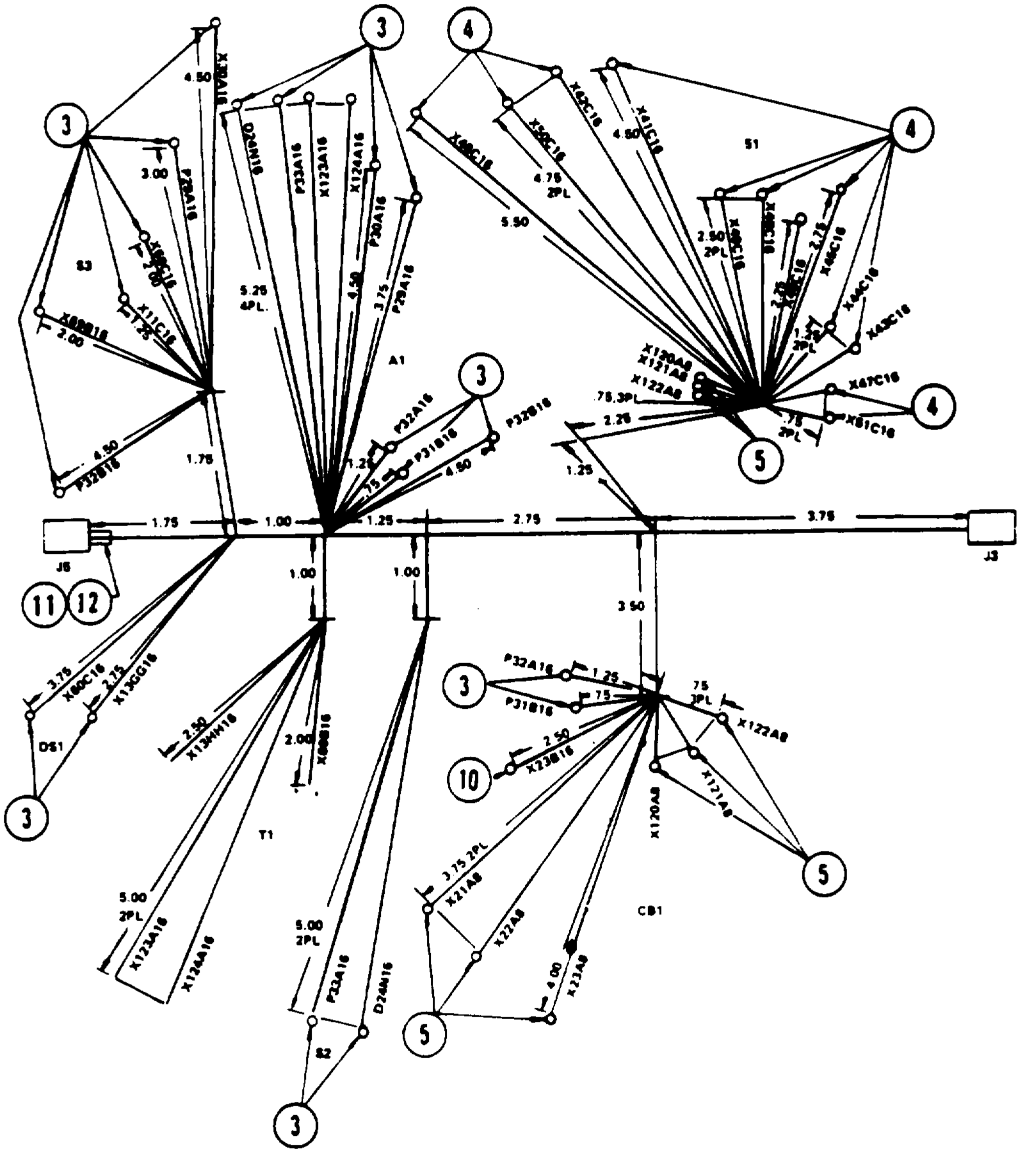


Figure 5-16. Control Box Assembly Branched Wiring Harness (Sheet 2 of 2), Drawing 72-2828

1. Nut
2. Screw & captive washer assy
3. Protective cap
4. Nut
5. Screw & captive washer assy
6. Load bank wiring
7. Top load bank wiring harness
8. Bottom load bank wiring harness
9. Split grommet
10. Housing assembly

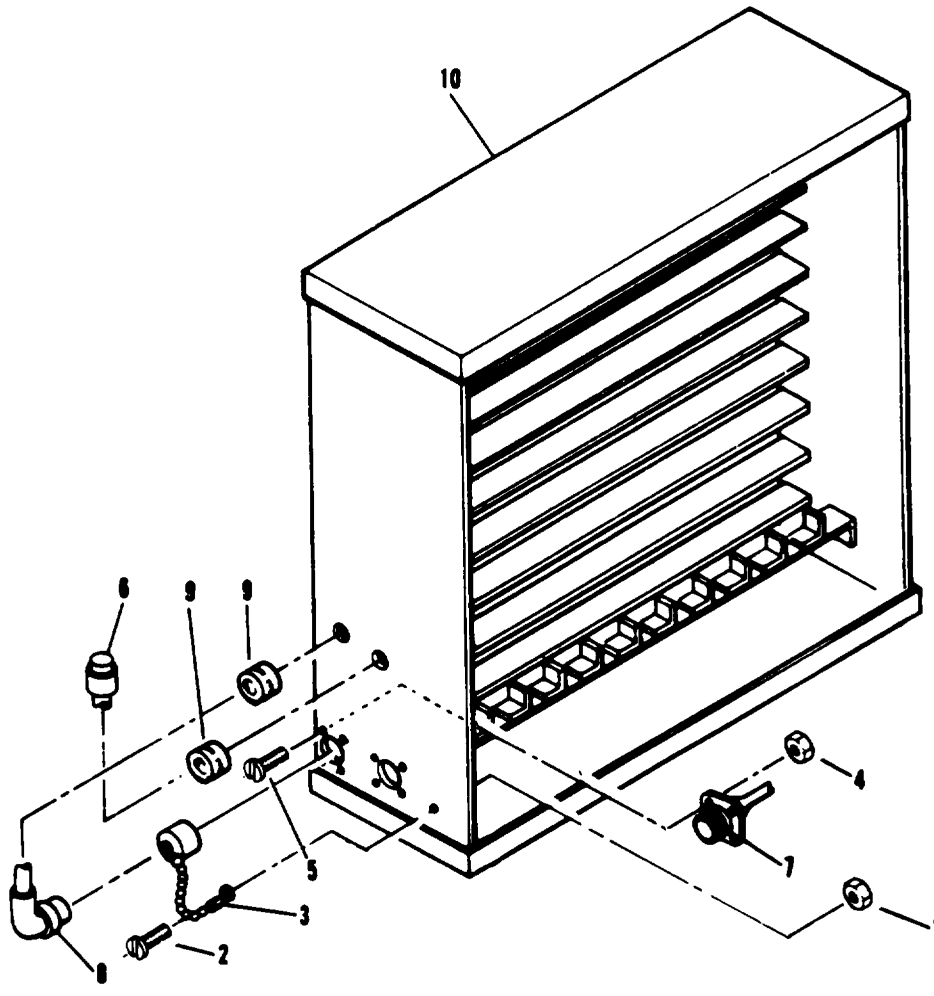


Figure 5-17. Load Bank Housing, Exploded View

NOTES:
1. INTERPRET DRAWING PER MIL–STD–100.
2. ALL SOLDERD CONNECTIONS SHALL BE IN ACCORDANCE WITH MIL–STD–454, REQUIREMENT 5. USING SOLDER FIND NO. 8.
3. INSTALL STRAPS, FIND NO. 7, AT APPROXIMATELY 2.5 INTERVALS AND AT EACH CABLE BREAK–OUT.
4. WIRE MARKING TO BE IN ACCORDANCE WITH MIL–W–5088 EXCEPT THAT LENGTH BETWEEN GROUPS OF NUMBERS SHALL NOT EXCEED 6 INCHES.
5. CRIMPED TERMINALS SHALL MEET THE PERFORMANCE REQUIREMENTS OF MIL–T–7928.
6. STRIP .25 EACH WIRE WITHOUT TERMINATION AND TIN IN ACCORDANCE WITH MIL–STD–454, REQUIREMENT 5.
7. REFERENCES:
   a) FOR WIRING DIAGRAM SEE DRAWING 72–2826.
   b) FOR SCHEMATIC DIAGRAM SEE DRAWING 72–2827.

WIRE MARKING	TERMINATION				WIRE FIND NO.	WIRE LENGTH REF.	MARKING COLOR
	FROM	FIND NO REF.	TO	FIND NO REF.			
X51B16	P2–A	1	R24–2	4	6	52.75	BLACK
X50B16	P2–B	1	R22–2	4	6	51.00	BLACK
X49B16	P2–C	1	R20–2	4	6	49.25	BLACK
X48B16	P2–D	1	R18–2	4	6	47.50	BLACK
X47B16	P2–E	1	R16–2	4	6	45.75	BLACK
X46B16	P2–F	1	R14–2	4	6	44.00	BLACK
X45B16	P2–G	1	R12–2	4	6	42.25	BLACK
X44B16	P2–H	1	R10–2	4	6	40.50	BLACK
X43B16	P2–I	1	R8–2	4	6	38.75	BLACK
X42B16	P2–J	1	R6–2	4	6	37.00	BLACK
X41B16	P2–K	1	R4–2	4	6	35.25	BLACK
X40B16	P2–L	1	R2–2	4	6	33.50	BLACK
X60B16	P2–O	1	R9–1	4	6	29.00	BLACK
X13D16	P2–U	1	BUSS	4	6	32.00	BLACK
X13E16	P2–V	1	BUSS	4	6	32.00	BLACK
X68B16	P2–S	1	R17–1	4	6	36.00	BLACK
X13C6	PS–X	1	BUSS	3	5	30.75	BLACK
X23C16	P2–P	1	P1–d	–	6	31.00	BLACK
X11B16	P2–T	1	P1–b	–	6	31.00	BLACK

FIND NO.	SYM	CODE IDENT	DWG SIZE	PART OR IDENTIFYING NO.	QTY REQD	NOMENCLATURE OR DESCRIPTION	SPEC	MATERIAL
1				MS3106F32–6S	1	CONNECTOR, PLUG, ELECT. STRAIGHT		
2				CLASS 1, 1.00 ID	AR	INSUL. SLVG. ELECT. HEAT SHRINKABLE FLEX. POLYOLEFIN, CROSSLINKED	MIL–I–23053/5	
3				MS20659–130	1	TERMINAL LUG, CRIMP STYLE, COP, RING TONGUE, BELL MOUTHED, TYPE I, CLASS 1 NO. 10 STUD, NO. 6 AWG WIRE		
4				MS20659–104	16	TERM, LUG, CRP. STYLE COP. RING TONGUE BELL MOUTHED TYPE I, CLASS 1, NO. 10 STUD, NO. 16 AWG WIRE		
5				MS17412–6	AR	WIRE ELECT. , FLUOROCARBON INSUL. ABRASION RES, EXTRUDED TFE NKL. CTD. COP. NO. 6 AWG		
6				MS17412–16	AR	WIRE, ELECT, FLUOROCARBON INSUL. ABRASION RES, EXTRUDED TFE. NKL. CTD. COP. NO. 16 AWG		
7				MS3367–5–9	AR	STRAP TIEDOWN ADJUSTABLE SELF– CLINCHING PLASTIC TYPE I CLASS 1		
8				MS25251–8	3	PLUG END SEAL		

NOTES: (CONTINUED)
8. FOR FULL SIZE HARNESS BOARD LAYOUT SEE DRAWING 72–2823.
9. MARK WITH "36024–72–2826" IN ACCORDANCE WITH MIL–STD–130.

Figure 5-18. Load Bank Wiring Harness (Sheet 1 of 2), Drawing No. 72-2823

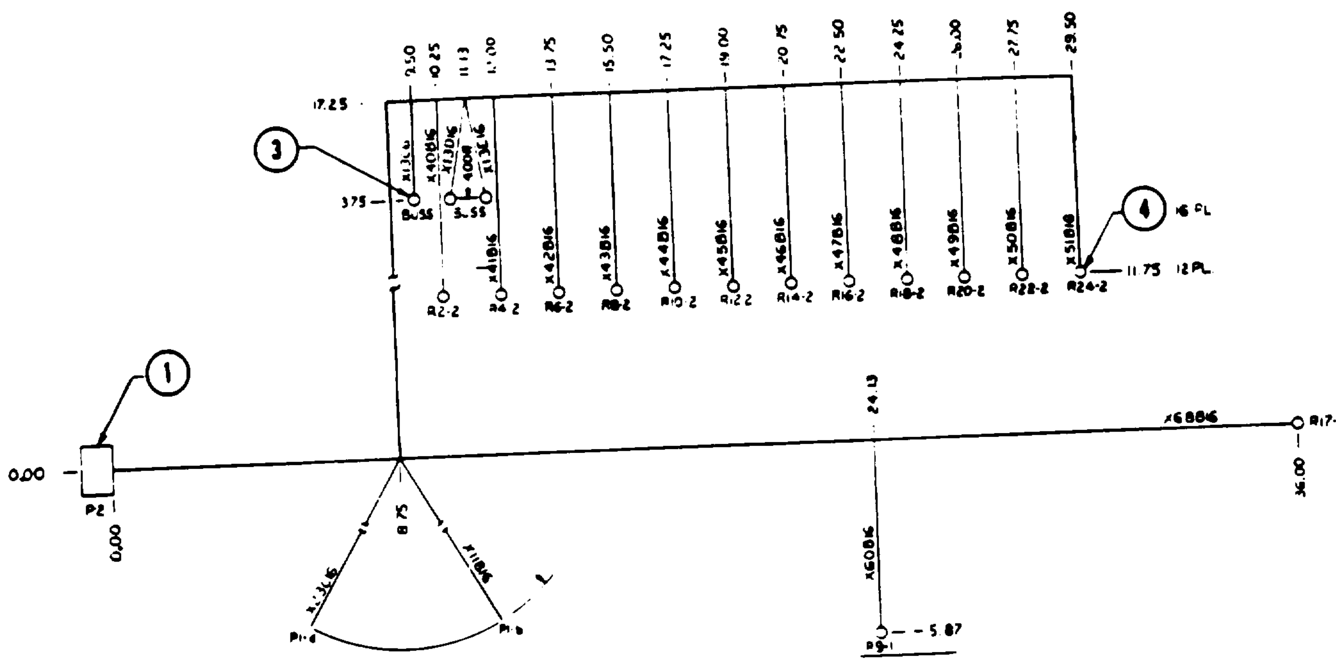
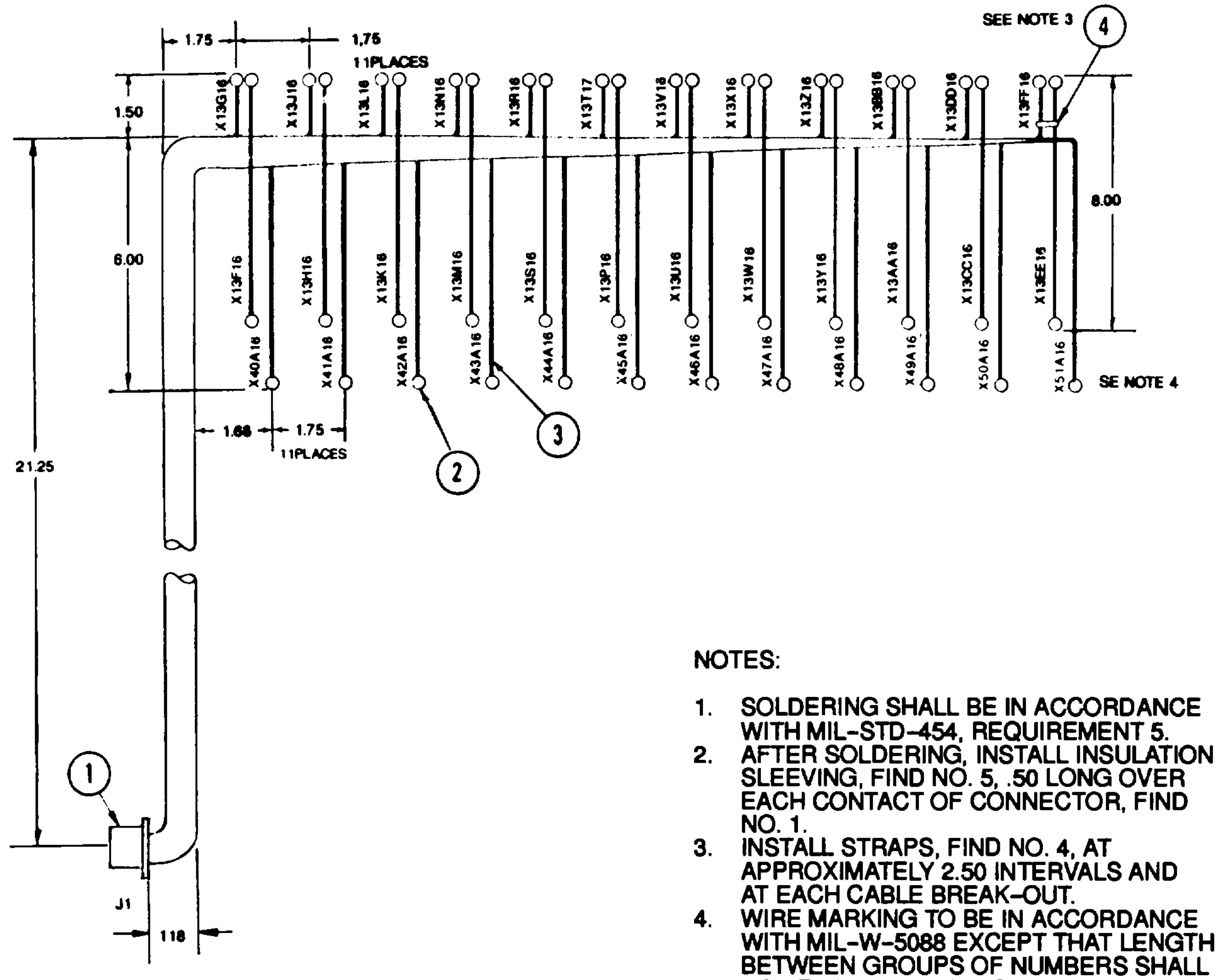


Figure 5-18. Load Bank Wiring Harness (Sheet 2 of 2), Drawing No. 72-2823



NOTES:

1. SOLDERING SHALL BE IN ACCORDANCE WITH MIL-STD-454, REQUIREMENT 5.
2. AFTER SOLDERING, INSTALL INSULATION SLEEVING, FIND NO. 5, .50 LONG OVER EACH CONTACT OF CONNECTOR, FIND NO. 1.
3. INSTALL STRAPS, FIND NO. 4, AT APPROXIMATELY 2.50 INTERVALS AND AT EACH CABLE BREAK-OUT.
4. WIRE MARKING TO BE IN ACCORDANCE WITH MIL-W-5088 EXCEPT THAT LENGTH BETWEEN GROUPS OF NUMBERS SHALL NOT EXCEED 6 INCHES.
5. CRIMPED TERMINALS SHALL MEET THE PERFORMANCE REQUIREMENTS OF MIL-T-7928.
6. INTERPRET DRAWING PER MIL-STD-100.
7. FOR WIRING DIAGRAM, SEE DRAWING 72-2826.
8. FOR SCHEMATIC DIAGRAM, SEE DRAWING 72-2827.

FIND NO.	SYM	CODE IDENT	DWG SIZE	PART OR IDENTIFYING NO.	QTY REQD	NOMENCLATURE OR DESCRIPTION	SPEC	MATERIAL
1				MS3102R28-12P	1	CONNECTOR, RECEPTACLE, ELECT. J1		
2				MS20659-104	48	TEMINAL, LUG, 16 AWG WIRE, NO. 10 STUD		
3				MS22759/6-16-9	AR	WIRE, ELECT. 16 AWG, EXTRUDED TEE	MIL-W-22759/6	
4				MS3667-5-9	AR	STRAP, TIEDOWN, ADJUSTABLE		
5				CLASS 1, CLEAR	AR	SLVG, INSUL .187 ID HEAT SHRINKABLE	MIL-I-23053/5	

Figure 5-19. Top Load Bank Wiring Harness (Sheet 1 of 2), Drawing No. 72-2822

	TERMINATION		TERMINATION				
WIRE NO.	FROM	FIND NO REF.	TO	FIND NO REF.	WIRE FIND NO	WIRE LENGTH REF.	MARKING COLOR
X132A16	J1–b	1	J1–d	1	3	4.00	BLACK
X40A16	J1–A	1	R2–2	2	3	30.00	BLACK
X13G16	J1–B	1	BUSS	2	3	25.50	BLACK
X41A16	J1–C	1	R4–2	2	3	31.75	BLACK
X13J16	J1–D	1	BUSS	2	3	27.75	BLACK
X42A16	J1–E	1	R6–2	2	3	33.50	BLACK
X13L16	J1–F	1	BUSS	2	3	29.00	BLACK
X43A16	J1–G	1	R8–2	2	3	35.25	BLACK
X13N16	J1–H	1	BUSS	2	3	30.75	BLACK
X44A16	J1–J	1	R10–2	2	3	27.00	BLACK
X13R16	J1–K	1	BUSS	2	3	32.50	BLACK
X45A16	J1–L	1	R12–2	2	3	38.75	BLACK
X13T16	J2–M	1	BUSS	2	3	34.25	BLACK
X46A16	J1–N	1	R14–2	2	3	40.50	BLACK
X13V16	J1–P	1	BUSS	2	3	36.00	BLACK
X47A16	J1–R	1	R16–2	2	3	42.25	BLACK
X13X16	J1–S	1	BUSS	2	3	37.75	BLACK
X48A16	J1–T	1	R18–2	2	3	44.00	BLACK
X13Z16	J1–U	1	BUSS	2	3	39.50	BLACK
X49A16	J1–V	1	R20–2	2	3	45.75	BLACK
X13BB1	J1–W	1	BUSS	2	3	41.25	BLACK
X50A16	J1–X	1	R22–2	2	3	47.50	BLACK
X13DD16	J1–Y	1	BUSS	2	3	43.00	BLACK
X51A16	J1–Z	1	R24–2	2	3	49.25	BLACK
X13FF16	J1–a	1	BUSS	2	3	44.75	BLACK
X13F16	BUSS	2	R1–2	2	3	6.00	BLACK
X13H16	BUSS	2	R3–2	2	3	6.00	BLACK
X13K16	BUSS	2	R5–2	2	3	6.00	BLACK
X13M16	BUSS	2	R7–2	2	3	6.00	BLACK
X13P16	BUSS	2	R9–2	2	3	6.00	BLACK
X13S16	BUSS	2	R11–2	2	3	6.00	BLACK
X13U16	BUSS	2	R13–2	2	3	6.00	BLACK
X13W16	BUSS	2	R15–2	2	3	6.00	BLACK
X13Y16	BUSS	2	R17–2	2	3	6.00	BLACK
X13AA16	BUSS	2	R19–2	2	3	6.00	BLACK
X13CC16	BUSS	2	R21–2	2	3	6.00	BLACK
X13EE16	BUSS	2	R23–2	2	3	6.00	BLACK

Figure 5-19. Top Load Bank Wiring Harness (Sheet 2 of 2) Drawing No. 72-2822

NOTES:

1. INTERPRET DRAWING PER MIL–STD–100.
2. SOLDERING SHALL BE IN ACCORDANCE WITH MIL–STD–454, REQUIREMENT 5.
3. INSTALL STRAPS, FIND NO. 7, AT APPROXIMATELY 2.50 INTERVALS AND AT EACH CABLE BREAK–OUT.
4. WIRE MARKING TO BE IN ACCORDANCE WITH MIL–W–5088 EXCEPT THAT LENGTH BETWEEN GROUPS OF NUMBERS SHALL EXCEED 6.00 INCHES.
5. CRIMPED TERMINAL SHALL MEET THE PERFORMANCE REQUIREMENTS OF MIL–T–7928.
6. FOR WIRING DIAGRAM SEE DRAWING 72–2826.
7. FOR SCHEMATIC DIAGRAM SEE DRAWING 72–2827.
8. INSTALL PLUG FIND NO. 8 IN UNUSED PINS OF CONNECTOR FIND NO. 1.
9. AFTER SOLDERING INSTALL INSULATION SLEEVING, FIND NO. 4 .50 LONG OVER EACH CONTACT OF CONNECTOR, FIND NO. 1.

WIRE MARKING	TERMINATION				WIRE FIND NO.	WIRE LENGTH REF.
	FROM	FIND NO REF.	TO	FIND NO REF.		
X52A16	P1–A	1	R1–1	6	5	25.00
X5316	P1–B	1	R2–1	6	5	25.85
X54A16	P1–C	1	R3–1	6	5	26.75
X55A16	P1–D	1	R4–1	6	5	27.60
X56A16	P1–E	1	R5–1	6	5	26.50
X57A16	P1–F	1	R6–1	6	5	29.35
X58A16	P1–G	1	R7–1	6	5	30.25
X59A16	P1–H	1	R8–1	6	5	31.10
X60A16	P1–J	1	R9–1	6	5	32.00
X61A16	P1–K	1	R10–1	6	5	32.85
X62A16	P1–L	1	R11–1	6	5	33.75
X63A16	P1–M	1	R12–1	6	5	34.60
X64A16	P1–N	1	R13–1	6	5	35.50
X65A16	P1–P	1	R14–1	6	5	36.35
X66A16	P1–R	1	R15–1	6	5	37.25
X67A16	P1–S	1	R18–1	6	5	38.10
X68A16	P1–T	1	R17–1	6	5	39.00
X69A16	P1–U	1	R18–1	6	5	39.85
X70A16	P1–V	1	R19–1	6	5	40.75
X71A16	P1–W	1	R20–1	6	5	41.60
X72A16	P1–X	1	R21–1	6	5	42.50
X73A16	P1–Y	1	R22–1	6	5	43.43
X74A16	P1–Z	1	R23–1	6	5	44.25
X75A16	P1–a	1	R24–1	6	5	45.10
X23C16	P1–d	1	P2–P	–	5	31.00
X11B16	P1–b	1	P2–T	–	5	31.00

FIND NO.	SYM	CODE IDENT	DWG SIZE	PART OR IDENTIFYING NO.	QTY REQD	NOMENCLATURE OR DESCRIPTION	SPEC	MATERIAL
1				MS3108R28–125	1	CONN, PLUG, ELEC 90°		
2				MS3057–16A	1	CLAMP, CABLE		
3				MS3420–16	1	BUSHING, CABLE, ADAPTER		
4				CLASS 1 1.00 ID	AR	INSUL. SLEEVING, HEAT SHRINKABLE, CLEAR	MIL–I–23053/5	
5				M22759/6–16–9	AR	WIRE, ELECTRIC, 16 AWG WHITE		
6				MS20659–104	24	TERMINAL, LUG, NO. 16 AWG WIRE		
7				MS3367–5	AR	STRAP, TIEDOWN, ADJUSTABLE		
8				MS25251–16	2	PLUG END SEAL		

Figure 5-20. Bottom Load Bank Wiring Harness (Sheet 1 of 2), Drawing No. 72-2825

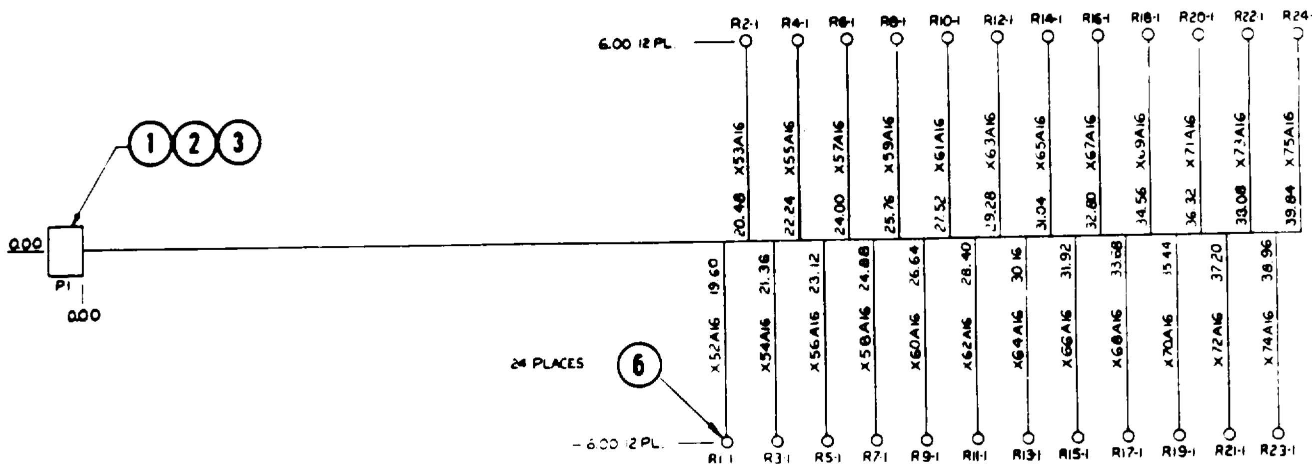
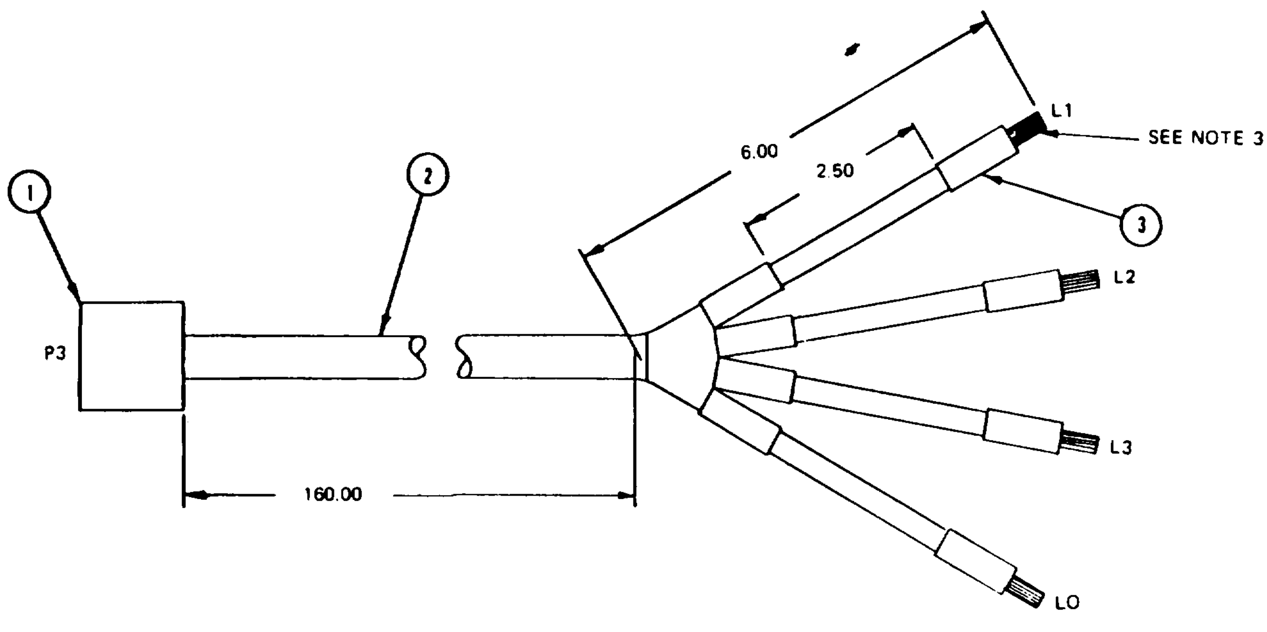


Figure 5-20. Bottom Load Bank Wiring Harness (Sheet 2 of 2), Drawing No. 72-2825

NOTES:

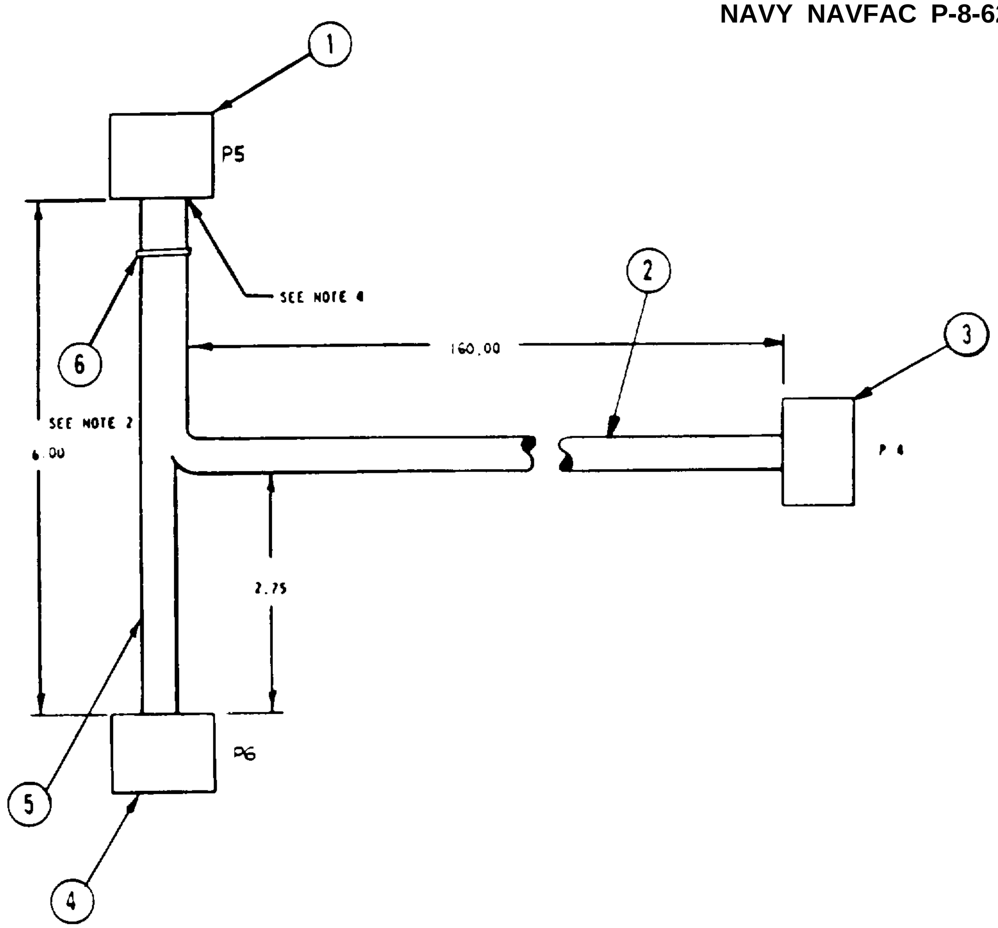
1. SOLDERING SHALL BE IN ACCORDANCE WITH MIL–STD–454, REQUIREMENT 5.
2. WIRE NUMBER SHALL BE STAMPED ON 1.00 LENGTHS OF TUBING, FIND NO. 3, AND PLACED OVER EACH WIRE TERMINATION AT 2.50 INTERVALS.
3. STRIP .50 INCHES AND TIN IN ACCORDANCE WITH NOTE 1.
4. INTERPRET DRAWING PER MIL–STD–100.



WIRE NO.	TERMINATION FROM	FIND NO REF.	TERMINATION TO	FIND NO REF.	WIRE FIND NO	WIRE LENGTH REF.
X13JJ6	P3–D	1	LO	–	2	167.00
X23A6	P3–C	1	L3	–	2	167.00
X22A6	P3–B	1	L2	–	2	167.00
X21A6	P3–A	1	L1	–	2	167.00

FIND NO.	SYM	CODE IDENT	DWG SIZE	PART OR IDENTIFYING NO.	QTY REQD	NOMENCLATURE OR DESCRIPTION	SPEC	MATERIAL
1				MS3106F32–17S	1	CONNECTOR, PLUG, ELECT, STRAIGHT		
2				CO–04HDF (4/6)	AR	CABLE, ELECT, 4 NO. 6 AWG	MIL–C–3432	
3				CLASS 1, .375 ID	AR	INSULATION SLEEVING, HEAT SHRINKABLE, WHITE	MIL–I–23–53/5	

Figure 5-21. Load Bank Power Wiring Harness, Drawing No. 72-2829



MARKING COLOR	WIRE MARKING	TERMINATION FROM	FIND NO. REF	TERMINATION TO	FIND NO REF	WIRE FIND NO. REF	WIRE LENGTH
BLACK	X7G16	P5-A	1	P6-A	4	5	6.50
BLACK	X8G16	P5-B	1	P6-B	4	5	6.50
BLACK	X9N16	P5-C	1	P6-C	4	5	6.50
BLACK	X115D16	P5-D	1	P6-D	4	5	6.50
BLACK	X116D16	P5-E	1	P6-E	4	5	6.50
BLACK	X117D16	P5-F	1	P6-F	4	5	6.50
RED	D24G16	P5-G	1	P6-G	4	5	6.50
—	JUMPER	P5-G	1	P5-H	1	7	.75
—	JUMPER	P5-F	1	P5-J	1	5	1.50
BLACK	X12Y16	P5-K	1	P6-K	4	5	6.50
BLACK	X12Z16	P5-L	1	P6-L	4	5	6.50
BLACK	X12AA16	P5-M	1	P6-M	4	5	6.50
BLACK	K101A16	P5-N	1	P6-N	4	5	6.50
—	JUMPER	P5-D	1	P5-P	1	7	.75
—	JUMPER	P5-E	1	P5-R	1	7	.75
BLACK	K102A16	P5-S	1	P6-S	4	5	6.50
—	BLACK	P5-P	1	P4-A	3	2	164.00
—	RED	P5-R	1	P4-B	3	2	164.00
—	GREEN	P5-J	1	P4-C	3	2	164.00
—	WHITE	P5-H	1	P4-D	3	2	164.00

NOTES:

1. SOLDERING SHALL BE IN ACCORDANCE WITH MIL-STD-454, REQUIREMENT 5.
2. INSTALL STRAPS, FIND NO. 6, AT APPROXIMATELY 2.50 INCH 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. AFTER ASSEMBLY OF CONNECTOR, FIND NO. 1, APPLY POTTING COMPOUND, FIND NO. 1, IN ACCORDANCE WITH MANUFACTURER'S REQUIREMENTS.
5. INTERPRET DRAWING PER MIL-STD-100.

FIND NO	SYM	CODE IDENT	DWG SIZE	PART OR IDENTIFYING NO	QTY REQD	NOMENCLATURE OR DESCRIPTION	SPEC	MATERIAL
1				72 2805	1	PLUG, CABLE CONNECTING		
2				CO-04HDF (4/18)	AR	CABLE, ELECT, 4 NO. 18 AWG COND	MIL C 3432	
3				MS3106F18-4S	1	CONNECTOR, ELECT, STRAIGHT, AN TYPE		
4				MS3106R20-29S	1	CONNECTOR, ELECT, STRAIGHT, AN TYPE		
5				M5086/2-16-9	AR	WIRE, ELECT, 16 AWG, 600 V	MIL-C-5086/2	
6				MS3367-4-9	AR	STRAP, TIEDOWN, ADJUSTABLE		
7				TYPE S	AR	WIRE, SOLID COPPER, 18 AWG	00-W-343	
8				72-2806	AR	COMPOUND, SEALING, SILICONE RUBBER		

Figure 5-22. Load Bank Signal Wiring Harness, Drawing No. 72-2830

Section V. APPLICATIONS KIT

5-23. GENERAL.

The applications kit provides the MEP–113A generator set with remote control of the emergency stop and battle short capabilities, and remote low fuel monitoring. The kit consists of a connector plate, remote housing assembly, cable harness assembly, and electrical tiedown straps.

NOTE

Remove the application kit before generator set is forwarded for depot maintenance. Application kit must be retained for installation on replacement generator set.

5-24. TROUBLESHOOTING.

Table 5-3 contains a list of malfunctions which is useful in diagnosing and correcting unsatisfactory operation or failure of the applications kit. Each malfunction is followed by a listing of probable causes. The corresponding listing of corrective actions references the applicable maintenance paragraph for the necessary procedures.

NOTE

Refer to the Operator and Unit Maintenance Manual for troubleshooting information applicable to lower levels of maintenance.

5-25. APPLICATIONS KIT INSTALLATION AND REMOVAL.

a. Installation.

WARNING

Before maintenance, shut down AC power. Shut down DC power by removing the generator set battery cable from the negative terminal (–). High voltage will cause death and/or burns. Open all doors and allow generator set to cool. Excessive heat will also cause burns.

(1) Connector Plate.

(a) Remove plug and sleeve assembly (1, figure 5-23) by removing six capscrews (2) and lockwashers (3) securing plate to generator housing. (Refer to the Operator and Unit Maintenance Manual for procedures.)

(b) Remove four corner capscrews and lockwashers from cover plate leaving two center capscrews securely fastened to plate.

NOTE

Place the four capscrews and lockwashers in the marked bag supplied with the applications kit and store in the generator set tool stowage compartment.

(c) Mount plate and sleeve assembly (1, figure 5-24) over cover plate (2). Secure using four capscrews (3), lockwashers (4), and spacers (5) provided with applications kit.

(d) Feed cable harness assembly (1, figure 5-25), attached to connector plate assembly (2), through the opening made by the removal of plate and sleeve assembly.

Table 5-3. APPLICATIONS KIT TROUBLESHOOTING CHART

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

1. REMOTE LOW FUEL MONITOR NOT FUNCTIONING

Step 1. Defective printed circuit band (PCB) inside remote housing (11, figure 5-29).

Replace remote functions assembly (para 5-27).

Step 2. Defective cable assembly (figure 5-27).

Repair cable assembly (para 5-26)

Step 3. Defective K3 relay on remote housing (figure 5-31).

Replace remote functions assembly (para 5-27).

Step 4. Defective relay wire harness or relay socket (figure 5-29).

Replace remote functions assembly (para 5-27).

2. **GENERATOR SET DOES NOT RESPOND TO REMOTE STOP SIGNAL**

Step 1. Defective cable assembly (figure 5-27).

Repair cable assembly (para 5-26).

Step 2. Defective relay K2 on remote housing (figure 5-31).

Replace remote functions assembly (para 5-27).

Step 3. Defective relay socket harness or relay socket (figure 5-29).

Replace remote functions assembly (para 5-27).

3. **GENERATOR SET DOES NOT RESPOND TO REMOTE BATTLE SHORT SIGNAL**

Step 1. Defective cable assembly (figure 5-27).

Repair cable assembly (para 5-26).

Step 2. Defective relay K1 on remote housing (figure 5-31).

Replace remote functions assembly (para 5-27).

Step 3. Defective relay wire harness or relay socket (figure 5-29).

Replace remote functions assembly (para 5-27).

NOTES

Insure the dust rover retaining chain (figure 5-25) on connector J1 is mounted on the lower right hand mounting screw of connector. A third lockwasher is added between the mounting nut and ground lug on connector mounting screw.

(e) Mount connector plate using six capscrews (3) and lockwashers (4) removed from plate and sleeve assembly.

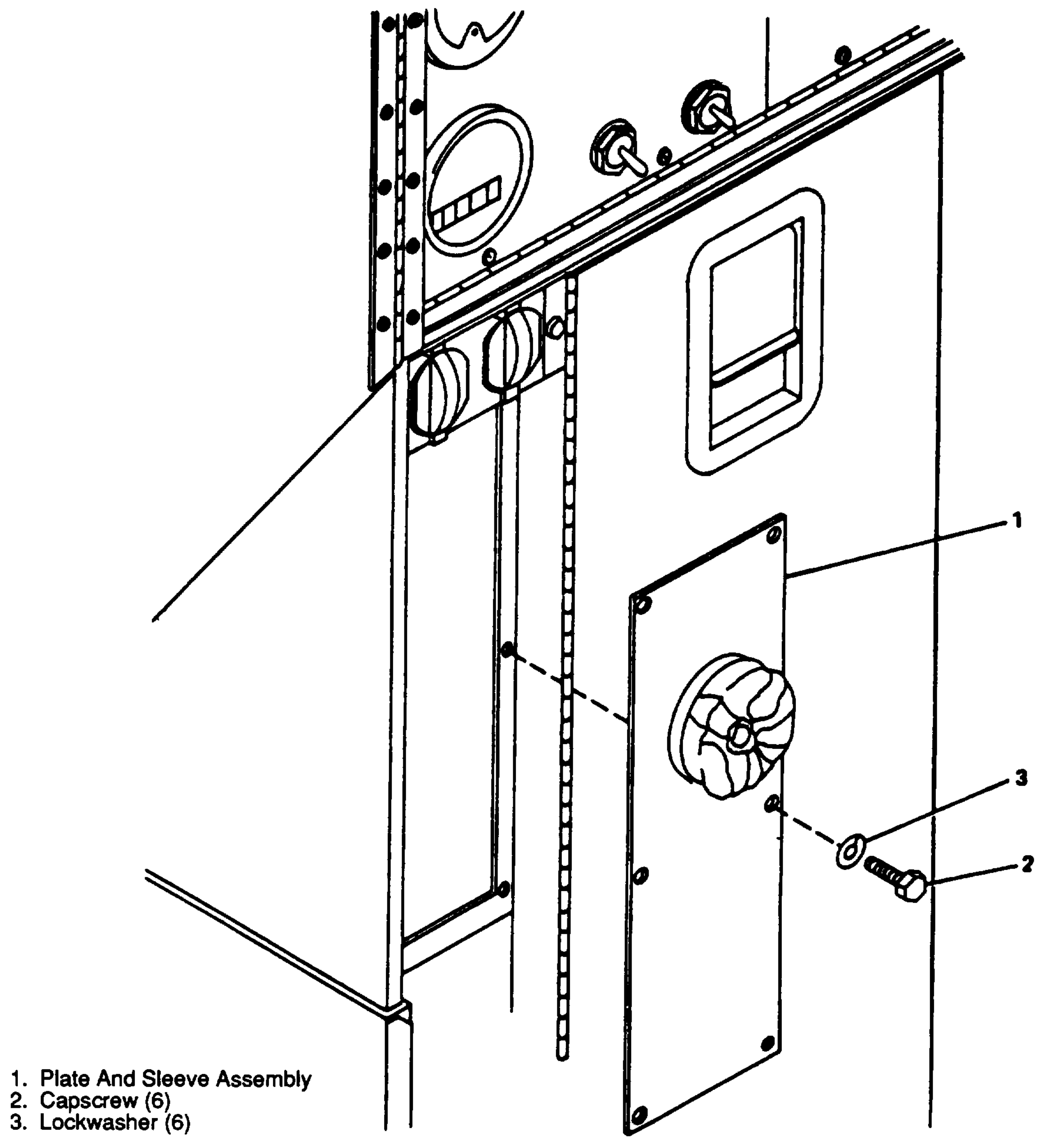
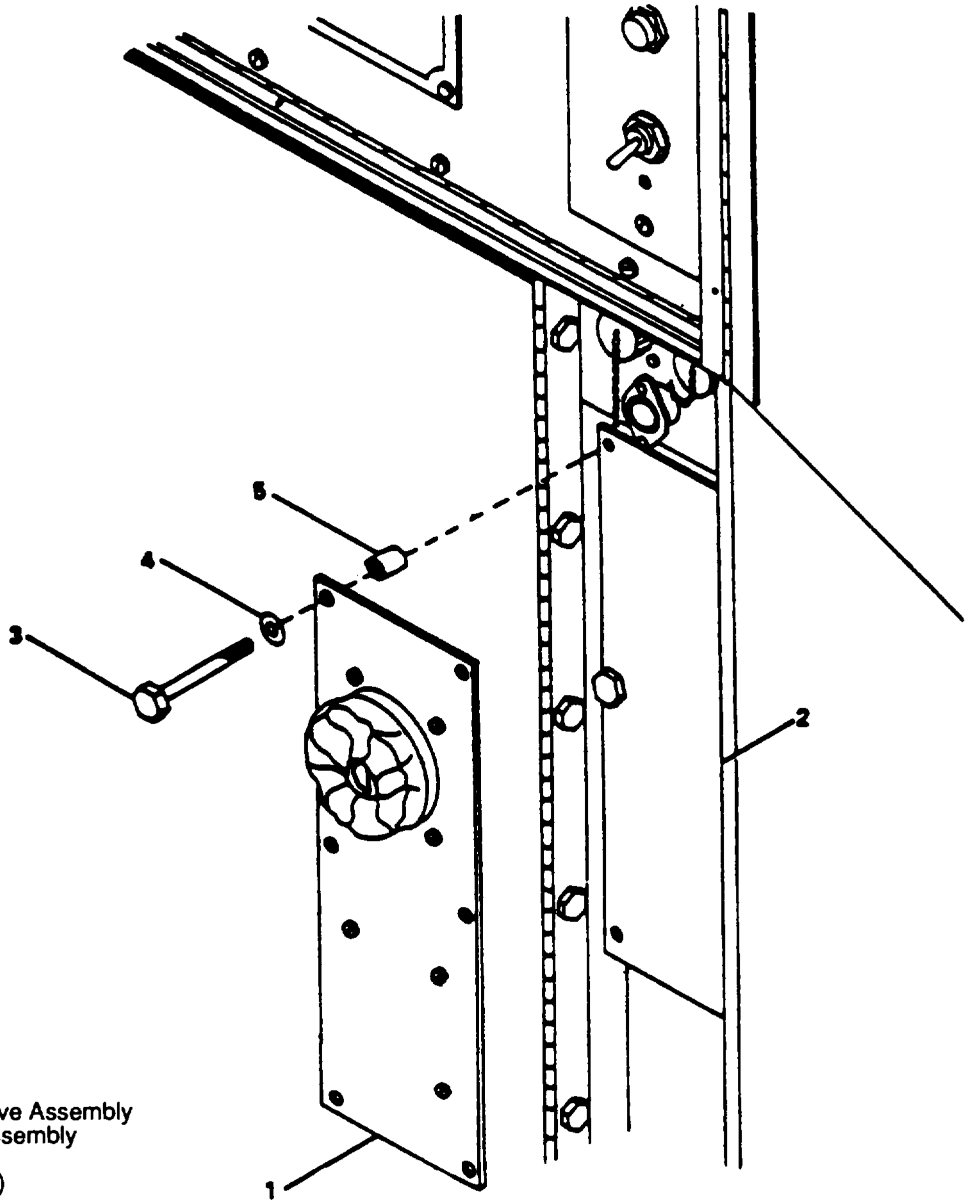


Figure 5-23. Plate and Sleeve Assembly Removal



1. Plate and Sleeve Assembly
2. Cover Plate Assembly
3. Capscrew (4)
4. Lockwasher (4)
5. Spacer (4)

(c)

(1) Tag load cables for identification purposes.

(2) Using a small crescent wrench remove six hex terminal studs and retainers.

(3) Beginning from L1 load terminal, install one flat washer, terminal lug, the other flat washer, lock washer and hex nut onto load terminal. Insure the terminal lug is oriented as in figure 5-26.

(4) Tighten the hex nut securely.

(5) Repeat Steps (3) and (4) for the remaining terminal lugs.

(6) Remove tags from load terminal cables.

(7) Reinstall load terminal board using the six hex terminal studs with wrench retaining lead assembly attached to the middle left stud.

(8) Tighten load terminal clamping nut.

(9) Reinstall load terminal cover using the six screws and Iockwashers and replace plastic shield (Refer to figures 3-106, 5-25, 5-26, and table 5-4).

(d) Route remaining eleven No. 16 AWG wires between top of load measurement unit and bottom of mounting shelf (refer to figure 5-25).

(e) Locate three wires (P18A16N, P18B16N, and P18C16N) with a ring type terminal lug. Route the wire downward between load terminal board assembly and tactical relay assembly to generator set chassis grounding stud (13, figure 5-25). Remove ground stud nut, place ring type terminal over stud on the inside of generator set. Replace nut and tighten securely.

(f) Remove rubber grommet from hole in mounting shelf. Route the remaining eight wires over the top of the tactical relay assembly and up through the hole in the mounting shelf. Split the rubber grommet and replace it.

(g) Position cable branch consisting of four wires ending in screw connectors P4 and J3 (5 and 6, figure 5-25) rearward on the relay table top between main lead contactor and the special relay assy. Disconnect main load contactor connector.

(h) Route single wire ending in screw in screw-type connector P7 (2) to connecting point J29 (3) on top of special relay assembly. Remove dust cover and connect P7 to J29.

(i) Locate single wire harness branch PI2A16, ending in a three way adapter with two six inch wires, P12B16 and P12C16 attached to it. Route the wire over the special relay assembly, down the opposite side of generator, behind the engine starter assembly. Follow the same path as the existing wire to the fuel sensor (1, figure 5-27) located on top of fuel tank. Disconnect the existing wire (6) to the fuel sensor and connect to cable harness wire P12C16. Connect cable harness wire P12B16 (2) to fuel level sensor. Double excess the existing wire back and tie all wires together in several places with tie-down straps provided with application kit.

(j) Route two remaining wires ending in the screw– type connectors P6 and J5 (15 & 17, figure 5-25) into engine compartment following path of existing wires to the engine speed switch. Disconnect existing speed switch plug (14, figure 5-25) from its connector (16) and connect cable harness connector (17) in its place. Connect existing plug (14) to remaining cable harness connector (15).

(k) Tie all cable harness branches to existing generator set wiring bundles using tie-down straps provided in applications kit.

1. Fuel Level Sensor Wire (To P9)
2. Connector P7
3. Connector J29
4. Connector J41
5. Connector P4
6. Connector J3
7. Connector P41
8. Connector J1
9. Generator Ground
10. Connector P2
11. Connector J2
12. Load Terminal Board Assy Leads
13. Chassis Ground
14. Connector P37
15. Connector J5
16. Connector J37
17. Connector P6
18. Nut
19. Flatwasher
20. Lockwasher
21. Terminal Lug

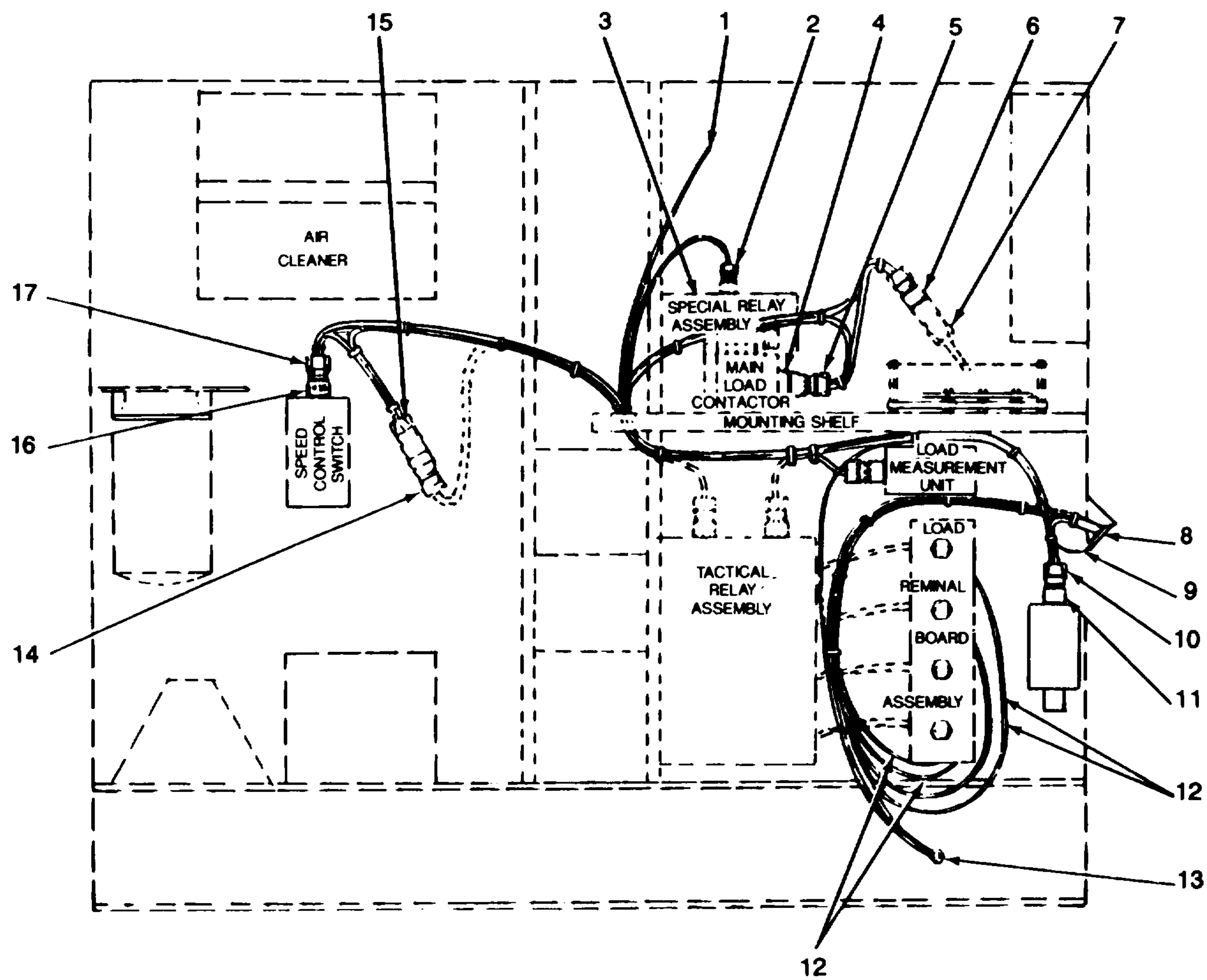


Figure 5-25. Application Kit Cable Harness Assembly Installation (Right Side)

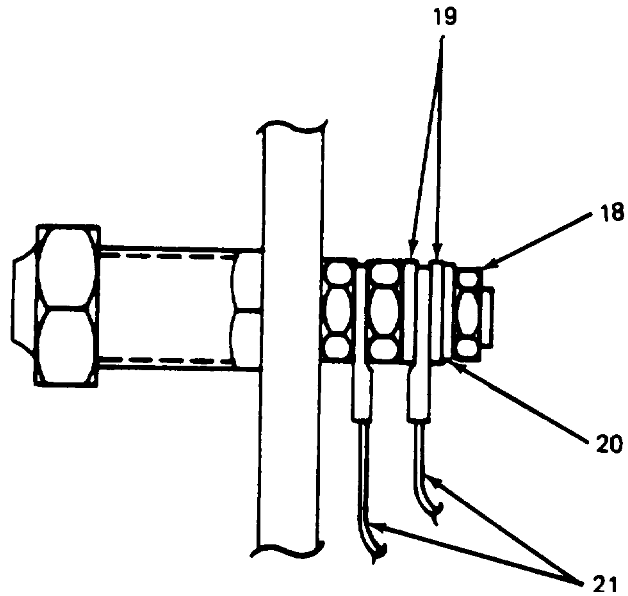


Figure 5-26. Load Terminal Board Stud Assembly

b. Test.

(1) Remote Battle Short Function.

NOTE

Refer to the Operator and Unit Maintenance Manual for generator set controls and switches.

(a) Close DC circuit breaker.

(b) Place START–RUN-STOP switch in RUN position.

(c) Place BATTLE SHORT switch in ON position.

NOTE

The electric fuel pumps should immediately start to run making a steady clicking sound.

(d) Connect test lead from positive terminal of generator set battery to pin D of connector J1 (8, figure 5-26).

(e) Connect test lead from negative terminal of generator set battery to pin K of connector J1 (8).

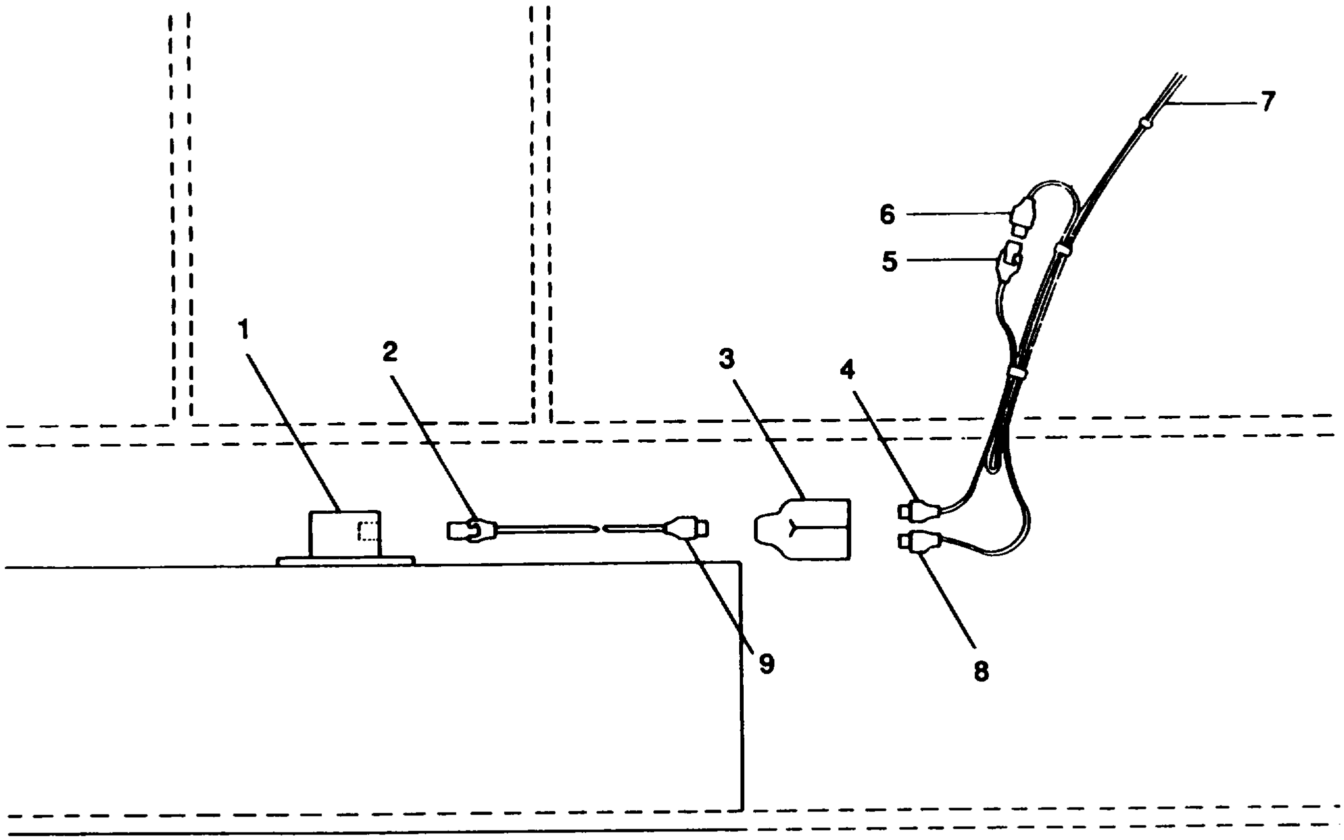
NOTE

The AC circuit breaker indicator light should light and the electric fuel pumps should continue to run.

(f) Open AC circuit breaker switch.

NOTE

The AC circuit breaker indicator light should stay lit and the electric fuel pumps should continue to run.



1. Fuel Level Sensor
2. Connector P10
3. Connector P11
4. Connector J9
5. Connector P9
6. Connector P5
7. Fuel Level Sensor Wire (from P2)
8. Connector J8
9. Connector J10

Figure 5-27. Applications Kit Cable Harness Assembly Installation (Left Side)

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

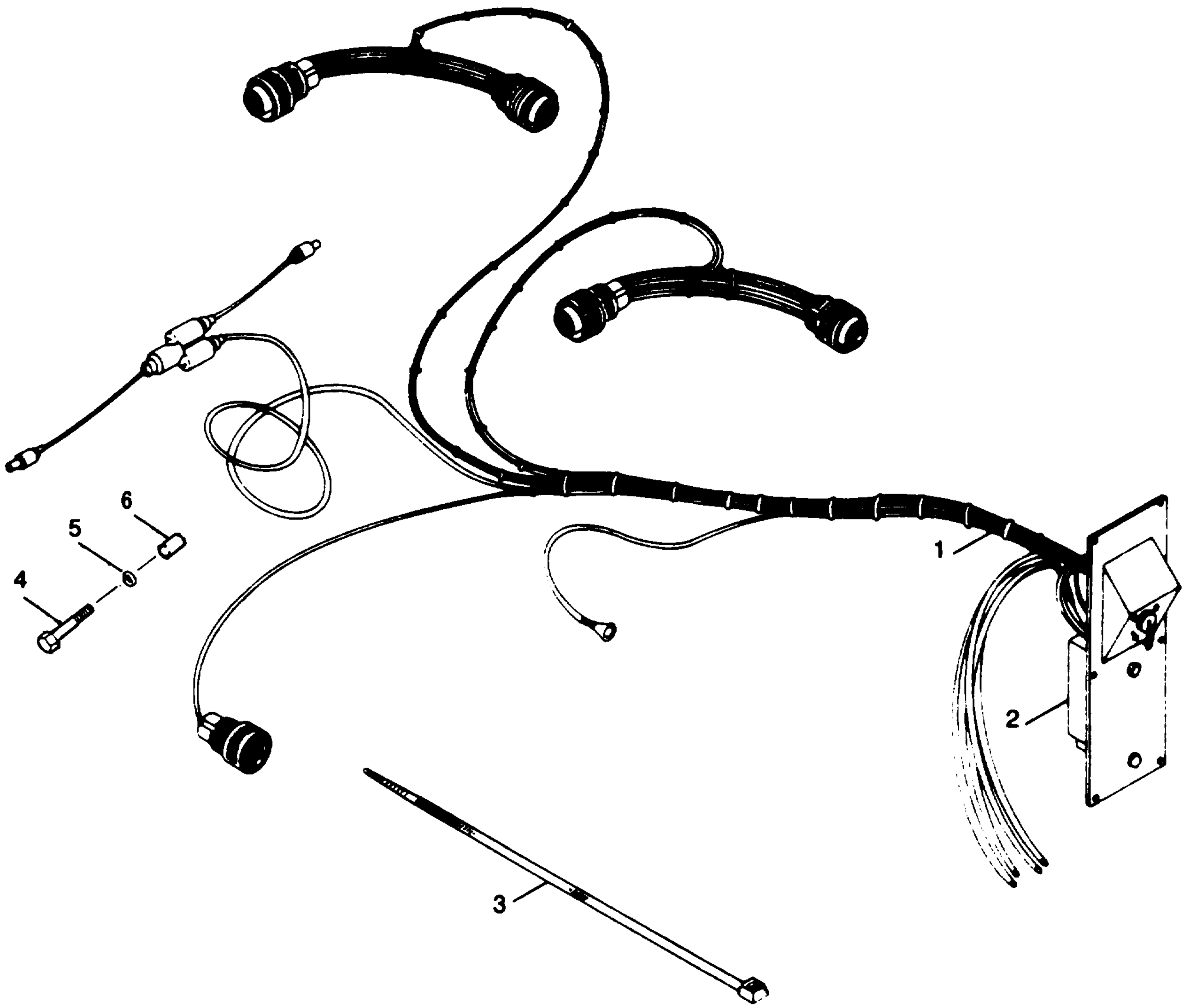


Figure 5-28. Application Kit Components

(9) Place BATTLE SHORT switch in OFF position.

NOTE

The AC circuit breaker indicator light should stay lit and the electric fuel pumps should continue to run, indicating that the REMOTE BATTLE SHORT is operational.

(2) Remote stop function.

NOTE

This test should be conducted immediately after testing the remote battle short function. Test leads and generator set controls and switches should not be changed. The circuit breaker indicator light must be lit and the fuel pumps must be operating before continuing this test.

(a) Connect another test lead from negative terminal of generator set battery to pin J of connector J1 (8).

(b) Connect another test lead from positive terminal of generator set battery to pin H of connector J1 (8).

NOTE

The AC circuit breaker indicator light should go out and the fuel pumps should stop operating, indicating that the REMOTE STOP is operational.

(c) Disconnect test leads from connector J1 and generator set battery.

(d) Return START-RUN-STOP switch to STOP position.

(3) Low Fuel Monitoring Function.

NOTE

If generator set main fuel tank has never been filled, disconnect fuel level sensor electrical connector and ground this connector lead to generator set chassis before conducting this test.

(a) Disconnect fuel level sensor electrical connector (2, figure 5-27) at main fuel tank.

(b) Place START–RUN-STOP switch in RUN position.

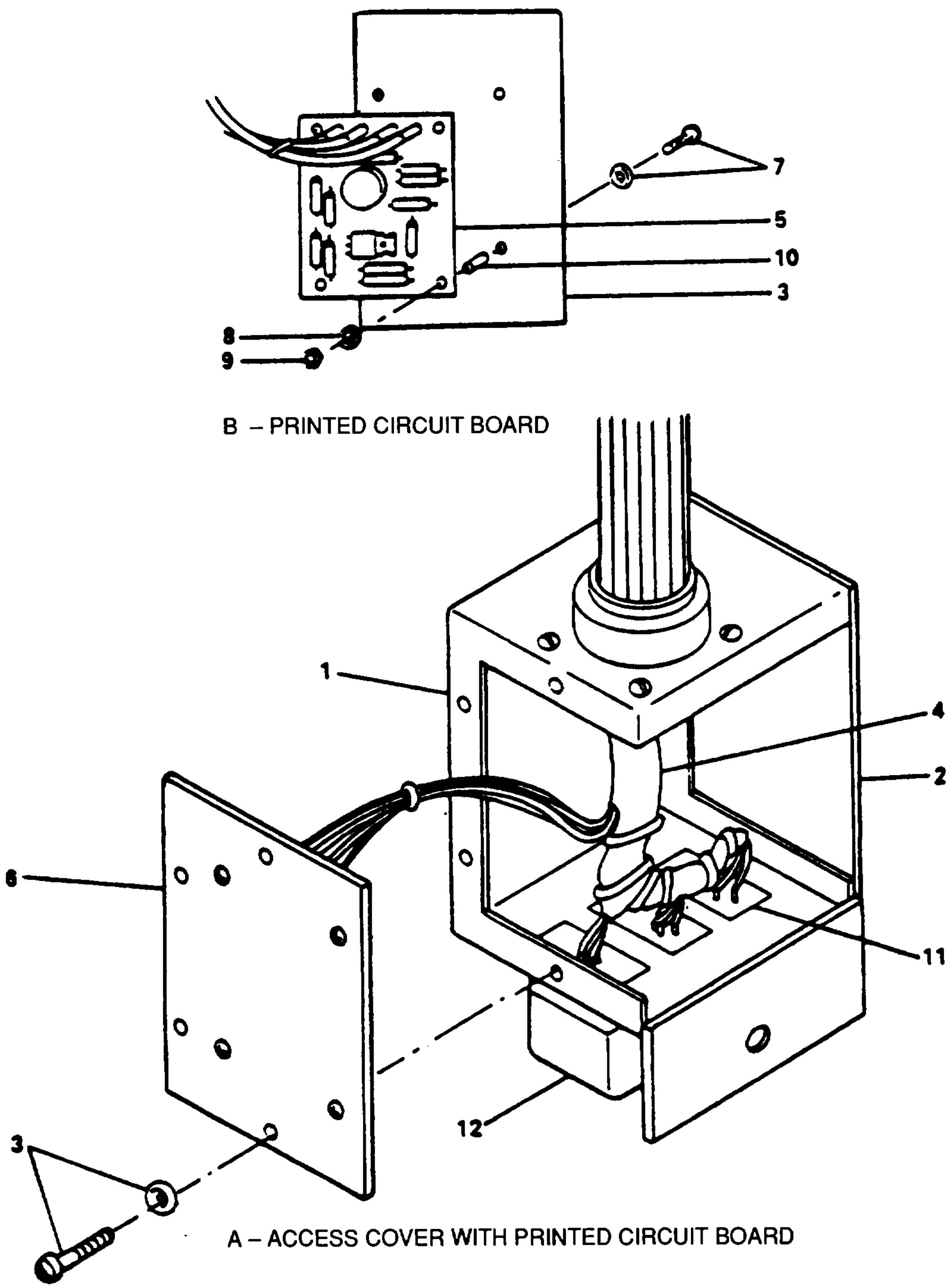
(c) Place BATTLE SHORT switch in ON position. Fuel pumps start to run, fuel gauge should register FULL.

(d) Connect test leads of ohmmeter to pins E and M on connector J1 (8, figure 5-25). Ohmmeter should indicate continuity.

(e) Ground fuel level sensor connector to generator set chassis. Ohmmeter should read infinity (i.e., open circuit) and FUEL LEVEL gauge should indicate EMPTY.

NOTE

This test indicates that the low fuel monitoring function is operational.



1. Remote Functions Assembly
2. Remote Functions Assembly Right Access Cover
3. Screw (4) and Captive Wash
4. Wiring Harness
5. Printed Circuit Board
6. Remote Functions Assembly Left Access Cover
7. Screw (4) and Captive Washer
8. Flat Washer
9. Nut (4)
10. Spacer (4)
11. Relay Socket (3)
12. Electrical Relay (3)

Figure 5-29. Remote Functions Assembly

WIRE RUNNING LIST				
WIRE REF NO..	FROM	TO	WIRE SIZE	WIRE LENGTH REF (IN.)
1	J2–A	K2–1	22	6
2	K2–1	K1–4	22	5
3	K1–4	K1–5	22	4
4	K1–5	K3–7	22	5
5	K3–7	E1	22	8
6	J2–B	K2–7	22	6
7	J2–C	K2–2	22	6
8	J2–D	K2–3	22	6
9	J2–E	E3	22	6
10	J2–F	K1–3	22	7
11	K1–3	J2–N	22	7
12	J2–G	K1–6	22	7
13	K1–6	J2–M	22	7
14	J2–H	E4	22	6
15	J2–I	K3–3	22	8
16	J2–J	K3–5	22	8
17	J2–K	K1–2	22	7
18	J2–L	K1–7	22	7
19	K3–2	E2	22	8

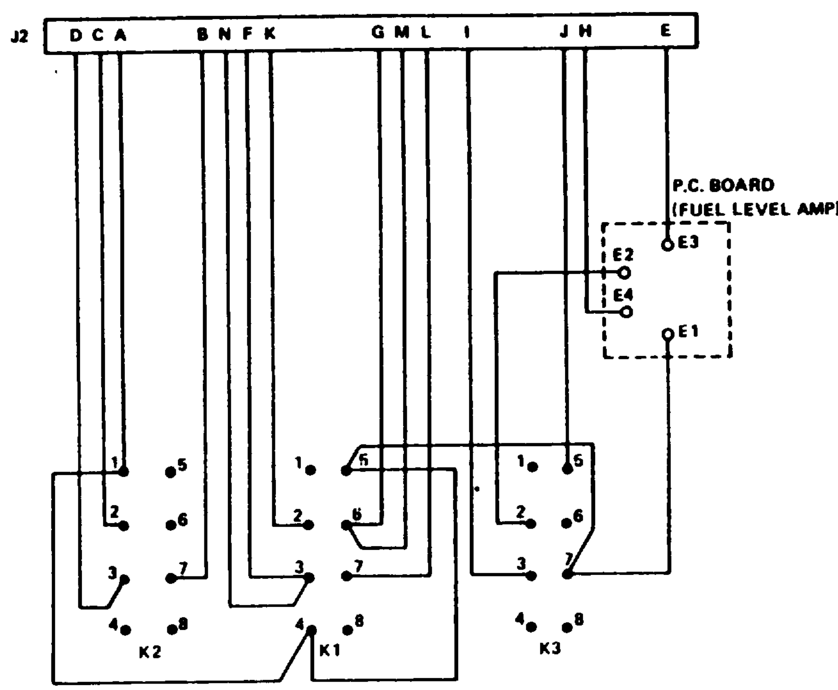


Figure 5-30. Wiring Harness Assembly Diagram

5-26. CABLE HARNESS ASSEMBLY.

a. Test

(1) Set multimeter on ohms scale.

(2) Test each point on cable assembly.

NOTE

Use Table 5-4 and figures 5-32 and 5-33 as guides.

b. Repair. Replace wires, terminals, and connectors by unsoldering connections, installing replacement parts, and soldering connections.

5-27. REMOVAL/INSTALLATION REMOTE FUNCTIONS ASSEMBLY.

a. Removal (figure 5-31)

(1) Open left rear access cover.

(2) Disconnect P2(5) from remote functions assembly.

(3) Remove two hex head screws (1) and washers (2).

(4) Remove remote functions assembly,

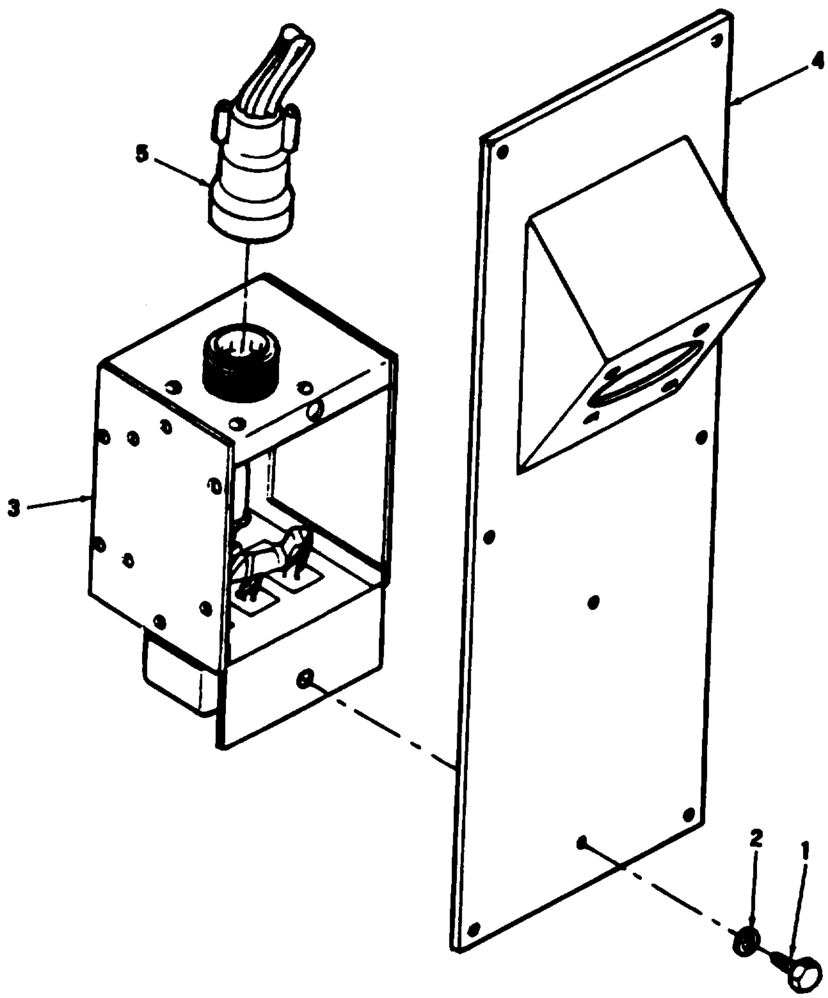
b. Installation.

(1) Position remote functions assembly.

(2) Install washers (2) and two hex head screws (1).

(3) Connect P2(5) to remote functions assembly.

(4) Close left rear access cover.



1. Hex Head Screw (3)
2. Lockwashers (2)
3. Housing Assembly
4. Connector Panel
5. Connector J2

Figure 5-31. Relay Socket Replacement

Table 5-4. CABLE HARNESS ASSEMBLY WIRING LIST- Continued

From	To	Wire No.	Function
JIA	L1	X1A6A	One phase of generator voltage
JIB	L2	X2A6B	One phase of generator voltage
JIC	Gnd	P18A16N	Generator chassis ground
JID	P2L	P16A16	Remote control panel launching station
JIE	P21	P13A16	Remote control panel launching station
JIF	Gnd	P18B16N	Generator chassis ground
JIG	Gnd	P18C16N	Generator chassis ground
JIH	P2B	P6A16	Remote control panel launching station
JIJ	P2C	P7A16	Remote control panel launching station
J1K	P2K	P15A16	Remote control panel launching station
J1L			Not used
JIM	P2J	P14A16	Remote control panel launching station
J I N			Not used
JIP	Gnd		Ground to J1 housing
JIQ	LO	X4A6N	Neutral for three phase generator voltage
JIR	L3	X3A6C	One phase of generator voltage
P2A	P6H	P5A16	Generator speed switch
P2B	JIH	P6A16	Remote control panel launching station
P2C	JIJ	P7AI16	Remote control panel launching station
P2D	J5H	P8A16	Generator set wire harness (P37)
P2E	P7E	P9A16	Generator ground on Special Relay Assembly
P2F	P4A	P1OA16	Main load contractors (CB1)
P2G	P4J	P11A16	Main load contractors (CB1)
P2H	P11A	P12A16	Fuei level sensor **(J8)**
P21	JIE	P13A16	Remote control panel launching station
P2J	JIM	P14A16	Remote control panel launching station
P2K	JIK	P15A16	Remote control panel Launching station
P2L	JID	P16A16	Remote control panel launching station
P2M	J3J	P11B16	Generator set wire harness (P41)

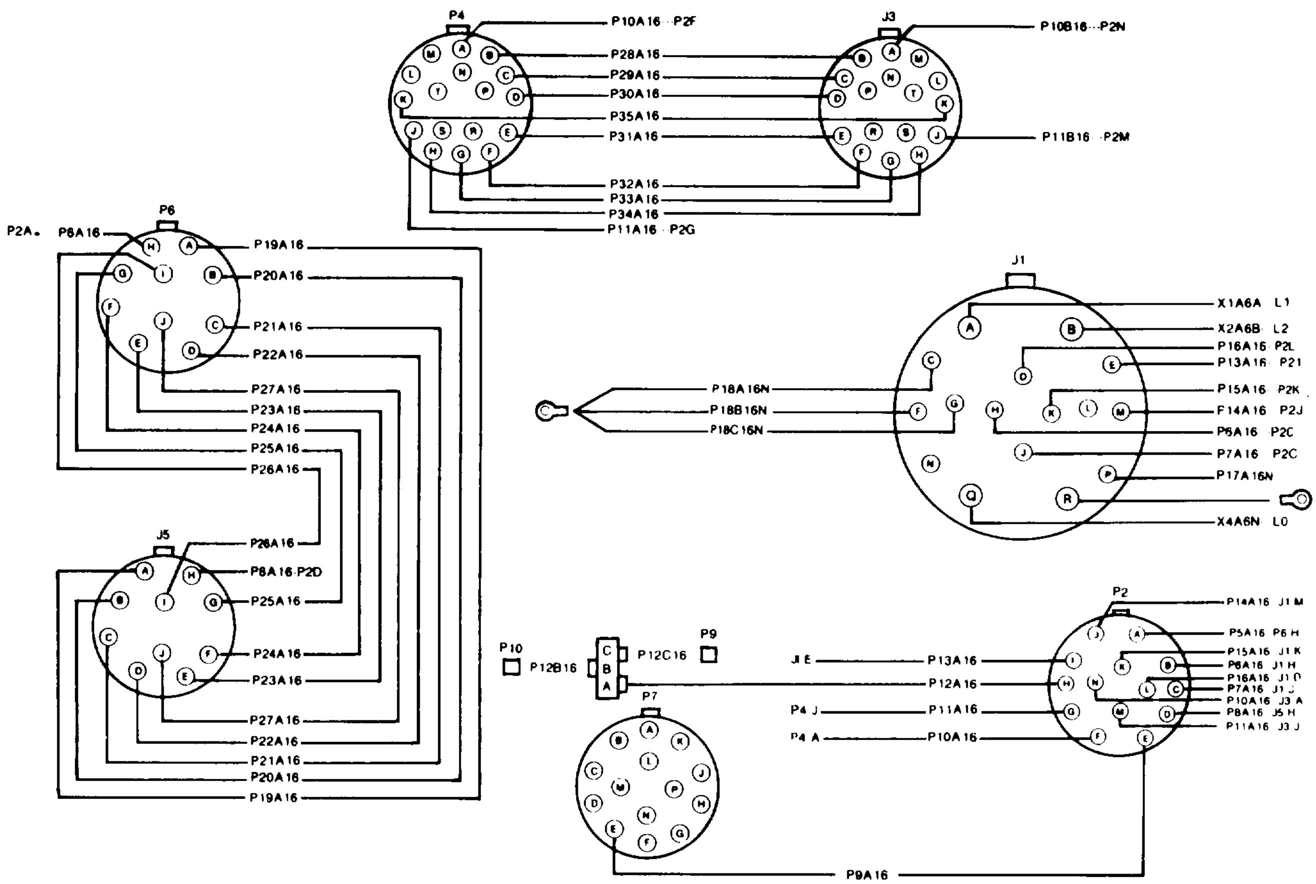
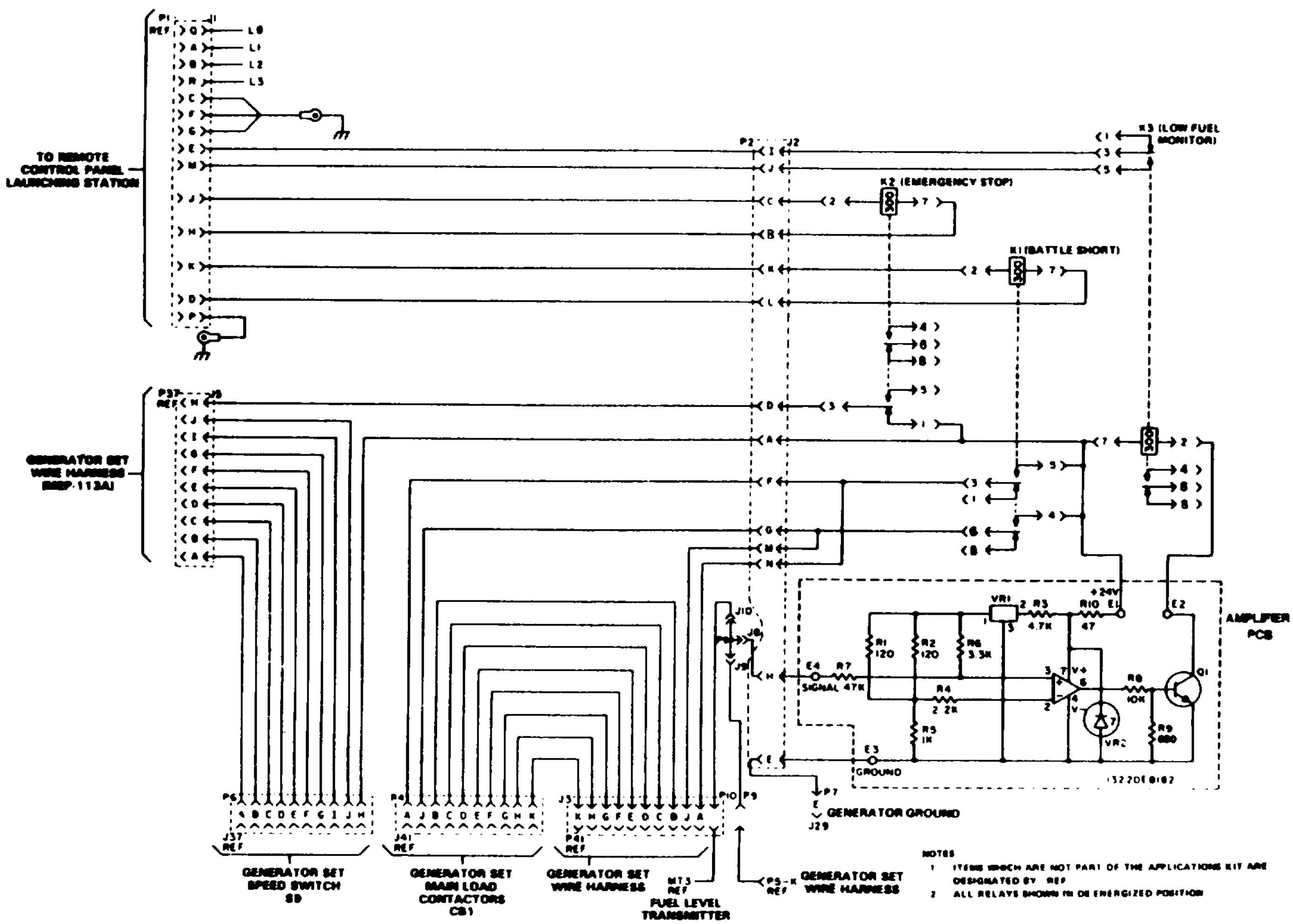


Figure 5-32. Application Kit Cable Harness Diagram



NOTES:

1. ITEMS WHICH ARE NOT PART OF THE APPLICATIONS KIT ARE DESIGNATED BY "REF"
2. ALL RELAYS SHOWN IN DEENERGIZED POSITION.

Figure 5-33. Application Kit Electrical Schematic Diagram

Section VI. ACOUSTIC SUPPRESSION KIT

5-28. GENERAL

The acoustic suppression kit provides the ability to lower the noise level of the generator set to 70 dB(A) at 7 meters. It consists of panels, doors, and components that rover 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.

Remember that the overall weight and cube of the generator set will increase with the acoustic suppression kit installed. (Refer to TM 9-8115-464-12, para 1-10.) Inspect the components of the acoustic suppression kit upon delivery for bends, cracks, dents, missing components, or other damage.

5-29. ACOUSTIC SUPPRESSION KIT INSTALLATION AND REMOVAL.

NOTE

Do not allow components with rubber seals to slide on surfaces. Damage to rubber seals will result.

a. Prepare generator set for installation of acoustic suppression kit.

WARNING

Do not use hoisting equipment with maximum capacity less than 5,000 pounds. Do not allow generator set to swing 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.

CAUTION

Use a minimum bridle of 5 feet on the hoisting sling to avoid undue side pressure on the lifting frame. Failure to observe this caution could result equipment damage.

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 clip, and attach the mounting bolts. Bolts should be torqued to 5 ft- lb (6.80 Nm) and jam nuts installed. (Jam nuts are common hardware items.) Once the acoustic 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) Refer to operator and unit maintenance manual, paragraph 4-135, and remove the following: battery box doors, radiator grill, side doors, louver doors under control panel, control panel doors, and both front and rear top covers.

NOTE

Remove all data plates and schematics from generator panels. Remove generator set data plate, and using data plate as a pattern for the rivet holes, mount data plate on right side of control panel. Mount data plates and schematics on rings supplied with acoustic suppression kit, and place behind document box mounted on rear panel. Data plates and schematics should be on separate rings. Reinstall radiator mounting bolts after removing radiator grill. One capscrew in top left rear door hinge cannot be removed. Install hex nut on this capscrew to prevent rattles.

NOTE

Some original hardware will be used to mount the acoustic suppression kit. Store all components removed and not used from the generator set and acoustic suppression kit in accordance with local SOP. If acoustic suppression kit is to be removed, original generator components must be reinstalled.

(2) Refer to operator and unit maintenance manual, paragraph 4-103, and remove the roll pin and rain cap from the exhaust flange.

WARNING

Disconnect batteries prior to removing the ground stud. Death or serious injury could result.

WARNING

Fuel tank is behind skid. Do not allow drill bit to enter fuel tank. Death or serious injury could result.

(3) Locate left rear tiedown on skid base. Remove ground stud. Measure 5-1/8 inches down from lip of skid base, and 3-5/8 inches from vertical lip of skid base. Center punch where two lines meet. Refer to figure 5-35. Using ground stud as a guide, drill two holes in skid base. Install ground stud in holes. Remove ground plate and install under ground stud. (Refer to figure 5-34.) It maybe necessary to remove wire ties from the ground wire wiring harness to attach the ground wire to the ground stud.

NOTE

To remove the acoustic suppression kit from shipping container, refer to steps (25) thru (14) and step (8) of paragraph b in reverse order. Ensure all components are removed from shipping container.

b. Install acoustic suppression kit on generator set.

CAUTION

Location of first hole is critical. Read steps(1) thru (4) and study figure 5-35 carefully before marking and drilling first hole. Failure to observe this caution could result in equipment damage.

(1) Using template supplied with acoustic suppression kit in vertical position, mark rear of skid base in two positions. (Refer to figure 5-35.)

(2) Using template in horizontal position, mark rear of skid base in two positions. (Refer to figure 5-35.)

(3) After making four marks, draw a vertical and horizontal line through the marks. (Refer to figure 5-35.)

(4) Where lines cross, drill a 1 /2–inch hole. (Refer to figure 5-36.)

NOTE

Do not tighten capscrews in step 5.

(5) Position mounting member on skid base, and install the capscrew, flatwashers, Iockwasher, and nut.

(6) Position the mounting member until it is parallel to the top of the skid base. Mounting member's top surface should be 7/8 inch lower than top of skid base. (Refer to figure 5-36.) Use a C-clamp to hold mounting member in position.

(7) Measure mounting member along skid, and using mounting member as a template, drill end hole, and install capscrew, washers, Iockwasher, and nut. Measurement from top of mounting member to top of skid base bar must be 7/8 inch before holes are drilled. (Refer to figure 5-35.)

(8) Drill holes and install remaining capscrews, flatwashers, Iockwashers, and nuts on mounting member. Heads of capscrews must be outside of skid. (Due to location of tool box, one capscrew must have head positioned in tool box.) (Refer to figure 5-36.) This capscrew is longer than other capscrews. Do not tighten capscrews.

(9) Repeat steps (1) thru (5) for mounting member on other skid.

(l0) Remove oil drain plug. Install fitting, hose, and clamp supplied with acoustic suppression kit.

(11) Position roof stiffeners and sealing angle on generator set. Install hexhead capscrews and Iockwashers to secure roof stiffeners. Do not tighten cap-crews on sealing angle. (Refer to figure 5-34.)

NOTE

Lifting clevises must be in raised position prior to installing side paneIs. Ensure rubber mounting pads remain in position when installing side panels.

NOTE

Bottom tray assembly will only go onto unit one way. Note location of weld nuts in relation to fork Iift tunnels. Bottom tray assembly must be cleaned and rubber seal greased with GAA prior to installing.

(12) Using a suitable lifting device, raise generator set and place 6"x6" blocks under skids. Lower generator set onto blocks.

(13) Grease inside of generator set skids with grease (GAA).

(14) 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.

(15) Slide bottom tray under generator set. Ensure weld nuts are positioned in down position. Weld nuts should be centered on fork lift tunnel holes.

(16) Raise bottom tray assembly, and install keepers, washers, and capscrews to secure one side of bottom tray assembly. (Refer to figure 5-34.)

(17) 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.

(18) Install keepers, washers, and capscrews to secure the bottom tray assembly. (Refer to figure 5-34.)

(19) 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. Failure to observe this caution could result in equipment damage.

(20) Raise side panel skirt 90° and remove from side panel assembly. Remove screws, capscrews, washers, keepers, and remove upper side panel skirt. (Refer to figure 5-37.) Attach lifting sling, and carefully raise and position side panel assembly on mounting member.

(21) Install three rubber washers, three flatwashers, and three locking nuts supplied with kit in bottom of 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. (Refer to figure 5-36.)

(22) Remove lifting sling from side panel.

(23) Repeat steps (20) thru (22) to install other side panel.

CAUTION

Do not allow front lower panel to drop or set on ground. Damage to brackets could result if caution is not observed.

(24) Position front lower panel assembly on generator set. Ensure top rubber flap is in raised position on radiator shell lip. Remove plastic plugs from rotolock holes. Align male and female rotolocks and, using hex tool, turn rotolocks to secure the front lower panel assembly. (Refer to figure 5-37.) Install plastic plugs. Ensure mounting zee is below bottom tray assembly.

(25) 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 rotolock holes. Align male and female rotolocks and, using hex tool, turn rotolock to secure the front top panel assembly. Remove lifting strap. (Refer to figure 5-37.) Install plastic plugs.

(26) Position exhaust extension on engine exhaust. Install and tighten clamp 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 if caution is not observed.

(27) 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 5-37.) 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.

(28) 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 5-37.) Install plastic plugs. Install two socket head capscrews to secure roof panel assembly.

(29) Slide sealing angle into position, and tighten capscrews.

(30) Tighten capscrews securing mounting members.

(31) 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 5-37.) Install plastic plugs.

(32) 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 5-37.) Install plastic plugs.

NOTE

Keepers, washers, and capscrews must be moved to end panels to secure side panel skirts.

(33) Position upper side panel skirt on side panels and install screws, keepers, washers, and capscrews.

(34) Install side panel skirts on slip-joint hinge and secure with keepers.

(35) Lower side panel skirts.

(36) Ensure inlet door, discharge door, control panel access door, and access doors are closed.

(37) 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 washers on capscrews, and install capscrews. Lower side panel skirts.

(2) Glue isolators on skid base or surface of trailer. (Refer to figure 5-34.)

(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 Nm). 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.

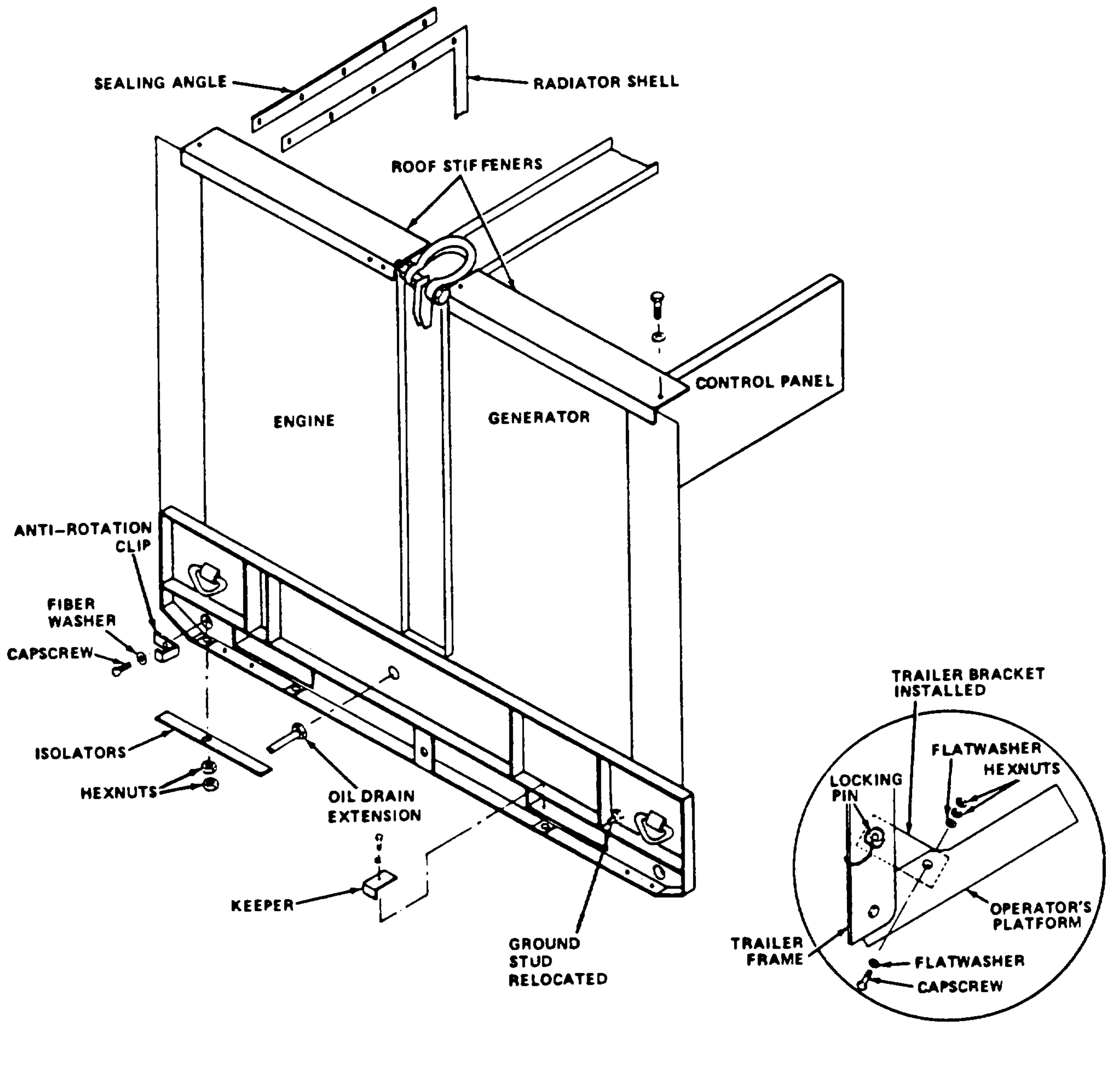


Figure 5-34. Roof Stiffeners, Sealing Angle, Oil Drain, Isolators, Bottom Panel Tray Assembly, and Trailer Brackets

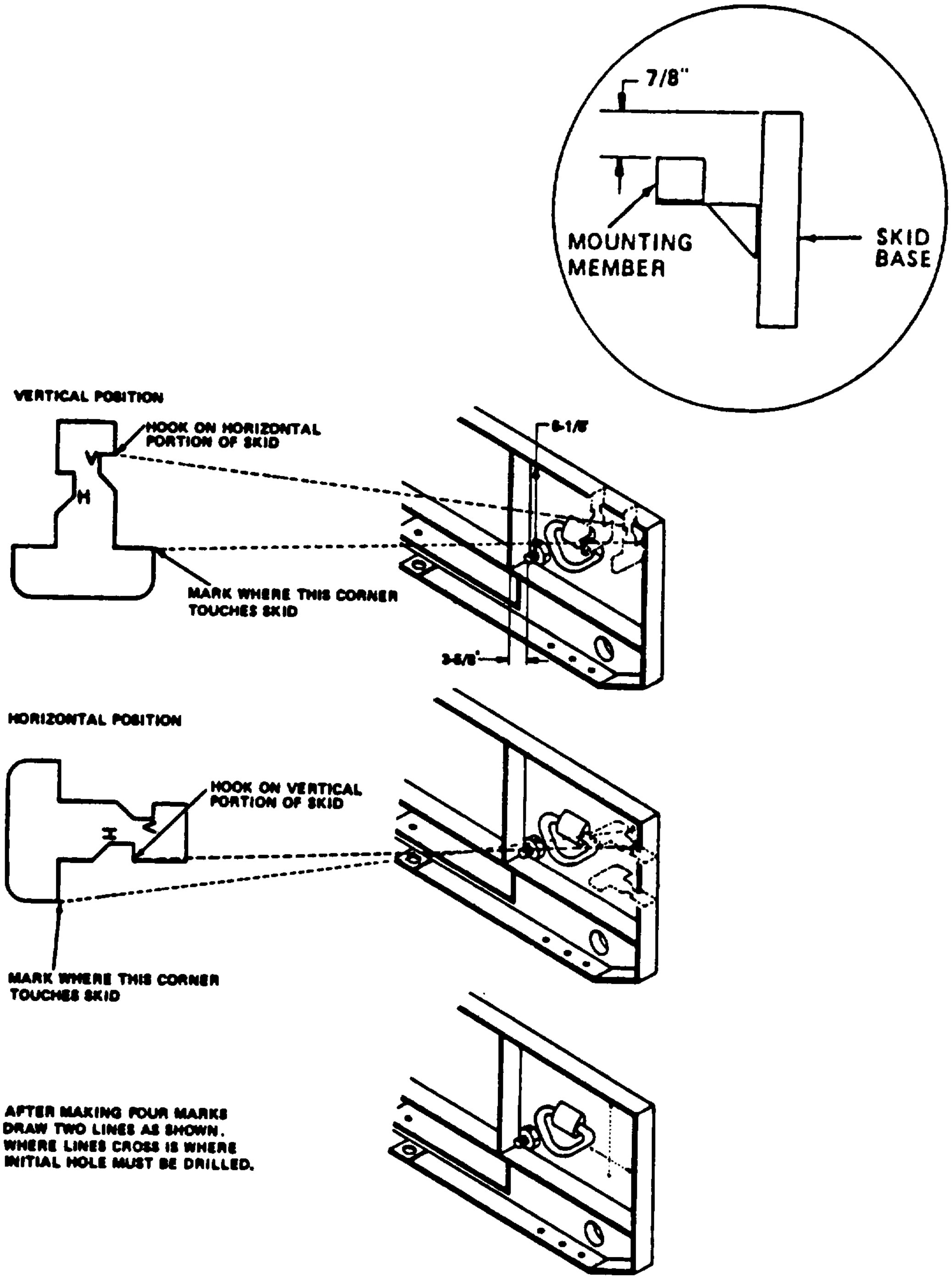


Figure 5-35. Hole Locations on Skid Base Assembly

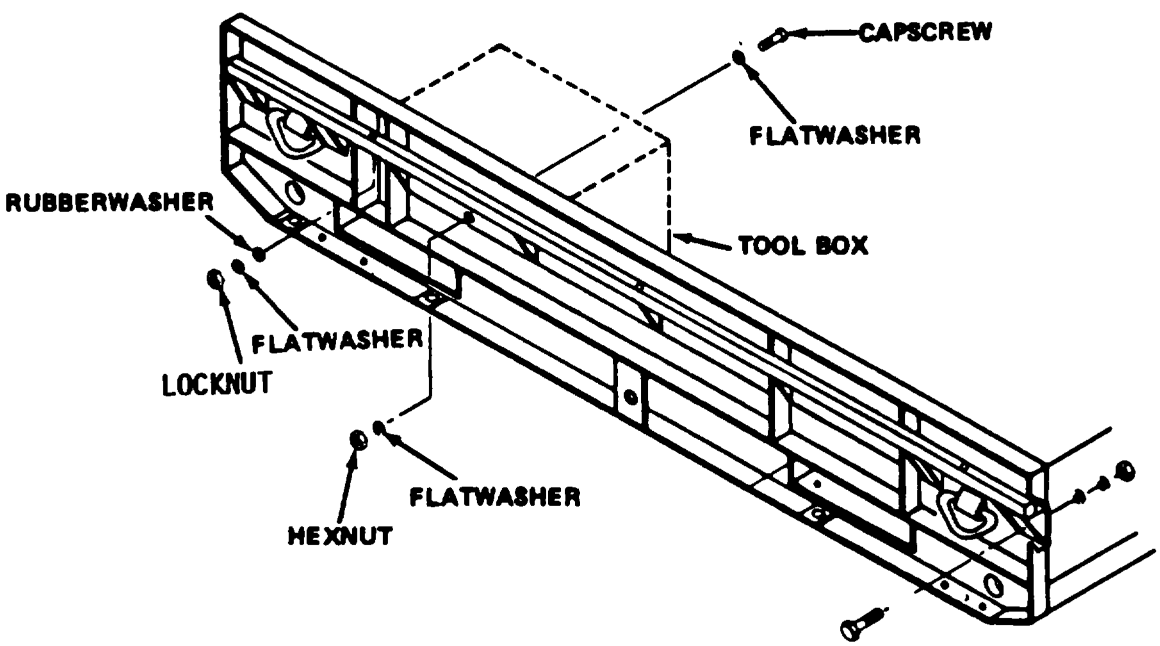


Figure 5-36. Mounting Hardware and Hole Location for Side Panel Assembly

1. Discharge Turn Assembly
2. Inlet Turn Assembly
3. Roof Panel Assembly
4. Rear Panel Assembly
5. Side Panel Skirt
6. Side Panel
7. Roof Stiffeners
8. Sealing Angle
9. Isolaters
10. Bottom Panel Tray Assembly
11. Front Lower Panel Assembly
12. Front Upper Panel Assembly
13. Lifting Strap
14. Mounting Zee
15. Capscrew
16. Under Side Panel Skirt
17. Document Box

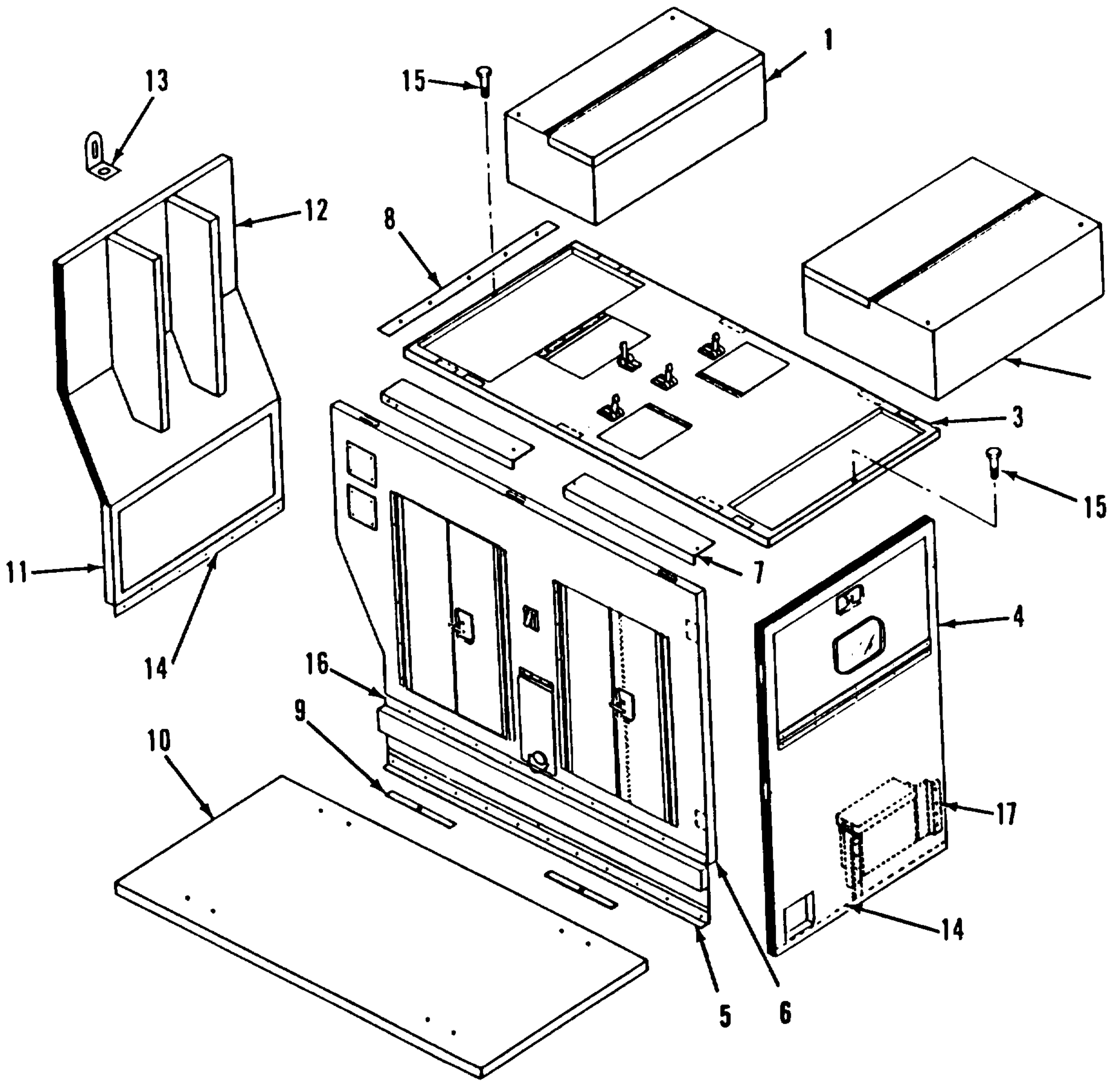


Figure 5-37. Acoustic Suppression Kit Major Components

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	Hand Portable Fire Extinguishers Approved for Army Users

A-2. LUBRICATION

C9100-IL	Identification List for Fuels, Lubricants, Oils and Waxes
LO 9-6115 464-12 (A)	Lubrication Order
LO 07523A-12 (M)	

A-3. PAINTING

T.O	35-1-3 (F) Painting and Marking of USAF Aerospace Ground Equipment
TM 9-0139 (A)	Painting Instructions for Field Use

A-4. RADIO SUPPRESSION

TO	31-1-141-13 (F) Basic Electronics Technology
FM 11-65 (A)	Radio Interference Suppression

A-5. MAINTENANCE.

T.O 00-25-234 (F)	General Shop Practice Requirements for the Repair, Maintenance and
Test of Electric Wiring	
T.O.1-1 A-14 (F)	Installation Practices for Aircraft Electric and Electronic Wiring
NAVWEPS 01 -1 A-505 (N)	
TM 55-1500-323-24 (A)	
T.O.35-1-11 (F)	Unit, Intermedia.te and Depot Level Maintenance for FSC 6115 Non-Airborne Equipment
T.O.35-1-12 (F)	Components 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
Deleted	
TM 9-2610-200-14 (A)	Care and Maintenance of Pneumatic Tires and Inner Tubes
T.O.36Y32-1-142 (F)	Measurements and Instrumentations
TB 750-651 (A)	Use of Anti-freeze Solutions and Cleaning Compounds in Engine Cooling Systems
TM 738-750 (A)	The Army Maintenance Management Systems (TAMMS)
TM 9-6115-464-12 (A)	Operator and Unit Maintenance Manual
TO 35C2-3-445-1 (F)	
NAVFAC P-8-624-12 (Nt	
TM 07523A-12 (M)	

A-5	**MAINTENANCE (CONT)**	
	TM 9-611 5 24P (A) TO 35C2-3-445-1 (F) NAVFAC P-8-624-24P (N) SL-4-07532A	Unit, DS, GS and Depot Maintenance Repair Parts and Special Tools List
	TM 9-6140-200-14 (A)	Operator's and Unit, Intermedia.te Direct Support, and Intermedia.te General Support Maintenance Manual for Lead Acid Batteries
	T.O 36Y4-1-194 (F)	Batteries, Lead Acid Type
	T.O 34Y19-1-111 (F)	Electric Motor and Generator Repair
	TM 5-764 (A)	
	Deleted	
A-6	**SHIPMENT AND STORAGE**	
	T.O 35-1-4 (F)	Processing and Inspection of Aerospace Ground Equipment for Storage and Shipment
	T.O 38-1-5 (F)	Processing and Inspection of Non-Mounted, Non-Aircraft Gasoline and Diesel Engine for Storage and Shipment
	TB 740-97-2 (A)	Preservation of USAMEC Mechanical Equipment for Shipment and Storage
	AR 750-1 (A)	Administrative Storage of Equipment
A-7	**DESTRUCTION OF MATERIAL**	
	TM 750-244-3 (A)	Procedures for Destruction of Equipment to Prevent Enemy Use
A-8	**Deleted**	

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APPENDIX B

FABRICATION/ASSEMBLY OF PARTS

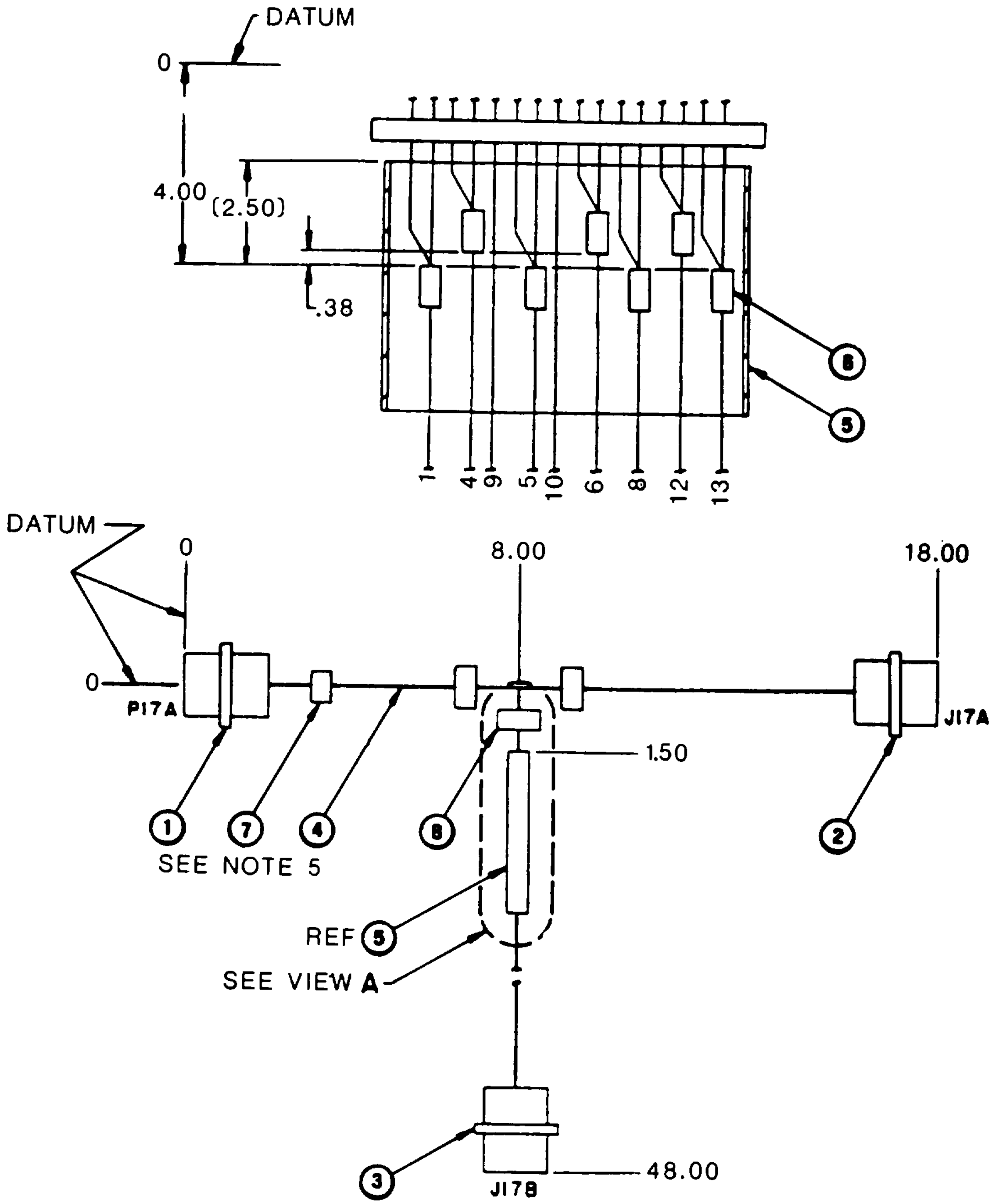

Figure 2-1. Breakout Cable (Sheet 1 of 2)

NOTES:

1. ALL CONDUCTORS SHALL BE STRIPPED .50 + .12 TINNED BEFORE ASSEMBLY USING SOLDER, FIND NO 11.
2. SOLDER IN ACCORDANCE WITH MIL–STD–454, REQUIREMENT 5 USING SOLDER, FIND NO. 11.
3. TIEDOWN STRAPS, FIND NO. 8, SHALL BE LOCATED APPROXIMATELY 3.00 APART AND ALL BREAKOUTS.
4. CONNECTORS, FIND NO. 1, 2 AND 3 SHALL BE RUBBER STAMPED OR STENCILED WITH REFERENCE DESIGNATIONS IN .25 HIGH, UPPER CASE GOTHIC STYLE CHARACTERS. PERMANENCY AND LEGIBILITY SHALL BE IN ACCORDANCE WITH MIL–STD–130.
5. ALL UNUSED CONNECTIONS IN CONNECTORS, FIND NO. 1, 2 AND 3 SHALL BE SEALED USING PLUG, FIND NO. 10.
6. EACH WIRE SHALL BE MARKED AT 6 INCH INTERVALS WITH THE APPROPRIATE PIN LETTER IN ACCORDANCE WITH MIL–STD–130.
7. IN LIEU OF USING TERMINAL SPLICES, FIND NO. 6, WIRES MAY BE TWISTED TOGETHER AND SOLDERED AT THREE WIRE SPLICES AND COVERED WITH HEAT SHRINKABLE TUBING, FIND NO. 9.

	Circuit NO.	TERMINATION FROM	FIND NO. REF.	TERMINATION TO	FIND NO. REF.	WIRE FIND NO.	WIRE LENGTH REF.
	1	P17A–B	1	J17A–B	2	4	AR
	2	P17A–B	1	J17B–B	3	4	AR
		P17A–C	1	J17A–C	2	4	AR
	3	P17A–D	1	J17A–D	2	4	AR
	4	P17A–F	1	J17A–F	2	4	AR
		P17A–F	1	J17B–F	3	4	AR
	5	P17A–G	1	J17A–G	2	4	AR
		P17A–G	1	J17B–G	3	4	AR
		P17A–H	1	J17A–H	2	4	AR
		P17A–H	1	J17B–H	3	4	AR
	7	P17A–J	1	J17A–J	2	4	AR
	8	P17A–K	1	J17A–K	2	4	AR
		P17A–K	1	J17B–K	3	4	AR
	9	P17A–L	1	J17B–L	3	4	AR
	10	P17A–N	1	J17B–N	3	4	AR
	11	P17A–R	1	J17A–R	2	4	AR
	12	P17A–S	1	J17A–S	2	4	AR
		P17A–S	1	J17B–S	3	4	AR
	13	P17A–T	1	J17A–T	2	4	AR
		P17A–T	1	J17B–T	3	4	AR

FIND NO.	FSCM	CODE IDENT	DWG SIZE	PART OR IDENTIFYING NO.	QTY REQD	NOMENCLATURE OR DESCRIPTION	SPECIFICATION	MATERIAL
1				MS3106R20–29S	1	CONNECTOR, ELECTRICAL		
2				MS3101R20–29P	1	CONNECTOR, ELECTRICAL		
3				MS3101R20–29S	1	CONNECTOR, ELECTRICAL		
4				M5086/2–16–9	AR	WIRE, ELECTRICAL, 16 AWG, COLOR WHT	MIL–W–5086/2	
5				M23053/7–108–0	1	INSULATION SLEEVING, ELEC, HEAT–SHRINKABLE 6.00 L,.75 ID	MIL–I–23053/7	
6				M7928/5–4	7	TERMINAL, SPLICE	MIL–T–7928/5	
7				M43436/1–3	1	BAND, MARKER, CRIMP STYLE	MIL–B–43436/1	
8				MS3367–5–9	AR	STRAP, TIEDOWN, ELECTRICAL		
9				M23053/7–104–9	AR	INSULATION SLEEVING, ELEC. HEAT–SHRINKABLE,.125 ID	MIL–I–23053/7	
10				MS25251–16	18	PLUG, END SEAL, ELECTRIC CONNECTOR		
11				SN60WRP2	AR	SOLDER	QQ–S–571	

Figure 2-1 Breakout Cable (Sheet 2 of 2)

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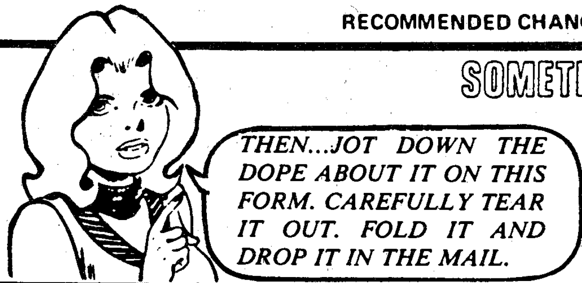

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