ARMY TECHNICAL MANUAL TM 5-6115-612-34
MARINE CORPS TECHNICAL MANUAL TM 6115-34/8
AIR FORCE TECHNICAL ORDER TO 35C2-3-471-2
NAVY PUBLICATION AG-320BO-MME-OOO

TECHNICAL MANUAL

INTERMEDIATE (FIELD), (DIRECT AND GENERAL SUPPORT) AND DEPOT MAINTENANCE MANUAL

GENERATOR SET, AVIATION, GAS TURBINE ENGINE DRIVEN, INTEGRAL TRAILER MOUNTED, 10KW, 28 VOLTS

DOD MODEL	CLASS	MODE	NSN
MEP 362A	PRECISE	DC	6115-01-161-3992

This manual supersedes TM 5-6115-612-34/TM 6115-34/8/TO 35C2-3-471-2 and AG-320BO-MME-OOO, 28 July 1986.

PUBLISHED UNDER THE AUTHORITY OF THE DEPARTMENTS OF THE ARMY, AIR FORCE, NAVY AND HEADQUARTERS U.S. MARINE CORPS

25 JULY 1988

CHANGE

NO. 4

HEADQUARTERS
DEPARTMENTS OF THE ARMY AND NAVY
WASHINGTON, D.C., 31 OCTOBER 1996

INTERMEDIATE (FIELD), (DIRECT AND GENERAL SUPPORT)
AND DEPOT MAINTENANCE MANUAL

GENERATOR SET, AVIATION, GAS TURBINE ENGINE DRIVEN,
INTEGRAL TRAILER MOUNTED, 10KW, 28 VOLTS

DOD MODEL	CLASS	HERTZ	NSN
MEP 362A.	**PRECISE**	**DC**	**6115-01-161-3992**

DISTRIBUTION STATEMENT A: Approved for public release; distribution is unlimited

TM 5-6115-612-34 / AG-320B0-MME-000, dated 25 JULY 1988, 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 though iv	i through iv
1-7 through 1-9/(1-10 blank)	1-7 through 1-10
4-13 and 4-14	4-13 and 4-14
4-19 and 4-20	4-19 end 4-20
6- and 6-10	6-9 and 6-10
7-7 through 7-10	7-7 through 7-10
8-11 through 8-16	8-11 through 8-16
8-19 through 8-24	8-19 through 8-24
8-29 through 8-40	8-29 through 8-40
8-43 through 8-50	8-43 through 8-50
8-55 through 8-61(8-62 blank)	8-55 through 8-61/(82 blank)
----------	14-1 through 14-9/(4-10 blank)
----------	B-1 and B-2
LP-29/(LP-30 Blank)	FP-29/(LP-30 Blank)
LP-31/(LP-32 Blank)	FP-31/(LP-32 Bank)

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

ARMY **TM 5-6115-612-34**
NAVY **AG-320B0-MME-000**

C4

By Order of the Secretaries of the Army and Navy:

DENNIS J. REIMER
General, United States Army
Chief of Staff

Official:
JOEL B. HUDSON
Administrative Assistant to the
Secretary of the Army
03106

J. E. BUFFINGTON
Rear Admiral, CEC, US Navy
Commander
Navy Facilities Engineering
Command

DISTRIBUTION: To be distributed in accordance with DA Form 12-25-E, block no. 3855, requirements for TM 5-6115-612-34.

CHANGE

No. 3

HEADQUARTERS,
DEPARTMENTS OF THE ARMY AND NAVY
WASHINGTON, D.C., 26 FEBRUARY 1993

Intermediate (Field), (Direct and General Support)
and Depot Maintenance Manual

GENERATOR SET, AVIATION, GAS TURBINE ENGINE DRIVEN,
INTEGRAL TRAILER MOUNTED, 10 KW, 28 VOLTS

DISTRIBUTION STATEMENT A: Approved for public release; distribution is unlimited.

TM 5-6115-612-34/AG-320BO-MME-OOO, 25 July 1988, 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
4-5 and 4-6	4-5 and 4-6

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

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

GORDON R. SULLIVAN
General, United States Army
Chief of Staff

Official:

Milton H. Hamilton

MILTON H. HAMILTON
Administrative Assistant to the
Secretary of the Army
3957

DAVID E. BOTTORFF
Rear Admiral, CEC, US Navy
Commander
Navy Facilities Engineering Command

DISTRIBUTION:
To be distributed in accordance with DA Form 12-25-E, block no. 3855, requirements for TM5-6115-612-34/AG-320BO-MME-OOO.

CHANGE

NO. 2

HEADQUARTERS,
DEPARTMENTS OF THE ARMY AND NAVY
WASHINGTON, D.C., 7 December 1990

Intermediate (Field), (Direct And General Support)
And Depot Maintenance Manual

GENERATOR SET, AVIATION, GAS TURBINE ENGINE DRIVEN,
INTEGRAL TRAILER MOUNTED, 10 KW, 28 VOLTS

DOD MODEL	CLASS	MODE	NSN
MEP 362A	PRECISE	DC	6115-01-161-3992

Approved for public release; distribution is unlimited

TM 5-6115-612-34/TM 6115-34/8/TO 35C2-3-471-2/AG-320BO-MME-000, 25 July 1988 is changed as follows:

1. The U.S. Marine Corps TM 6115-34/8 and Air Force TO 35C2-3-471-2 are being deleted from this manual. All future change pages or revisions will reflect this.

2. 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
2-37/(2-38 blank)	2-37 and 2-38
FP-9/(FP-10 blank)	FP-9/(FP-10 blank)
FP-15/(FP-16 blank)	FP-15/(FP-16 blank)

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

By Order of the Secretaries of the Army and Navy:

CARL E. VUONO
General, United States Army
Chief of Staff

Official:

THOMAS F. SIKORA
Brigadier General, United States Army
The Adjutant General

DAVID E. BUTTORFF
Rear Admiral, CEC, US Navy
Commander
Navy Facilities Engineering Command

DISTRIBUTION:

To be distributed in accordance with DA Form 12-25E, (qty rqr block no. 3855)

CHANGE NO. 1

HEADQUARTERS,
DEPARTMENTS OF THE ARMY, NAVY AND AIR FORCE
AND HEADQUARTERS U.S. MARINE CORPS
WASHINGTON, D.C., 30 May 1990

Intermediate (Field), (Direct And General Support) And Depot Maintenance Manual

GENERATOR SET, AVIATION, GAS TURBINE ENGINE DRIVEN, INTEGRAL TRAILER MOUNTED, 10KW, 28 VOLTS

DOD MODEL	CLASS	MODE	NSN
MEP 362A	PRECISE	DC	6115-01-161-3992

Approved for public release; distribution is unlimited

TM 5-6115-612-34/TM 6115-34/8/TO 35C2-3-471-2/AG-320BO-MME-OOO, 25 July 1988 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
v and vi	v and vi
2-3 and 2-4	2-3 and 2-4
2-5 and 2-6	2-5 and 2-6
4-1 through 4-6	4-1 through 4-6
10-7 through 10-10	10-7 through 10-10
---	10-10.1/10-10.2
10-11 through 10-14	10-11 through 10-14
---	10-14.1 and 10-14.2
10-15 and 10-16	10-15 and 10-16

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

By Order of the Secretaries of the Army, Air Force and Navy (Including the Marine Corps):

CARL E. VUONO
General, United States Army
Chief of Staff

Official:

WILLIAM J. MEEHAN, II
Brigadier General, United States Army
The Adjutant General

LARRY D. WELCH, General USAF
Chief of Staff

Official:

ALFRED G. HANSEN
General, USAF, Commander, Air Force Logistics Command

B. F. MONTOYA
Rear Admiral, CEC, US Navy
Commander
Navy Facilities Engineering Command

H. E. REESE
Executive Director
Marine Corps Research, Development and Acquisition Command

DISTRIBUTION:

To be distributed in accordance with DA Form 12-25E, Direct and General Support Maintenance requirements for Generator Set, Gas Driven, 2 Wheel Mounted, 28V, DC, 7.5KW (JHGV7.5A).

WARNING

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

HIGH VOLTAGE

testing may cause serious or fatal injury from electrical shock. Avoid bodily contact with test probes and perform testing on a wooden bench, or place an insulated mat under test items. The electrical charge stored in turbine engine ignition exciters may be lethal. Ground igniter plug and lead and do not touch or put hand near base of plug while igniter unit is activated. Take precautions when discharging igniters. A special enclosed box with a viewing window should be used. Handle batteries with caution, verifying that all switches and controls on the control panel are off or neutralized prior to hookup of battery terminals. Disconnect battery quick-disconnect prior to performing maintenance on wiring harness.

DEATH

or severe burns may result if personnel fail to observe safety precautions. To avoid electrocution, the generator set must always be grounded. Do not operate the generator set until the ground terminal stud has been properly connected to a suitable ground. When performing maintenance on this equipment, personnel should remove all jewelry and secure loose-fitting clothing to prevent it from catching in moving parts. Do not attempt to inspect, service, adjust, repair, or replace parts until generator set has been completely shut down.

SEVERE INJURY

and equipment damage could result from foreign material entering the compressor inlet causing violent turbine or compressor failure. Do not operate generator set with engine access cover removed. Shut down unit and stow cable prior to towing.

EXPLOSION, FIRE, OR ELECTROCUTION

may be induced by frayed, cut or missing insulation on power supply cable. Exercise care in handling power supply cable. Do not route over airframe. Fuels used in the generator set are flammable; cleaning solvents are flammable; and batteries, when shorted, can deliver high currents and a spark may cause cells to explode. To prevent explosion or fire, use and store fuels and solvents in a well-ventilated area, do not smoke, and keep area free of spark and open flame.

DANGEROUS MATERIALS

Personnel must be adequately protected to prevent injury resulting from contact with heated or chilled parts; toxic primer and paint ; solvents used in cleaning parts; corrosive chemicals contained in batteries; compressed air used for cleaning or drying; and radiation, sparks and airborne particles produced during welding activity. Personnel should use proper equipment and wear protective clothing such as goggles/face shields with tinted lenses, rubber gloves, boots, and aprons. MIL-L-7808 lubricant contains a poisonous additive readily absorbed by the skin. Use appropriate personnel protective equipment as designated by local occupational health authority. Dry cleaning solvent P-D-680 is flammable and toxic to the skin, eyes, and respiratory tract. All activities requiring exposure to these materials should be performed in well-ventilated areas with extinguishers and vat or tank covers on hand in case of fire.

WARNING

Injury to personnel may result from improper lifting or movement of the generator set cart. Do not attempt lunette lift with less than two persons. Set handbrake and anchor lunette eye to suitable object to prevent accidental movement. During inspection, apply handbrake and chock front and rear of both wheels. Exercise care when releasing handbrake to prevent inadvertent movement. When lifting cart for movement, use an overhead hoisting device with lifting capacity of 2000 pounds (907.2 kg).

TECHNICAL MANUAL
NO. 5-6115-612-34

HEADQUARTERS, DEPARTMENTS OF
THE ARMY AND THE NAVY
WASHINGTON, D.C., 25 JULY 1988

INTERMEDIATE (FIELD), (DIRECT AND GENERAL SUPPORT)
AND DEPOT MAINTENANCE MANUAL

GENERATOR SET, AVIATION, GAS TURBINE ENGINE DRIVEN, INTEGRAL TRAILER MOUNTED, 10KW, 28 VOLTS

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 these procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 20282 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. You may also submit your recommended changes by Email directly to <mpmt%avma28@st-louis-emh7.army.mil>. A reply will be furnished directly to you. Instructions for sending an electronic 2028 may be found at the back of this manual immediately preceding the hard copy 2028.

TABLE OF CONTENTS

NOTE

An alphabetical index is located at the back of this manual.

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS (Continued)

LIST OF ILLUSTRATIONS (Continued)

LIST OF TABLES

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1-1. SCOPE. This manual contains instructions for use in maintaining the 10kW, 28Vdc, Aviation Generator Set, MEP 362A. The type I (tactical), class 1 (precise), and mode IV (dc output) set is used in applications where precise power is required. The maintenance procedures described herein are within the scope of the intermediate and depot maintenance personnel as allocated by the Maintenance Allocation Chart (MAC). The procedures specified in this manual shall be followed if in conflict with the contents of any referenced document.

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

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

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 AFM-66-1 and the applicable 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.

d. (MC) Maintenance forms and records used by Marine Corps personnel are prescribed by TM 4700-15/1.

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

a. (A) Army - DA form 2028 -2 located in back of this manual direct to: Commander, US Army Troop Support Command, ATTN: AMSTR-MCTS, 4300 Goodfellow Blvd., St. Louis, MO 63120-1798.

b. (F) Air Force--AFTO form 22 directly to: Commander, Sacramento Air Logistics Center, ATTN: MMEDT, McClellan Air Force Base, CA 95652, in accordance with T0-00-5-I.

c. (N) Navy--by letter directly to: Commanding Officer, US Navy Ships Parts Control Center, ATTN: Code 783, Mechanicsburg, PA 17055.

d. (MC) Marine Corps--by NAVMC form 10772 directly to: Commandant, Headquarters, US Marine Corps, ATTN: Code LMA-1, WASH DC 20380. (Narrative manuals only.)

e. (MC) Marine Corps--by NAVMC form 10772 directly to: Commanding General, ILS ME/O DIV (Code 837), Marine Corps Logistical Base, Albany, GA 31704.

1-5. **LEVELS OF MAINTENANCE ACCOMPLISHMENT.**

a. (A, MC) Army and Marine Corps users shall refer ‘to the Maintenance Allocation Chart (MAC.) for tasks and levels of maintenance to be performed.

1-5. LEVELS OF MAINTENANCE ACCOMPLISHMENT. (cont)

b. (F) Air Force users shall accomplish maintenance at the user level consistent with their capability in accordance with policies established in AFM 66-1.

c. (N) Navy users shall determine their maintenance levels in accordance with their service directives.

Section II. DESCRIPTION AND DATA

1-6. DESCRIPTION. A general description of the generator set is contained in the Operator and Organizational Maintenance Manual, TM 5-6115-612-12. For location of major set components see figures 1-1 and 1-2. Detailed descriptions of these components and major set subsystems are provided in the applicable maintenance paragraphs of this manual.

1-7. TABULATED DATA. Information required by the intermediate and depot level maintenance personnel to maintain the generator set is contained in the Tabulated Data. The general scope of this data is as follows:

a. Location and Description of Idetification and Instruction Plates. Information pertaining to identification and instruction plates located throughout the set is contained in the Operator and Organizational Maintenance Manual, TM 5-6115-612-12.

b. Tabulated Data. Details on the manufacturer, model and type of equipment, weight (wet/dry), dimensions, and detailed data on components follows under Tabulated Data.

Torque Data. See table 1-1 of TM 5-6115-612-12 for torque data.

d. Repair and Replacement Standards. Table 1-1 contains the repair and replacement standards established for generator set components.

e. Diagrams and Schematics. The following diagram and schematic foldouts are located at the back of this manual.

- FO-1. Engine Electronic Control Module (EECM) Schematic
- FO-2. Engine Electronic Control Module (EECM) Wire List
- FO-3. EECM Switch Circuit Card Schematic
- FO-4. EECM MPU Board Schematic
- FO-5. EECM Power supply Board Schematic
- FO-6. Generator to GECM Wiring Harness
- FO-7. Branched EECM to Engine Wiring Harness
- FO-8. GECM/Control Panel/EECM Wiring Harness
- FO-9. Controls and Instruments Block Diagram (2 sheets)
- FO-10. GECM Printed Wiring Schematic (4 sheets)
- FO-11. GECM Assembly Wiring Diagram
- FO-12. GECM Assembly Schematic

1-6. DESCRIPTION. (cont)

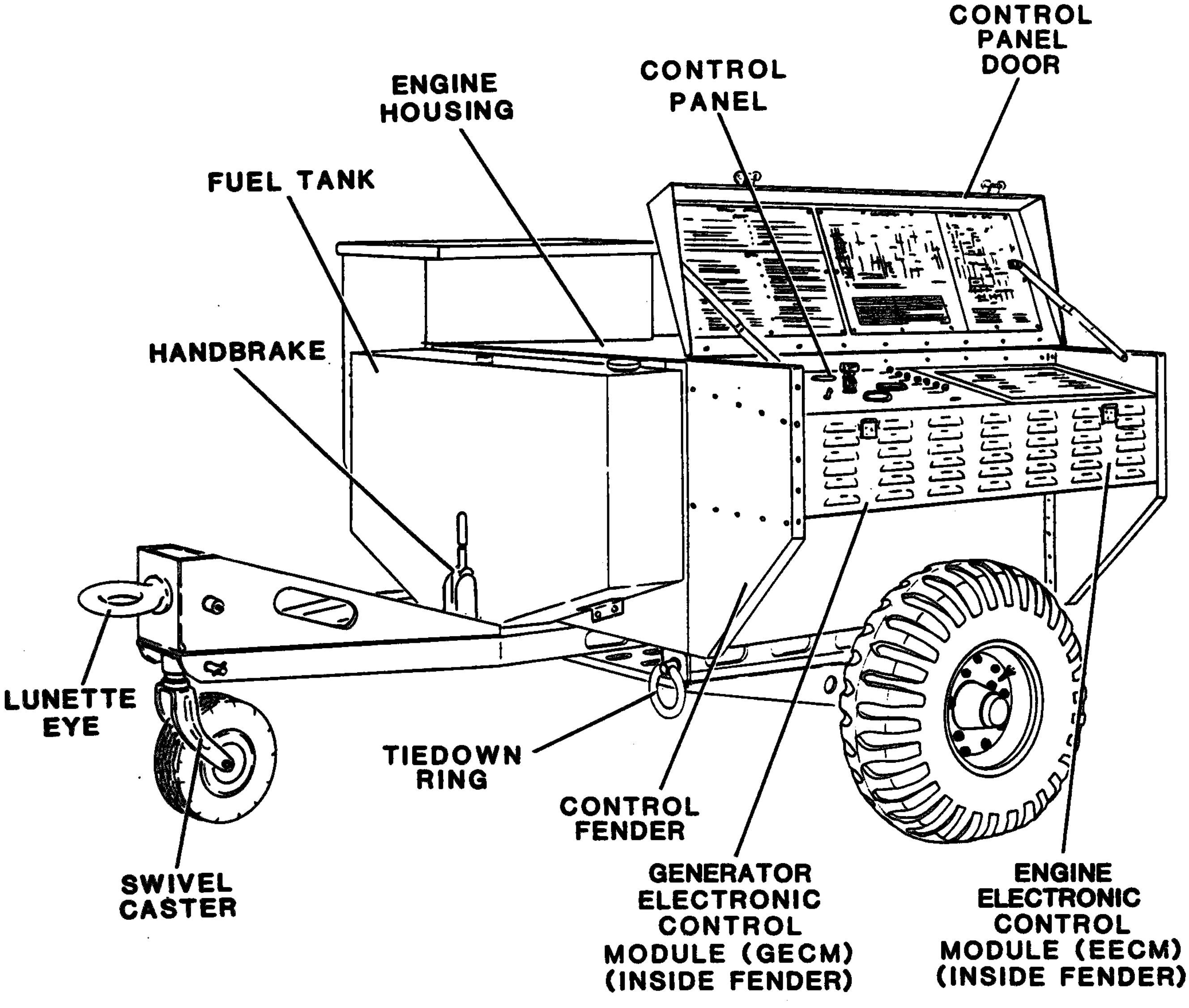
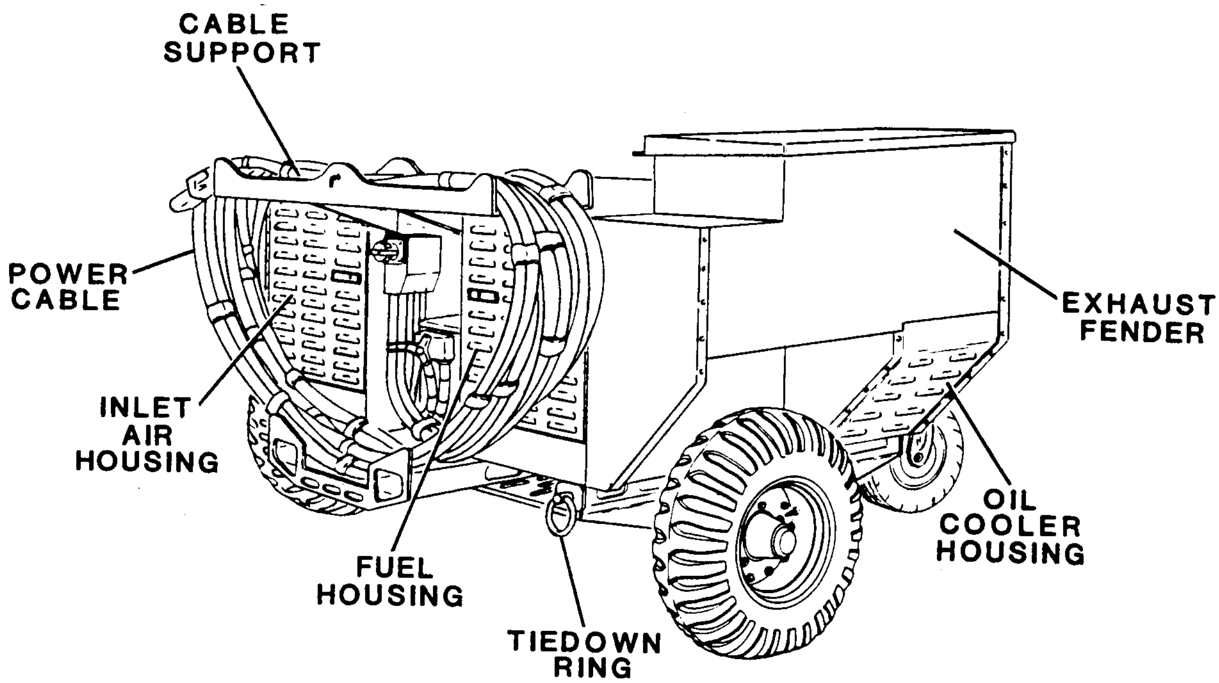


Figure 1-1. Aviation Generator Set, Front 3/4 View

1-6. DESCRIPTION. (cont)



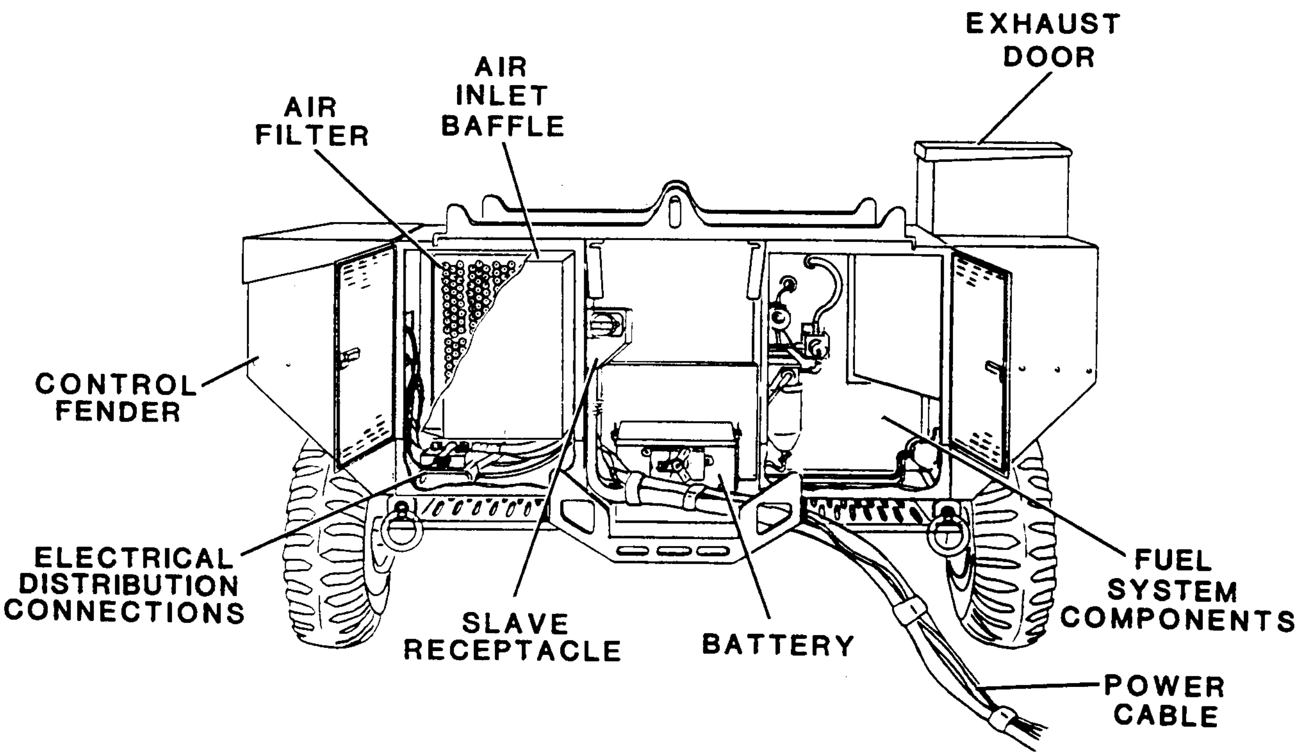


Figure 1-2. Aviation Generator Set, Rear View

1-7. TABULATED DATA. (cont)

1. GENERATOR SET	
DOD DRAWING NUMBER	83-362
Manufacturer	Tiernay Turbines, Inc.
Model	MEP 362A
Engine Model	TT10-1
Mode	28 Vdc (IV)
Class	1 (precise)
Fuel Consumption	52 pph (23.6 kg/h) (8 gal/30.3 1)
Operating Altitude Range	O to 8000 ft (O to 2438 m)
Operating Temperature Range	-65°F (-53°C) to 125°F (51.7°C) with 107°F (41.7°C) max at 5000 ft (1524m)
Capacities:	
Lube Oil System	4 qt (3.79 1)
Fuel System	32 gal (121.13 1) (208 lb/94.4kg)
Dimensions and Weights:	
Overall length (max)	89 in. (226.06 cm)
Overall width (max)	71 in. (180.34 cm)
Overall height (max)	49 in. (124.46 cm)
Clearance (rein)	9 in. (22.86 cm)
Net weight (wet)	1175 lbs (533kg)
Net weight (dry)	960 lbs (435.45 kg)
2. FRAME AND HOUSING	
Air Filter	
DOD Drawing Number	83-14441
Manufacturer	Pall Land Marine
Cleaned Air Flow	1320 scfm (1.65 lb/see)
Scavenging Air Flow	10% of cleaned air flow
Pressure Differential	2 in. (50 mm) of water at 1320 scfm (max)
Noise Attenuation	7 to 10 decibels between 5000 and 10,000 Hz
Weight	5 lb (2.27 kg)
System Efficiency	92%
Frontal Area	162 square in.

1-7. TABULATED DATA. (cont)

3. DC ELECTRICAL AND CONTROL SYSTEM

Generator Electronic
Control Module (GECM)

DOD Drawing Number	83-14134

4. ELECTRICAL POWER GENERATION AND CONTROL SYSTEM

Starter Assembly

Manufacturer	Tiernay Turbines, Inc
Part Number	**101679-1**
System	**24V**
Model	MUF-6001T
No Load Readings (nom)	180 amps
Stall Readings (nom)	400 amps
Contacts	200 amps, O to 24 Vdc

Current Shunt (2)

Specification	MIL-S-61B
Manufacturer	EMPRO
Part Number	MSA200, MSC102
Current Rating	20 amps, 1000 amps

5. FUEL SYSTEM

Engine Fuel Tank

DOD Drawing Number	83-14108
Manufacturer	Tiernay Turbines, Inc
Capacity	32 gal (121.13 1)
Operating Time Provision	4 hours

6. ENGINE/GENERATOR CONTROLS AND INSTRUMENTS

Wiring Harnesses

Branched EECM to Engine DOD Drawing Number	83-14255
Branched GECM to Control Panel and EECM DOD Drawing Number	83-14256

1-7. TABULATED DATA (cont)

Table 1-1. Repair and Replacement Standards

Component	Manufacturer Tolerance		Desired Clearance		Maximum Allowable	Maximum Allowable
	Minimum	**Maximum**	**Minimum**	**Maximum**	**Wear**	**Clearance**
ENGINE						
BACKSCHROUD (Dwg #107606)						
Overall Length	1.568	1.576				
Major OD (B)	7.3150	7.3160				
Inside Diameter	7.025	7.035				
Surface -A- Flatness	2.500	2.502				
Diameter (C)	0.001					
BEARING HOUSING (Dwg #101403)						
Bearing bore	1.8506	1.8511				
Major OD	3.1870	3.1873				
Seal ID	1.3195	1.3200				
Overall length	2.055	2.065				
Surface -A- Flatness	0.001					
COMBUSTION CHAMBER						
Major OD	9.650	9.660				
Inside Diameter	5.31	5.32				
COMBUSTION CHAMBER CASE (Dwg #101418)						
Overall length	8.47	8.49				
Major OD (D)	11.776	11.796				
Inside Diameter (C)	10.758	10.760				
Surface -A- Flatness	0.002					
Surface - Runout	0.020					
Surface -B- Diameter	10.900	10.902				
Perpendicular to -A-	0.001					
Surface -G- Parallel to -A-	0.008					
COMPRESSOR WHEEL & SHAFT (Dwg #101682)						
Wheel Major OD (A)	6.300	6.310				
Shaft Inside Diameter (B)	0.6255	0.6260				
Shaft Inside Diameter (C)	0.6658					
Wheel blades						
					Nicks and	
Blade clearance to hsg			0.014	0.016	scratches	
Side clearance to hsg			0.009	0.05	0.002	
Surface -C-						
Perpendicular to Centerline	0.002					
Dimension -D-	3.355	3.365				
Dimension -E-	3.892	3.908				
Dimension -G-	1.076	1.078				
DIFFUSER SET (Dwg #101580)						
Surface -A- Flatness	0.005					
Surface -C- Parallel to -A-	0.001					
DIFFUSER CAP (Dwg #107582)						
Diameter -A- Flatness	0.002					
Diameter -B-	3.3565	3.3570				
Diameter -C-	2.492	2.494				
Diameter -D-	1.80	1.82				

1-7. TABULATED DATA (cont)

Table 1-1. Repair and Replacement Standards -Continued

Component	Manufacturer Tolerance		Desired Clearance		Maximum Allowable	Maximum Allowable
	Minimum	Maximum	Minimum	Maximum	Wear	Clearance
<u>ENGINE</u> (Cont)						
INLET HOUSING (Dwg #101401)						
Overall Length	7.435	7.460				
Inside diameter	3.1875	3.1880				
Diameter -A-	10.903	10.907				
Diameter -B-	10.7505	10.7530				
Diameter -C-	7.747	7.749				
Surface -A- Flatness	0.001					
Surface -B- parallel to -A-	0.001					
Surface -C- parallel to -A-	0.001					
Surface -D- parallel o -A-	0.001					
LABYRINTH SEAL (COMPRESSOR)						
Inside Diameter	0.7870	0.7874				
Overall length	0.9290	0.9310				
Major OD	1.350	1.370				
OD over teeth	1.2482	1.2485				
LABYRINTH SEAL (TURBINE)						
Inside Diameter	0.7870	0.7874				
Overall length	0.760	0.770				
Major OD	1.8530	1.8535				
OD over teeth	1.8530	1.8535				
TURBINE WHEEL AND SHAFT						
Major OD (D)	6.325	6.335				
Bearing journal (B)	0.6653	0.6655				
Blade clearance to nozzle			0.022	0.026		0.026
Diameter -A-	0.6254	0.6256				
Diameter -C-	0.7875	0.7878				
Surface -E- Perpendicular to centerline	0.0002					
TURBINE NOZZLE OUTER (dwg #101687)						
surface -A- Flatness	0.002					
surface -B-	7.3150	7.3160				
surface -E- Perpendicular to -B-						
Diameter -C-	0.001					
Diameter -D-	9.665	9.670				
	9.790	9.795				
TURBINE NOZZLE INNER (DWG #101688)						
Surface -A- (Top of Vanes) Flatness	0.0005					
Surface -B- Diameter	4.309	4.311				
Perpendicular to -A-	0.001					

1-7. TABULATED DATA (cont)

Table 1-1. Repair and Replacement Standards -Continued

Component	Manufacturer Tolerance		Desired Clearance		Maximum Allowable	Maximum Allowable
	Minimum	Maximum	Minimum	Maximum	Wear	Clearance
GEARBOX						
GEARBOX HOUSING (Dwg #107434)						
Bearing bore (Generator) (A)	2.4412	2.4416				
Bearing bore (Oil Pump) (B)	0.7500	.7505				
Bearing bore (Output) (C)	1.8506	1.8511				
Bearing bore (Starter) (D)	2.1657	2.1662				
Bearing bore (Generator Mount) (E)	4.125	4.127				
Bearing bore (Compressor Inlet Housing) (F)	7.750	7.752				
GEARBOX SURFACE						
-A- (Compressor Side)	0.002					
-B- (Oil Pump)	0.002					
-C- (Generator)						
SHOULDERED SHAFT (Generator)						
Major Diameter	1.730	1.750				
Bearing journals	1.3775	1.3779				
SPUR GEAR (Output)						
Major Diameter	4.620	4.625				
Inside Diameter	1.3781	1.3784				
Spline minor dia	1.650	1.655				
SPUR GEAR (Pinion)						
Major Diameter	1.1617	1.1667				
Inside Diameter	0.4620	0.4670				
Bearing journals	0.7875	0.7878				
SPUR GEAR (STARTER)						
Bearing journals	1.3781	1.3784				
Overall length	2.305	2.325				
Root Diameter	6.220ref					
Major OD	6.411	6.416				
STARTER MOUNTING COVER						
Major OD	7.00ref					
O-ring Diameter	6.6380	6.6390				
Bearing bore	2.1657	2.1662				

1-7. TABULATED DATA (cont)

Table 1-1. Repair and Replacement Standards -Continued

Component		Manufacturer Tolerance		Desired Clearance		Maximum Allowable	Maximum Allowable
		Minimum	Maximum	Minimum	Maximum	Wear	Clearance
OIL PUMP							
HOUSING (Dwg #101456)							
Cover Diameter		2.3145	2.3148				
Cover length		0.380	0.385				
Surface -A-	Flatness	0.001					
Surface -B-	Diameter	2.559	2.560				
	Perpendicular to -A-	0.001					
Surface -C-	Diameter	0.5007	0.5012				
	Perpendicular to -A-	0.005					
Surface -G-	Parallel to -A-	0.005					
Surface -H-	Diameter	2.3145	2.3165				
	Centered on B	0.0005					
Surface -K-	Diameter	2.3145	2.3165				
	Centerline Perpendicular to -A-	0.005					
Surface -L-	Perpendicular to -C-	0.005					
Diameter -M-		1.250	1.252				
Diameter -M-		1.2002	1.2007				
Diameter -P-		1.2002	1.2007				
PUMP COVER							
Overall length		0.420	0.46				
OD at O-ring		1.244	1.247				
Groove width		0.1411	0.151				
O-ring Diameter		1.077	1.080				
SHOULDERED SHAFT (DRIVE)							
Shouldered Diameter		0.610	0.640				
shaft Diameter		0.4998	0.5001				
Overall length		1.76	1.80				
Inside Diameter		0.390	0.410				
SHOULDER SHAFT (QUILL)							
Shaft OD		0.3400	0.3410				
Minor OD		0.270	0.280				
Overall length		1.850	1.870				
SPUR GEAR (IDLER)							
Inside Diameter		0.5010	0.5015				
Major Diameter		1.1965	1.1970				
Overall length		0.2490	0.2496				
SPUR GEAR (PUMP)							
Inside Diameter		0.5004	0.5009				
Major Diameter		1.1965	1.1970				
Overall length		0.2490	0.2496				

CHAPTER 2

GENERAL MAINTENANCE

Sectlon I. REPAIR PARTS, SPECIAL TOOLS, TEST, MEASUREMENT, DIAGNOSTIC EQUIPMENT (TMDE), AND SUPPORT EQUIPMENT

2-1. REPAIR PARTS. Repair parts are listed and Illustrated in the Organizational, Intermediate (Field) (Direct and General Support) and Depot Maintenance Repair Parts and Special Tools List manual, TM 5-6115-612-24P.

2-2. TOOLS AND EQUIPMENT. This section contains special tools, inspection and test equipment, and fabricated tools and equipment required for the general maintenance of the generator set.

a. Special Tools. Table 2-1 lists the special tools required for the maintenance of the generator set.

b. Inspection and Test Equipment. Table 2-2 lists common Inspection and test equipment.

Fabricated Tools and Equipment. Table 2-3 contains detailed descriptions, instructions, parts lists, and illustrations necessary for fabrication of tools and equipment essential for maintenance.

2-2. TOOLS AND EQUIPMENT. (cont)

Table 2-1. Special Tools

Item	Drawing no.	Reference Fig. no.	Reference Para. no.	Use	Fig.
Wrench, oil filter	YA2380 (55719)	TM 5-6115-612-12		Remove oil filter	None
Wrench, generator	101699-1 (51913)	2-2	2-6.a(13)	Remove generator	None

Table 2-2. Inspection and Test Equipment

Item	NSN or part number	Figure and paragraph	Use
Depth micrometer		As applicable	Measure depth.
Inside micrometer		As applicable	Inside diameters.
Outside micrometer		As applicable	Outside diameters.
Wheatstone bridge		As applicable	Measure resistance.
Kelvin bridge		As applicable	Measure resistance.
Pressure gage		As applicable	Test pressure.
Variable dc power supply (15 amp capability)		As applicable	Provide dc voltage for testing.
Frequency meter		As applicable	Measure frequency of test voltages.
Thickness gage	5210-00-221-1999	As applicable	Measure thickness.
Function generator	6625-01-028-4989	As applicable	To perform EECM test.
Oscilloscope	6625-01-159-3106	As applicable	Electrical testing.
Gage,Surface GGG-G17	5210-00-221-1999	As applicable	Indicator Holder

2-2. TOOLS AND EQUIPMENT. (cont)

Table 2-2. Inspection and Test Equipment - Continued

Item	NSN or part number	Figure and paragraph	Use
Digital multimeter	6625-01-139-2512	As applicable	Electrical testing.
Digital multimeter	6625-01-221-9367	As applicable	Electrical testing.
Digital counter	6625-01-106-0453	As applicable	To perform EECM test.
Power supply (0-30 Vdc ± 1%, 10 amps)	Kepco ATE36-15M	As applicable	Electrical testing.
Power supply (Millivolt source, 0-60 millivolts dc, ±0.5 millivolts)	Use 10-turn potentiometer	As applicable	Electrical testing.
EECM test fixture	User fabricated	As applicable	To perform EECM test.
Timing device	Stopwatch or digital counter	As applicable	Electrical testing.
Universal counter (O-4 kHz at 10V ± 1%)	6625-01-106-0453	As applicable	Electrical testing.
GECM test fixture	User fabricated	As applicable	GECM testing.
Power supply (0-40 Vdc ± 0.5V)	---	As applicable	Electrical testing.
Power supply (O-5 Vdc ±0.lV)	---	As applicable	Electrical testing.
Recording oscillo-graph	Western Graphtecx WR3101	As applicable	Engine testing
Velocity trans-ducer (vibration pickups)	Bell & Howell 09384/4-123-0001	As applicable	Engine testing
Torque, Wrench GGG-W686	Equivalent (0-50,0-150,0-750 In, pounds 5210-00-000-0000		Engine Maintenance
Torque, Screwdriver GGG-W636	(0-100 IN LBS) or equivalent 5210-00-021-2041		Engine Maintenance

2.2 TOOLS AND EQUIPMENT. (cent)

Table 2–3. Fabricated Tools and Equipment

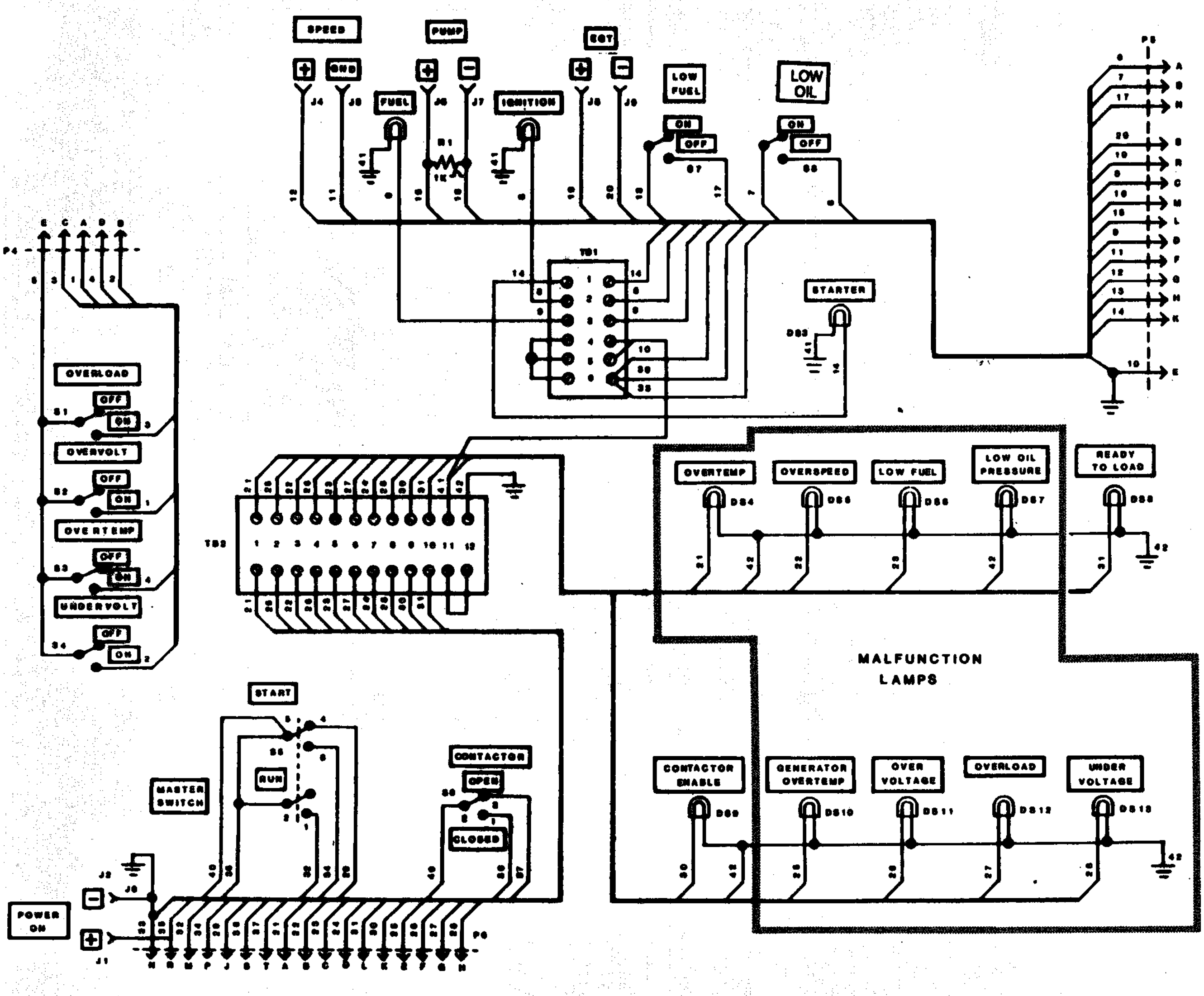
Nomenclature	Reference No. or NSN	Material required
EECM test fixture Parts list		

Ref Des	Nomenclature	Part Number	Qty
DS1–DS13	LAMP, INDICATOR, INCANDESCENT, 24-28 VOLTS MODULAR ASSEMBLY	35F3712–TYPE F328 01AT1 (lMLEC)	13
DS1 , DS2, DS3, DS8, AND DS9	LAMP LENS, YELLOW, TOP HAT STYLE MODULAR ASSEMBLY (REQS 5 mm HOLE)	35 F3706-TYPE 106-Y 01AT1 (lMLEC)	5
DS4 TO DS7, DS10TODS13	LAMP LENS, WHITE, FLUSH STYLE, MODULAR ASSEMBLY (REQS 5 mm HOLE)	35 F3704–TYPE 105–W 01AT1 (lMLEC)	8
J1 , J4, J6, AND J8	CONNECTOR, QUICK CONNECT (RED) INSULATED BINDING POSTS, BANANA PLUG, WIRE, ETC.	ITT 5018-2	4
J2, J45 J7, AND J9	CONNECTOR, QUICK CONNECT (BLACK) INSULATED BINDING POSTS, BANANA PLUG, WIRE, ETC.	ITT 5018–0	4
P4	CONNECTOR, PLUG, MULTIPIN, STRAIGHT PLUG WITH CABLE CLAMP	MS3106R18-1 P	1
P5	CONNECTOR, PLUG, MULTIPIN, STRAIGHT PLUG WITH CABLE CLAMP	MS3106R20-29P	
P6	CONNECTOR, PLUG, MULTIPIN, STRAIGHT PLUG WITH CABLE CLAMP	MS3106R22-14S	
RI	1,000 OHM, 1/4 WAIT RESISTOR		1
S1 THRU S4, S7, AND S8	SWITCH, TOGGLE (SPST)	MS24523-22	6
S5	SWITCH, TOGGLE (DPDT)	MS27407-5	1
S6	SWITCH, TOGGLE (DPST)	MS24523-27	1
- - - -	ENCLOSURE, METAL (AL, 12 X 15 IN) WITH LID, HANDLE, AND PANEL MOUNTING		1
TB1	TERMINAL STRIP		1
TB2	TERMINAL STRIP		1
- -	GROMMET, RUBBER 1/2 ID, FITS 13/1 6 IN DIA. 1/1 6 IN THK MATL.	MS35489-14	3
- -	STRAP, TIEDOWN, ELECTRICAL	MS3368-4-9D	3-12
- -	CABLE, POWER, ELECTRICAL, WHITE NO. 12 AWG	M16878/4BL69	AS REQD
- -	SOLDER		AS REQD

2-2. TOOLS AND EQUIPMENT (cont.)

Table 2-3. Fabricated Toois and Equipment- Continued

Nomenclature	Reference no. or NSN	Material required
EECM test fixture schematic	—	—

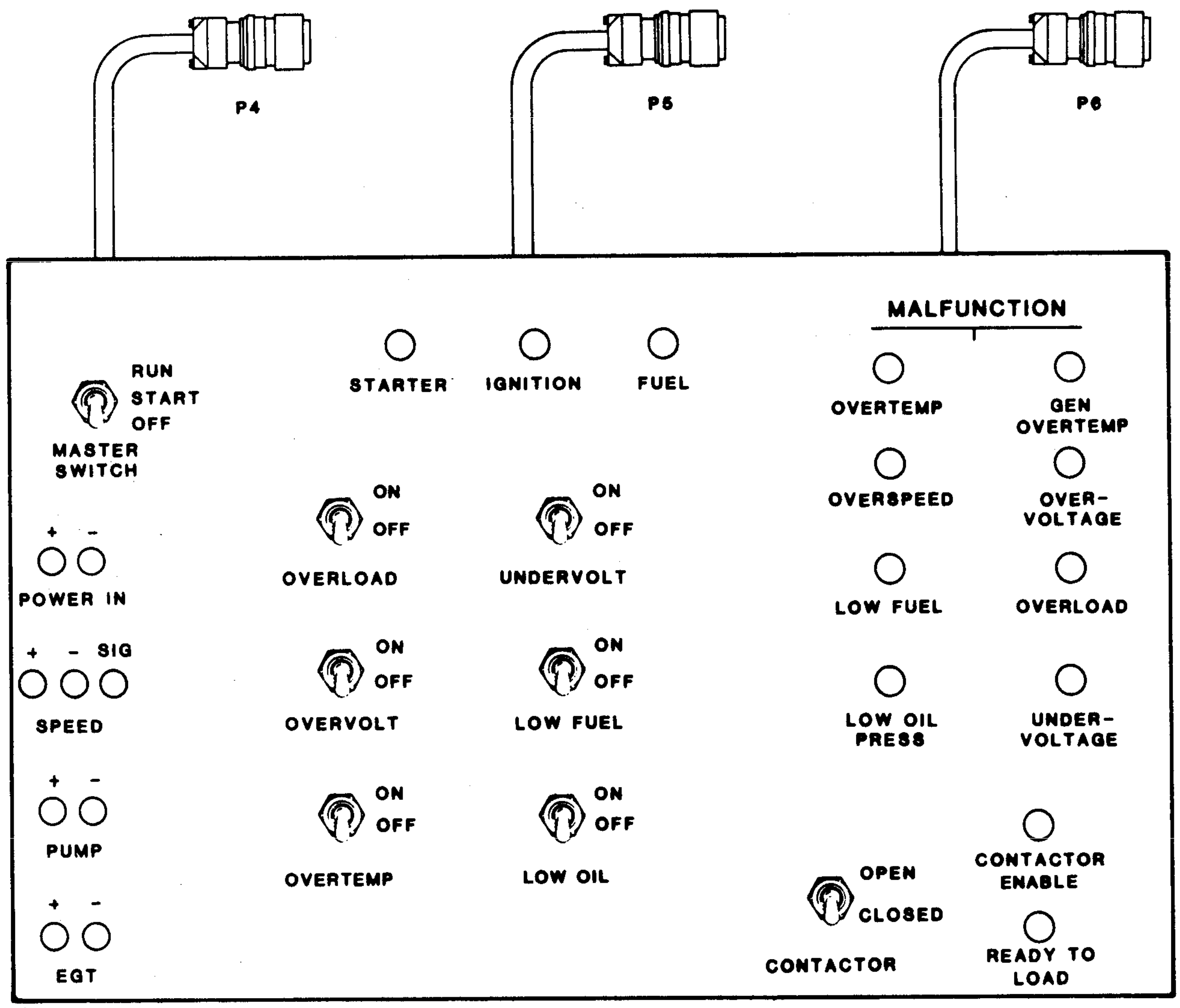


EECM TEST FIXTURE SCHEMATIC

2-2. TOOLS AND EQUIPMENT. (cont)

Table 2-3. Fabricated Tools and Equipment - Continued

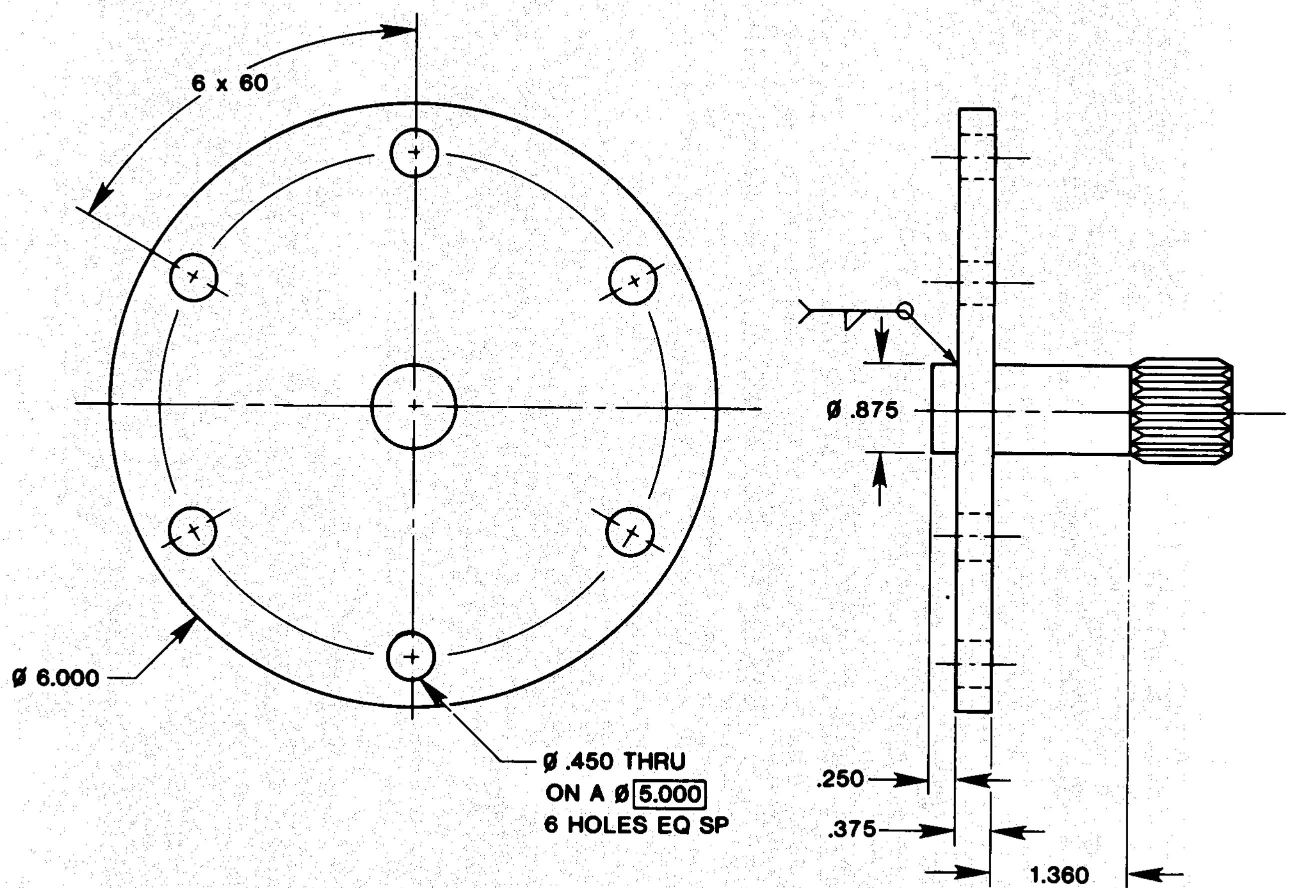
Nomenclature	Reference no. or NSN	Material required
EECM test fixture		See parts list



2-2. TOOLS AND EQUIPMENT. (cont)

Table 2-3. Fabricated Tools and Equipment - Continued

Nomenclature	Reference no. or NSN	Material required
Output ahaft torque tool	FT-21322	Cold rolled steel

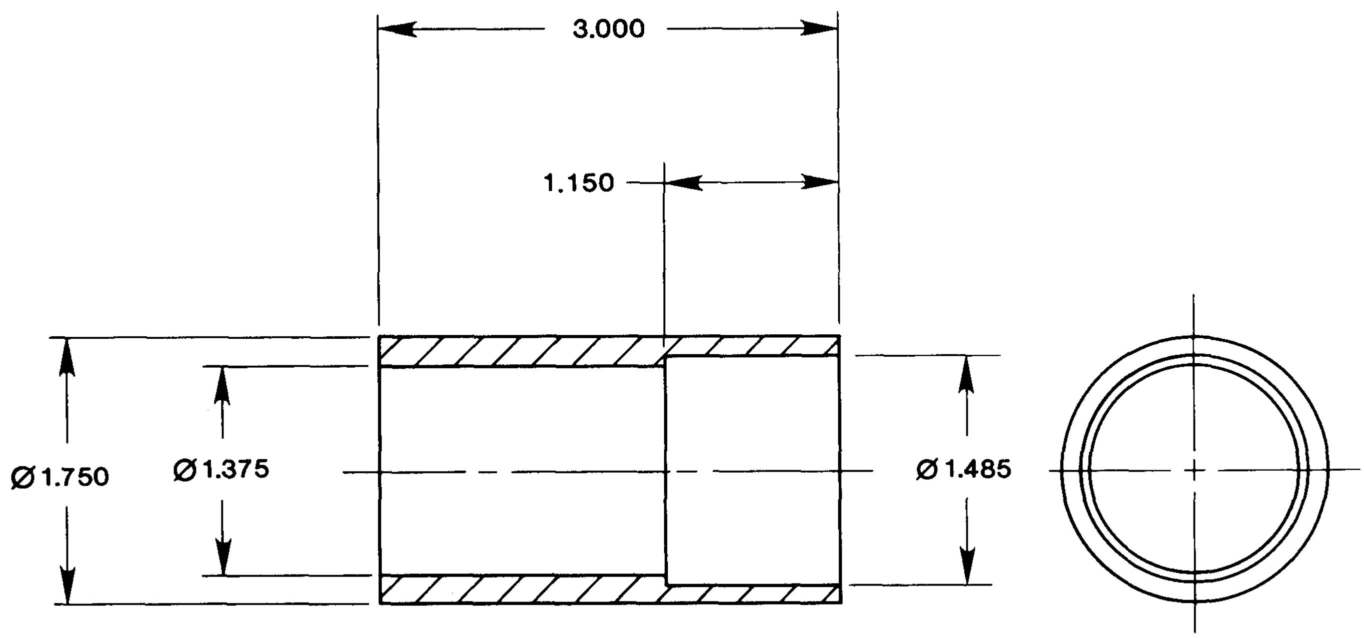


TOLERANCES: 3 PLACE DECIMALS ± 0.030

2-2. TOOLS AND EQUIPMENT. (cent)

Table 2-3. Fabricated Tools and Equipment - Continued

Nomenclature	Reference no. or NSN	Material required
Press arbor for starter gear and bearing inst.	FT-21324	Aluminum 6061-T6 6 required

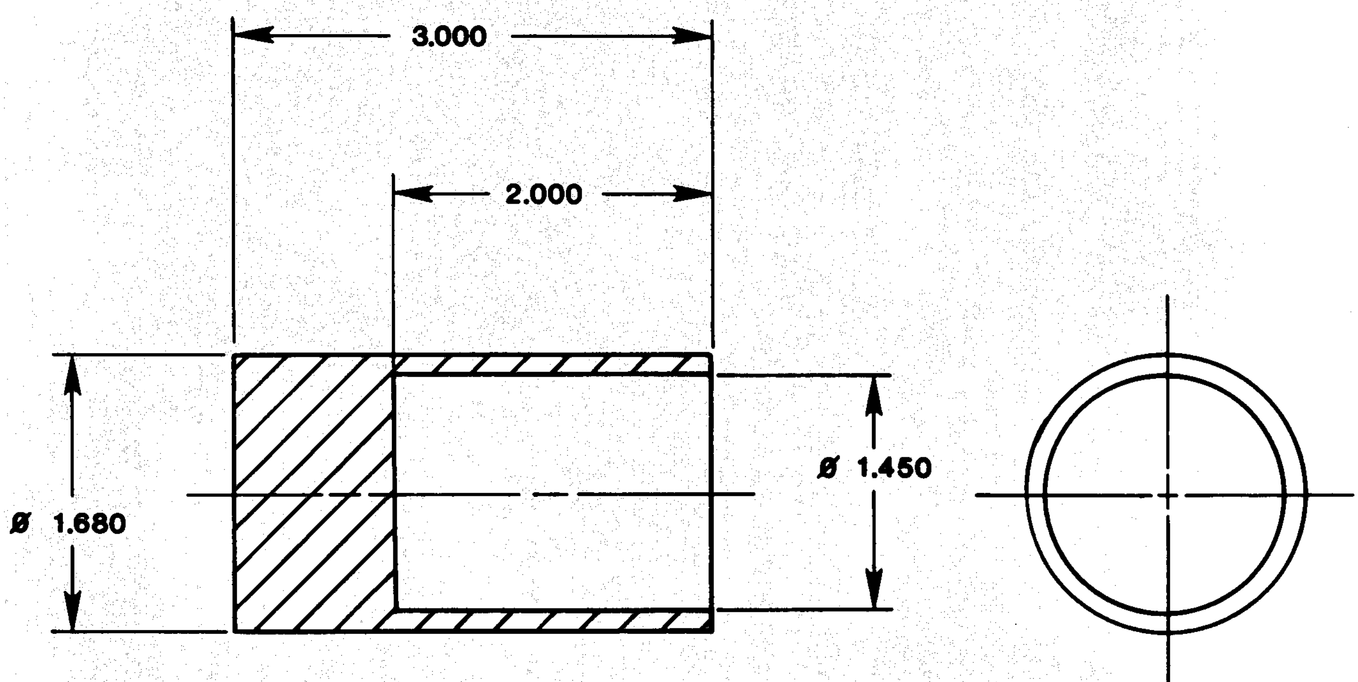


TOLERANCES: 3 PLACE DECIMALS + 0.030

2-2. TOOLS AND EQUIPMENT. (cont)

Table 2-3. Fabricated Tools and Equipment - Continued

Nomenclature	Reference no. or NSN	Material required
Press arbor for output shaft and bearing inst.	FT-21325	Aluminum 6061-T6 2 required

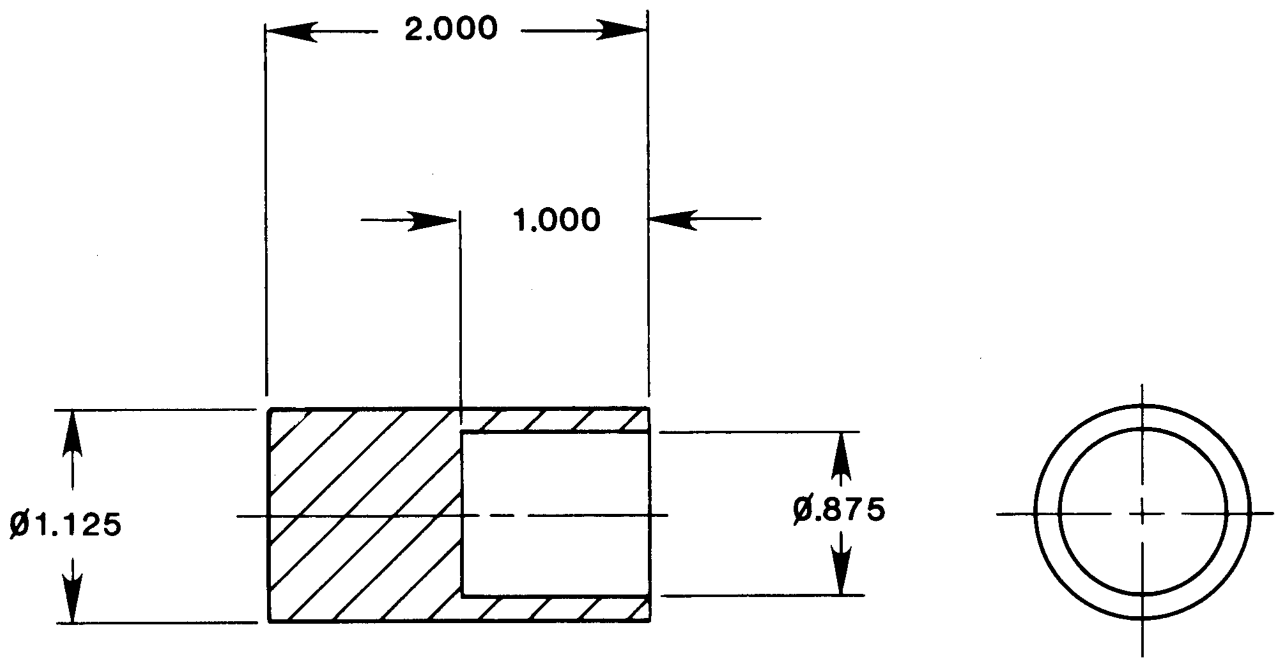


TOLERANCES: 3 PLACE DECIMALS ± 0.030

2-2. TOOLS AND EQUIPMENT. (cont)

Table 2-3. Fabricated Tools and Equipment - Continued

Nomenclature	Reference no. or NSN	Material required
Press arbor for pinion gear and bearing inst.	FT-21326	Aluminum 6061-T6 2 required



TOLERANCES: 3 PLACE DECIMALS 0.030

2-2 . TOOLS AND EQUIPMENT. (cont)

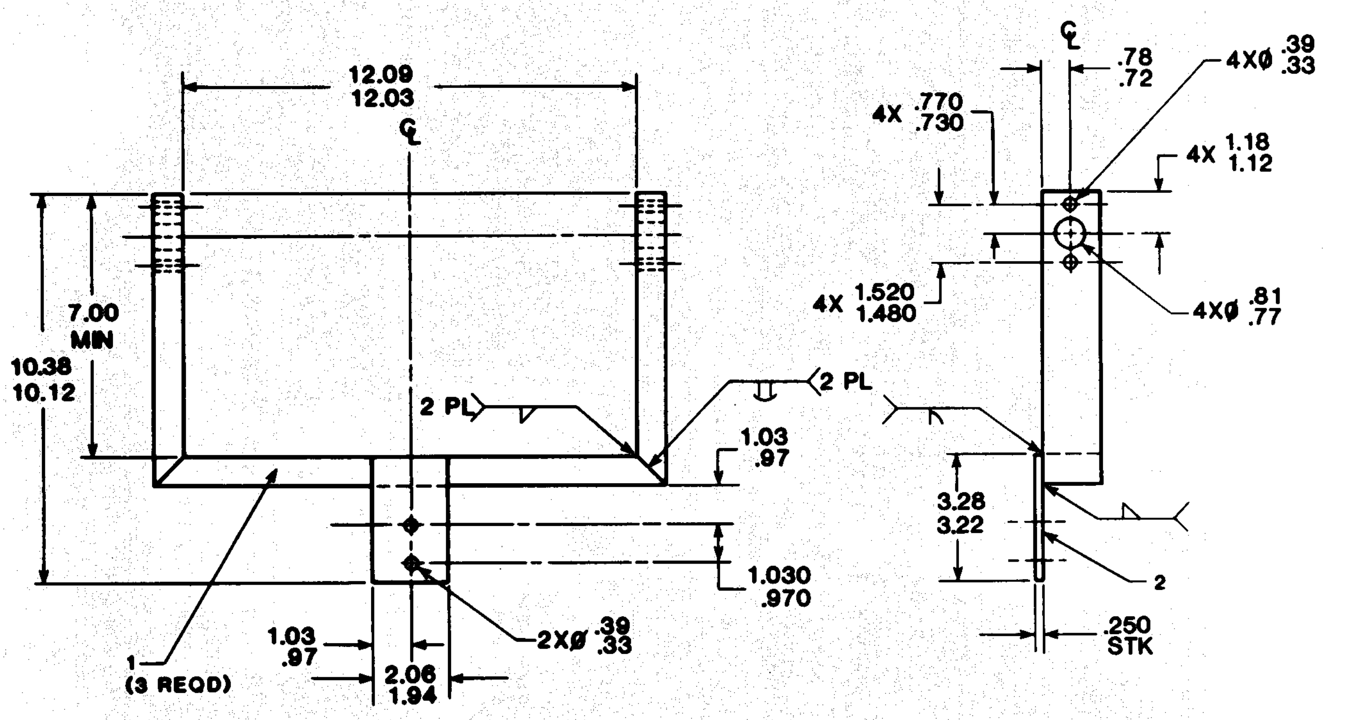
Table 2-3. Fabricated Tools and Equipment - Continued

Nomenclature	Reference no. or NSN	Material required
Gearbox holding fixture	**FT-21343**	**See** parts list

PARTS LIST

1. **MOUNTING PLATE - CARBON STEEL**
2. **TUBE 0.750 x 1.500 x 0.083 WALL CARBON STEEL, ASTM A513**

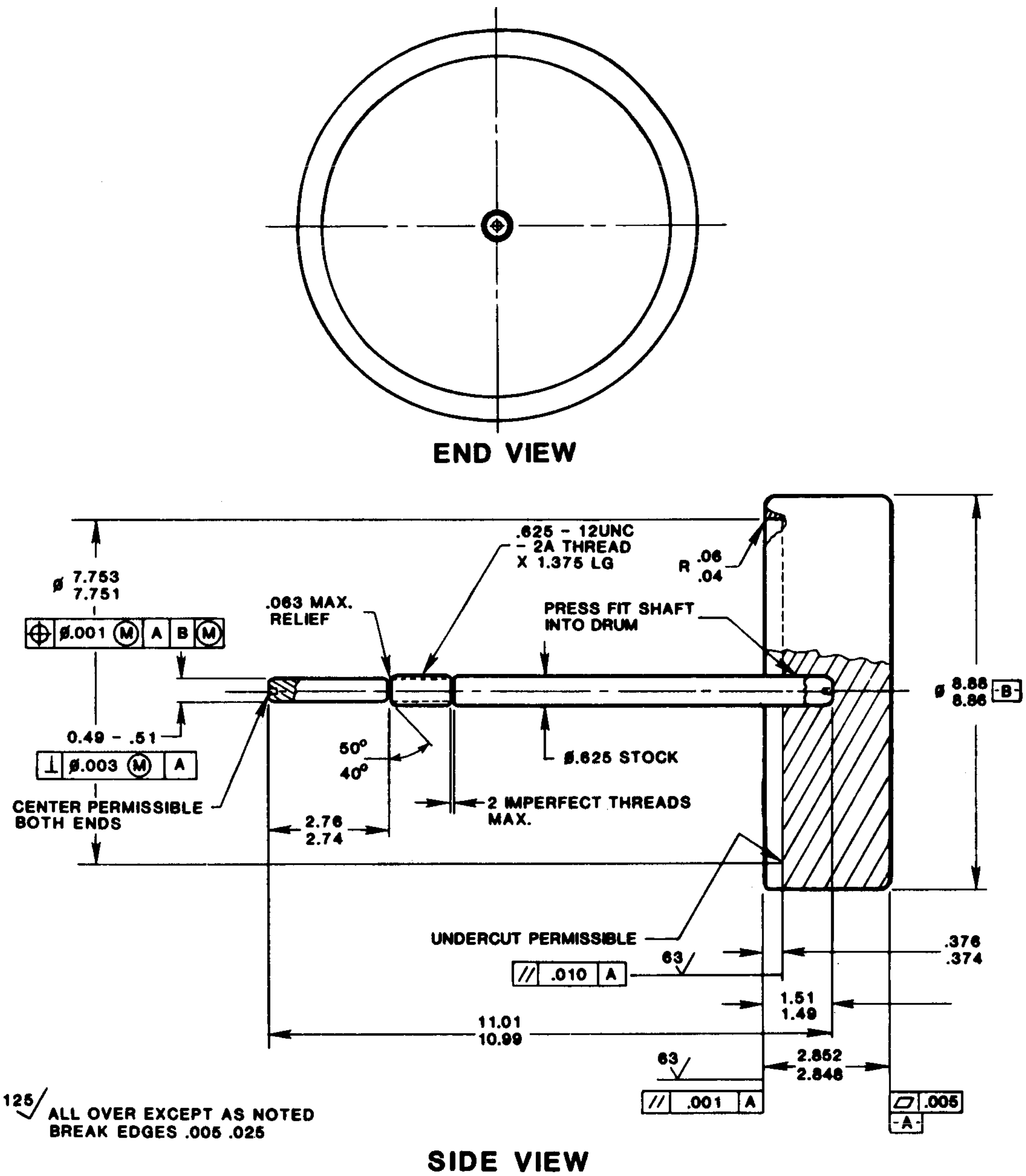
BREAK EDGES 0.020 MAX



2-? . TOOLS AND EQUIPMENT. (cont)

Table 2-3. Fabricated Tools and Equipment - Continued

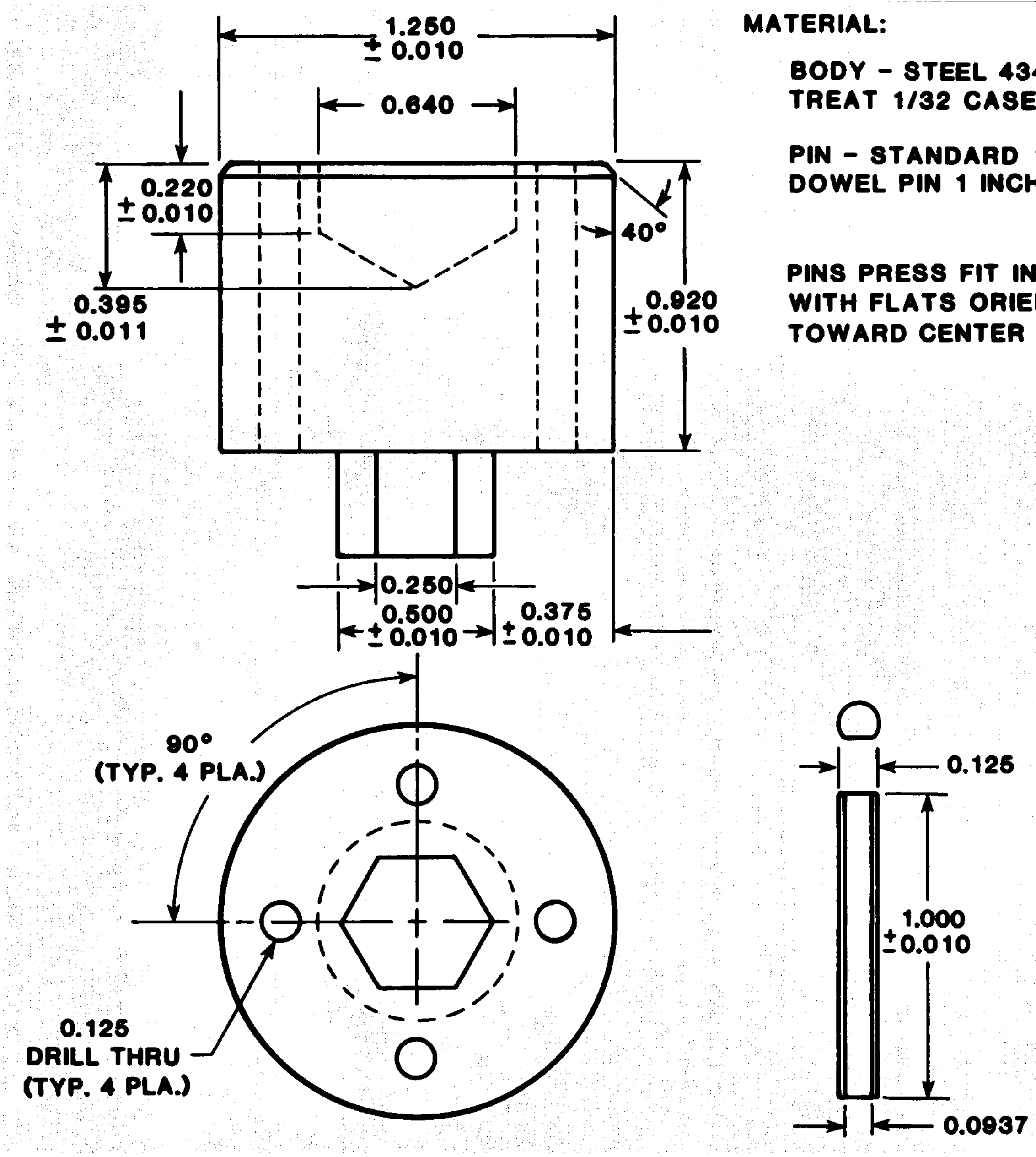
Nomenclature	Reference no. or NSN	Material required
Inlet housing assembly fixture	FT-21360	Shaft - carbon steel Drum - aluminum alloy



2-2. TOOLS AND EQUIPMENT. (cont)

Table 2-3. Fabricated Tools and Equipment - Continued

Nomenclature	Reference no. or NSN	Material required
Speed pickup nut torque tool	FT-21368	



MATERIAL:

BODY - STEEL 4340 HEAT TREAT 1/32 CASE HARDEN.

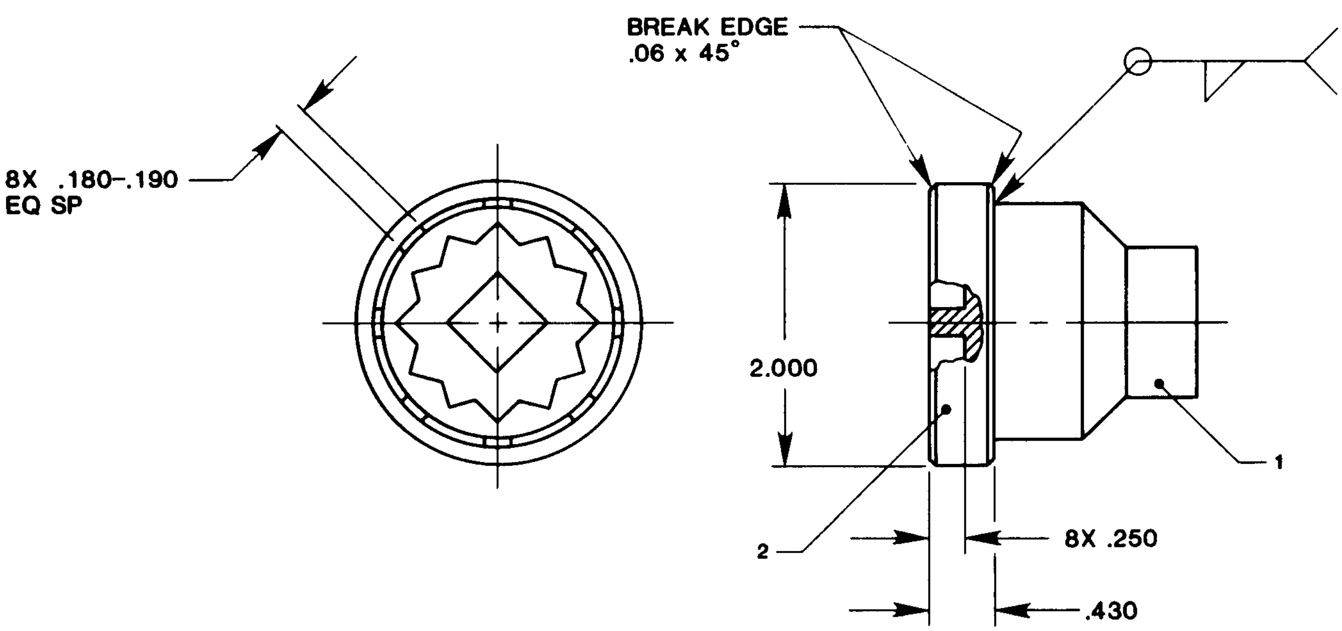
PIN - STANDARD 1/8 INCH DOWEL PIN 1 INCH LONG.

PINS PRESS FIT INTO BODY WITH FLATS ORIENTED TOWARD CENTER OF BODY.

2-2. TOOLS AND EQUIPMENT. (cont)

Table 2-3. Fabricated Tools and Equipment - Continued

Nomenclature	Reference no. or NSN	Material required
Torque fixture	FT-21369	See parts list



PARTS LIST

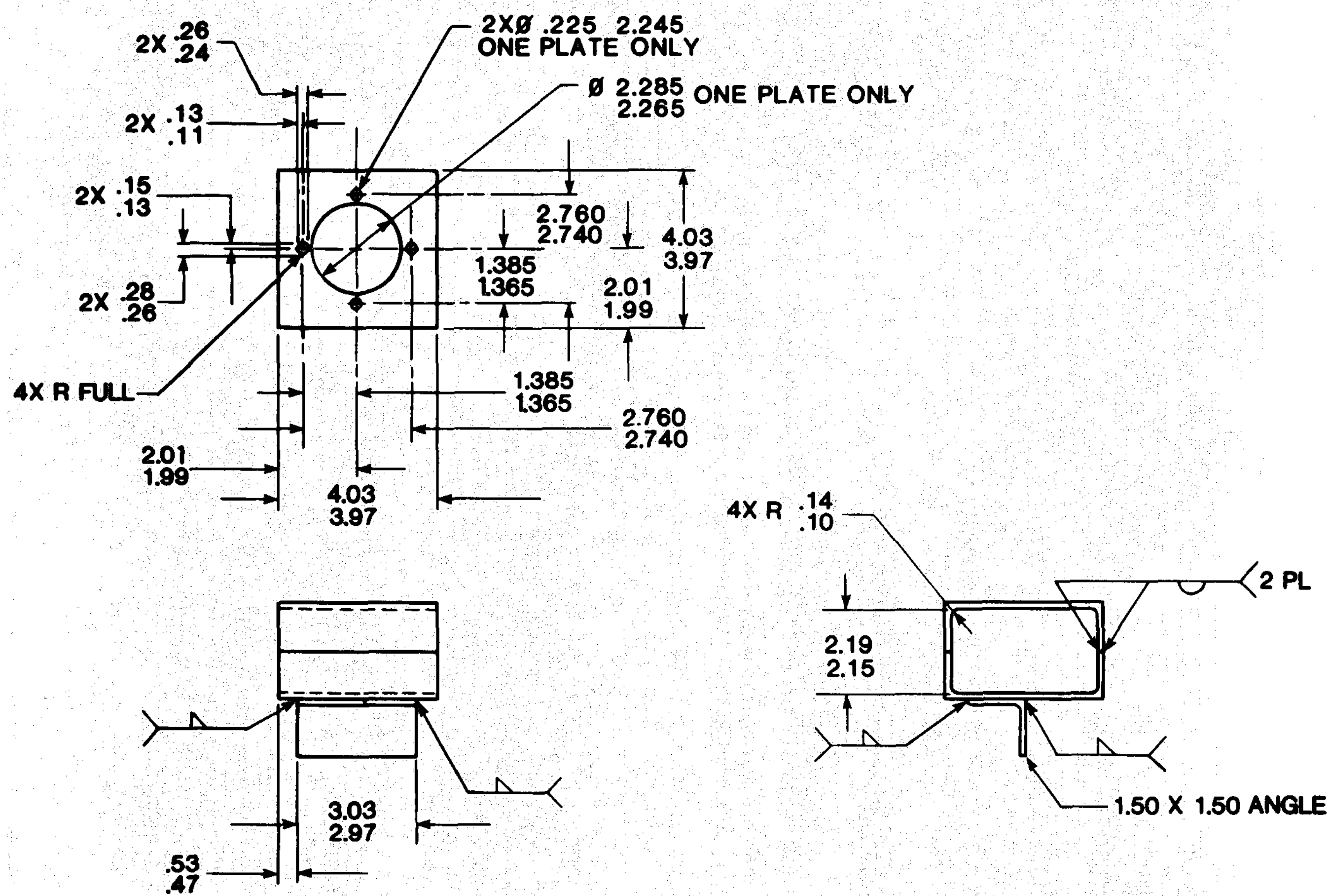
1. 1-1/4 SOCKET, 1/2 DRIVE

2. RING 2 IN. O.D. x 7/16

2-2. TOOLS AND EQUIPMENT. (cont)

Table 2-3. Fabricated Tools and Equipment - Continued

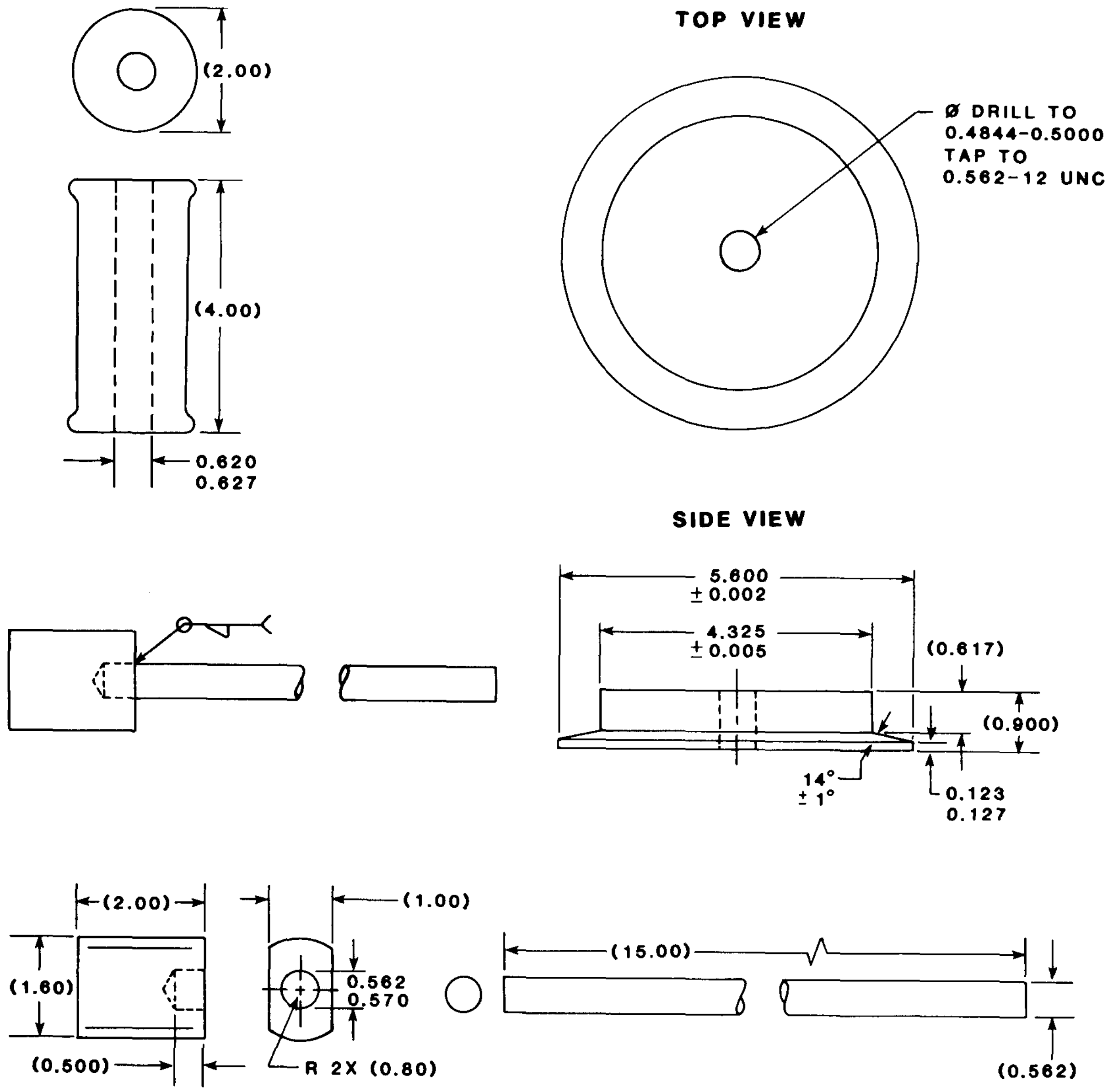
Nomenclature	Reference no. or NSN	Material required
Bearing carrier fixture	FT-21498	Aluminum alloy



2-2. TOOLS AND EQUIPMENT. (cont)

Table 2-3. Fabricated Tools and Equipment - Continued

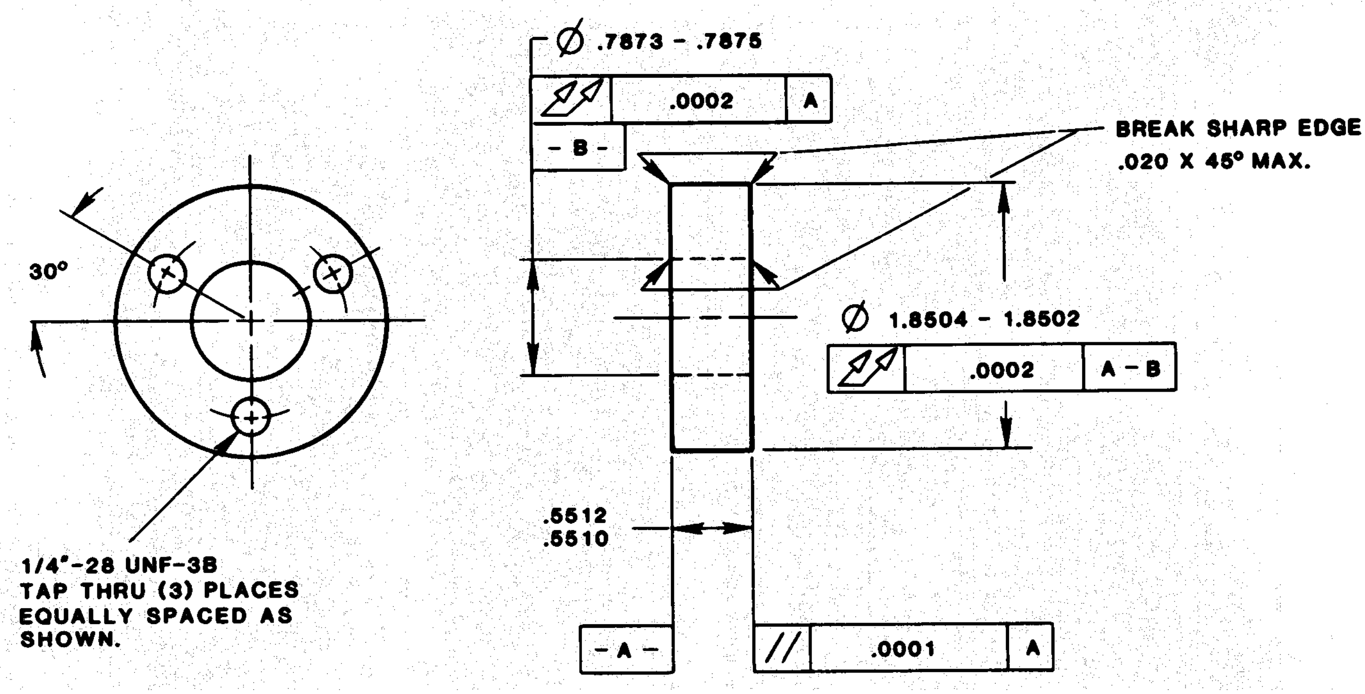
Nomenclature	Reference no. or NSN	Material required
Combustor housing removal tool	FT-21519	Cold rolled steel



2-2. T00LS AND EQUIPMENT. (cont)

Table 2-3. Fabricated Tools and Equipment - Continued

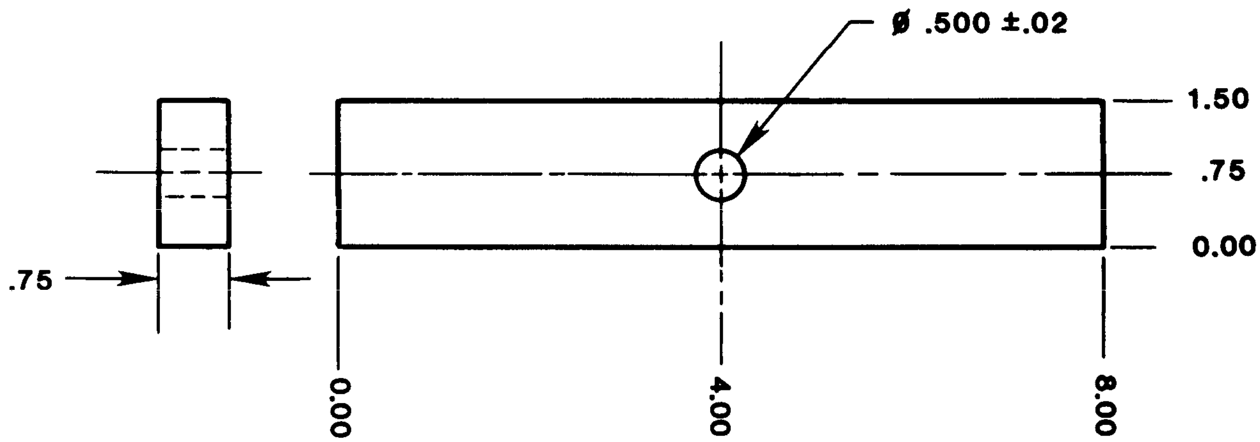
Nomenclature	Reference no. or NSN	Material required
Dummy bearing	FT-21538	52100 bearing steel Heat treat to 58/62 RC



2-2. TOOLS AND EQUIPMENT. (cont)

Table 2-3. Fabricated Tools and Equipment - Continued

Nomenclature	Reference no. or NSN	Material required
Stretch reference bar	FT-21539	0.75 CRS Black oxide finish

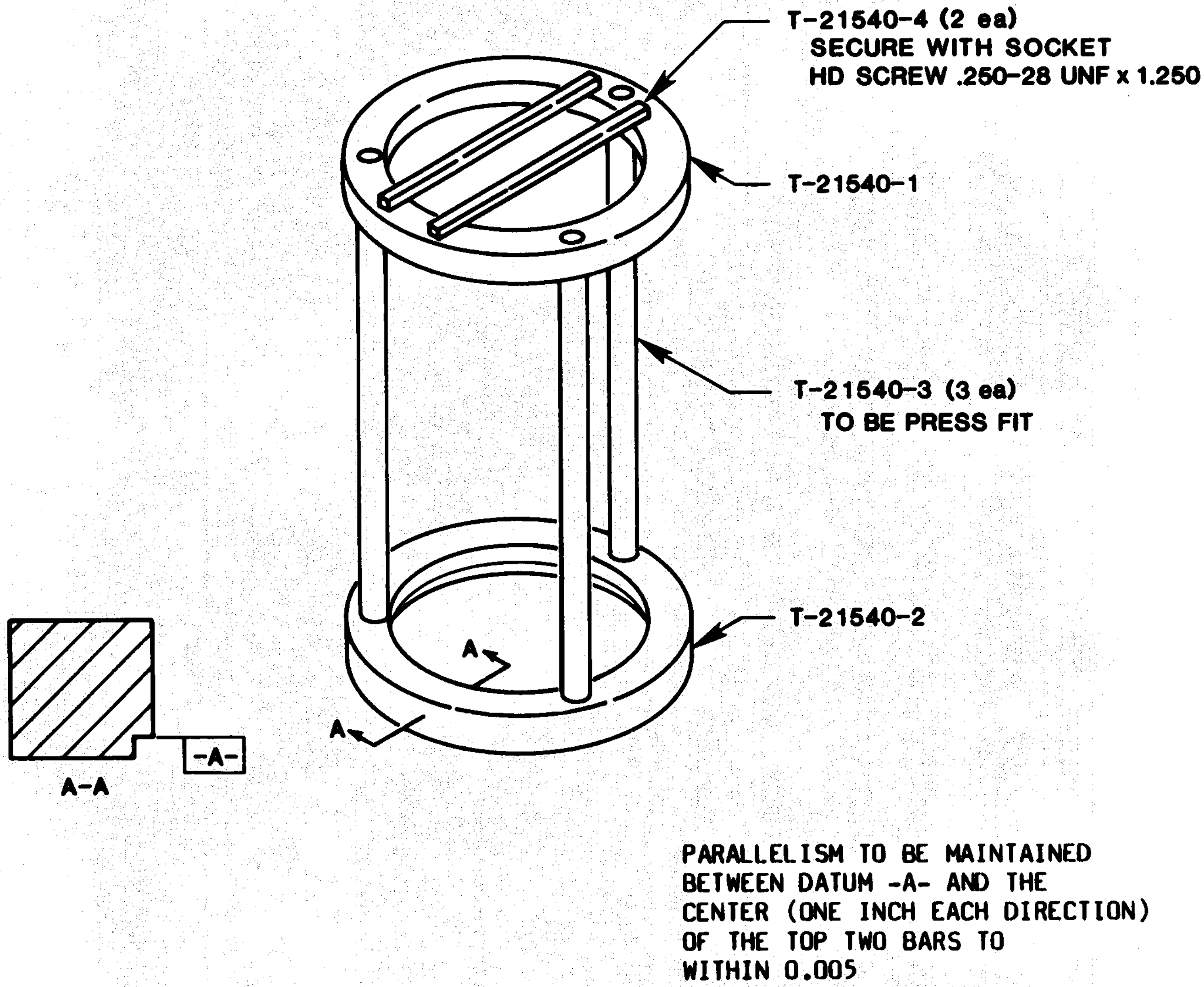


TOLERANCES: 2 PLACE DECIMALS ± 0.03
UNLESS OTHERWISE SPECIFIED

2-2. TOOLS AND EQUIPMENT. (cont)

Table 2-3. Fabricated Tools and Equipment - Continued

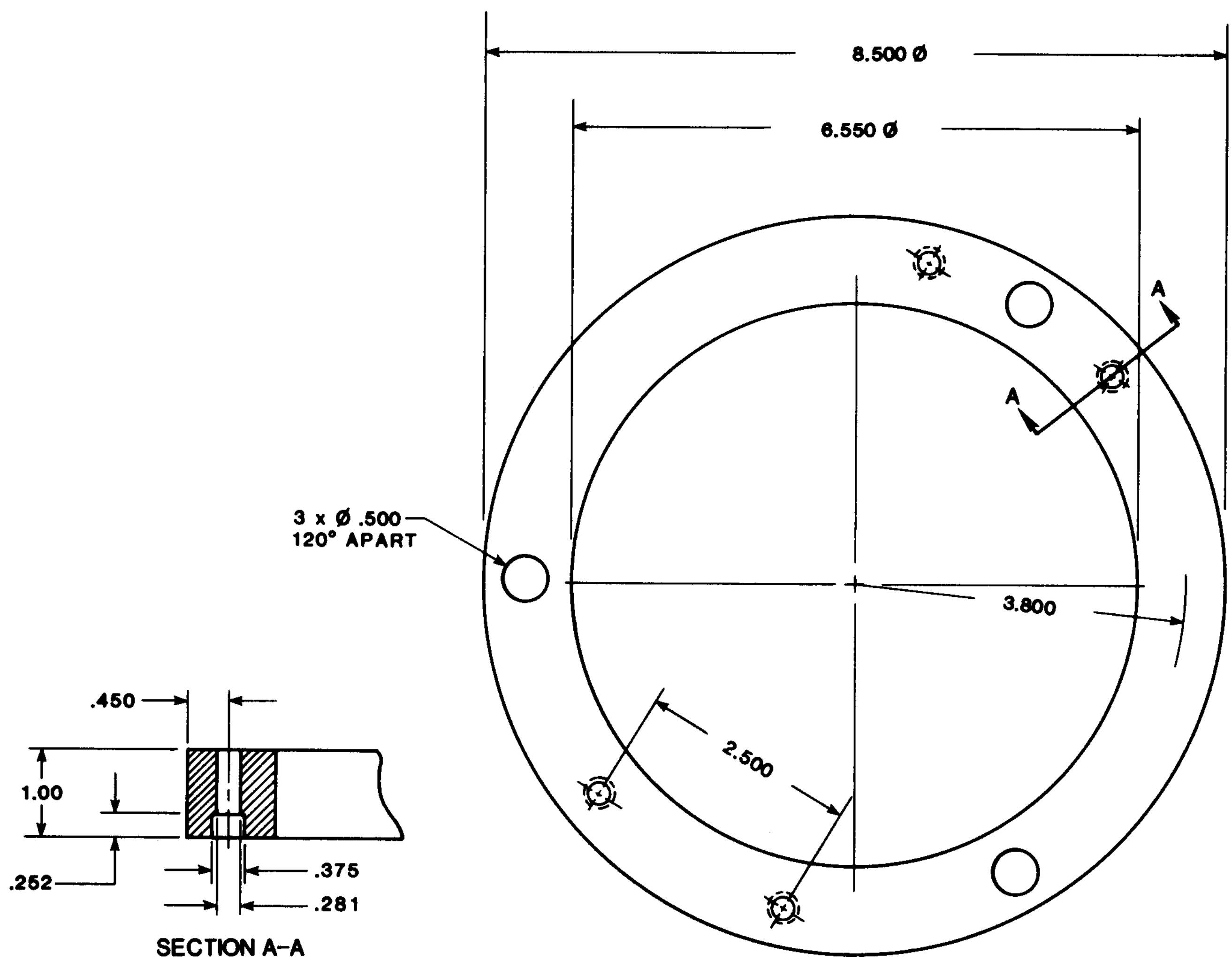
Nomenclature	Reference no. or NSN	Material required
Stretch fixture	FT-21540 (Sheet 1 of 5)	Refer to individual piece part drawings



2-2. TOOLS AND EQUIPMENT. (cont)

Table 2-3. Fabricated Tools and Equipment - Continued

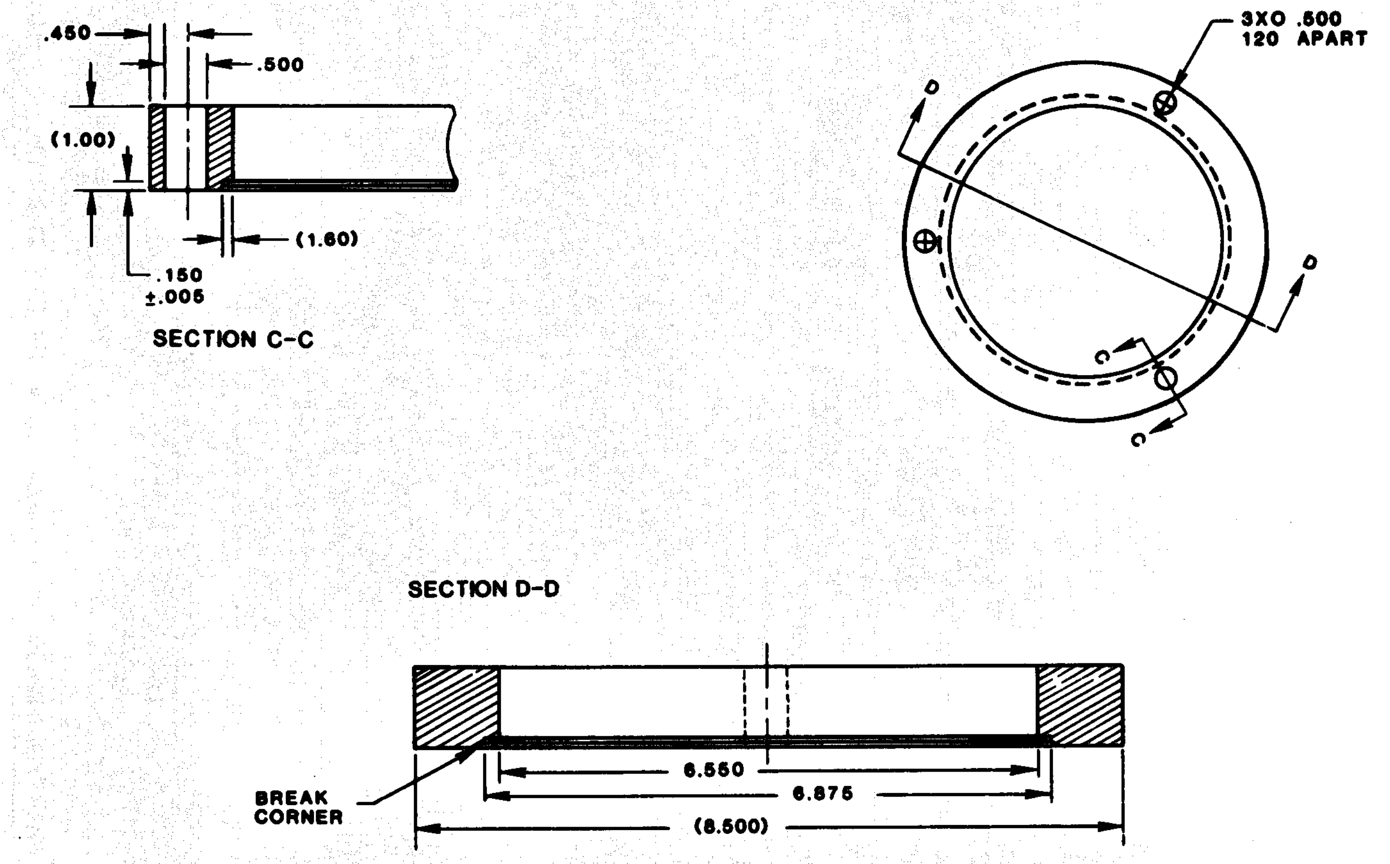
Nomenclature	Reference no. or NSN	Material required
Stretch fixture (Part of FT-21540)	FT-21540-1 (Sheet 2 of 5)	Carbon steel plate 1 inch thick



2-2. TOOLS AND EQUIPMENT. (cont)

Table 2-3. Fabricated Tools and Equipment - Continued

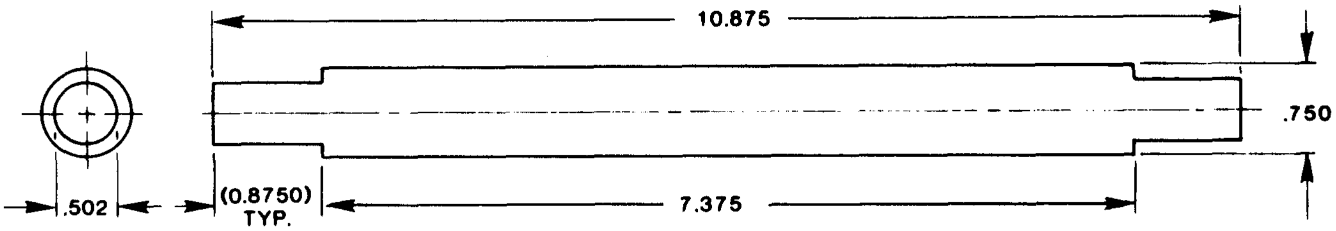
Nomenclature	Reference no. or NSN	Material required
Stretch fixture (Part of FT-21540)	FT-21540-2 (Sheet 3 of 5)	Carbon steel plate 1 inch thick



2-2. TOOLS AND EQUIPMENT. (cont)

Table 2-3. Fabricated Tools and Equipment - Continued

Nomenclature	Reference no. or NSN	Material required
Support post (Part of FT-21540)	FT-21540-3 (Sheet 4 of 5)	0.750 round bar stock carbon steel. 3 req.

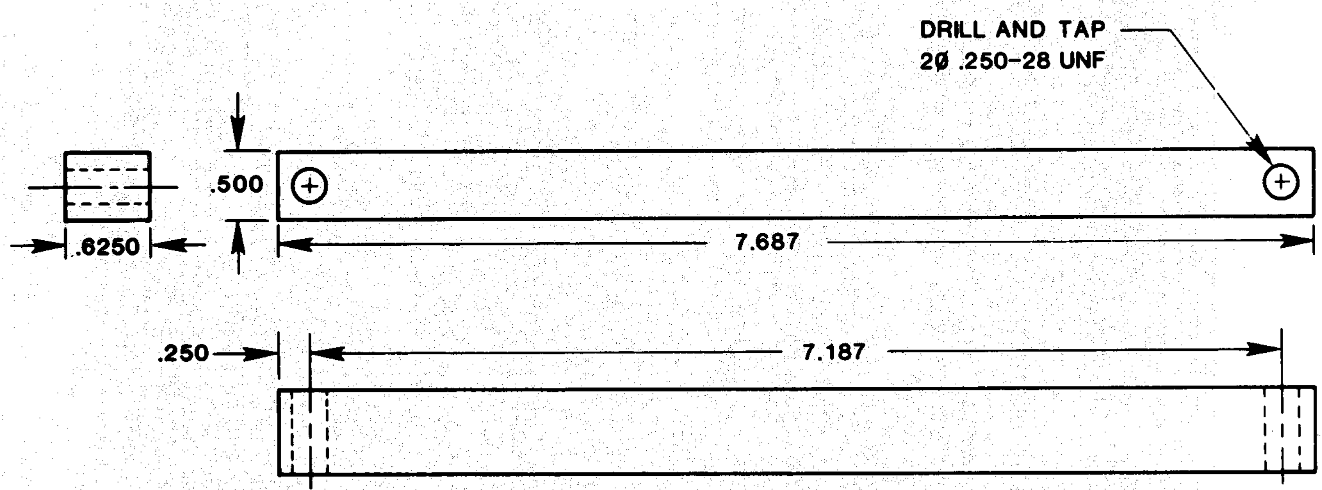


TOLERANCES: 3 PLACE DECIMALS 0.030

2-2. TOOLS AND EQUIPMENT. (cont)

Table 2-3. Fabricated Tools and Equipment - Continued

Nomenclature	Reference no. or NSN	Material required
Horizontal bar (Part of FT-21540)	FT-21540-4 (Sheet 5 of 5)	Oil hardened ground flat stock 0.500 x 0.6250 2 required

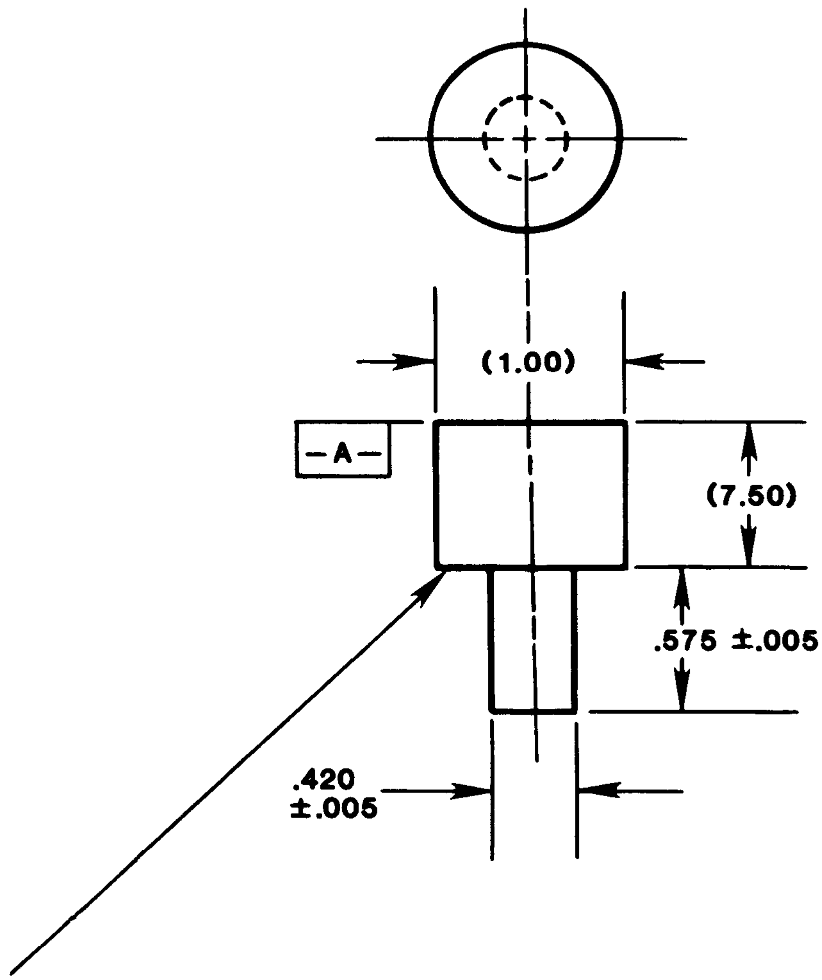


TOLERANCES: 2 PLACE DECIMALS ± 0.02
3 PLACE DECIMALS ± 0.005

2-2. TOOLS AND EQUIPMENT. (cont)

Table 2-3. Fabricated Tools and Equipment - Continued

Nomenclature	Reference no. or NSN	Material required
Stretch reference plug	FT-21565	1.00 Round stainless steel - 300 series

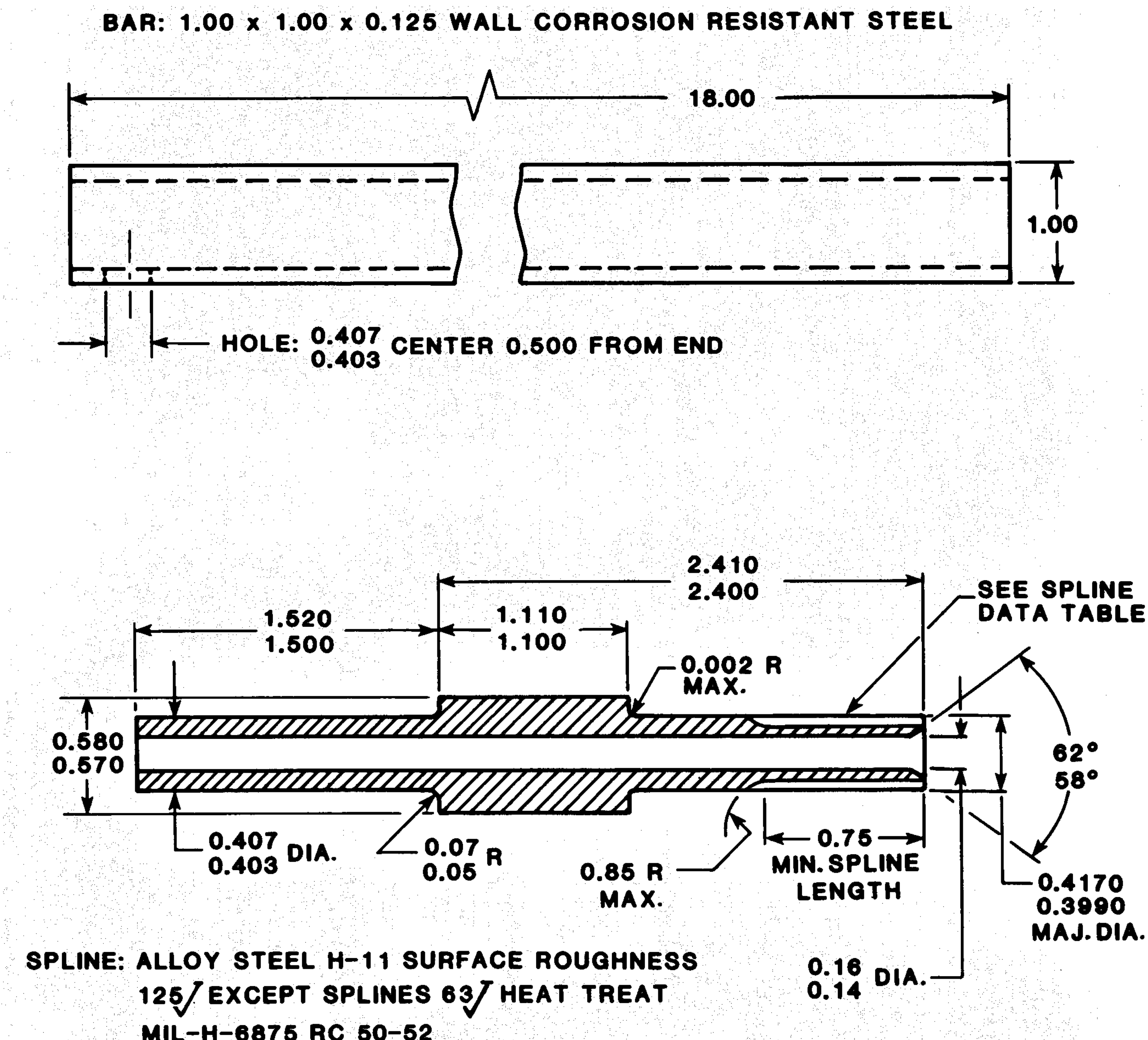


NOTE: DATUM -A- TO BE PARALLEL TO BOTTOM SURFACE WITHIN ±.001

2-2. TOOLS AND EQUIPMENT. (cont)

Table 2-3. Fabricated Tools and Equipment - Continued

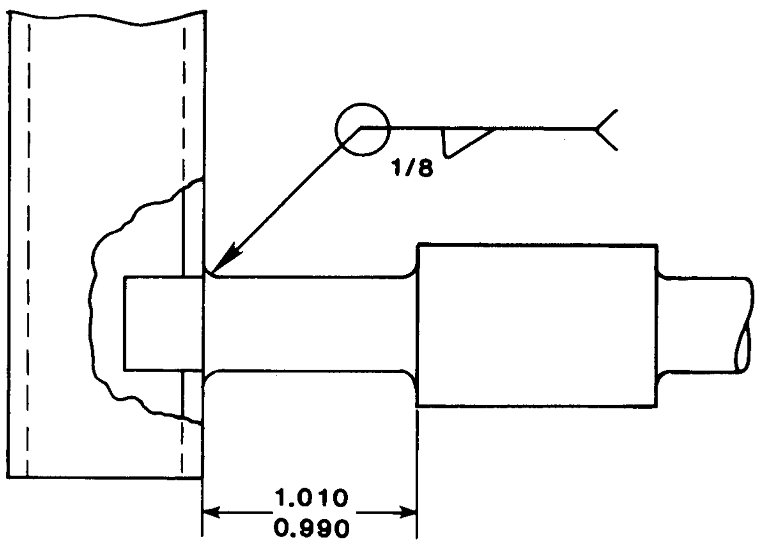
Nomenclature	Reference no. or NSN	Material required
Stretch tool (turbine wheel)	FT-21570 (sheet 1 of 2)	



2-2. TOOLS AND EQUIPMENT. (cont)

Table 2-3. Fabricated Tools and Equipment - Continued

Nomenclature	Reference no. or NSN	Material required
Stretch tool (turbine wheel)	FT-21570 (sheet 2 of 2)	-

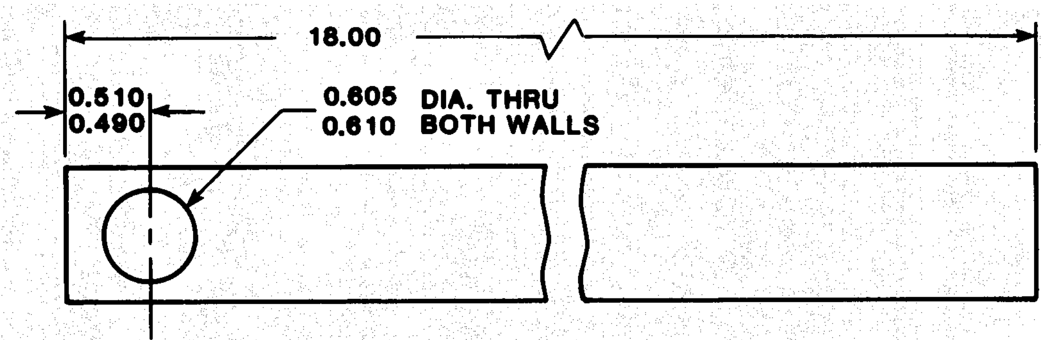


EXTERNAL INVOLUTE SPLINE DATA	
NUMBER OF TEETH	9
DIAMETRAL PITCH	24/48
PRESSURE ANGLE	30°
BASE DIAMETER	0.3248 REF.
FORM FLAT ROOT SIDE FIT PER ANSI	B92.1-1970 CL5
DIAMETER (MINOR)	0.307 MIN.
INVOLUTE FORM DIAMETER	0.3359 REF.
CIRCULAR TOOTH THICKNESS MAX. ON STANDARD PITCH DIAMETER	0.0654 REF. 0.375 REF.
MEASUREMENT OVER TWO PINS	0.4864-0.4880
PIN DIAMETER	0.0800 REF.

2-2. TOOLS AND EQUIPMENT. (cont)

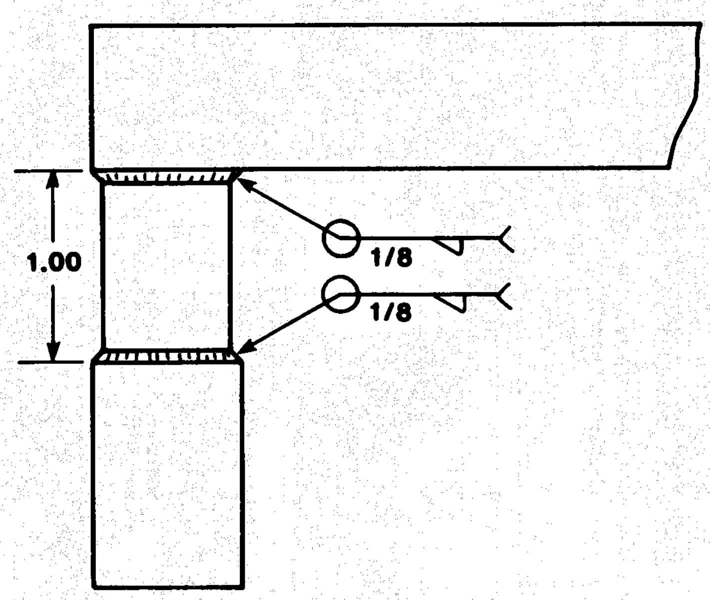
Table 2-3. Fabricated Tools and Equipment - Continued

Nomenclature	Reference no. or NSN	Material required
Stretch tool (turbine wheel nut)	FT-21571	



PARTS LIST:

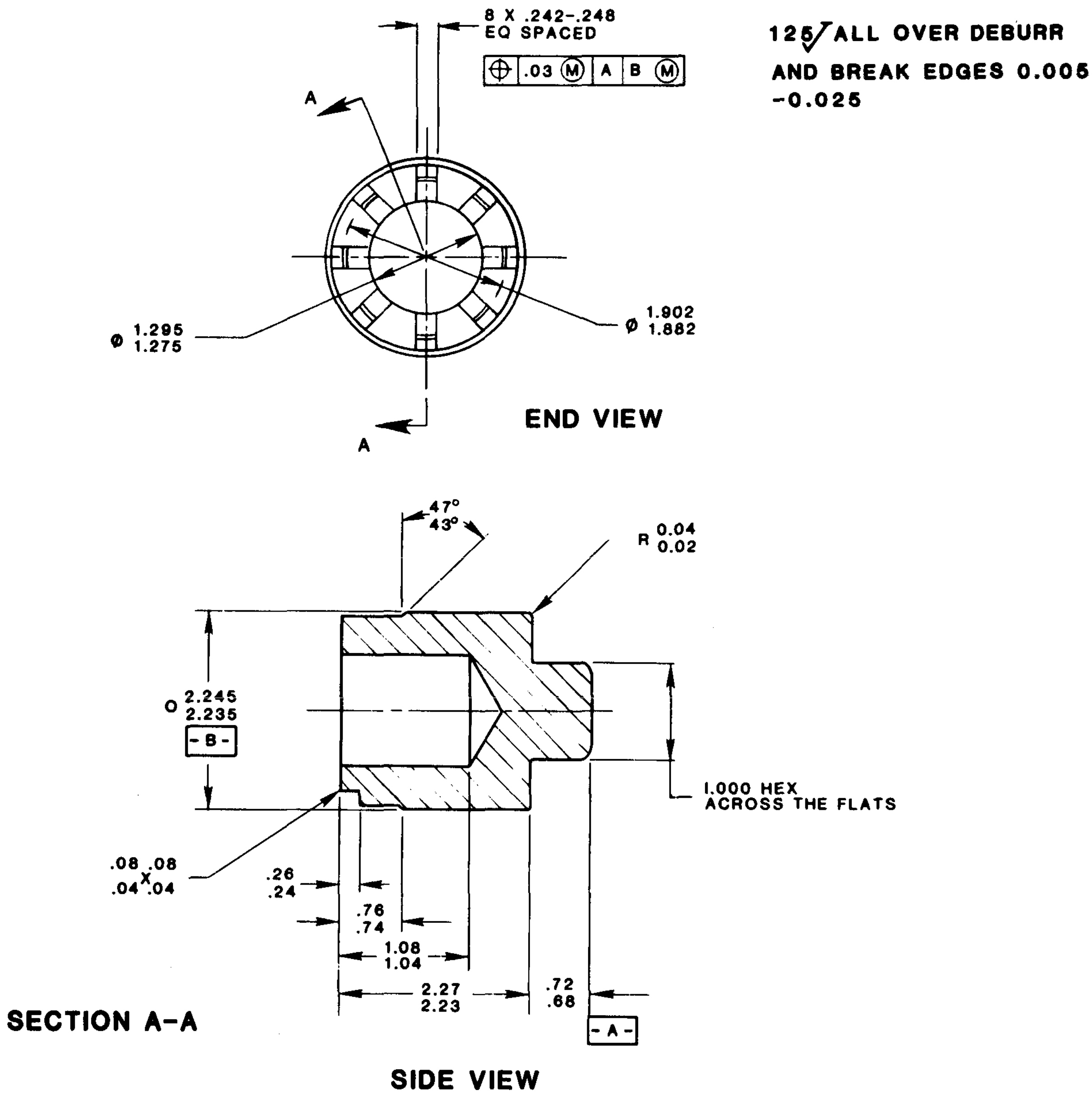
BAR - 1.00 x 1.00 x 0.125 WALL CORROSION RESISTANT STEEL
SOCKET - 12-POINT STANDARD 13/16 (SQUARE DRIVE REMOVED)
TUBE STANDOFF - 1.00 x 1.00 x 0.203 WALL CORROSION RESISTANT STEEL



2-2. TOOLS AND EQUIPMENT. (cont)

Table 2-3. Fabricated Tools and Equipment - Continued

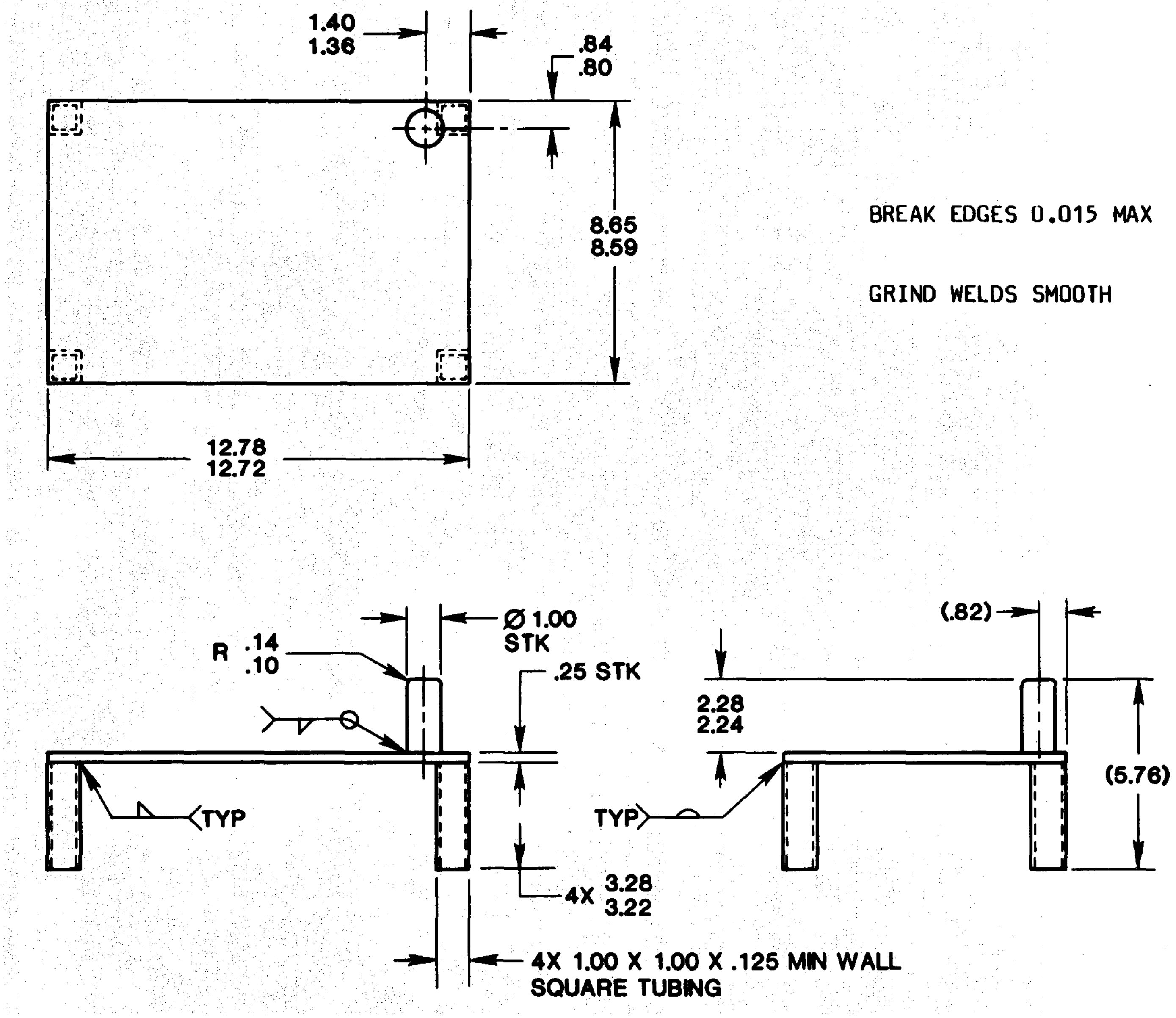
Nomenclature	Reference no. or NSN	Material required
Torque tool for bearing retainer nut	FT-21583	Carbon steel



2-2. TOOLS AND EQUIPMENT. (cont)

Table 2-3. Fabricated Tools and Equipment - Continued

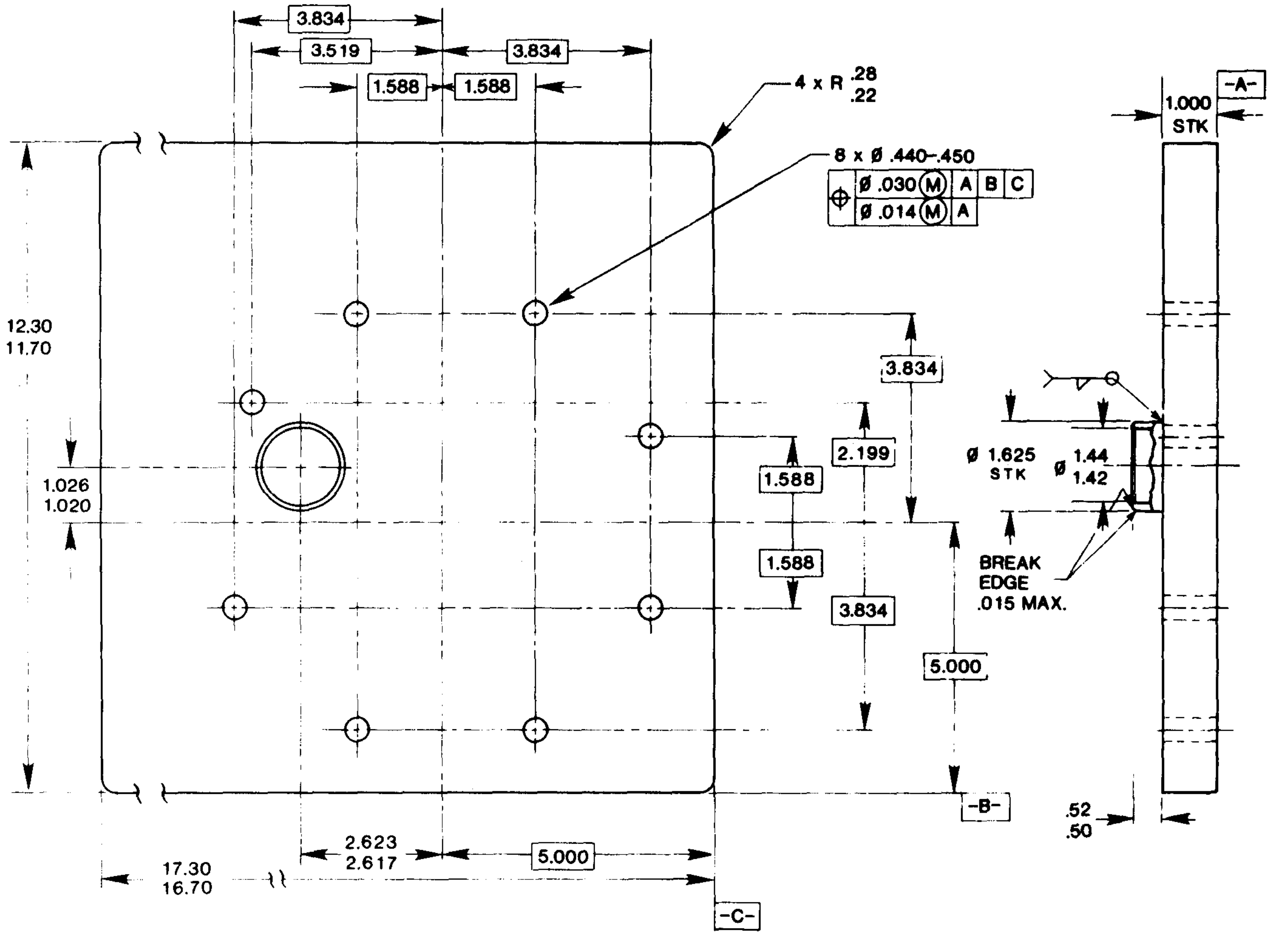
Nomenclature	Reference no. or NSN	Material required
Gearbox support base	FT-21589	Aluminum alloy



2-2. TOOLS AND EQUIPMENT. (cont)

Table 2-3. Fabricated Tools and Equipment - Continued

Nomenclature	Reference no. or NSN	Material required
Gearbox support plate	FT-21590	Aluminum tooling plate Aluminum alloy round stock

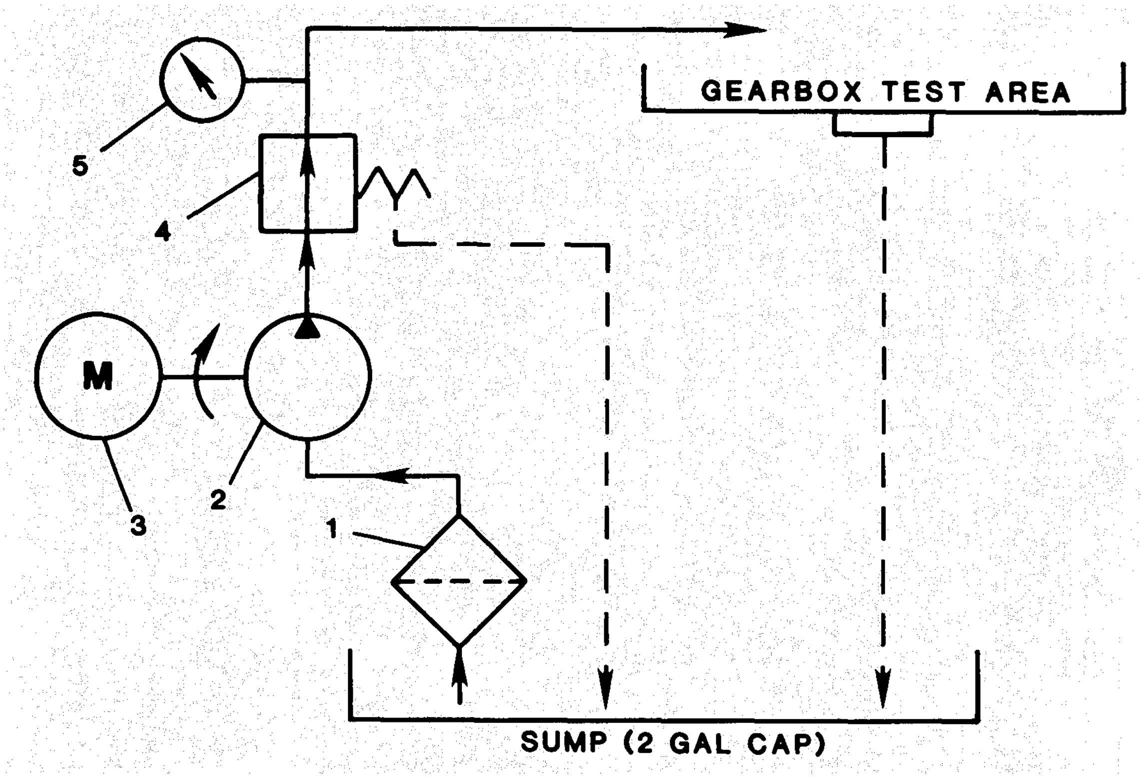


BREAK EDGES 0.015 MAX

2-2. TOOLS AND EQUIPMENT. (cont)

Table 2-3. Fabricated Tools and Equipment - Continued

Nomenclature	Reference no. or NSN	Material required
Oil impingement test stand	FT-21600 (sheet 1 of 2)	See parts list



Parts List

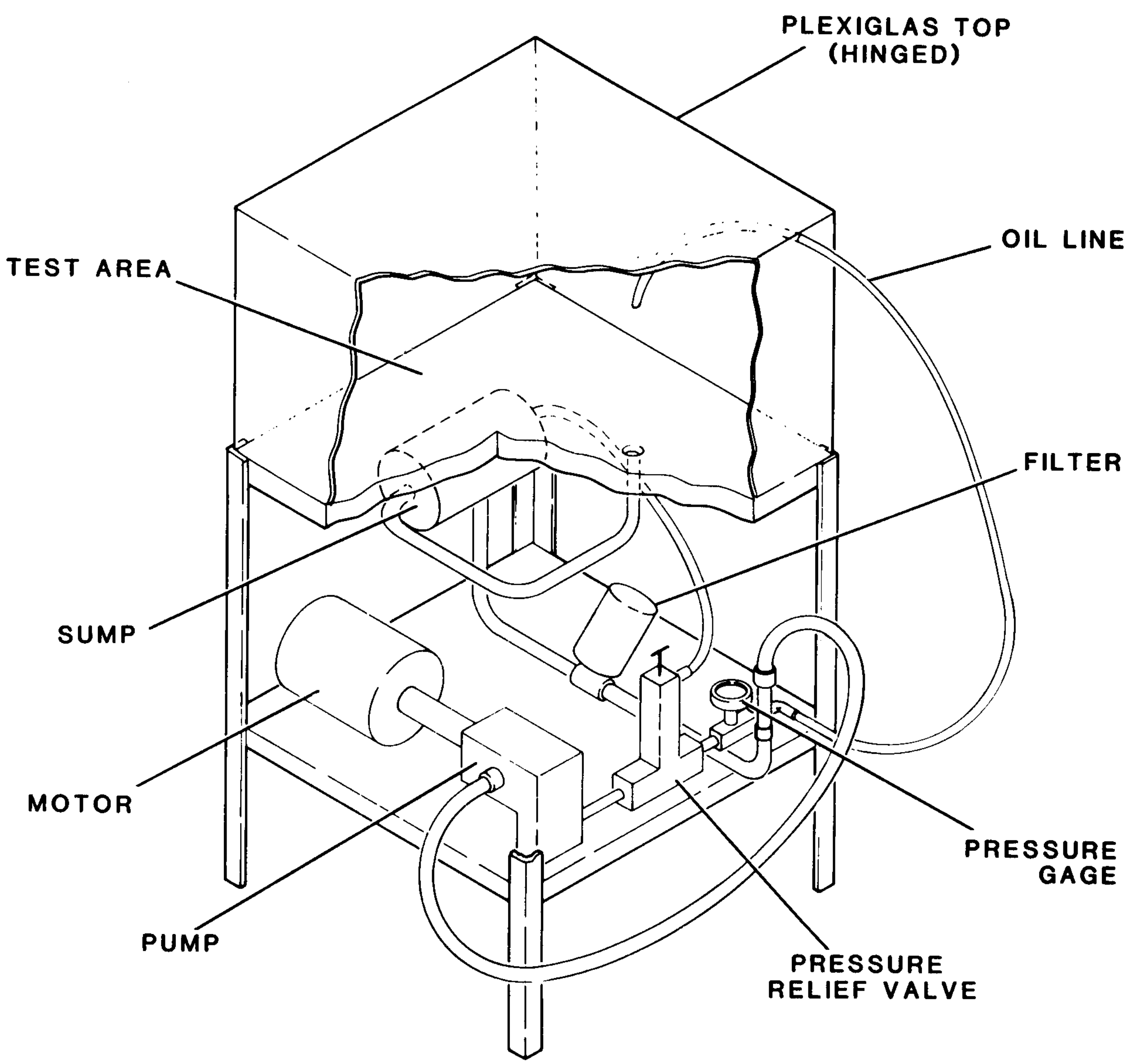
1. Filter - standard automobile oil filter (10 micron)
2. Pump, Rotary Gear 1725 rpm max., 40 psi, 10.3 gpm, 3/4 hp, 1/2 inch ports
3. Electric Motor, AC 1725 rpm nominal, 115V/60 Hz/11.6 Amps 3/4 hp, Frame 56
4. Valve, Pressure Relief (Adjustable) 1/2 inch ports, psi range 5-300, max 6 gpm
5. Gage, Pressure

Note: Fittings, connectors, and 1/2 inch tubing as required

2-2. TOOLS AND EQUIPMENT. (cont)

Table 2-3. Fabricated Tools and Equipment - Continued

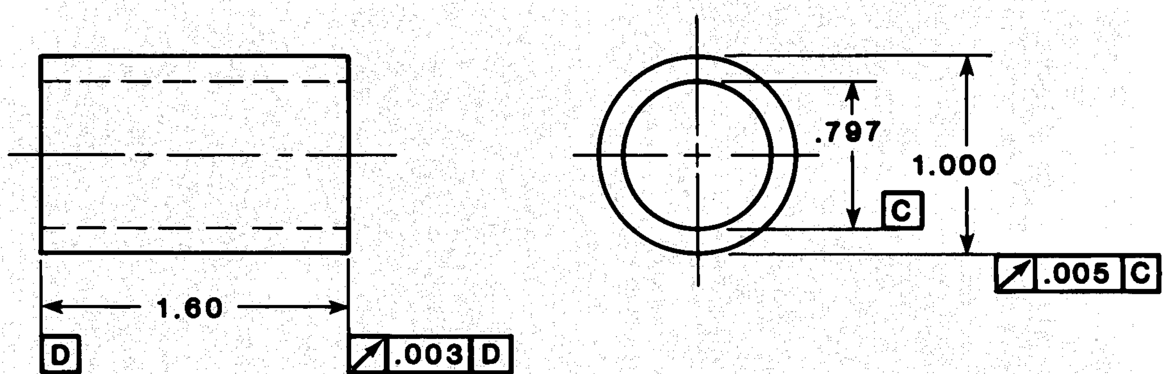
Nomenclature	Reference no. or NSN	Material required
Oil impingement test stand	FT-21600 (sheet 2 of 2)	See parts list



2-2. TOOLS AND EQUIPMENT. (cont)

Table 2-3. Fabricated Tools and Equipment - Continued

Nomenclature	Reference no. or NSN	Material required
Generator bearing press sleeve	FT-59735-1	CRES STL rod per QQ-5-764 Type 303



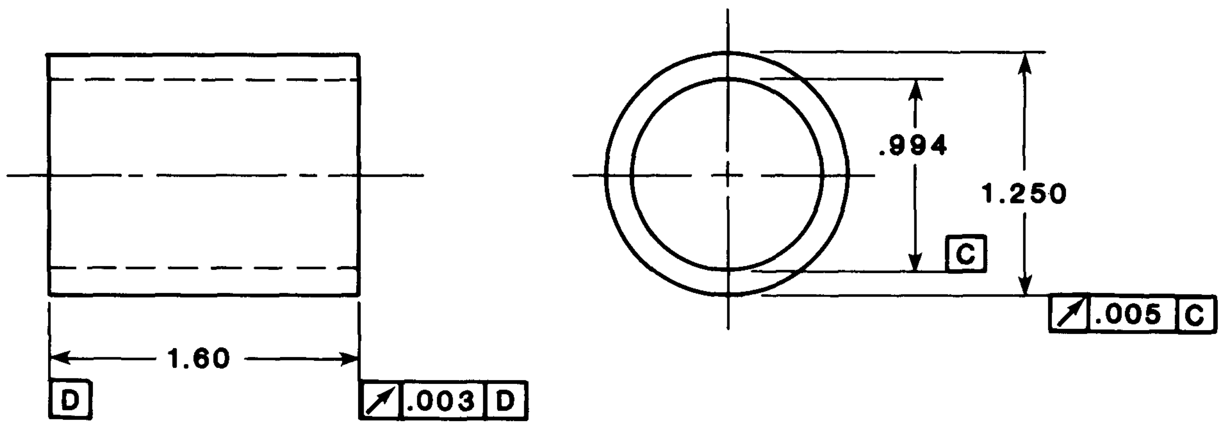
NOTES

1. TOLERANCE: 2 PLACE DECIMALS ± 0.02
   3 PLACE DECIMALS ± 0.005
2. 125/ALL MACHINED SURFACES
3. REMOVE BURRS AND BREAK SHARP EDGES
4. PASSIVATE PER ASTM A380

2-2. TOOLS AND EQUIPMENT. (cont)

Table 2-3. Fabricated Tools and Equipment - Continued

Nomenclature	Reference no. or NSN	Material required
Generator bearing press sleeve	FT-59735-2	CRES STL rod per QQ-5-764 Type 303



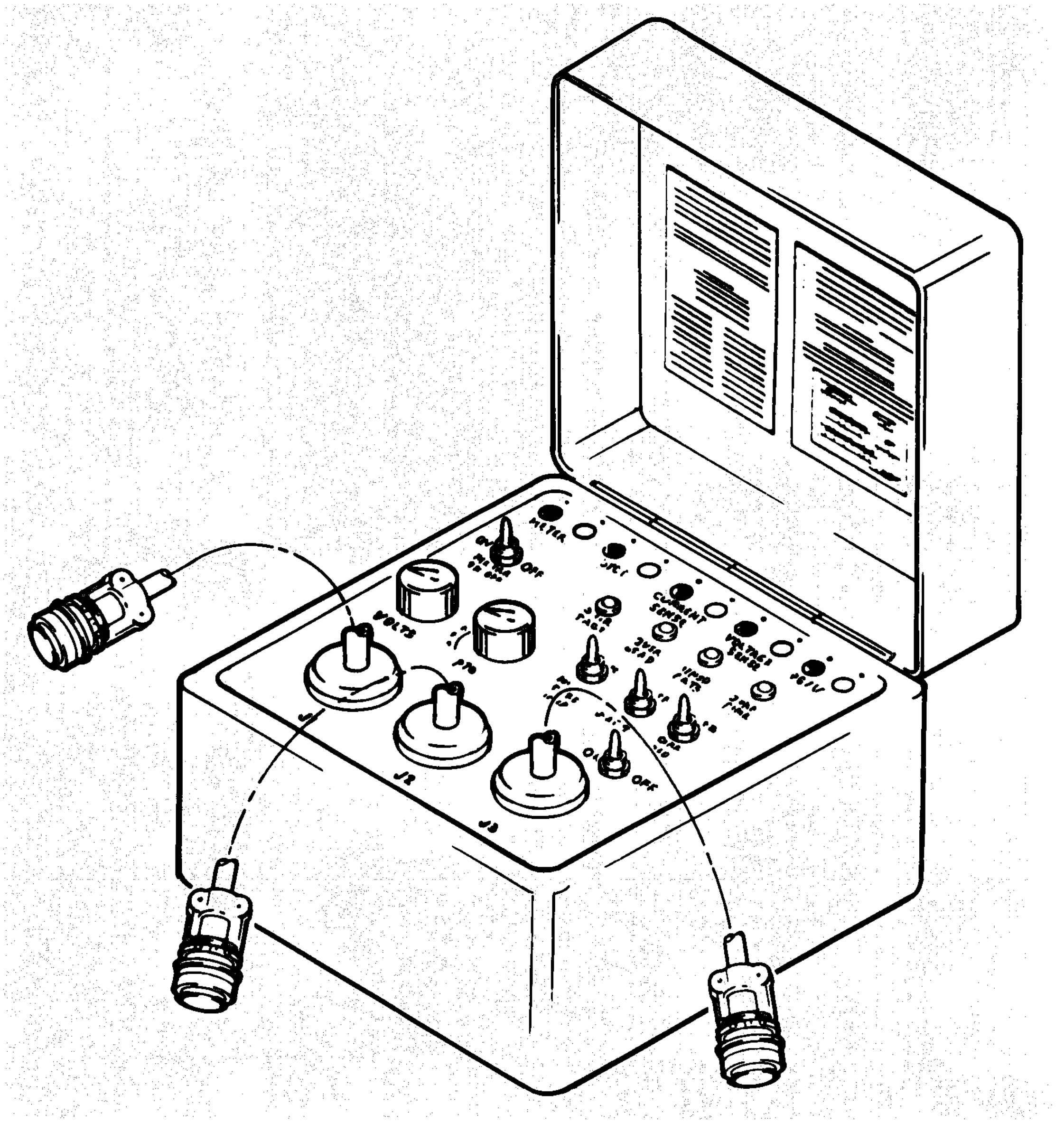
NOTES

1. TOLERANCE: 2 PLACE DECIMALS ± 0.02
   3 PLACE DECIMALS ± 0.005
2. 125/ ALL MACHINED SURFACES
3. REMOVE BURRS AND BREAK SHARP EDGES
4. PASSIVATE PER ASTM A380

2-2. TOOLS AND EQUIPMENT. (cont)

Table 2-3. Fabricated Tools and Equipment - Continued

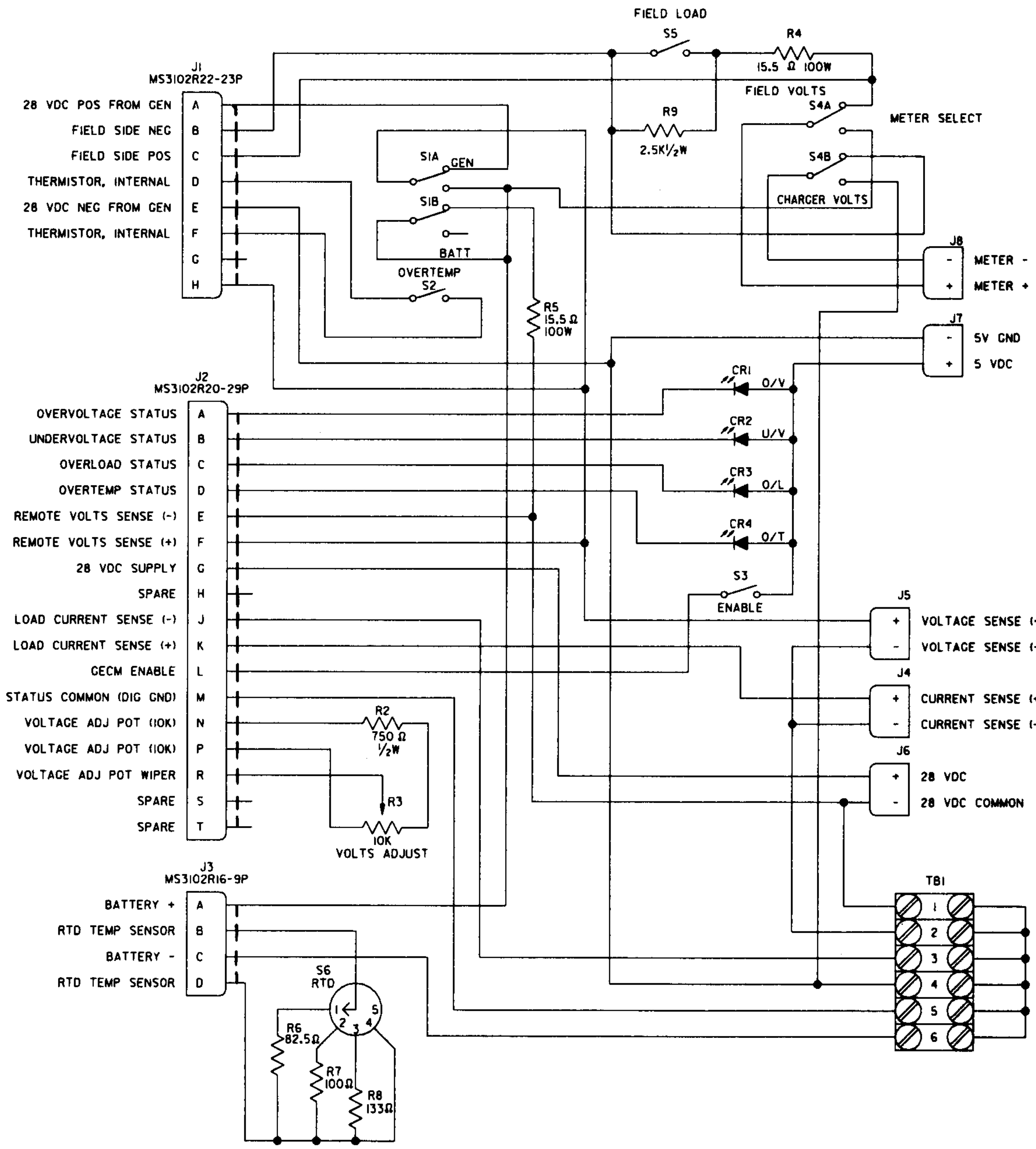
Nomenclature	Reference no. or NSN	Material required
GECM test fixture	101815	---



2-2. TOOLS AND EQUIPMENT. (cont)

Table 2-3. Fabricated Tools and Equipment - Continued

Nomenclature	Reference no. or NSN	Material required
GECM test fixture schematic	101815	---



2-2. TOOLS AN EQUIPMENT. (cont)

Table 2-3. Fabricated Tools and Equipment - Continued

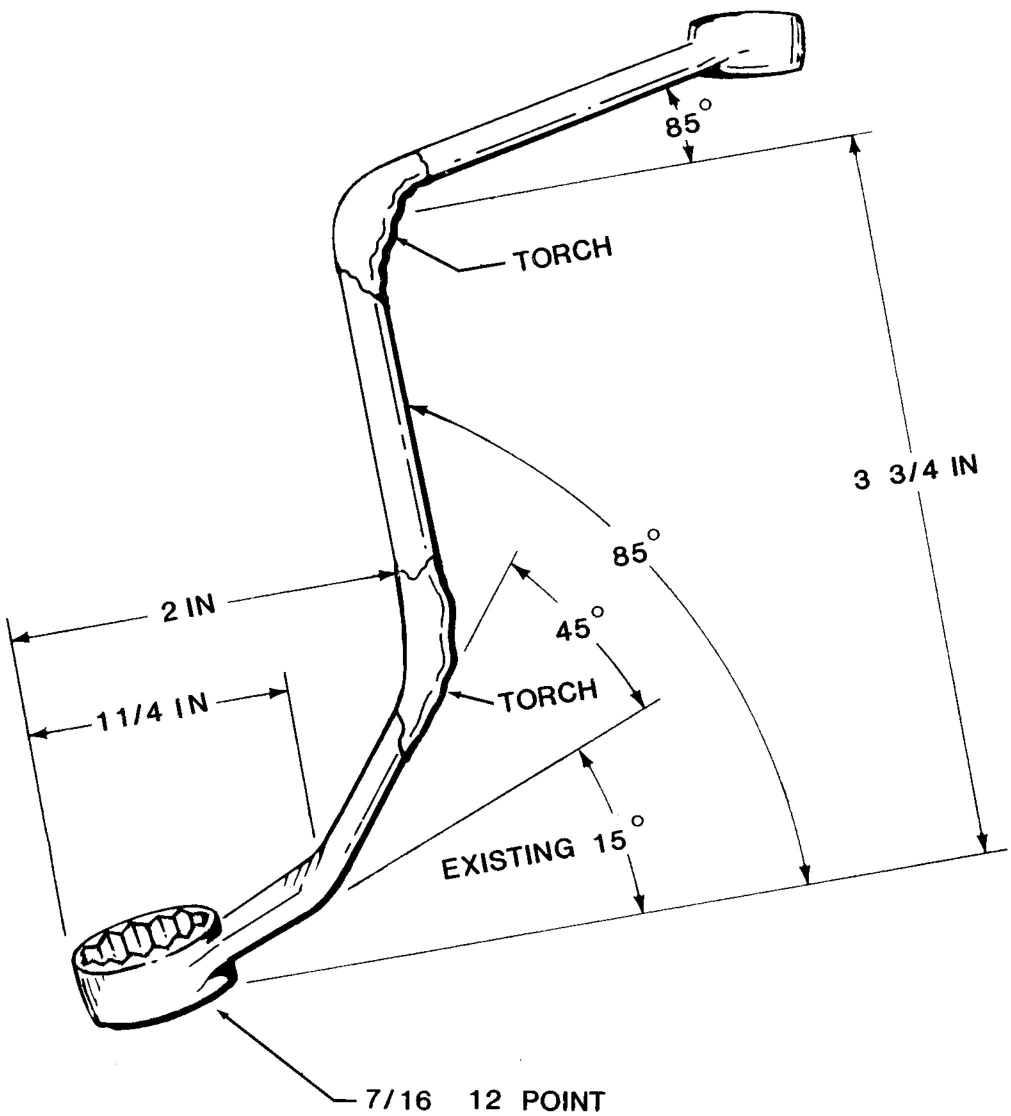
Nomenclature	Reference no. or NSN	Material required
GECM test fixture parts list	101815	---

Ref des	Nomenclature	Part no.	Qty
	Enclosure, metal	236BS28P16H2M	1
	Panel, mounting	---	1
J1	Connector	MS3106F22-23S	1
J2	Connector	MS3106F20-29S	1
J3	Connector	MS3106F16-9S	1
J4-J8	Connector, quick connect (BLK)	ITT 5018-0	5
J4-J8	Connector, quick connect (RED)	ITT 5018-2	5
CR1-CR4	Diode, light emitting (red), with holder	HLMP-3300	4
S1,S4	Switch, toggle (DPDT)	MS24524-21	2
S2,S3,S5	Switch, toggle (SPST)	MS24523-22	3
TB1	Board, terminal	KULKA 37TB6	1
R2	Resistor, 750Ω, 1/2W	RCR20G751KM	1
R3	Resistor, variable 10kΩ, 2W	RA2ONASD1O3A	1
R4,R5	Resistor, 15.5Ω, 100W	RE77N15R5	2
R6	Resistor, 82.5Ω, 1/2W	RN60D82R5F	1
R7	Resistor, 100 Ω, 1/2W	RN60D1OOOFJ	1
R8	Resistor, 133 Ω, 1/2W	RN60D1330F	1
R9	Resistor, 2.5kΩ, 1/2W	RN60D2502FJ	1
RTD(S6)	Switch, rotary, 5 position	MS25002-1	1
	Binding post, red	ITT5018-2	5
	Binding post, black	ITT5018-O	5
	Grommet, rubber 1/2 ID, Fits 13/16 Dia. IN 1/16 THK MATL	MS35489-14(96906)	3
	Strap, tiedown, electrical components, clear	MS3368-4-9D (96906)	3
	Cable, Power, electrical, white No.12 AWG	M16878/4BL69 (8/349)	1
	Solder	As required	

2.2 TOOLS AND EQUIPMENT. (cont)

Table 2-3. Fabricated Tools and Equipment (Continued)

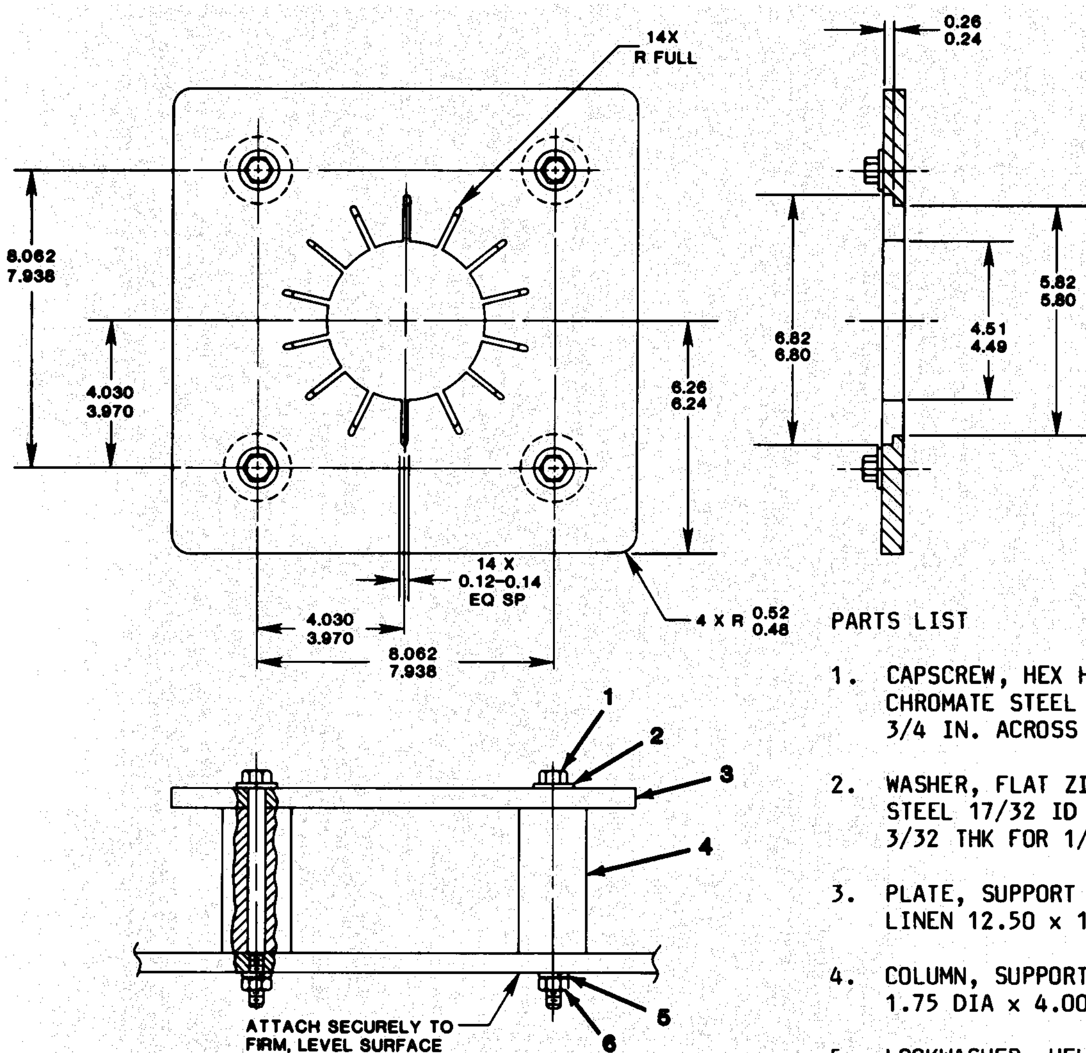
Nomenclature	Reference No. or NSN	Material required
Wrench, Generator		Double head, 12-point 15o offset. 7/16", 1/2" 5120-00-596-8556



2-2. TOOLS AND EQUIPMENT. (cont)

Table 2-3. Fabricated Tools and Equipment - Continued

Nomenclature	Reference no. or NSN	Material required
Assembly fixture	FT-21616	See parts list



PARTS LIST

1. CAPSCREW, HEX HEAD ZINC CHROMATE STEEL 1/2-13 x 6 IN. LG 3/4 IN. ACROSS FLATS 5/16 HT
2. WASHER, FLAT ZINC PLATED STEEL 17/32 ID 1-1/16 OD 3/32 THK FOR 1/2 IN. BOLT
3. PLATE, SUPPORT PHENOLIC LINEN 12.50 x 12.50 x 0.50 THK
4. COLUMN, SUPPORT AL ALY 1.75 DIA x 4.00 LG
5. LOCKWASHER, HELICAL SPRING ZINC PLATED STEEL 0.125 THK FOR 1/2 IN. BOLT
6. NUT, HEX ZINC CHROMATE FINISHED STEEL 9/16-12 3/4 IN ACROSS FLATS 7/16 HT

Section II. TROUBLESHOOTING

2-3. GENERAL. This section contains troubleshooting information for locating and correcting malfunctions that have been isolated to the engine electronic control module (EECM) and to the generator electronic control module (GECM). Table 2-4 lists the malfunctions by number and provides troubleshooting procedures. Each malfunction is followed by tests and inspections that will help determine the probable cause and the corrective action to take. Perform the tests/inspections and corrective actions in the order listed. After repair, always repeat the test/inspection listed in table 2-4 to ensure that the malfunction has been corrected and that no other malfunctions exist. This manual cannot list all malfunctions that may occur, nor all tests, inspections, and corrective actions. If a malfunction is not listed or cannot be corrected by listed corrective actions, notify supervisor. Refer to paragraphs 4-2 and 10-2 for additional GECM and EECM testing and maintenance procedures.

Table 2-4. Troubleshooting

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

1. DC CIRCUIT BREAKER TRIPPING - PROBLEM ISOLATED TO EECM.

Step 1. Use an ohmmeter and measure resistance between P6-M and P6-N. Move MASTER SWITCH to RUN.

If resistance is less than 100 ohms, go to Step 2.

If resistance is greater than 100 ohms, replace power supply circuit card (paragraph 10-2b).

Step 2. Disconnect connector P1 from power supply circuit card. Again, use an ohmmeter and measure resistance between J6-M and J6-N.

If resistance is greater than 100 ohms, replace power supply circuit card (paragraph 10-2b).

If resistance is less than 100 ohms, go to Step 3.

Step 3. Disconnect connector P2 from switch circuit card. Again measure resistance between J6-M and J6-N.

If resistance is greater than 100 ohms, replace switch circuit card (paragraph 10-2b).

If resistance is less than 100 ohms, go to Step 4.

2-3. GENERAL. (cont)

Table 2-4. Troubleshooting - continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

Step 4. Disconnect one lead from capacitor C1. Use an ohmmeter and measure resistance across C1.

If resistance is below 1k ohms, replace C1 (paragraph 10-2).

If resistance is above 1k ohms, go to Step 5.

Step 5. Disconnect one lead from resistor VR1. Use an ohmmeter and measure resistance across VR1.

If resistance is below 1k ohms, replace VR1 (paragraph 10-2).

If resistance is above 1k ohms, check for shorts between VR1, E1, and E2. Repair as necessary.

2. NO CONTROL PANEL POWER - PROBLEM ISOLATED TO EECM.

Step 1. Use an ohmmeter and check resistance between J6-M(+) and J4-C(-).

If resistance is more than 3 ohms, measure resistance directly across diode CR5. Observe polarity of CR5. If resistance is more than 3 ohms, replace CR5 (paragraph 10-2).

If resistance is less than 3 ohms, check for continuity between J6-M and power supply circuit card connector P1-2.

If continuity present, go to Step 2.

If no continuity, repair or replace wires as necessary.

Step 2. Check for continuity between J6-N and power supply circuit card connector P1-4.

If continuity present, reconnect P1 and go to Step 3.

If no continuity, repair or replace wires as necessary.

2-3. GENERAL. (cont)

Table 2-4. Troubleshooting - continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

Step 3. Connect EECM to EECM tester. Disconnect connector P2 from switch circuit card. Connect voltmeter to P2-31(+) and P2-33. Move tester MASTER SWITCH to RUN position and check voltage.

If voltage is less than 4.5 or greater than 5.5 Vdc, replace power supply circuit card (paragraph 10-2b).

If voltage is between 4.5 and 5.5 Vdc, go to Step 4.

Step 4. Connect voltmeter to switch circuit card P2-24(+) and P2-27(-) and measure voltage.

If voltage is less than 11 or greater than 13 volts, replace power supply circuit card (paragraph 10-2b).

If voltage is 11-13 volts, go to Step 5.

Step 5. Reconnect connector P2 to switch circuit card. Measure voltage on switch connector P1, pins P1-19(+) and P1-20(-).

If voltage is less than 4.5 Vdc, replace switch circuit card (paragraph 10-2b).

If voltage is greater than 5.5 Vdc, repair/replace microprocessor circuit card (paragraph 10-2b).

3. ENGINE DOES NOT CRANK - PROBLEM ISOLATED TO EECM.

Step 1. Connect EECM under test to EECM tester. Connect voltmeter to switch circuit card J6-J and to E1(-) ground terminal. Move MASTER SWITCH to RUN position and ensure that unit has power and has reset (lights will momentarily flash and relays will click to reset). Move MASTER SWITCH to START and hold in that position while making measurements.

If no voltage, use a sharp probe and check for continuity between J6-J and P2-22. Repair or replace as necessary.

If voltage is 20 Vdc or greater, connect voltmeter positive(+) lead to P1-12. If voltage measures 1.5 to 5.0 Vdc, go to Step 2. If voltage is less than 1.5 Vdc, replace switch circuit card (paragraph 10-2b).

2-3. GENERAL. (cont)

Table 2-4. Troubleshooting - continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

Step 2. Connect voltmeter to P1-11(+). Release MASTER SWITCH to RUN.

If voltage is less than 1.5 Vdc, replace microprocessor circuit card (paragraph 10-2b).

If voltage is 1.5 Vdc or greater, connect voltmeter positive(+) to switch circuit card TB1-2. If voltage is less than 20 Vdc, replace switch card (paragraph 10-2b). If voltage is 20 Vdc or greater, check continuity.

P2-20 to K2-X1	K2-A2 to E2
K2-X1 to E1 (ground)	K2-A1 to J5-K

Repair or replace as necessary. If continuity is present, replace relay K2 (paragraph 10-2g).

4. ENGINE OVERTEMP MALFUNCTION - PROBLEM ISOLATED TO EECM.

Step 1. Inspect and check continuity of wires from J5-R and J5-S to microprocessor board P2-6 and P2-7.

Repair or replace wires as necessary.

Step 2. Connect EECM under test to EECM tester. Short EGT input terminals together. Move MASTER SWITCH to RUN position. Connect voltmeter to P1-8(+) and E1(-) ground terminal.

If voltage is less than 1.5 Vdc, replace microprocessor circuit card (paragraph 10-2b).

If voltage is 1.5 Vdc or greater, connect voltmeter positive(+) to switch circuit card Q1-C. If voltage is 19 Vdc or less, replace switch circuit card (paragraph 10-2b).

5. OVERSPEED MALFUNCTION INDICATOR - PROBLEM ISOLATED TO EECM.

Step 1. Inspect and check continuity of wires from J5-G to microprocessor board P2-5 and from J5-F to microprocessor board P2-8.

If no continuity, repair or replace wires as necessary.

If continuity present, go to Step 2.

2-3. GENERAL. (cont)

Table 2-4. Troubleshooting - continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

Step 2. Connect EECM under test to EECM tester. Move MASTER SWITCH to START position and then to RUN position. Inject a signal into SPEED input. Increase frequency to 3352 Hz ± 67 Hz. Connect an oscilloscope or frequency counter to P1-15(+) and to E1(-) ground terminal.

If oscilloscope or frequency counter does not show 3352 Hz ± 67 Hz, replace MPU circuit card (paragraph 10-2b).

If frequency is correct, move oscilloscope or frequency counter to P1-13(+). If frequency is still correct, go to Step 3. If no frequency indicated, replace switch circuit card (paragraph 10-2b).

Step 3. Connect voltmeter to P1-3(+) and E1(-) ground terminal.

If voltage is less than 1.5 Vdc, replace microprocessor circuit card (paragraph 10-2b).

If voltage is greater than 1.5 Vdc, move voltmeter to switch circuit card Q2-C. If voltage is greater than 1.5 Vdc, replace switch circuit card (paragraph 10-2b).

6. NO READY TO LOAD LIGHT/GENERATOR ENABLE - PROBLEM ISOLATED TO EECM.

Step 1. Connect EECM under test to EECM tester. Move MASTER SWITCH to START position and then to RUN position. Inject a signal into SPEED input. Increase frequency to 3352 Hz ± 67 Hz. Connect a voltmeter to P1-5(+) and E1(-) ground terminal.

If voltage is less than 1.5 Vdc, replace switch circuit card (paragraph 10-2b).

If voltage is greater than 1.5 Vdc, replace microprocessor circuit card (paragraph 10-2b).

Step 2. Move voltmeter to switch circuit card Q9-C.

If voltage is less than 19 Vdc, replace switch circuit card (paragraph 10-2b).

If voltage is 19-28 Vdc, go to Step 3.

2-3. GENERAL. (cont)

Table 2-4. Troubleshooting - continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

Step 3. Check continuity of wires from switch circuit card P2-17 to J6-L and from P2-29 to J4-F.

Repair or replace wires as necessary.

7. LOW OIL PRESS MALFUNCTION LIGHT - PROBLEM ISOLATED TO EECM.

Step 1. Check continuity of wires from J5-A to switch circuit card P2-2 and from J5-B to E1(-) ground terminal.

Repair or replace wires as necessary.

Step 2. Connect EECM under test to EECM tester. Move LOW OIL switch to ON. Move MASTER SWITCH to START position and then to RUN position. Inject a signal into SPEED input. Increase frequency to 3352 Hz ± 67 Hz. Connect voltmeter to switch board Q7-C and to E1(-) ground terminal.

If voltage is greater than 1.5 Vdc, replace switch circuit card (paragraph 10-2b).

Step 3. If LOW OIL PRESS light comes on but unit does not shut down, connect voltmeter to P1-9(+) and to E1(-) ground terminal. Move LOW OIL switch to OFF.

If voltage is less than 1.5 Vdc, replace switch board (paragraph 10-2b).

If voltage is greater than 1.5 Vdc, replace microprocessor circuit card (paragraph 10-2b).

8. **ANY GENERATOR** MALFUNCTION - PROBLEM ISOLATED TO EECM.

Step 1. Use an ohmmeter and check the following wires between J4 and switch circuit card P2 for damage or shorts.

J4-A to P2-15	J4-B to P2-9
J4-C to P2-6	J4-D to P2-12

Repair or replace wires as necessary.

If no shorts or damage, go to Step 2.

2-3. GENERAL. (cont)

Table 2-4. Troubleshooting - continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

Step 2. Connect EECM under test to EECM tester. Place MASTER SWITCH in START position and release to RUN position. Inject a signal into SPEED input. Increase frequency to 3352 Hz ± 67 Hz. Connect a voltmeter to P2-6(+) and E1(-) ground terminal. Read voltage.

If voltage is more than 1.5 Vdc, go to Step 3.

If voltage is below 1.5 Vdc, replace switch circuit card (paragraph 10-2b).

Step 3. Connect EECM as in Step 2. Move voltmeter (+) to P2-9, then to P2-12, and then to P2-15. Read voltage at each point.

If voltage at any point is above 1.5 Vdc, go to Step 4.

If voltage is below 1.5 Vdc, replace switch circuit card (paragraph 10-2b).

Step 4. Connect EECM as in Step 2. Move voltmeter (+) to P2-8 and read voltage.

If voltage is above 1.5 Vdc, replace switch circuit card (paragraph 10-2b).

If voltage is below 1.5 Vdc, go to Step 5.

Step 5. Connect EECM as in Step 2. Move voltmeter(+) to P2-10, then to P2-11, and then to P2-14. Read voltage at each point.

If any voltage is above 1.5 Vdc, replace switch circuit card (paragraph 10-2b).

If voltage is below 1.5 Vdc, go to Step 6.

Step 6. Connect voltmeter to P1-2.

If voltage is above 1.5 Vdc, replace switch circuit card (paragraph 10-2b).

If voltage is below 1.5 Vdc, replace microprocessor circuit card (paragraph 10-2b).

2-3. GENERAL. (cont)

Table 2-4. Troubleshooting - continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

9. CONTACTOR CLOSED INDICATOR LIGHT WILL NOT COME ON - PROBLEM ISOLATED TO EECM.

Step 1. Check wires from J6-T to switch circuit card P2-21 and from J6-S to switch board P2-19.

Repair or replace as necessary.

Step 2. Connect EECM under test to EECM tester. Place MASTER SWITCH in START position and release to RUN position. Inject a signal into SPEED input. Increase frequency to 3352 Hz ± 67 Hz. Connect voltmeter to P1-1(+) and to E1(-) ground terminal. Read voltage.

If voltage is less than 1.5 Vdc, replace switch circuit card (paragraph 10-2b).

If voltage is more than 1.5 Vdc, replace microprocessor circuit card (paragraph 10-2b).

10. NO OUTPUT VOLTAGE - PROBLEM ISOLATED TO EECM.

Step 1. Perform steps under Malfunction 6.

11. UNDERVOLTAGE MALFUNCTION LIGHT COME ON - OUTPUT VOLTAGE NORMAL.

Step 1. Connect GECM to test fixture in accordance with paragraph 4-2a.

If UNDER VOLTS light comes on, go to Step 2.

If UNDER VOLTS light off, go to Step 5.

Step 2. Increase power supply 2 output voltage to 20 (± 1) Vdc.

If UNDER VOLTS light goes off, go to Malfunction 17.

If UNDER VOLTS light stays on, go to Step 3.

Step 3. Use voltmeter to check voltage at circuit card connector P1-39 (+) and P1-38(-).

If voltage reads same as power supply 2 output voltage, go to Step 4.

2-3. GENERAL. (cont)

Table 2-4. Troubleshooting - continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

If voltage is less than 17 Vdc, check wiring from J2-E to P1-38 and from J2-F to P1-39. Repair or replace as necessary.

Step 4. Use voltmeter to check voltage at circuit card connector P1-34(+) and P1-18(-).

If voltage is 5(±1) Vdc, replace circuit card (paragraph 4-2j).

If voltage is less than 1 Vdc, check wiring from J2-B to P1-34 and from J2-M to P1-18. Repair or replace as necessary.

Step 5. Set power supply 2 output voltage to less than 10 Vdc. Use voltmeter to check voltage at P1-48 and P1-18.

If voltage is same as output voltage of power supply 1 (28 Vdc), go to Step 6.

If voltage is not correct, check wiring from J2-G to P1-48 and from J2-M to P1-18. Repair or replace as necessary.

Step 6. Use voltmeter to check voltage from circuit card connector to P1-18(-).

If voltage is less than 1 Vdc, check wiring from J2-B to P1-34 and from J2-M to P1-18. Repair or replace as necessary.

If voltage checks correct, replace circuit card (paragraph 4-2j).

12. OVERVOLTAGE MALFUNCTION LIGHT COMES ON - OUTPUT VOLTAGE NORMAL.

Step 1. Connect GECM to test fixtures in accordance with paragraph 4-2a except place GEN SOURCE switch in GEN SOURCE position.

2-3. GENERAL. (cont)

Table 2-4. Troubleshooting - continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

CAUTION

To prevent damage, do not leave GECM in OVER VOLTS condition for more than 30 seconds.

If OVER VOLTS light comes on, shut down power and go to Malfunction 17.

If OVER VOLTS light stays off, go to Step 2.

Step 2. Increase power supply 2 output voltage to 38(±1) Vdc.

If OVER VOLTS light comes on, go to Malfunction 17.

If OVER VOLTS light stays off, go to Step 3.

Step 3. Use voltmeter to check voltage from circuit card connector P1-39(+) and P1-38(-).

If voltage reads same as power supply 2 output voltage, go to Step 4.

If voltage is less than 37 Vdc, check wiring from J2-E to P1-38 and from J2-F to P1-39. Repair or replace as necessary.

Step 4. Set power supply 2 output voltage to greater than 37 Vdc. Use voltmeter to check voltage at P1-48 and P1-18.

If voltage is same as output voltage of power supply 1 (28 Vdc), go to Step 5.

If voltage is not correct, check wiring from J2-G to P1-48 and from J2-M to P1-18. Repair or replace as necessary.

Step 5. Use voltmeter to check voltage at circuit card connector P1-35(+) and P1-18(-).

If voltage is 5(±1) Vdc, replace circuit card (paragraph 4-2j).

2-3. GENERAL. (cont)

Table 2-4. Troubleshooting - continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

If voltage is less than 1 Vdc, check wiring from J2-A to P1-35 and from J2-M to P1-18. Repair or replace as necessary.

13. GENERATOR OVERTEMP MALFUNCTION LIGHT COMES ON.

Step 1. Connect GECM to test fixture in accordance with paragraph 4-2a.

If OVER TEMP light comes on, go to Step 6.

If OVER TEMP light does not come on, go to Step 2.

Step 2. Move OVER TEMP switch to ON position.

If OVER TEMP light comes on, go to Step 3.

If OVER TEMP light does not come on, go to Malfunction 17.

Step 3. Use voltmeter to check voltage on circuit card connector P1-1(+) and P1-20(-).

If voltage is less than 1 Vdc, go to Step 4.

If voltage is greater than 1 Vdc, check wiring from P1-1 to thermal switch S1-2 and from S1-1 to J1-F. Repair or replace as necessary.

If wires check good use ohmmeter and check for open between S1-1 and S1-2. If open, replace thermal switch S1 (paragraph 4-2k).

Step 4. Use voltmeter to check voltage at P1-48 and P1-8.

If voltage same as power supply 1 (28 Vdc), go to Step 5.

If voltage is less than 28 Vdc, check wiring from J2-G to P1-48 and from J2-M to P1-18. Repair or replace as necessary. If wiring is good, replace circuit card (paragraph 4-2j).

2-3. GENERAL. (cont)

Table 2-4. Troubleshooting - continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

Step 5. Use voltmeter to check voltage at P1-36(+) and P1-18(-).

If voltage is 5 (±1) Vdc, replace circuit card (paragraph 4-2j).

If voltage is less than 1 Vdc, check wiring from J2-D to P1-36 and from J2-M to P1-18. Repair or replace as necessary.

14. OVERLOAD MALFUNCTION LIGHT COMES ON - CURRENT LOAD NORMAL.

Step 1. Connect GECM to test fixture in accordance with paragraph 4-2a.

If OVER LOAD light comes on, go to Step 3.

If OVER LOAD light does not come on, increase power supply 4 output voltage to 58(±1) millivolt dc. If OVER LOAD light comes on, go to Malfunction 17.

Step 2. Use voltmeter and measure voltage at P1-48 and P1-18.

If voltage reads same as power supply 1 (28 Vdc), go to Step 3.

If voltage is less than 28 Vdc, check wiring from J2-G to P1-48 and from J2-M to P1-18. Repair or replace as necessary.

Step 3. Use voltmeter and measure voltage at P1-24(+) and P1-18(-).

If voltage is less than 1 Vdc, check wiring from J2-C to P1-24 and from J2-M to P1-18. Repair or replace as necessary.

If wiring checks good, replace circuit card (paragraph 4-2j).

15. NO BATTERY CHARGING INDICATED.

Step 1. Connect GECM to test fixture in accordance with paragraph 4-2a. Turn all power supplies off. Use an ohmmeter and check the following:

2-3. GENERAL. (cont)

Table 2-4. Troubleshooting - continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

P1-29 to J3-B	J3-A to K1-A2
P1-18 to J3-D	J3-C to TB1-1

Repair or replace as necessary.

Step 2. Set power supply 1 at 28(±2) Vdc, power supply 2 at 0 volts, power supply 3 at 5(± 0.5) Vdc, and power supply 4 at 0 volts. Use oscilloscope and check for a pulse of at least 3 volts at P1-32, P1-33, P1-49, and P1-50.

If no pulse is measured, replace circuit card (paragraph 4-2j).

If correct is pulse measured, check transistors Q1 through Q5 and diodes D1 and D2 for shorts and opens. Replace as necessary (paragraph 4-21).

16. NO GENERATOR ENABLE - ALL INPUTS NORMAL.

Step 1. Connect GECM to test fixture in accordance with paragraph 4-2a, except place GEN SOURCE switch in GEN SOURCE position. Move ENABLE switch to ON position. Use voltmeter to check for 5 Vdc between P1-37 and case ground.

If voltage is correct, go to Step 2.

If voltage is incorrect, check wiring from J2-L to P1-37. Repair or replace as necessary.

Step 2. Use voltmeter and check for 24-28 Vdc at P1-13.

If voltage is measured, replace circuit card (paragraph 4-2j).

If no voltage is measured, check wiring from P1-13 to K1-X1. Repair or replace as necessary.

If wiring is good, check diodes D15 and D16 and coil of relay K1 for shorts and opens. Replace as necessary (paragraph 4-2m and 4-2n).

2-3. GENERAL. (cont)

Table 2-4. Troubleshooting - continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

17. NO OR POOR REGULATION - ALL INPUTS NORMAL.

Step 1. Check for low power limit setting in generator set. Increase load until there is a noticeable drop in voltage. Multiply output current by voltage to obtain power limit.

If power limit is above 10 kW, go to Step 2.

If power limit is below 10 kW, go to Malfunction 8.

Step 2. Use oscilloscope and check for a pulse of at least 5 Vdc at P1-41.

If pulse is correct, go to step 3.

If no pulse, replace circuit card (paragraph 4-2j).

Step 3. Check transistor Q5, diodes D5 and D9, and resistors R1 and R2 for shorts and opens. Replace as necessary (paragraph 4-21, 4-2n, 4-2o).

18. NO OR INCORRECT POWER LIMIT.

Step 1. Connect GECM to test fixture in accordance with paragraph **4-2a.** Set power supply 2 to 28 Vdc and power supply 4 to 22.7 millivolts dc. Use voltmeter and check for power supply 2 voltage (28 Vdc) at P1-38(+) and P1-39(-).

If voltage is correct, replace card (paragraph 4-2j).

If voltage is incorrect, check wiring from J2-E to P1-38 and from J2-F to P1-39. Repair or replace as necessary.

If wiring is good, go to Step 2.

Step 2. Use voltmeter and check for power supply 4 voltage at P1-25(+) and P1-26(-).

If voltage is correct, replace card (paragraph 4-2j).

If voltage is incorrect, check wiring from J2-K to P1-25 and from P2-J to P1-26. Repair or replace as necessary.

Section III. GENERAL MAINTENANCE

2-4. GENERAL MAINTENANCE FOR DIRECT SUPPORT, GENERAL SUPPORT AND DEPOT. This section provides general maintenance procedures for replacing lockbolts, gasket material, sound abatement material, and turnlock fasteners.

a. Lockbolt Removal/Installation.

(1) Center punch head of lockbolt pin.

(2) Use 3/16 inch drill bit and carefully drill into head of lockbolt pin.

(3) When drill bit is approximately 2/3 of the way into the lockbolt pin, the lockbolt pin should destruct. It may be necessary to lightly tap out lockbolt collar.

(4) Ensure that hole is not damaged. Remove any burrs.

(5) Install new lockbolt pin in hole.

(6) Place new collar on lockbolt pin.

(7) Use a pneumatic puller with a 3/16 inch nose adapter. Pull on collar side of lockbolt pin until pin breaks off even with collar.

b. Lockbolt Replacement. Lockbolts can be replaced with a screw, washers, and nut. This arrangement can be either temporary or permanent.

(1) Remove lockbolt in accordance with paragraph 2-4a, steps (1) through (4).

(2) Place flat washer on #10 hexhead screw and insert in hole.

(3) Install lockwasher and hex nut. Tighten nut until lockwasher is flattened.

c. Gasket Replacement.

WARNING

To prevent injury, use cleaning fluid in a well-ventilated area. Avoid prolonged or repeated breathing of vapor, and prolonged or repeated contact with skin. Use proper protective equipment.

(1) Remove damaged gasket. Use trichlorethylene (O-T-634) to thoroughly clean area.

(2) Measure and cut new gasket to fit.

(3) Peel backing from adhesive side of new gasket and firmly press in place. Trim to fit.

d. Insulation Replacement. Procedures for replacing engine housing insulation are identical to those for gasket replacement except that the edges of the insulation material must be treated with edge sealer before installing. Replacement of exhaust duct insulation is covered in paragraph 9-2b.

e. Turnlock Fastener Replacement. (See figure 2-1.)

(1) Receptacle replacement.

(a) Hold receptacle with screw driver.

(b) Loosen and remove retaining nut.

2-4. GENERAL MAINTENANCE FOR DIRECT SUPPORT, GENERAL SUPPORT AND DEPOT. (cont)

e. Turnlock Fasteners Replacement. (cont)

(c) Remove receptacle.

(d) Coat threads of replacement receptacle with threadlock compound (MIL-S-46163) and insert in housing.

(e) Secure with retaining nut.

(f) Aline receptacle slots in same direction as rest of receptacles.

(2) Stud replacement.

(a) Hold lockring with pliers.

(b) Close to opening in lockring, insert screw driver between lockring and stud and pry open.

(c) Turn stud to allow tab to slip past opening in lockring. Remove stud.

(d) Insert replacement stud with slot side to outside of access cover.

(e) Place lockring over stud. Aline slot with tab and slide down.

NOTE

In the following step, lockring should be between tabs and access cover.

(f) Pushing on top of stud to raise tabs, use pliers to squeeze lockring closed.

(g) Release top of stud and spring will push tabs against lockring securing stud in place.

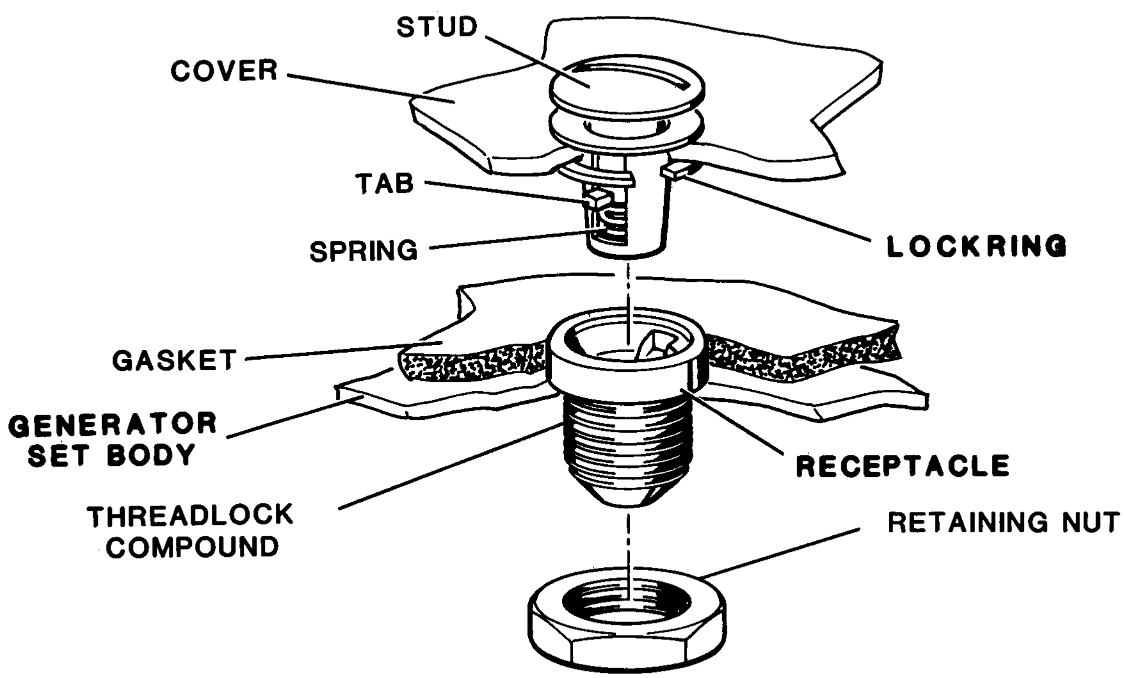


Figure 2-1. Turnlock Fastener

Section IV. REMOVAL AND INSTALLATION OF MAJOR COMPONENTS

2-5. GENERAL. This section contains instructions for removal and installation of the generator, engine and gearbox, and the control panel.

2-6. GENERATOR REMOVAL AND INSTALLATION.

a. Removal

(1) Set handbrake and chock both wheels.

WARNING

To prevent injury, ensure that battery is disconnected before performing maintenance on electrical components.

(2) Disconnect battery cable plug connector from battery.

(3) Loosen turnlock fasteners and remove engine housing access cover.

(4) Tag and disconnect electrical connections from positive (+) and negative (-) stud connectors (1 and 2, figure 2-2) on filter box (3).

(5) Tag and disconnect electrical connector from GECM connector (4).

(6) Disconnect oil filler/ breather vent tube (18) and oil return line (19) from breather assembly.

(7) Unscrew and remove filler cap and oil level gage (5).

(8) Tag and disconnect electrical connector from speed sensor (20).

(9) Loosen hose clamp (6) at top of oil filler tube (7) and install protective cap.

(10) Remove nuts (8), lockwashers (9), and capscrews (10) that secure oil filler/breather support bracket (11).

WARNING

The generator weighs approximately 56 pounds (25.4 kg). To prevent injury, use proper lifting device during removal and installation.

(11) Rig sling and lifting device to support generator.

(12) Use starter/manifold wrench and loosen nuts (12) that secure generator on gearbox. It is not necessary to remove nuts, lockwashers (13), and washers (14).

(13) Rotate generator (15) clockwise on mounting studs (16).

(14) Ensure that lifting device is supporting weight of generator.

(15) Pull generator forward and away from gearbox (17).

(16) Lift generator from engine housing and take to clean work area.

b. Installation.

WARNING

The generator weighs approximately 56 pounds (25.4 kg). To prevent injury, use proper lifting device during removal and installation.

(1) Rig sling and lifting device. Lift generator (15) into position in engine housing.

(2) Push generator into place on gearbox mounting studs (16).

2-6. GENERATOR REMOVAL AND INSTALLATION. (cont)

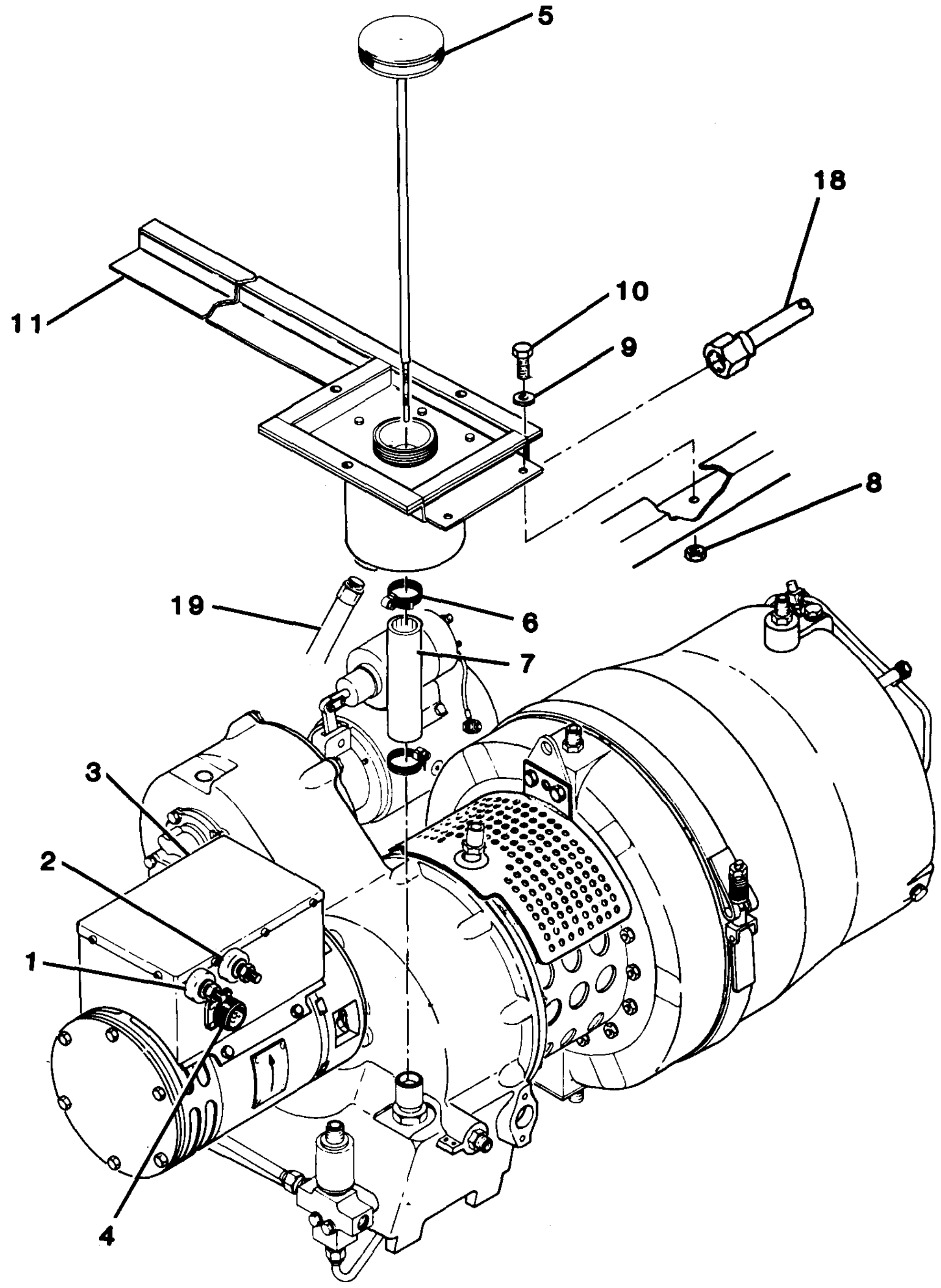
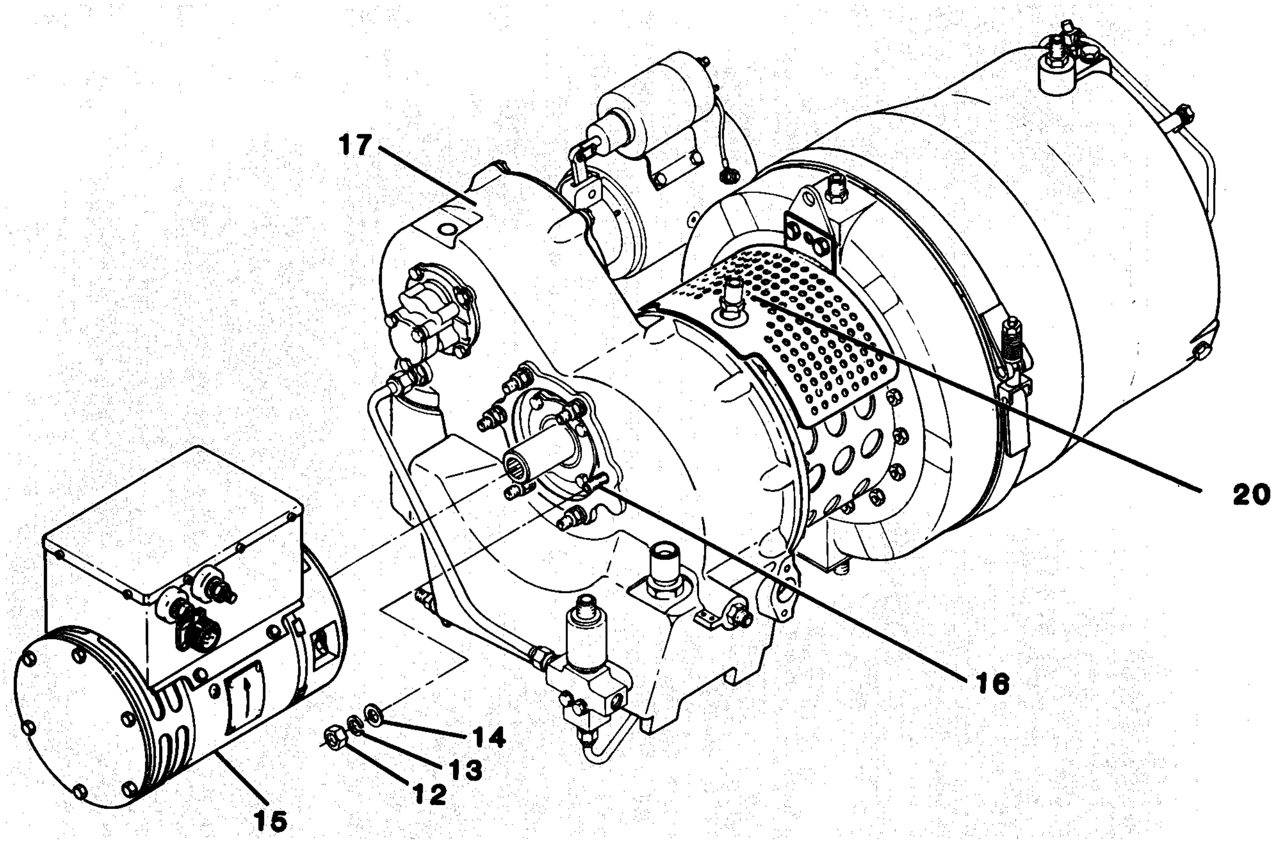


Figure 2-2. Generator Replacement (Sheet 1 of 2)

2-6. GENERATOR REMOVAL AND INSTALLATION. (cont)



LEGEND

1. POSITIVE (+) STUD CONNECTOR
2. NEGATIVE (-) STUD CONNECTOR
3. FILTER BOX
4. GECM CONNECTOR
5. FILLER CAP/OIL LEVEL GAGE
6. HOSE CLAMP
7. OIL FILLER TUBE
8. NUT
9. LOCKWASHER
10. CAPSCREW
11. OIL FILLER/BREATHER SUPPORT BRACKET
12. NUT
13. LOCKWASHER
14. WASHER
15. GENERATOR
16. MOUNTING STUD
17. GEARBOX
18. VENT TUBE
19. RETURN LINE
20. MONO PALE SPEED SENSOR

Figure 2-2. Generator Replacement (Sheet 2 of 2)

2-6. GENERATOR REMOVAL AND INSTALLATION. (cont)

b. Installation. (cont)

(3) Rotate generator counterclockwise to lock on mounting studs.

(4) Torque nuts (12) to 160-190 inch pounds (18.1-21.5 Nm). Bottom two nuts do not require torque.

(5) Remove sling and lifting device.

(6) Carefully place oil filler/breather and support bracket (11) in place. Secure with screws (10), washers (9), and nuts (8). Torque to 225-300 inch pounds (25-33.9 Nm).

(7) Remove protective cap. Connect oil filler tube (7) to breather and secure with hose clamp (6).

(8) Remove tag and connect electrical connector to speed sensor (20).

(9) Install oil level gage and filler cap (5) hand tight.

(10) Connect oil filler/breather vent tube (18) and oil return line (19) to breather assembly.

(11) Connect cable to GECM connector (4).

(12) Remove tags and connect electrical connections to positive (+) and negative (-) stud connectors (1,2).

(13) Install engine housing access cover and secure with turnlock fasteners.

(14) Connect battery cable plug connector to battery.

2-7. ENGINE AND GEARBOX REMOVAL AND INSTALLATION.

a. Removal.

(1) Set handbrake and chock both wheels.

WARNING

To prevent injury, ensure that battery is disconnected before performing maintenance on electrical components.

(2) Disconnect battery cable plug connector from battery.

(3) Loosen turnlock fasteners and remove engine housing access cover.

(4) Tag and disconnect electrical connection from speed sensor (7, figure 2-3).

(5) Remove oil filler/breather assembly and support bracket (paragraph 2-6a, steps 1-11).

(6) Tag and disconnect all electrical connections to generator.

(7) Disconnect fuel line (1) from fuel manifold connection (2).

(8) Loosen turnlock fasteners and remove plenum access cover.

CAUTION

To prevent damage, exhaust nozzle must be supported during engine removal. Failure to do so could result in torn/damaged nozzle gasket.

(9) In plenum compartment, place support (block of wood or other sturdy material) under exhaust nozzle.

2-7. ENGINE AND GEARBOX REMOVAL AND INSTALLATION. (cont)

a. Removal. (cont)

(10) Remove rim clenching clamp (3) that secures engine exhaust to exhaust nozzle.

(11) Tag and disconnect electrical connections from exhaust gas temperature thermocouple (4).

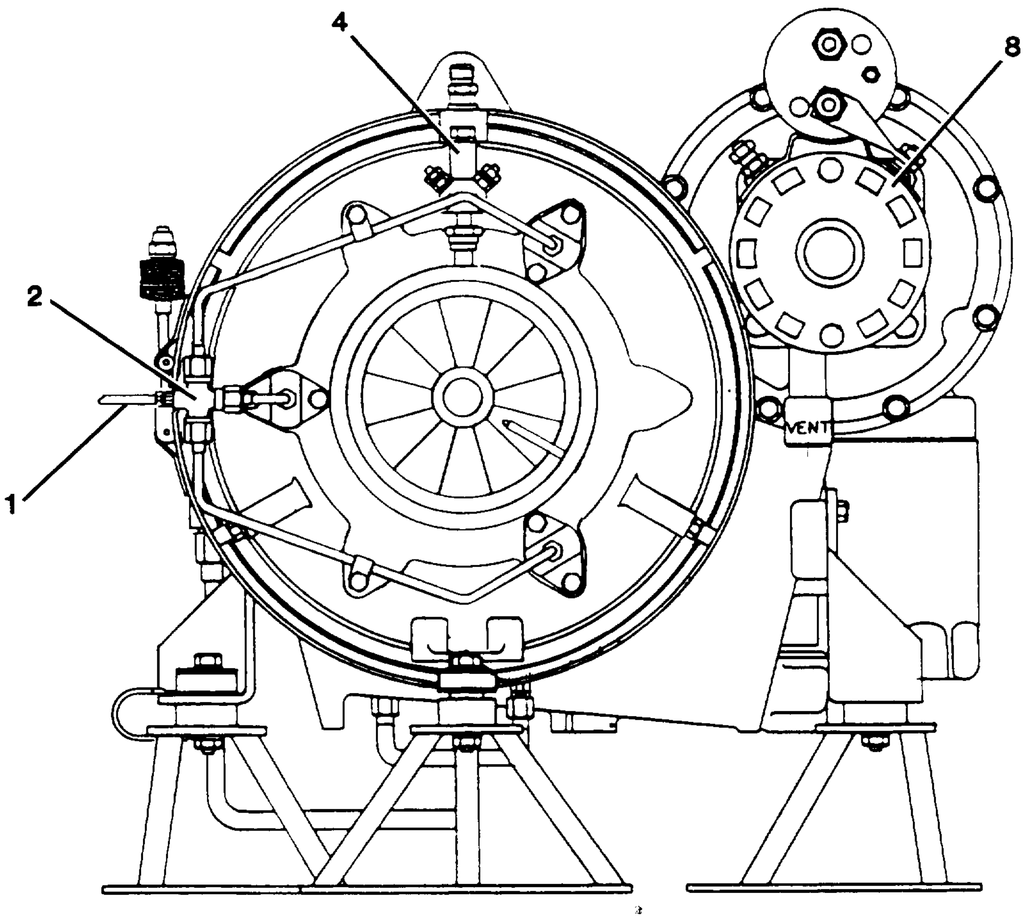
WARNING

To prevent injury, ground igniter to ensure stored voltage is discharged.

(12) Tag and disconnect high tension lead from igniter (5).

(13) Tag and disconnect bleed air line from bleed air connector (6).

2-7. ENGINE AND GEARBOX REMOVAL AND INSTALLATION. (cont)



LEGEND

1. FUEL LINE
2. FUEL MANIFOLD
3. RIM CLENCHING CLAMP
4. EGT THERMOCOUPLE
5. IGNITER
6. BLEED AIR CONNECTOR
7. MONOPOLE SPEED SENSOR
8. STARTER
9. LOW OIL PRESSURE SHUTDOWN SWITCH
10. SUPPLY AND RETURN LINES
11. CAPSCREW
12. WASHER
13. ENGINE SUPPORT

Figure 2-3. Engine and Gearbox Replacement (Sheet 1 of 3)

2-7. ENGINE AND GEARB0X REMOVAL AND INSTALLATION. (cont)

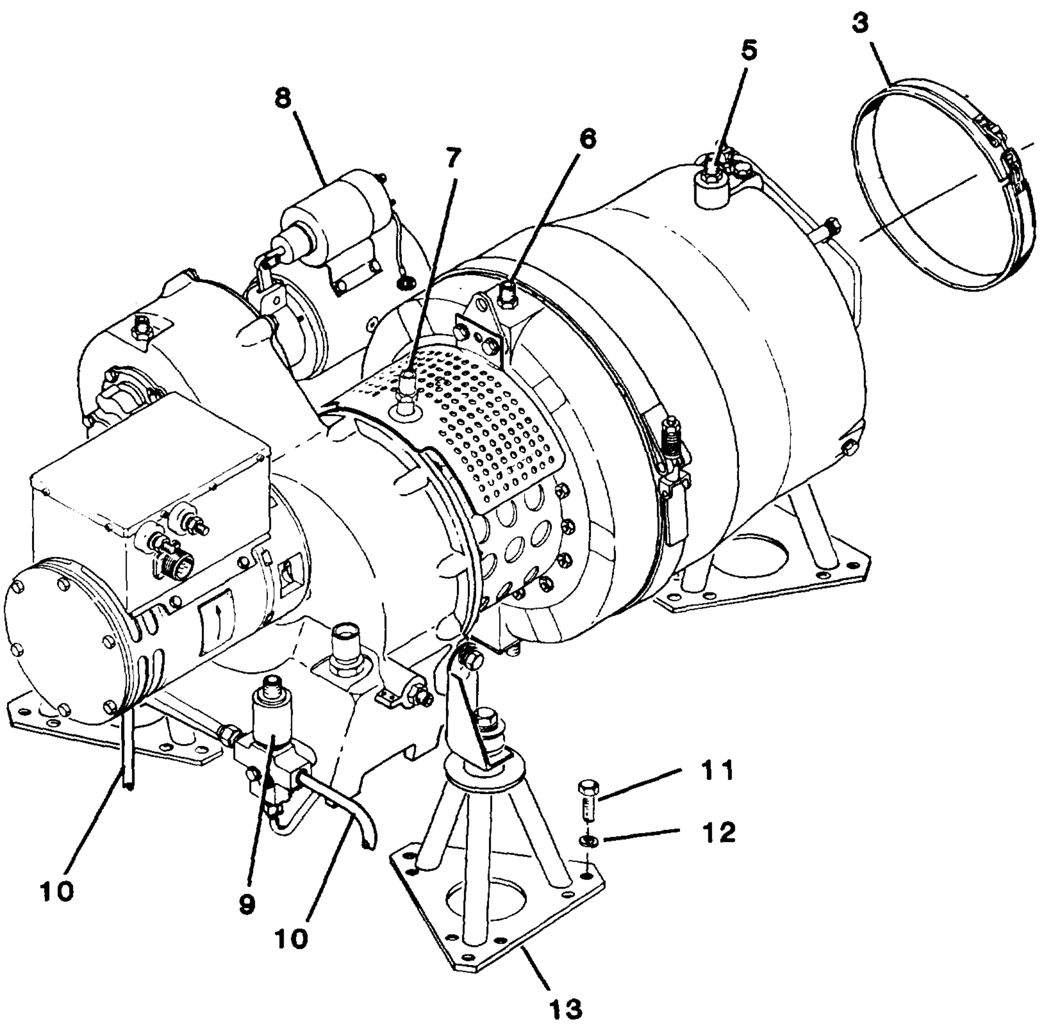


Figure 2-3. Engine and Gearbox Replacement (Sheet 2 of 3)

2-7. ENGINE AND GEARBOX REMOVAL AND INSTALLATION. (cont)

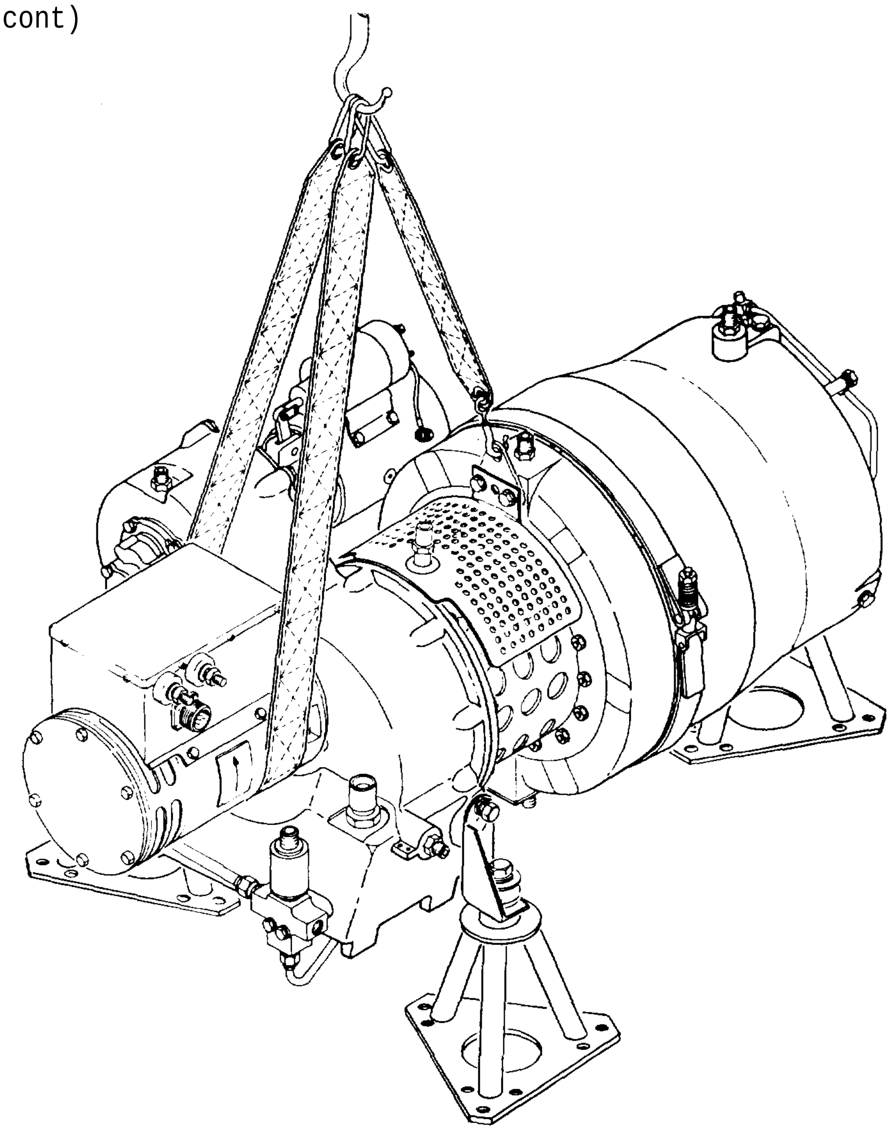


Figure 2-3. Engine and Gearbox Replacement (Sheet 3 of 3)

2-7. ENGINE AND GEARB0X REMOVAL AND INSTALLATION. (cont)

a. Removal. (cont)

(14) Tag and disconnect electrical connections from starter (8).

(15) Tag and disconnect electrical connections from low oil pressure shutdown switch (9).

(16) Drain oil from gearbox in accordance with paragraph 4-8, TM 5-6115-612-12.

(17) Remove fuel drain hose from retaining clamp.

(18) Tag and disconnect oil cooler supply and return lines (10) from engine. Install protective caps.

NOTE

Remainder of procedure requires two personnel.

(19) Remove capscrews (11) Fig 2-3 and washers (12) that secure engine support assemblies (13) to floor of engine housing.

(20) Make sure all wires, lines, and hoses are clear of engine, gearbox, and generator.

WARNING

The engine, gearbox, and generator weigh approximately 165 pounds (74.84 kg). To prevent injury, use proper lifting device during removal and installation.

(21) Rig lifting device in a manner similar to one shown in figure 2-3, sheet 3.

CAUTION

To prevent damage, one person must guide and steady engine while it is being hoisted out of engine housing.

(22) Firmly steady and guide engine to ensure proper balance and that engine does not hang up on electrical wiring, fuel lines, oil lines, or exhaust nozzle. Slowly hoist engine out of engine housing and clear of generator set.

(23) Carefully lower engine to floor. Ensure that engine support is squarely on floor before fully releasing hoist.

b. Installation.

WARNING

The engine and gearbox weigh approximately 165 pounds (74.84 kg). To prevent injury, use proper lifting device during removal and installation.

CAUTION

To prevent damage, one person must guide and steady engine while it is being hoisted into engine housing.

NOTE

This procedure requires two personnel.

2-7. ENGINE AND GEARBOX REMOVAL AND INSTALLATION. (cont)

b. Installation. (cont)

(1) Rig lifting device similar to one shown in figure 2-3, sheet 3

(2) Steady and guide engine to ensure proper balance. Carefully raise engine off floor and into position over engine housing.

(3) Carefully guide and lower engine into engine housing. Ensure that engine does not hang up on electrical wiring, fuel lines, oil lines, or exhaust nozzle.

(4) Ensure that mounting holes in engine support (13) are alined with mounting holes in floor of engine housing.

(5) Secure engine supports in place with washers (12), and capscrews (11). Torque to 290-325 inch pounds (32.8-36.7 Nm). Disconnect lifting device.

NOTE

Remainder of procedure can be done by one person.

(6) On underside of generator set, install fuel drain hose in retaining clamp. Install cover and secure with turnlock fasteners.

(7) Remove tags and connect oil cooler supply and return lines (10) to engine.

(8) Remove tags and connect electrical connections to low oil pressure valve (9).

(9) Remove tags and connect electrical connections to starter (8).

(10) Remove tags and connect electrical connections to monopole speed sensor (7).

(11) Remove tags and connect bleed air line to bleed air connector (6).

(12) Remove tags and connect high tension lead to igniter (5).

(13) Remove tags and connect electrical connections to exhaust gas temperature thermocouple (4).

(14) Secure engine exhaust to exhaust nozzle with rim clenching clamp (3).

(15) Remove support from under exhaust nozzle.

(16) Install plenum access cover and secure with turnlock fasteners.

(17) Connect fuel line (1) to fuel manifold connection (2).

(18) Fill gearbox with lubricating oil in accordance with paragraph 4-8, TM 5-6115-612-12.

(19) Remove tags and connect all electrical connections to generator.

(20) Install oil filler/breather assembly and support bracket.

(21) Install engine housing access cover and secure with turnlock fasteners.

2-7. ENGINE AND GEARB0X REMOVAL AND INSTALLATION. (cont)

b. Installation. (cont)

(21) Connect battery cable plug connector to battery.

2-8. CONTROL PANEL REMOVAL AND INSTALLATION.

a. Removal.

WARNING

To prevent injury, ensure that battery is disconnected before performing maintenance on electrical components.

(1) Disconnect battery cable plug connector from battery.

(2) Unlatch and open control panel access door.

(3) Loosen turnlock fasteners (1, figure 2-4) and open control panel.

(4) Remove self-locking nut (2), washer (3), screw (4), and remove loop clamp (5) from temperature sensing resistor (6).

(5) Remove self-locking nut (7), washer (8), screw (9), and loop clamp (10) from wire bundle (11).

(6) Tag and disconnect all wiring to control panel components.

(7) Remove self-locking nuts (12), washers (13), and screws (14) that secure control panel (15) to hinge (16).

(8) Remove control panel to work area.

b. Installation.

(1) Aline control panel (15) with mounting holes in hinge.

(2) Secure control panel to hinge (16) with screws (14), washers (13), and self-locking nuts (12).

(3) Remove tags and connect wiring to control panel components.

(4) Install loop clamp (10) on wire bundle (11) with screw (9), washer (8), and self-locking nut (7).

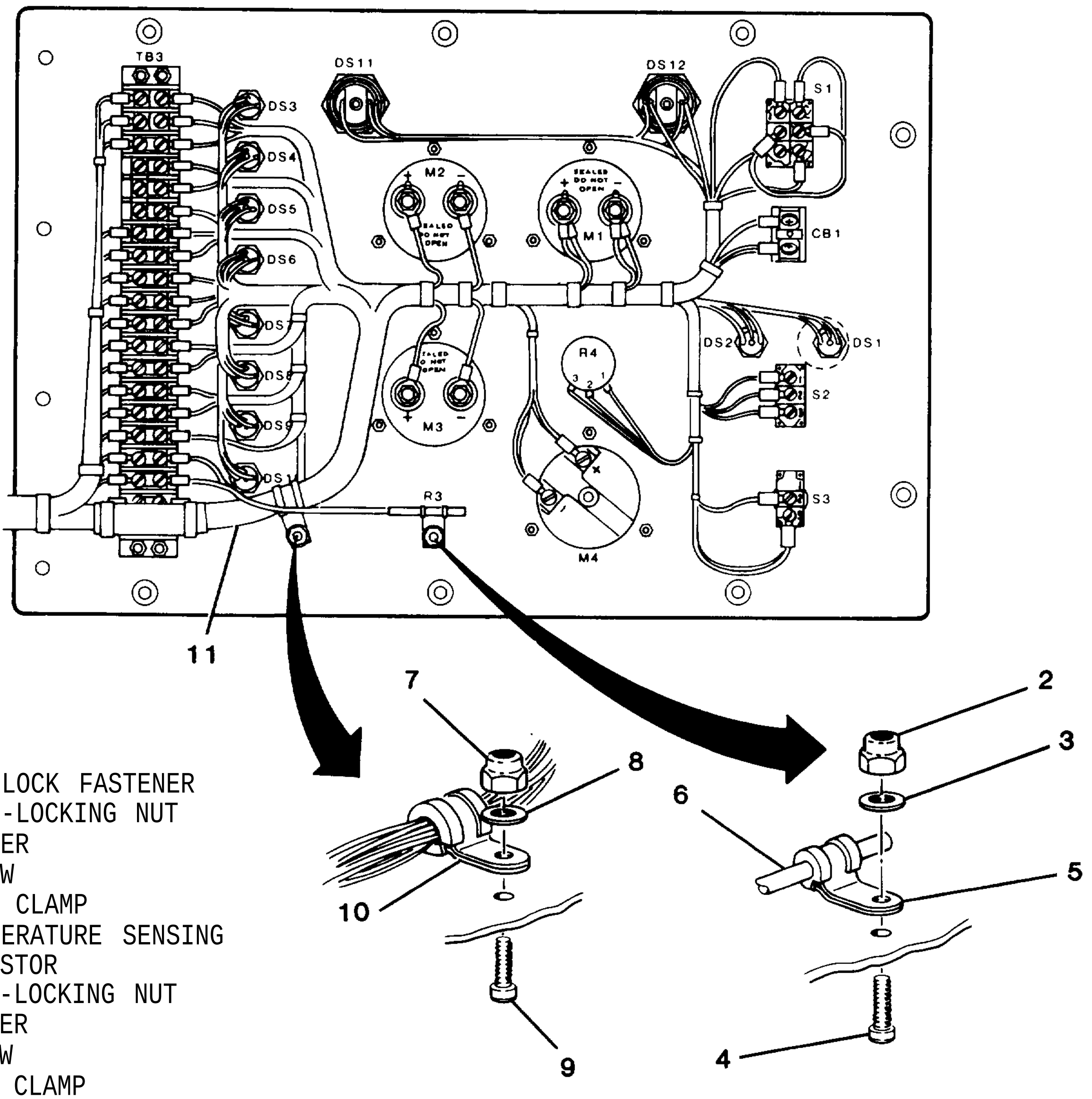
(5) Install loop clamp (5) on temperature sensing resistor (6) with screw (4), washer (3), and self-locking nut (2).

(6) Close control panel and secure with turnlock fasteners (1).

(7) Close control panel access door and latch securely.

(8) Connect battery cable plug connector to battery.

2-8. CONTROL PANEL REMOVAL AND INSTALLATION. (cont)



LEGEND

1. TURNLOCK FASTENER
2. SELF-LOCKING NUT
3. WASHER
4. SCREW
5. LOOP CLAMP
6. TEMPERATURE SENSING RESISTOR
7. SELF-LOCKING NUT
8. WASHER
9. SCREW
10. LOOP CLAMP
11. WIRE BUNDLE
12. SELF-LOCKING NUT
13. WASHER
14. SCREW
15. CONTROL PANEL
16. HINGE

Figure 2-4. Control Panel Replacement (Sheet 1 of 2)

2-8. CONTROL PANEL REMOVAL AND INSTALLATION. (cont)

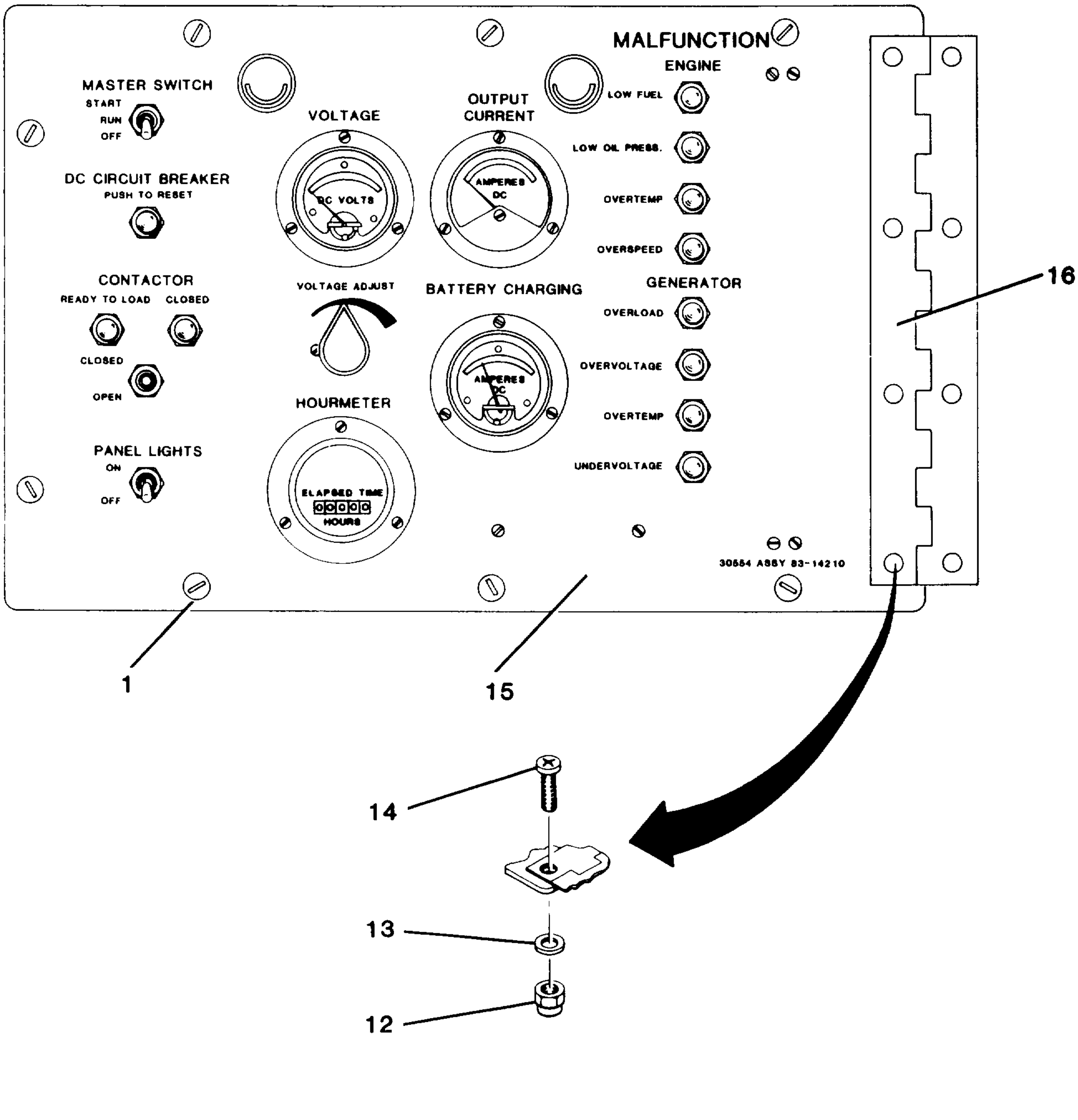


Figure 2-4. Control Panel Replacement (Sheet 2 of 2)

CHAPTER 3

MAINTENANCE OF FRAME AND HOUSING

3-1. GENERAL. The frame and housing provides support and a weathertight enclosure for the generator set. Provisions are included for using bleed air from the bleedport on the combustor housing to help keep the air filter free of foreign material. The frame and housing consists of the cable support, access doors and covers, control and exhaust fenders, housings for fuel and inlet air components, bleed air line, air filter, engine housing, engine support, and the chassis frame.

3-2. CABLE SUPPORT.

a. Removal. Refer to paragraph 2-4a for procedure to remove lockbolts. Remove lockbolts and cable support assembly.

b. Repair.

(1) Held cracks and holes.

(2) Remove dents and straighten bent section.

(3) Remove corrosion and chipped paint. Prime and repaint affected areas.

(4) Replace missing or damaged attaching hardware.

c. Installation. Refer to paragraph 2-4b for procedure to install lockbolts. Place cable support assembly in place and secure with lockbolts.

3-3. ACCESS DOORS AND COVERS.

a. Removal. Remove the damaged access door or cover in accordance with procedures in either paragraph 4-16 or 4-17, TM 5-6115-612-12.

b. Repair.

(1) Remove dents and straighten bends as needed.

(2) Weld cracks and holes.

(3) Remove corrosion and chipped paint. Prime and repaint affected areas.

(4) Replace damaged hinges and/or door latches as needed.

(5) Replace damaged gaskets as needed (paragraph 2-4c).

(6) Replace damaged turnlock fasteners (paragraph 2-4e).

c. Installation. Install access doors and covers in accordance with paragraphs 4-16 or 4-17, TM 5-6115-612-12.

3-4. CONTROL FENDER ASSEMBLY.

a. Removal. (See figure 1-1 for location.)

(1) Ensure that MASTER SWITCH is in OFF position.

WARNING

To prevent injury, ensure that battery is disconnected before performing maintenance on electrical components.

(2) Disconnect battery cable plug connector from battery.

(3) Loosen turnlock fasteners and remove engine housing access cover.

3-4. CONTROL FENDER ASSEMBLY. (cont)

a. Removal. (cont)

(4) Remove power cable from cable support.

(5) Remove inlet air housing access door (paragraph 4-16d, TM 5-611 5-612-12).

(6) Remove control panel access door (paragraph 4-16a, TM 5-6115-612-12).

(7) Remove self-locking nuts, washers, and screws that secure control panel access door support bar to hinge bracket mount.

(8) Refer to paragraph 2-4a for procedure to remove lockbolts. Remove lockbolts that secure hinge bracket to control fender.

(9) Remove nuts, screws, and washers that secure hinge to control fender.

(10) Loosen turnlock fasteners and open control panel.

(11) Tag and disconnect wiring. Remove control panel (paragraph 2-8a).

(12) Tag and unplug electrical connectors. Remove generator electronic control module (GECM) (paragraph 4-30a, TM 5-6115-612-12).

(13) Loosen turnlock fasteners and remove engine electronic control module (EECM) access cover.

(14) Tag and unplug electrical connectors. Remove EECM (paragraph 4-64a, TM 5-6115-612-12).

(15) Ensure that all wiring has been properly tagged and disconnected. Remove screws that hold grommet plates. Carefully pull wiring into engine housing and inlet air housing.

(16) Refer to paragraph 2-4a for procedure to remove lockbolts. With another person supporting control fender, remove lockbolts that connect control fender to generator set. Pull fender away from generator set.

b. Repair.

(1) Weld cracks and holes.

(2) Remove dents.

(3) Remove corrosion and chipped paint. Prime and repaint affected areas.

(4) Measure and fabricate new panels.

c. Installation.

(1) Refer to paragraph 2-4b for procedure to install lockbolts. Place control fender assembly in position and secure with lockbolts.

(2) Carefully feed wiring from engine housing and inlet air housing into control fender. Secure grommet plates to control fender with screws.

(3) Install EECM and plug in electrical connectors (paragraph 4-64b, TM 5-6115-612-12).

(4) Install EECM access cover and secure with turnlock fasteners.

3-4. CONTROL FENDER ASSEMBLY. (cont)

c. Installation. (cont)

(5) Install GECM and plug in electrical connectors (paragraph 4-30b, TM 5-6115-612-12).

(6) Install control panel and connect wiring (paragraph 2-8b). Close control panel and secure with turnlock fasteners.

(7) Install hinge on control fender and secure with screws, washers, and nuts.

(8) Refer to paragraph 2-4b for procedure to install lockbolts. Secure hinge bracket to control fender with lockbolts.

(9) Attach hinge bracket to control panel access door support bar with screws, washers, and self-locking nuts.

(10) Install control panel access door (paragraph 4-16a, TM 5-6115-612-12).

(11) Install inlet air housing access door (paragraph 4-16d, TM 5-6115-612-12).

(12) Stow power cable on cable support.

WARNING

To prevent injury, ensure that all tools and maintenance materials have been removed from the generator set prior to operation.

(13) Install engine housing access cover and secure with turnlock fasteners.

(14) Connect battery cable plug connector to battery.

(15) Run generator set to ensure proper operation (paragraph 2-3, TM 5-6115-612-12).

3-5. EXHAUST FENDER ASSEMBLY.

a. Removal. (See figure 1-2 for location.)

(1) Ensure that MASTER SWITCH is in OFF position.

WARNING

To prevent injury, ensure that battery is disconnected before performing maintenance on electrical components.

(2) Disconnect battery cable plug connector from battery.

(3) Loosen turnlock fasteners and remove engine housing access cover.

(4) Loosen turnlock fasteners and remove exhaust plenum access cover.

(5) Remove exhaust duct (paragraph 9-2).

(6) Remove fuel housing access door (paragraph 4-16c, TM 5-6115-612-12).

(7) Remove oil cooler housing access cover (paragraph 4-17e, TM 5-6115-612-12).

(8) Refer to paragraph 2-4a for procedure to remove lockbolts. With another person supporting exhaust fender, remove lockbolts that connect exhaust fender to generator set. Pull fender away from generator set.

3-5. EXHAUST FENDER ASSEMBLY. (cont)

b. Repair.

(1) Weld cracks and holes.

(2) Remove dents.

(3) Remove corrosion and chipped paint. Prime and repaint affected areas.

(4) Measure and fabricate new panels.

c. Installation.

(1) Refer to paragraph 2-4a for procedures to install lockbolts. Place exhaust fender in position and secure with lockbolts.

(2) Install exhaust duct. (paragraph 9-2).

(3) Install oil cooler access housing (paragraph 4-17e, TM 5-6115-612-12).

(4) Install fuel housing access door (paragraph 4-16c, TM 5-6115-612-12).

WARNING

To prevent injury, ensure that all tools and maintenance materials have been removed from the generator set prior to operation.

(5) Install exhaust plenum access cover and secure with turnlock fasteners.

(6) Install engine housing access cover and secure with turnlock fasteners.

(7) Connect battery cable plug connector to battery.

(8) Run generator set to ensure proper operation (paragraph 2-3, TM 5-6115-612-12).

3-6. FUEL HOUSING.

a. Removal. (See figure 1-2 for location.)

(1) Ensure that MASTER SWITCH is in OFF position.

WARNING

To prevent injury, ensure that battery is disconnected before performing maintenance on electrical components.

(2) Loosen turnlock fasteners and remove engine housing access cover.

(3) Remove power cable from cable support.

(4) Remove cable support (paragraph 3-2).

(5) Remove fuel housing access door (paragraph 4-16c, TM 5-6115-612-12).

(6) Remove electrical fuel transfer pump (paragraph 4-37c, TM 5-6115-612-12).

(7) Remove primary fuel filter (paragraph 4-38b, TM 5-6115-612-12).

(8) Remove secondary fuel filter (paragraph 4-40b, TM 5-6115-612-12).

(9) Remove high pressure electrical fuel pump and mounting brackets (paragraph 4-41a, TM 5-6115-612-12).

3-6. FUEL HOUSING. (cont)

a. Removal. (cont)

(10) Remove solenoid valve (paragraph 4-42a, TM 5-6115-612-12).

(11) Remove loop clamps that secure wiring to fuel housing.

(12) Remove screws that secure grommet plate to fuel housing.

(13) Ensure that all wiring has been properly tagged and disconnected. Carefully pull wiring into engine housing. Remove all fuel lines from fuel housing.

(14) Refer to paragraph 2-4a for procedure to remove lockbolts. Remove lockbolts that connect fuel housing to generator set.

b. Repair.

(1) Held cracks and holes.

(2) Remove dents.

(3) Remove corrosion and chipped paint. Prime and repaint affected areas.

(4) Measure and fabricate new panels.

c. Installation.

(1) Refer to paragraph 2-4a for procedure to install lockbolts. Place fuel housing in position and secure with lockbolts.

(2) Carefully feed wiring from engine housing into fuel housing. Install fuel lines.

(3) Install grommet plate and secure with screws. Torque to 24-36 inch pounds (2.7-4.1 Nm).

(4) Secure wiring to fuel housing with loop clamps.

(5) Install solenoid valve (paragraph 4-42b, TM 5-6115-612-12).

(6) Install mounting brackets and high pressure electrical fuel pump (paragraph 4-41b, TM 5-6115-612-12).

(7) Install secondary fuel filter (paragraph 4-40c, TM 5-6115-612-12).

(8) Install primary fuel filter (paragraph 4-38c, TM 5-6115-612-12).

(9) Install electrical fuel transfer pump (paragraph 4-37d, TM 5-6115-612-12).

(10) Install fuel housing access door (paragraph 4-16c, TM 5-6115-612-12).

(11) Install engine housing access cover and secure with turnlock fasteners.

(12) Install cable support (paragraph 3-2).

(13) Stow power cable on cable support.

WARNING

To prevent injury, ensure that all tools and maintenance materials have been removed from the generator set prior to operation.

(14) Run generator set to ensure proper operation (paragraph 2-3, TM 5-6115-612-12).

3-7. INLET AIR HOUSING.

a. Removal. (See figure 1-2 for location.)

(1) Ensure that MASTER SWITCH is in OFF position.

WARNING

To prevent injury, ensure that battery is disconnected before performing maintenance on electrical components.

(2) Disconnect battery cable plug connector from battery.

(3) Remove power cable and cable support assembly (paragraph 3-2).

(4) Remove inlet air housing access door (paragraph 4-16d, TM 5-6115-612-12).

(5) Remove battery cable assembly (paragraph 4-26a, TM5-6115-612-12).

(6) Remove slave receptacle (paragraph 4-29b, TM 5-6115-612-12).

(7) Remove power cable (paragraph 4-81a, TM 5-6115-612-12).

(8) Remove air filter muffler housing (paragraph 4-21a, TM5-6115-612-12).

(9) Remove air baffle (paragraph 4-22a, TM 5-6115-612-12).

(10) Remove air filter (paragraph 3-9a).

(11) Remove component mounting panel (paragraph 4-82a, TM 5-6115-612-12). Carefully pull wiring through access holes out of inlet air housing. Refer to FO-1, TM 5-6115-612-12.

(12) Open control panel access door.

(13) Loosen turnlock fasteners and remove EECM access cover.

(14) Loosen turnlock fasteners and open control panel.

(15) Carefully pull wiring out of inlet air housing into control fender.

(16) Close control panel and control panel access door.

(17) Remove 20 amp current shunt (paragraph 4-33b, TM 5-6115-612-12).

(18) Refer to paragraph 2-4a for procedure to remove lockbolts. Remove lockbolts that connect inlet air housing to generator set.

b. Repair.

(1) Weld cracks and holes.

(2) Remove dents.

(3) Remove corrosion and chipped paint. Prime and repaint affected areas.

(4) Measure and fabricate new panels.

c. Installation.

(1) Refer to paragraph 2-4a for procedure to install lockbolts. Place inlet air housing in position and secure with lockbolts.

(2) Open control panel access door.

(3) Loosen turnlock fasteners and open control panel.

3-7. INLET AIR HOUSING. (cont)

c. Installation. (cont)

(4) Install 20 amp current shunt (paragraph 4-33c, TM 5-6115-612-12).

(5) Carefully feed wiring through access holes from control fender to inlet air housing.

(6) Close control panel and secure with turnlock fasteners.

(7) Install EECM access cover and secure with turnlock fasteners.

(8) Close control panel access door.

(9) Install component mounting panel (paragraph 4-82b, TM 5-6115-612-12). Ensure that all wiring is properly connected. Refer to FO-1, TM 5-6115-612-12).

(10) Install air filter (paragraph 3-9b).

(11) Install air baffle (paragraph 4-22d, TM 5-6115-612-12).

(12) Install air filter muffler housing (paragraph 4-21d, TM 5-6115-612-12).

(13) Install power cable (paragraph 4-81b, TM 5-6115-612-12).

(14) Install slave receptacle (paragraph 4-29c, TM 5-6115-612-12).

(15) Install battery cable assembly (paragraph 4-26d, TM 5-6115-612-12).

WARNING

To prevent injury, ensure that all tools and maintenance materials have been removed from the generator set prior to operation.

(16) Install engine housing access cover and secure with turnlock fasteners.

(17) Install inlet air housing access door (paragraph 4-16d, TM5-6115-612-12).

(18) Install cable support (paragraph 3-2).

(19) Stow power cable on cable support.

(20) Connect battery cable plug connector to battery.

(21) Run generator set to ensure proper operation (paragraph 2-3, TM 5-6115-612-12).

3-8. BLEED AIR LINE.

a. Removal. Remove bleed air line in accordance with paragraph 4-19b, TM 5-6115-612-12.

b. Repair.

(1) Measure length of damaged hose.

(2) Use fine-toothed hacksaw and cut new hose (MIL-H-27267-2) to match length of damaged hose.

(3) If fittings on hose to be replaced are not damaged, cut off and use again.

3-8. BLEED AIR LINE. (cont)

b. Repair. (cont)

(4) Clean bore of new hose.

(5) Put socket in vise and screw hose counterclockwise into socket until it bottoms. Back off quarter turn.

(6) Lightly lubricate nipple threads and inside of hose with petrolatum (VV-P-236).

(7) Screw nipple clockwise into socket and hose. Leave maximum clearance of 1/32 to 1/16 inch (0.0794 to 0.1588 cm) between hex and socket.

c. Installation. Install bleed air line in accordance with paragraph 4-19c, TM 5-6115-612-12.

3-9. AIR FILTER ASSEMBLY.

a. Removal.

WARNING

To prevent injury, ensure that battery is disconnected before performing maintenance on electrical components.

(1) Disconnect battery cable plug connector from battery.

(2) Remove power cable from cable support.

(3) Open inlet air housing access door. Secure in open position.

(4) Loosen turnlock fasteners and remove engine housing access cover.

(5) Disconnect bleed air line (1, figure 3-1) from air filter (2).

(6) Remove air baffle (paragraph 4-22a, TM 5-6115-612-12).

(7) Remove capscrews (3), nuts (4), and washers (5) that secure air filter (2) to housing.

CAUTION

To prevent damage to ejectors, use care when removing air filter from inlet air housing.

NOTE

It may be necessary to tag and disconnect some wiring to ease removal of the air filter assembly.

(8) Carefully pull air filter forward. Alternately tilt and pull forward to ensure that ejectors (6) have adequate clearance during removal.

b. Installation.

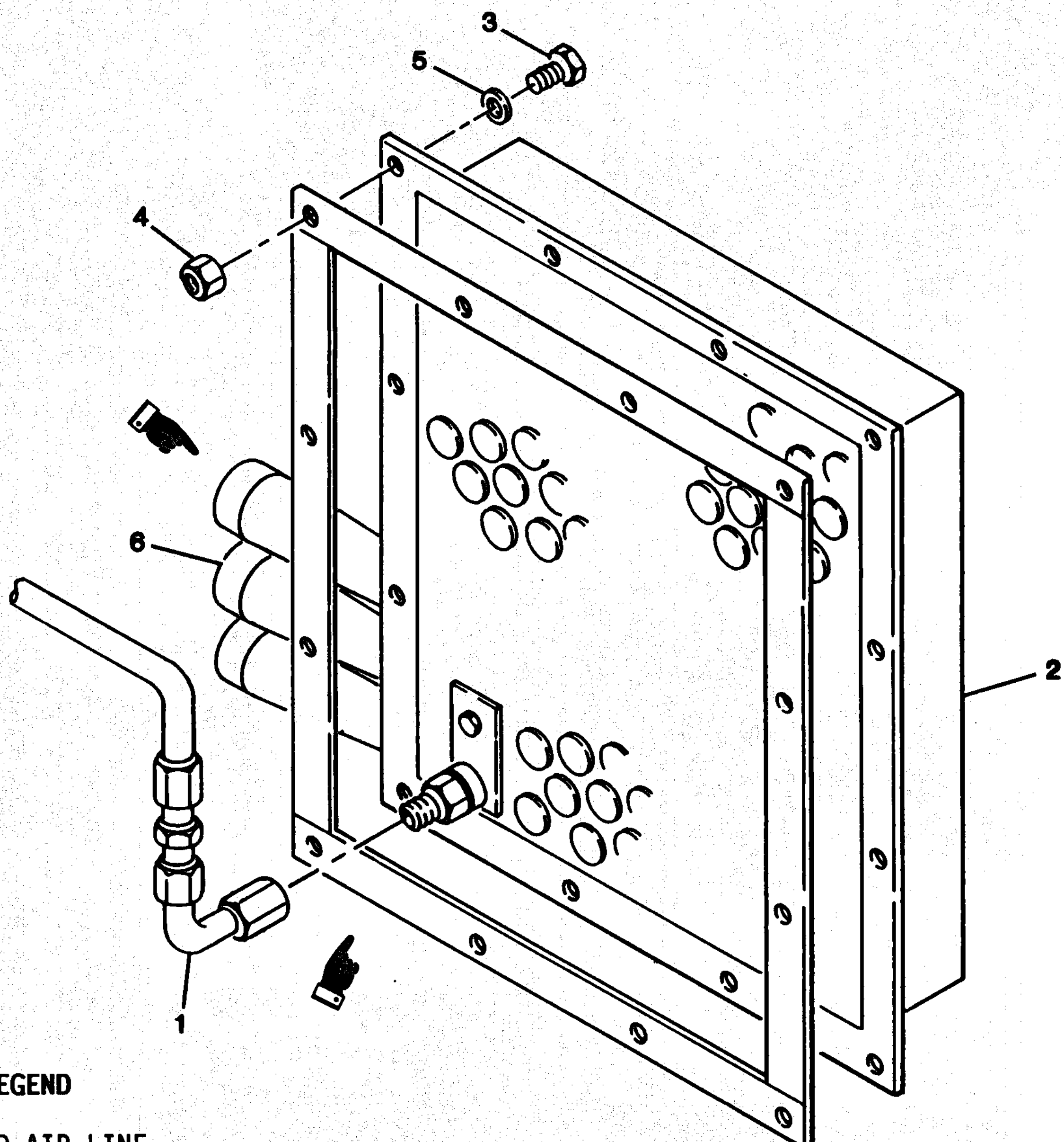
CAUTION

To prevent damage to ejectors, use care when installing air filter in inlet air housing.

(1) Carefully guide air filter ejectors (6) through muffler opening in right side of inlet air housing.

(2) Aline air filter (2) with mounting holes and secure with capscrews (3), washers (5) and nuts (4). Torque to 74-82 inch pounds (8.4-9.3 Nm).

3-9. AIR FILTER ASSEMBLY. (cont)



LEGEND

1. BLEED AIR LINE
2. AIR FILTER
3. CAPSCREW
4. NUT
5. WASHER
6. EJECTORS

Figure 3-1. Air Filter Replacement

3-9. AIR FILTER ASSEMBLY. (cont)

b. Installation. (cont)

(3) Install air baffle (paragraph 4-22d, TM 5-6115-612-12).

(4) Connect bleed air line (1) to air filter.

(5) Install engine housing access cover and secure with turn- lock fasteners.

(6) Close and securely latch inlet air housing access cover.

(7) Stow power cable on cable support.

(8) Connect battery cable plug connector to battery.

3-10. ENGINE HOUSING.

a. Removal.

WARNING

To prevent injury, ensure that battery cable plug connector is disconnected before performing maintenance.

(1) Disconnect battery cable plug connector from battery.

(2) Gain access to fuel housing (paragraph 4-34a, TM 5-6115-612-12).

(3) Drain fuel system (paragraph 4-34b, TM 5-6115-612-12).

(4) Drain lubricating oil (paragraph 4-8a, TM 5-6115-612-12).

(5) Unlatch and open inlet air housing access door. Secure in open position.

(6) Loosen turnlock fasteners and remove engine housing access cover.

(7) Loosen turnlock fasteners and remove exhaust plenum access cover.

(8) Loosen turnlock fasteners and open control panel.

(9) In engine housing, disconnect and remove oil/filler breather (paragraph 4-50b, TM 5-6115-612-12).

(10) Tag and disconnect all wiring, fuel lines, and lubrication lines from engine and generator.

(11) Remove engine and gearbox with generator (paragraph 2-7a).

(12) Remove exhaust duct (paragraph 9-2a).

(13) Remove oil cooler (paragraph 7-3a).

(14) Remove all loop clamps that secure wiring to engine housing.

(15) Remove screws that secure all grommet plates to engine housing.

(16) Remove wiring harness W3 (paragraph 4-79f, TM 5-6115-612-12.)

(17) Pull other wiring into fuel housing, inlet air housing, or control fender as appropriate.

(18) Remove loop clamps and all fuel/lubrication lines from engine housing.

(19) Remove ignition coil (paragraph 4-48b, TM 5-6115-612-12).

(20) Remove air filter (paragraph 3-9a).

3-10. ENGINE HOUSING. (cont)

a. Removal. (cont)

(21) Remove fuel tank (paragraph 4-39a, TM 5-6115-612-12).

(22) Remove control panel access door (paragraph 4-16a, TM 5-6115-612-12).

(23) Provide support for control and exhaust fenders.

(24) Remove any identification/instruction plates from engine housing.

(25) Refer to paragraph 2-4a for procedure to remove lockbolts. Remove lockbolts and engine housing.

b. Repair.

(1) Weld cracks and holes.

(2) Remove dents.

(3) Remove corrosion and chipped paint. Prime and repaint affected areas.

(4) Replace damaged sound/thermal insulation (paragraph 2-4d).

(5) Refer to paragraph 2-4e and install new turnlock fastener receptacles.

(6) Measure and fabricate new panels.

c. Installation.

(1) Refer to paragraph 2-4a for procedure to install lockbolts. Install engine housing and secure with lockbolts.

(2) Install all identification/instruction plates.

(3) Install control panel access door (paragraph 4-16a, TM 5-6115-612-12).

(4) Install fuel tank (paragraph 4-39b, TM 5-6115-612-12).

(5) Install air filter (paragraph 3-9b).

(6) Install ignition coil (paragraph 4-48c, TM 5-6115-612-12).

(7) Install fuel/lubrication lines in engine housing and secure with loop clamps.

(8) Pull wiring into engine housing from fuel housing, inlet air housing and control fender.

(9) Install wiring harness W3 (paragraph 4-79h, TM 5-6115-612-12).

(10) Install grommet plates and secure with screws. Torque to 24-36 inch pounds (2.7-4.1 Nm).

(11) Secure wiring to engine housing with loop clamps.

(12) Install oil cooler (paragraph 7-3b).

(13) Install exhaust duct (paragraph 9-2).

(14) Install engine and gearbox with generator (paragraph 2-7b).

(15) Connect lubrication lines, fuel lines, and wiring to engine and generator.

(16) Install oil filler/breather (paragraph 4-50d, TM 5-6115-612-12).

(17) Close control panel and secure with turnlock fasteners.

3-10. ENGINE HOUSING. (cont)

c. Installation. (cont)

(18) Install exhaust plenum access cover and secure with turnlock fasteners.

(19) Install engine housing access cover and secure with turnlock fasteners.

(20) Close inlet air housing access door.

(21) Connect battery cable plug connector to battery.

(22) Fill oil reservoir (paragraph 4-8b, TM 5-6115-612-12).

3-11. ENGINE SUPPORT ASSEMBLY.

a. Removal.

(1) Ensure that MASTER SWITCH is in OFF position.

WARNING

To prevent injury, ensure that battery is disconnected before performing maintenance on electrical components.

(2) Disconnect battery cable plug connector from battery.

(3) Remove engine in accordance with paragraph 2-7a. Do not disconnect lifting device.

(4) Maintain light strain on lifting device.

(5) Remove capscrew (1, figure 3-2), self-locking nut (2), washers (3), resilient mount (4), spacer (5), and resilient mount (6) to free engine support (7) from engine mount plate (10).

(6) Remove capscrews (8), lockwashers (9), engine mount plate (10), and rear spacer (11) from bottom of combustion chamber case.

(7) Remove capscrew (12), nuts (13), washers (14), ground strap (15), resilient mounts (16), spacers (17), and resilient mounts (18) to free engine support (19) from engine mounts (22).

(8) Remove capscrews (20), lockwashers (21), and engine mounts (22) from sides of gearbox.

b. Repair.

(1) Weld cracks and holes.

(2) Remove dents and straighten bent sections.

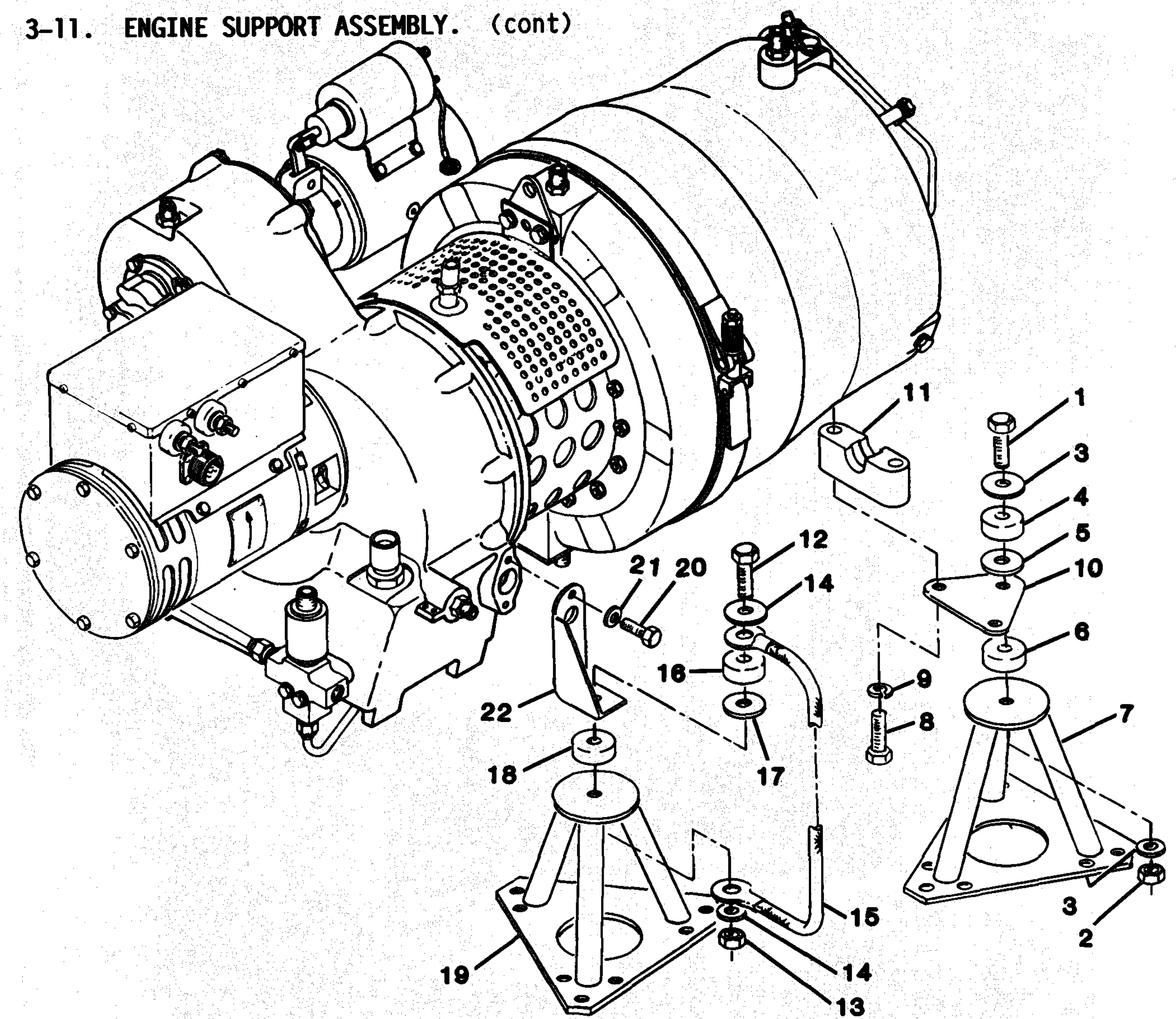
(3) Remove corrosion and chipped paint. Prime and repaint affected areas.

(4) Replace resilient mounts if dry or cracked, or if damaged by fuel/oil contamination.

c. Installation.

(1) Install engine mounts (22) on sides of gearbox and secure with lockwashers (21), and capscrews (20). Torque to 100-140 inch pounds (11.3-15.8 Nm).

3-11. ENGINE SUPPORT ASSEMBLY. (cont)



1.	CAPSCREW
2.	NUT
3.	WASHER
4.	RESILIENT MOUNT
5.	SPACER
6.	RESILIENT MOUNT
7.	ENGINE SUPPORT
8.	CAPSCREW
9.	LOCKWASHER
10.	ENGINE MOUNT PLATE
11.	REAR SPACER
12.	CAPSCREW
13.	NUT
14.	WASHER
15.	GROUND STRAP
16.	RESILIENT MOUNT
17.	SPACER
18.	RESILIENT MOUNT
19.	ENGINE SUPPORT
20.	CAPSCREW
21.	LOCKWASHER
22.	ENGINE MOUNT

Figure 3-2. Engine Support Assembly Replacement

3-11. ENGINE SUPPORT ASSEMBLY. (cont)

c. Installation. (cont)

(2) Place resilient mounts (18) between engine mounts (22) and engine supports (19). Ensure that mounting holes are alined.

(3) Stack, in order, spacers (17), resilient mounts (16), ground strap (15), and washers (14) on engine mount (22). Aline mounting holes and insert capscrews (12). Place other lug of ground strap over threaded end of capscrew. Secure with washer (14) and nut (13). Torque to 160-190 inch pounds (18.1-21.5 Nm).

(4) Secure engine spacer (11) and engine mount plate (10) to bottom of combustion chamber case with lock-washers (9) and capscrews (8). Torque to 50-70 inch pounds (5.6-7.9 Nm).

(5) Place resilient mount (6) between engine mount plate (10) and engine support (7). Ensure that mounting holes are alined.

(6) Stack, in order, spacer (5), resilient mount (4), and washer (3) on engine mount plate (10). Aline mounting holes and insert capscrew (1). Secure with remaining washer (3) and self-locking nut (2). Torque to 160-190 inch pounds (18.1-21.5 Nm).

(7) Install engine and gearbox, with generator attached, in accordance with paragraph 2-7b.

(8) Connect battery cable plug connector to battery.

3-12. CHASSIS FRAME ASSEMBLY.

a. Removal.

WARNING

To prevent injury, ensure that battery is disconnected before performing maintenance on electrical components.

(1) Disconnect battery cable plug connector from battery.

(2) Loosen turnlock fasteners and remove engine housing access cover.

(3) Remove generator (paragraph 2-6a).

(4) Remove engine and gearbox (paragraph 2-7a).

(5) Remove power cable from cable support.

(6) Unlatch and open inlet air housing access door. Secure in open position.

(7) Remove power cable (paragraph 4-81a, TM 5-6115-612-12).

(8) Remove battery holddown (paragraph 4-15a, TM 5-6115-612-12) and battery.

(9) Remove battery cable (paragraph 4-26a, TM 5-6115-612-12).

(10) Remove component mounting panel (paragraph 4-82, TM 5-6115-612-12).

(11) Unlatch and open fuel housing access door. Secure in open position.

3-12.

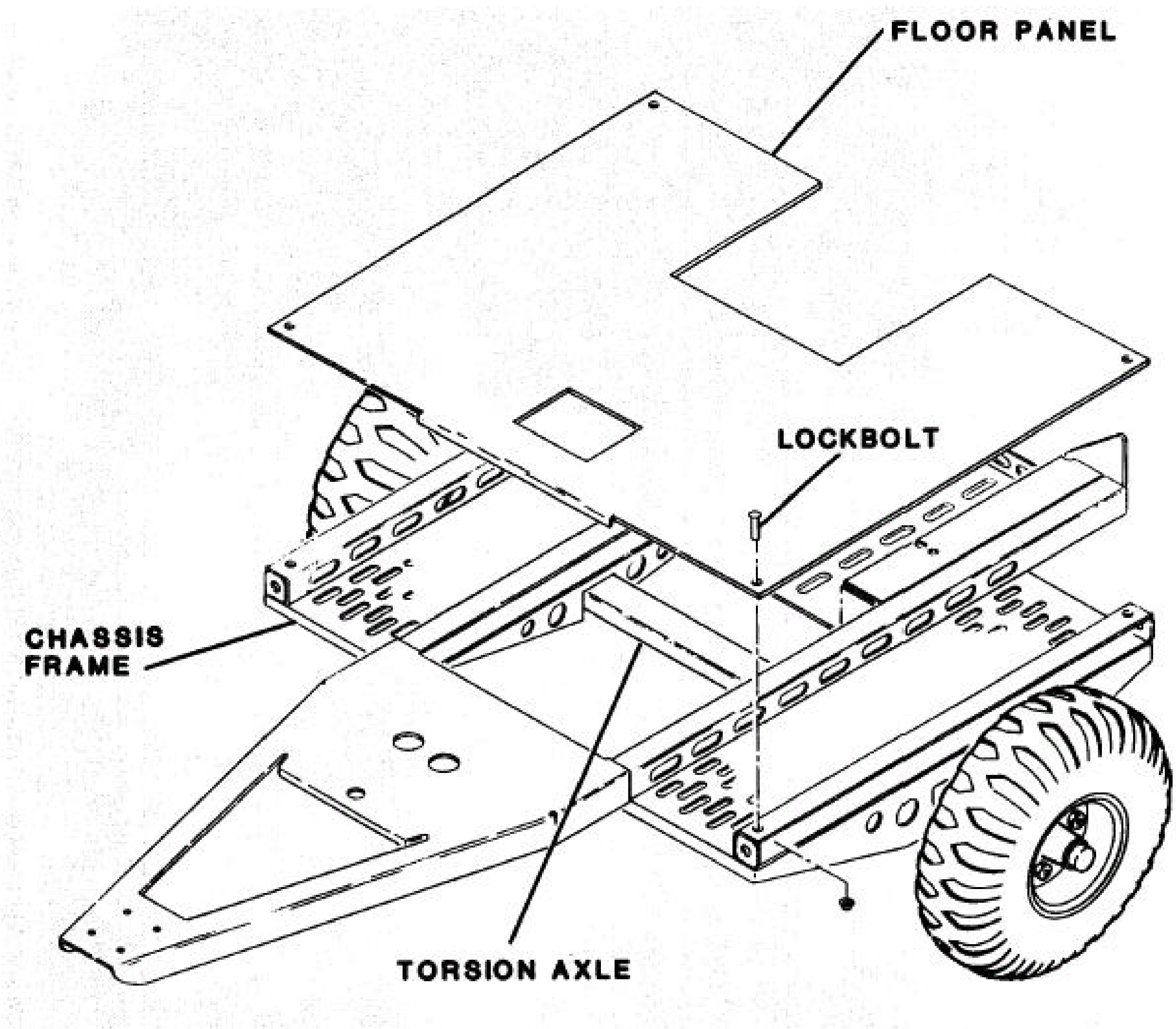


Figure 3-3. Chassis Frame Replacement

3-12. CHASSIS FRAME ASSEMBLY. (cont)

a. Removal. (cont)

(12) Loosen turnlock fasteners and remove plenum access cover.

(13) Support discharge end of exhaust nozzle. Remove self-locking nuts, washers, capscrews, and four-section nozzle gasket retainer. Pull nozzle into engine housing and remove.

(14) Remove oil cooler (paragraph 7-3a) and oil cooler supply and return lines.

(15) Remove engine fuel tank (paragraph 4-39a, TM 5-6115-612-12).

(16) Remove brake control installation (paragraph 4-90c, TM 5-6115-612-12).

(17) Ensure that all fuel/lubrication lines and electrical wiring that go through, or are secured to, the floor panel are tagged, disconnected, and secured within the upper housings or completely removed from the generator set.

(18) Refer to paragraph 2-4a for procedure to remove lockbolts. Remove all lockbolts that secure housings to floor panel and chassis frame.

(19) Lift housings off floor panel.

(20) Remove lockbolts (figure 3-3). Lift floor panel off chassis frame.

(21) Remove torsion axle (paragraph 12-2a).

(22) Remove tiedown rings (paragraph 4-14a, TM 5-6115-612-12).

(23) Remove nut (1, figure 3-4), washer (2), terminal lug (3) of ground cable, washer (2) and nut (4) to remove ground stud (5) from chassis frame (6).

b. Repair.

(1) Held cracks and holes.

(2) Remove dents and straighten bent sections.

(3) Remove corrosion and chipped paint. Prime and repaint.

(4) Measure and fabricate new parts.

c. Installation.

(1) Install ground stud (5, figure 3-4) and secure with nut (4). Torque to 74-82 inch pounds (8.4-9.3 Nm). Install washer (2) and terminal lug (3). Secure with washers (2) and nut (1). Torque to 74-82 pounds (8.4-9.3 Nm).

(2) Install tiedown rings (paragraph 4-14b, TM 5-6115-612-12).

(3) Install torsion axle (paragraph 12-2b).

(4) Place floor panel in position and secure with lockbolts at each corner.

(5) Place housings in position on floor panel.

(6) Refer to paragraph 2-4b for procedure to install lockbolts. Secure housings and floor panel to chassis.

(7) Ensure that all fuel/lubrication lines and electrical wiring are routed to correct locations and securely fastened where required.

3-12. CHASSIS FRAME ASSEMBLY. (cont)

c. Installation. (cont)

(8) Install brake control (paragraph 4-90e, TM 5-6115-612-12).

(9) Install engine fuel tank (paragraph 4-39b, TM 5-6115-612-12).

(10) Install oil cooler (paragraph 7-3b), supply and return lines.

(11) Install exhaust nozzle through engine housing. Support nozzle.

(12) Install four-section nozzle gasket retainer. Secure nozzle and retainer with capscrews, washers, and self-locking nuts.

(13) Install component mounting panel (paragraph 4-82b, TM 5-6115-612-12).

(14) Install battery cable (paragraph 4-26d, TM 5-6115-612-12).

(15) Install battery holddown (paragraph 4-15c, TM 5-6115-612-12) and battery.

(16) Install power cable (paragraph 4-81b, TM 5-6115-612-12).

(17) Install engine and gearbox (paragraph 2-7b).

(18) Install generator (paragraph 2-6b).

(19) Install engine housing access cover and secure with turnlock fasteners.

(20) Connect battery cable plug connector to battery.

LEGEND

1. NUT
2. WASHER
3. TERMINAL LUG
4. NUT
5. GROUND STUD
6. CHASSIS FRAME

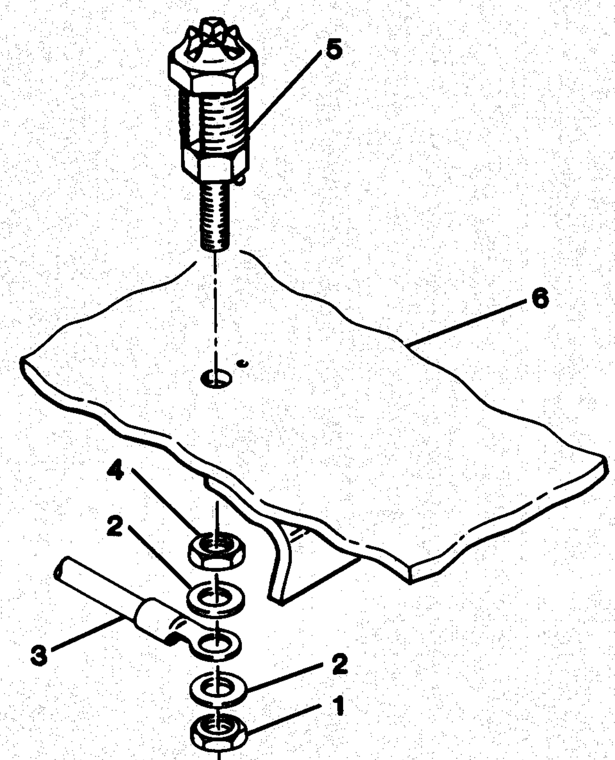


Figure 3-4. Ground Stud Replacement

CHAPTER 4

MAINTENANCE OF DC ELECTRICAL AND CONTROL SYSTEM

4-1. PURPOSE AND FUNCTION OF DC ELECTRICAL AND CONTROL SYSTEM. This section gives a functional description and maintenance procedures for the DC electrical and control system. The system consists of the battery cable, battery, wiring harness (W1), slave receptacle, generator electronic control module (GECM), circuit breaker, starter, and 20 amp current shunt.

a. Purpose. The DC electrical and control system provides turbine rotation during startup, generator output control and sensing, generator protection, and battery charging.

b. Functional Description. The following is a simplified functional description of the DC electrical and control system. The description is keyed to the schematic in FO-5, TM 5-6115-612-12.

(1) Startup. When startup is begun, 24 volts from the battery are applied through the DC CIRCUIT BREAKER (CB1) to the MASTER SWITCH. When the MASTER SWITCH is placed in the RUN position, the transfer pump will come on and fill fuel filters. When the switch is placed in the START position, the 24V signal is connected to the engine electronic control module (EECM) on the start circuit. If the EECM has not detected any faults in the generator set, it outputs the start enable signal to the starter solenoid. The solenoid energizes, supplies 24 volts to the starter motor, and repositions the actuator. As the starter motor begins to turn, the actuator causes the starter gear to mesh with the turbine flywheel. Turbine speed is sensed by the digital speed sensor and relayed to the EECM. When turbine speed reaches 60 percent of maximum, the EECM interrupts the start enable power. The solenoid removes power from the starter and retracts the starter gear from the turbine flywheel.

(2) Generator Output Control and Sensing. generator field-winding power and provide overtemperature protection. These functions are controlled and monitored by the GECM and the EECM. If the EECM does not sense a fault in the generator set, it enables the GECM via the enable circuit on J4 pin F to the GECM J2 pin L. The GECM senses the temperature of the generator field winding at J1 pin F. If the temperature is normal or below, field winding power is switched onto the field positive (+) and negative (-) lines (J1 pins C and B) to the generator. The amount of field winding power is adjusted by the GECM to maintain the output voltage level set by the VOLTAGE ADJUST knob. The GECM compares the output voltage setting at J2 pin R with the remote voltage sense at J2 pins E and F. If the two inputs are different, circuitry in the GECM adjusts the field power until the output voltage is correct.

(3) Generator Protection. The generator is protected from over-temperature, overvoltage, under-voltage, and overloading. If any condition exceeds programmed limits, the GECM interrupts the field current and sends a fault signal to the EECM. When the EECM detects a fault, it turns on the appropriate MALFUNCTION indicator light and starts engine shutdown. The EECM will not permit startup until the malfunction has been corrected. Each of these conditions is described below.

4-1. PURPOSE AND FUNCTION **OF DC** ELECTRICAL AND CONTROL SYSTEM. **(cont)**

b. Functional Description. (cont)

(a) Overtemperature. The generator temperature is monitored by a thermo switch mounted on the generator field winding. This information is input to the GECM on Jl pins D and F. If the temperature exceeds 210 °F (98.9 °C), the switch opens and a signal s output on J2 pin 0 to the EECM. The EECM will turn on the GENERATOR OVERTEMP malfunction light and begin engine shutdown.

(b) Overvoltage and Undervoltage. The output voltage is constantly monitored to ensure that it is maintained within programmed limits. If output voltage exceeds 35.5 volts and stays above this limit for 0.75 seconds, the GECM will generate a fault signal through J2 pin A to the EECM. The EECM opens the output contactor, turns on the GENERATOR OVERVOLTAGE indicator light, and begins engine shutdown. If output voltage falls below 20 volts and stays below this limit for 0.75 seconds, the GECM generates a fault signal through J2 pin B to the EECM. The EECM opens the output contactor, turns on the GENERATOR UNDERVOLTAGE indicator light, and begins engine shutdown.

(c) Overload Protection. The output current is sensed by the 1000A shunt located in the negative (–) output circuit. As the load draws current through the shunt, a voltage is developed between pins C and D of the shunt. This voltage is input to the circuit board on J2 pins J and K. If the load is drawing more than 1070A, the board outputs a signal to the EECM on J2 pin C. The EECM then turns on the GENERATOR OVERLOAD malfunction light and begins engine shutdown.

(4) Battery Charging. This circuit monitors battery voltage and supplies charging power to the battery. The battery voltage is input to the GECM on J3 pin A through the 20A shunt. If the battery charge is low, the charger, located on the GECM board, s enabled. The charger receives power from the generator on J1 pins G and H. The voltage is regulated by the GECM and output to the battery at J3 pin A through the shunt. Current being drawn by the battery causes a voltage drop across the shunt. This drop is indicative of current and is shown on the BATTERY CHARGING meter. The charging current is also monitored by circuitry in the GECM and if programmed limits are exceeded, the charger will be disabled.

4-2. GENERATOR ELECTRONIC CONTROL MODULE. Maintenance of the generator electronic control module (GECM) consists of testing and replacement of GECM components.

a. Test Setup Procedure.

(1) Fabricate a GECM test fixture. An illustration, parts list, and schematic, are provided in Table 2–3. Table 4–1 lists additional equipment required for GECM testing.

(2) Connect GECM to test fixture as shown in Figure 4–1.

(3) Adjust test fixture switches and knobs as follows:

SWITCH	SWITCH SETTING
SOURCE GEN/BATT	BATT
METER SELECT	CHARGER VOLTS
RTD (5 POSITIONS)	2
OVERTEMP	ON
VOLTS ADJUST	FULL COUNTER–CLOCKWISE
FIELD	OFF
ENABLE	OFF

(4) Adjust power supply No. 1 to 28 (± 4) Vdc.

(5) Adjust power supply No. 2 to 0 Vdc.

(6) Adjust power supply No. 3 to 5 (± 0.5) Vdc.

(7) Adjust power supply No. 4 to 0 Vdc.

(8) Move ENABLE switch to ON position. The UNDER VOLTS light should be on.

(9) Move SOURCE switch back to GEN position.

b. Charger Voltage Test.

(1) Perform test setup procedure (paragraph 4–2a).

(2) Move SOURCE switch to GEN.

(3) Increase voltage from power supply No. 2 to 28 (± 2) Vdc. The UNDER VOLTS light should go off between 18 to 18.7 Vdc. Reset GECM electronic logic by moving SOURCE switch to BATT position and back to GEN position, Voltmeter on test fixture should show between 28.6 to 29.6 Vdc. Record voltmeter reading.

4-2. GENERATOR ELECTRONIC CONTROL MODULE. (cent)

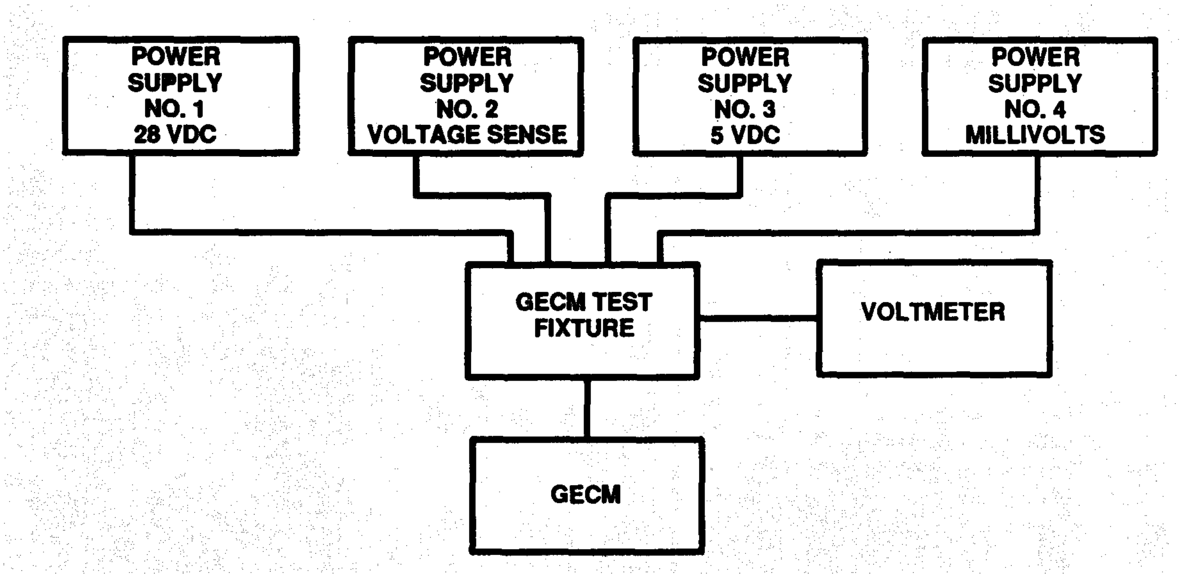


Figure 4-1. GECM Test Setup

Table 4-1. GECM Test Equipment

NOMENCLATURE	MFR and MODEL	QTY	NSN
DIGITAL MULTIMETER (0-20 MegaOhm ± 1% (0-40 Vdc ± 1%)	AN/PSM-45 Simpson Model 467 or equivalent	1	6625-01-139-2512
DIGITAL MULTIMETER (0-60 millivolts dc (± 0.5 millivolts)	AN/GSM-64D Fluke Model 8840 A/AF or equivalent	1	6625-01-221-9367
GECM Test Fixture	Fabricated	1	Part No. 101815 (CAGE 51225)
POWER SUPPLY NO.1 (0-30 Vdc ± 0.5 V 10 Amps)	Kepco, Inc. Model ATE36-15M or equivalent	1	6130-01-143-5967
POWER SUPPLY NO.2 (0-40 Vdc ± 0.5 V	Equivalent	1	6130-00-000-0000
POWER SUPPLY NO.3 (0-5 Vdc ± 0.1 V	Equivalent	1	6130-00-000-0000
POWER SUPPLY NO.4 (Millivolt Source 0-60 millivolts dc ± 0.5 millivolts)	Use 10-turn potentiometer (30K ohm), with BA 3090/U Battery (9 Vdc) or equivalent	1	6130-00-000-0000

4-2. GENERATOR ELECTRONIC CONTROL MODULE. (cont)

b. Charger Voltage Test. (cont)

(4) Move RTD knob to position 1 for cold temperature test. Voltmeter should indicate between 30.5-31.5 Vdc. Record voltmeter reading. Reset GECM electronic logic by moving SOURCE switch to BATT position and back to GEN position.

(5) Move RTD knob to position 3 for hot temperature test. Voltmeter should indicate between 25.5-26.5 Vdc. Record voltmeter reading. Reset GECM electronic logic by moving SOURCE switch to BATT position and back to GEN position.

(6) Move RTD knob to position 4 for shorted RTD test. Voltmeter should indicate less than 1 Vdc. Record voltmeter reading. Reset GECM electronic logic by moving SOURCE switch to BATT position and back to GEN position.

(7) Move RTD knob to position5 for open RTD test. Voltmeter should indicate less than 1 Vdc. Record voltmeter reading. Reset GECM electronic logic by moving SOURCE switch to BATT position and back to GEN position.

(8) Move RTD knob to position 2. Reset GECM electronic logic by moving SOURCE switch to BATT position and back to GEN position

(9) Decrease voltage from power supply (± 0.5) Vdc. Voltmeter should indicate 26-28 Vdc. Record voltmeter reading.

(10) Increase power supply No. 2 voltage to 35 (± 0.5) Vdc. Voltmeter should indicate 28.8-29.8Vdc. Record voltmeter reading.

(11) Any discrepancy noted during the above procedure indicates a failure in the GECM battery charging circuit. Refer to table 2-4, Malfunction 15.

c. Undervoltage Test.

(1) Perform test setup procedure (paragraph 4-2). Reset GECM electronic logic by moving SOURCE switch to BATT position and back to GEN position

(2) Increase voltage from power supply No. 2 until UNDER VOLTS light goes off. Voltage should be 17-20 Vdc. Reset GECM electronic logic by moving SOURCE switch to BAT position and back to GEN position.

(3) Any discrepancy noted during the above procedure indicates a failure in the GECM undervoltage circuit. Refer to Table 2-4, Malfunction 11.

d. Overvoltage Test.

(1) Perform test setup procedure (paragraph 4-2a). Reset GECM electronic logic by moving SOURCE switch to BATT position and back to GEN position.

(2) Increase voltage from power supply No. 2 until OVER VOLTS light comes on. This voltage should be between 35.5–39.0 Vdc. The test fixture voltmeter reading will go to 0 when the OVER VOLTS light goes on.

(3) Any discrepancy noted during the above procedure indicates a failure in the GECM overvoltage circuit. Refer to Table 2-4, Malfunction 12.

e. Overtemperature Test.

(1) Perform test setup procedure (paragraph 4-2a). Reset GECM electronic logic by moving SOURCE switch to BATT position and back to GEN position.

(2) Adjust power supply No. 2 to 28 (± 0.5) Vdc.

(3) Move OVER TEMP switch to NORMAL position OVER TEMP light should come on.

(4) Move OVER TEMP switch to ON. OVER TEMP light should go off.

(5) Any discrepancy noted during above procedure indicates a failure in GECM temperature monitoring circuit. Refer to table 2-4, Malfunction 13.

f. Overload Test.

(1) Perform test setup procedure (paragraph 4-2a). Reset GECM electronic logic by moving SOURCE switch to BATT position and back to GEN position.

(2) Increase power supply No. 2 to 28 (+0.5) Vdc.

(3) Slowly increase voltage from power supply No. 4 until OVER LOAD light comes on. Voltage should be 53.75-58.75 millivolts.

(4) Decrease voltage from power supply No. 4 to 22.3-23.7 millivolts. OVER LOAD light should go out.

4-2. GENERATOR ELECTRONIC CONTROL MODULE. (cont)

f. Overload Test. (cont)

NOTE

This should occur between 58.8 and 22.3 millivolts. If it is below 22.3, then there is a failure in the circuit.

(5) Any discrepancy noted during the above procedure indicates a failure in the GECM overload circuit. Refer to table 2-4, Malfunction 14.

g. Power Limit Test.

(1) Perform ten setup procedure (paragraph 4-2a). Leave SOURCE switch in BATT position.

(2) Place METER SELECT switch in FIELD VOLTS position.

(3) Set SOURCE switch at GEN.

(4) Adjust power supply No. 2 to 28 (±0.5) Vdc and power supply No. 4 to 1 millivolt.

(5) Adjust VOLTS ADJUST knob until voltmeter shows 29 (± 0.5) Vdc.

(6) Increase voltage from power supply No. 4 to 22.5 (± 0.2) millivolts.

(7) Decrease voltage from power supply No. 2 until voltmeter read 29 (± 0.5) Vdc. The output of power supply No. 2 should be 24.5 (± 0.5) Vdc.

(8) Increase voltage from power supply No. 4 to 50 (± 0.2) millivolts.

(9) Decrease voltage from power supply No. 2 until voltmeter reads 17 (± 1.5) Vdc. The output voltage of power supply No. 2 should be 11 (± 0.5) Vdc.

(10) Decrease voltage from power supply No. 4 to 1 millivolt. UNDER VOLTS light should come on.

(11) Increase voltage from power supply No. 2 until UNDER VOLTS light goes off. Slowly decrease voltage of power supply No. 2 just until UNDER VOLTS light comes on.

(12) Increase voltage from power supply No. 4 until UNDER VOLTS light goes off. The output voltage of power supply No. 4 should be greater than 17.5 millivolts.

(13) Any discrepancy noted during the above procedures indicates a failure in the GECM power limiting circuit. Refer to table 2-4, Malfunction 18.

h. Enable Test.

(1) Perform test setup procedure (paragraph 4-2a).

(2) Set power supply No. 2 voltage at 28 (± 0.5) Vdc.

(3) Set power supply No. 4 to 0 volts.

(4) Turn VOLTS ADJUST knob to center/mid-range position.

(5) Move METER SELECT switch to FIELD VOLTS.

(6) Move ENABLE switch to OFF position. Voltmeter should indicate less than 1 Vdc.

(7) Move ENABLE switch to ON position. Voltmeter should indicate 29 (± 0.5) Vdc.

(8) Any discrepancy noted during the above procedure indicates a failure in the GECM enabling circuit. Refer to table 2-4, Malfunction 16.

i. Regulator Test.

(1) Adjust test fixture switches and knobs as follows:

SWITCH	SWITCH SETTING
METER SELECT	FIELD VOLTS
ENABLE	OFF
OVER TEMP	ON
SOURCE	BATT
RTD	2
FIELD	OFF
VOLTS ADJUST	FULL COUNTER-CLOCKWISE

(2) Adjust power supply No. 1 to 24 (±4) Vdc.

(3) Adjust power supply No. 2 to 0 Vdc.

(4) Adjust power supply No. 3 to 5 (±0.5) Vdc.

(5) Adjust power supply No. 4 to 0 Vdc.

(6) UNDER VOLTS light should be on and all others off.

(7) Move ENABLE switch to ON.

4-2. GENERATOR ELECTRONIC CONTROL MODULE. (cont)

g. Power Limit Test. (cont)

(12) Increase voltage from power supply No. 4 until UNDER VOLTS light goes off. The output voltage of power supply No. 4 should be greater than 17.5 millivolts.

(13) Any discrepancy noted during the above procedures indicates a failure in the GECM power limiting circuit. Refer to table 2-4, Malfunction 18.

h. Enable Test.

(1) Perform test setup procedure (paragraph 4-2a).

(2) Set power supply No. 2 voltage at 28 (± 0.5) Vdc.

(3) Set power supply No. 4 to zero volts.

(4) Turn VOLTS ADJUST knob to center/mid-range position.

(5) Move METER SELECT switch to FIELD VOLTS.

(6) Move ENABLE switch to OFF position. Voltmeter should indicate less than 1 Vdc.

(7) Move ENABLE switch to ON position. Voltmeter should indicate 29 (± 0.5) Vdc.

(8) Any discrepancy noted during the above procedure indicates a failure in the GECM enabling circuit. Refer to table 2-4, Malfunction 16.

i. Regulator Test.

(1) Adjust test fixture switches and knobs as follows:

i. Regulator Test. (cont)

METER SELECT	FIELD VOLTS
ENABLE	OFF
OVER TEMP	ON
SOURCE	BATT
RTD	2
FIELD	OFF

(2) Adjust power supply No. 1 to 24 (± 4) Vdc.

(3) Adjust power supply No. 2 to 0 Vdc.

(4) Adjust power supply No. 3 to 5 (± 0.5) Vdc.

(5) Adjust power supply No. 4 to 0 Vdc.

(6) UNDER VOLTS light should be on and all others off.

(7) Move ENABLE switch to ON.

(8) Move SOURCE switch to GEN position.

(9) Adjust voltage from power supply No. 2 to 20 (± 1) Vdc.

(10) Turn VOLTS ADJUST knob until voltmeter indicates 29 (± 0.5) Vdc.

(11) Move FIELD switch to LOAD position. Voltmeter should indicate 28 (± 0.5) Vdc.

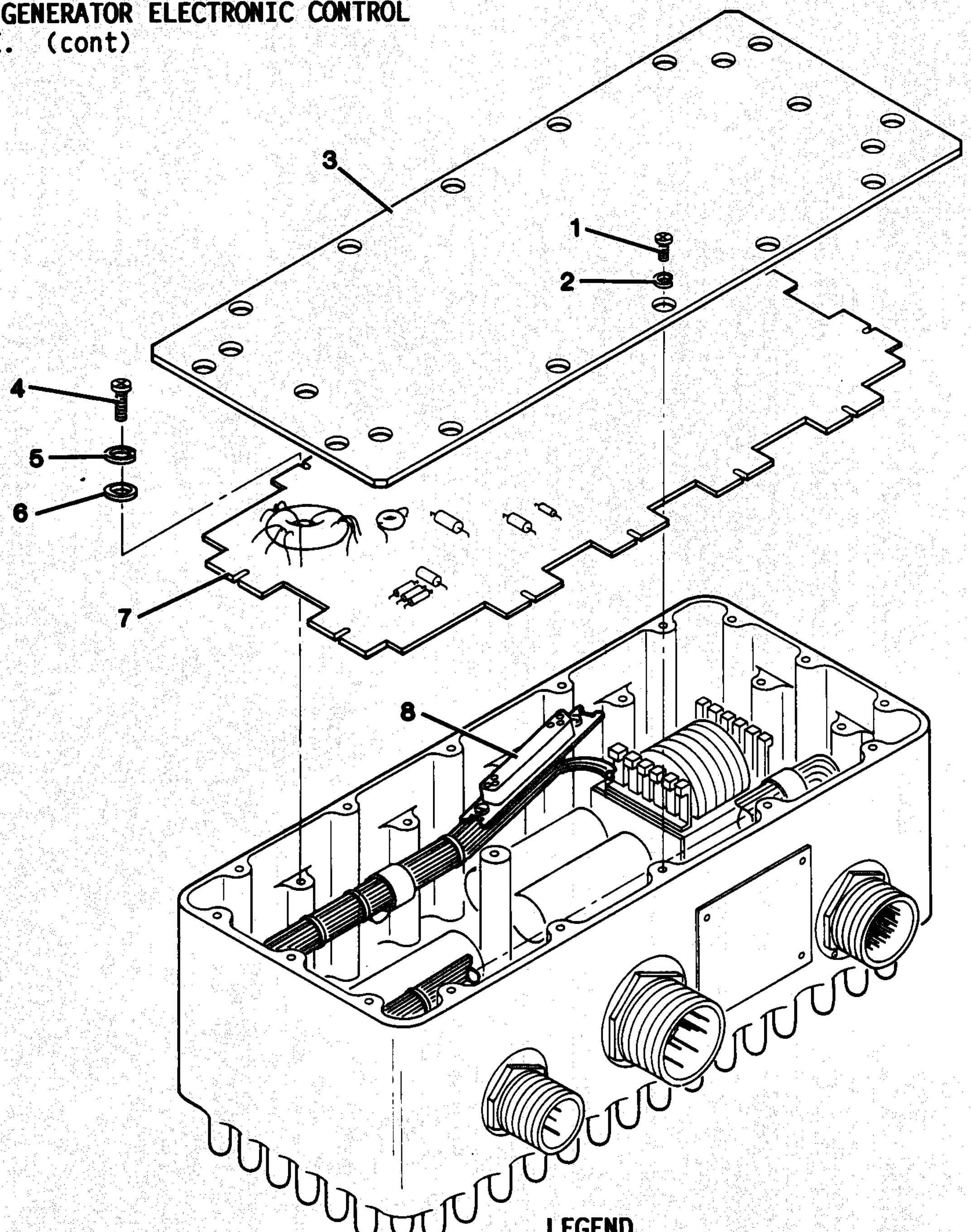
(12) Move FIELD switch to OFF position.

(13) Increase voltage from power supply No. 2 to 35 (± 0.5) Vdc.

* U.S. GOVERNMENT PRINTING OFFICE: 1993 - 755-028/80172

PIN: 060188-003

4-2. GENERATOR ELECTRONIC CONTROL MODULE. (cont)



LEGEND

1. SCREW	5. LOCKWASHER
2. LOCKWASHER	6. WASHER
3. CONTROLLER BASE	7. CIRCUIT CARD/EMI SHIELD
4. SCREW	8. CONNECTOR

Figure 4-2. Circuit Card Replacement

4-2. GENERATOR ELECTRONIC CONTROL MODULE. (cont)

i. Regulator Test. (cont)

(14) Turn VOLTS ADJUST knob until voltmeter indicates 34 (± 0.5) Vdc.

(15) Move FIELD switch to LOAD position. Voltmeter should indicate 33 (± 0.5) Vdc.

(16) Move FIELD switch to OFF position.

(17) Decrease voltage from power supply No. 2 to 28 Vdc.

(18) Move FIELD switch to LOAD position. Voltmeter should indicate 28 (± 0.5) Vdc.

(19) Failure to meet any of the requirements of the regulator test indicates a problem in the regulator circuit. Refer to table 2-4, Malfunction 11.

j. Circuit Card Replacement.

(1) Removal.

(a) Remove GECM in accordance with paragraph 4-30a, TM5-6115-612-12.

(b) Remove screws (1, figure 4-2), lockwashers (2), and controller base (3).

(c) Remove screws (4), lockwashers (5), washers (6), and circuit card and EMI shield (7).

(d) Carefully lift circuit card and EMI shield. Disconnect wiring harness connector (8) from circuit card.

(2) Installation.

(a) Plug connector (8) through EMI shield into circuit card (7).

(b) Place circuit card and EMI shield into position and secure with washers (6), lockwashers (5), and screws (4).

(c) Position controller base (3) on GECM housing and secure with lockwashers (2) and screws (1).

(d) Install GECM in accordance with paragraph 4-30b, TM5-6115-612-12.

k. Thermal Switch (S1) Replacement.

(1) Removal.

(a) Remove GECM in accordance with paragraph 4-30a, TM5-6115-612-12.

(b) Remove screws (1, figure 4-2), lock- washers (2), and controller base (3).

(c) Remove screws (4), lock-washers (5), washers (6), and circuit card (7).

(d) Carefully lift circuit card. Disconnect wiring harness connector (8) from circuit card.

(e) Tag and disconnect wires from thermal switch (3, figure 4-3).

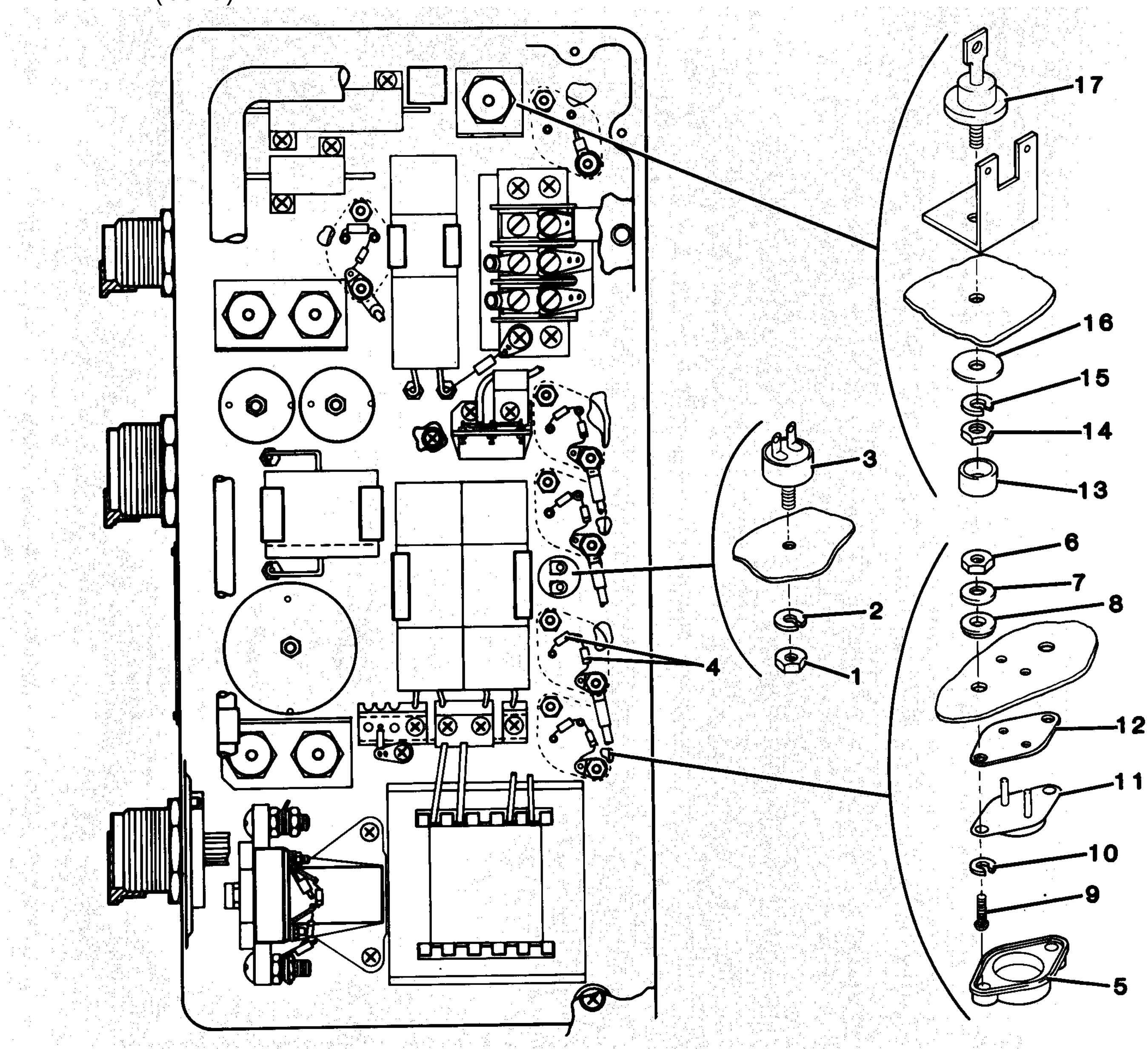
(f) Remove nut (1), lockwasher (2), and thermal switch.

(2) Installation.

(a) Insert thermal switch (3) through mounting hole and secure with lockwasher (2) and nut (1).

(b) Connect wires to thermal switch.

4-2. GENERATOR ELECTRONIC CONTROL MODULE. (cont)



LEGEND

1. NUT
2. LOCKWASHER
3. THERMAL SWITCH
4. RESISTOR
5. COVER
6. NUT
7. WASHER
8. SHOULDERED WASHER
9. SCREW
10. LOCKWASHER
11. TRANSISTOR
12. INSULATOR
13. CAP
14. NUT
15. LOCKWASHER
16. SHOULDERED WASHER
17. DIODE

Figure 4-3. GECM Component Replacement

4-2. GENERATOR ELECTRONIC CONTROL MODULE. (cont)

k. Thermal Switch (S1) Replacement. (cont)

(c) Plug connector (8, figure 4-2) into circuit card (7).

(d) Place circuit card into position and secure with washers (6), lockwashers (5), and screws (4).

(e) Position controller base (3) on GECM housing and secure with lockwashers (2) and screws (1).

(f) Install GECM in accordance with paragraph 4-30b, TM5-6115-612-12.

l. Transistor Replacement. This procedure applies to transistors Q1 through Q5.

(1) Removal.

(a) Remove GECM in accordance with paragraph 4-30a, TM5-6115-612-12.

(b) Remove screws (1, figure 4-2), lockwashers (2), and controller base (3).

(c) Remove screws (4), lockwashers (5), washers (6), and circuit card (7).

(d) Carefully lift circuit card. Disconnect wiring harness connector (8) from circuit card.

(e) Tag and disconnect wiring from transistor (11, figure 4-3). Transistor Q3 is being used as an example in this procedure.

(f) Tag and carefully disconnect resistors (4).

(g) Remove cover (5).

(h) Remove nuts (6), washers (7), shouldered washers (8), screws (9), and lockwashers (10).

(i) Remove transistor (11) and insulator (12).

(2) Installation.

(a) Place insulator (12) on transistor (11). Install transistor in GECM housing mounting holes.

(b) Place lockwashers (10) on screws (9).

(c) Secure transistor in housing with screws (9), shouldered washers (8), washers (7), and nuts (6). Torque to 7-7.5 inch pounds (0.8-0.85 Nm).

(d) Snap cover (5) into place.

(e) Install resistors (4). Remove tags.

(f) Reconnect wiring. Remove tags.

(g) Plug connector (8, figure 4-2) into circuit card (7).

(h) Place circuit card into position and secure with washers (6), lockwashers (5), and screws (4).

(i) Position controller base (3) on GECM housing and secure with lockwashers (2) and screws (1).

(j) Install GECM in accordance with paragraph 4-30b, TM5-6115-612-12.

4-2. GENERATOR ELECTRONIC CONTROL MODULE. (cont)

m. Diode Replacement. This procedure is applicable to diodes D1 through D5. All other diodes are simply soldered in place.

(1) Removal.

(a) Remove GECM in accordance with paragraph 4-30a, TM5-6115-612-12.

(b) Remove screws (1, figure 4-2) lockwashers (2), and controller base (3).

(c) Remove screws (4), lockwashers (5), washers (6), and circuit card (7).

(d) Carefully lift circuit card. Disconnect connector (8).

(e) Tag and disconnect wiring from diode (17, figure 4-3). Diode D5 is being used in this example.

(f) Unscrew and remove cap (13, figure 4-3) and nut (14). Nut may remain in cap.

(g) Remove lockwasher (15) and shouldered washer (16).

(h) Remove diode (17).

(2) Installation.

(a) Install diode (17) In mounting hole.

(b) Install shouldered washer (16) and lockwasher (15).

(c) Install nut (14). Torque to 15-18 inch pounds (1.7-2.0 Nm).

(d) Install cap (13).

(e) Reconnect wiring to diode.

(f) Plug connector (8, figure 4-2) into circuit card (7).

(g) Place circuit card into position and secure with washers (6), lockwashers (5), and screws (4).

(h) Position controller base (3) on GECM housing and secure with lockwashers (2) and screws (1).

(i) Install GECM in accordance with paragraph 4-30b, TM5-6115-612-12.

n. Relay (K1) Replacement.

(1) Removal.

(a) Remove GECM in accordance with paragraph 4-30a, TM5-6115-612-12.

(b) Remove screws (1, figure 4-2) lockwashers (2), and controller base (3).

(c) Remove screws (4), lockwashers (5), washers (6), and circuit card (7).

(d) Carefully lift circuit card. Disconnect wiring harness connector (8) from circuit card.

(e) Tag and disconnect wiring from relay (3, figure 4-4).

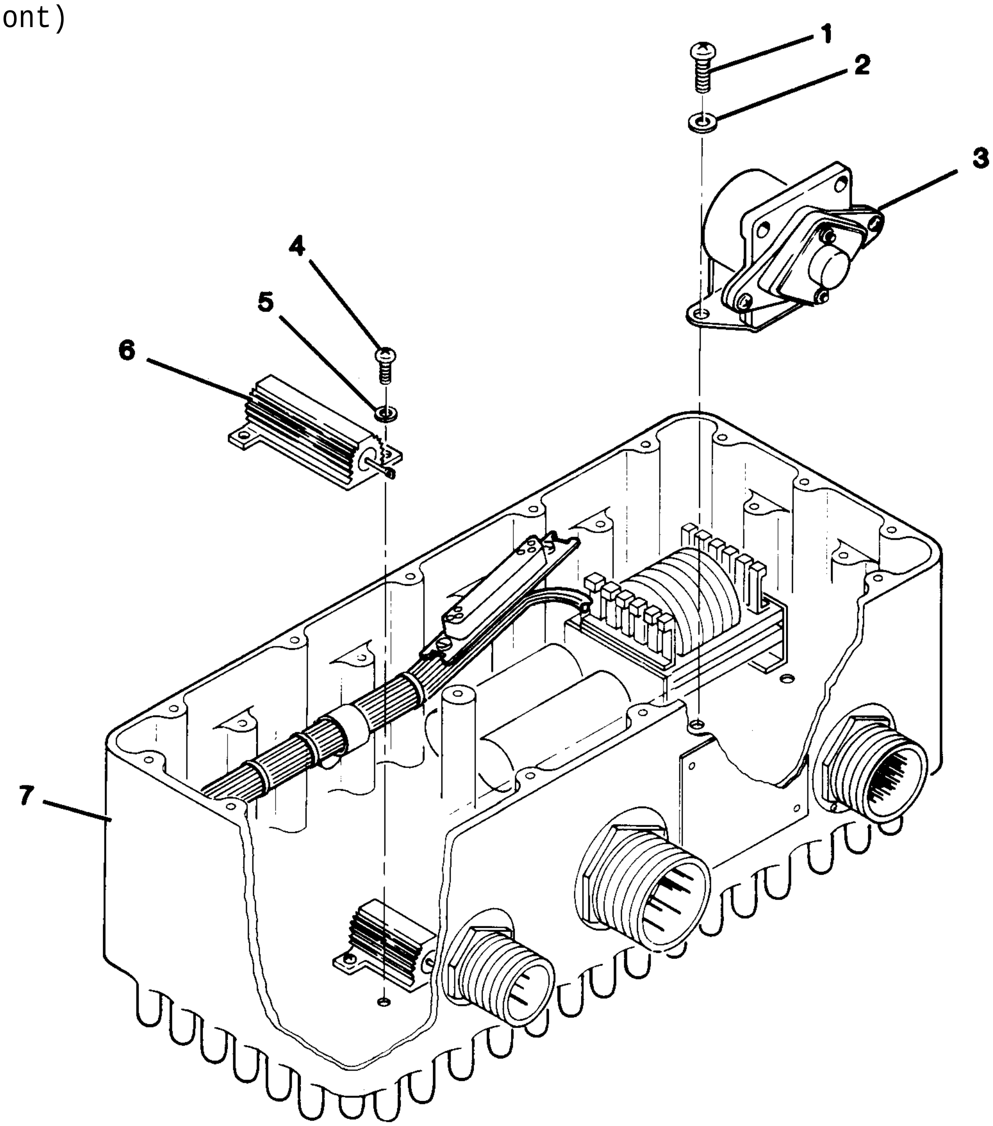
(f) Remove screws (1), lockwashers (2), and relay (3).

(2) Installation.

(a) Install relay (3) and secure with lockwashers (2) and screws (1).

(b) Reconnect wiring to relay. Remove tags.

4-2. GENERATOR ELECTRONIC CONTROL MODULE. (cont)



LEGEND

1. SCREW
2. LOCKWASHER
3. RELAY
4. SCREW
5. LOCKWASHER
6. RESISTOR R2
7. RESISTOR R1

Figure 4-4. GECM Resistor and Relay Replacement

4-2. GENERATOR ELECTRONIC CONTROL MODULE. (cont)

n. Relay (K1) Replacement. (cont)

(c) Plug connector (8, figure 4-2) into circuit card (7).

(d) Place circuit card into position and secure with washers (6), lockwashers (5), and screws (4).

(e) Position controller base (3) on GECM housing and secure with lockwashers (2) and screws (1).

(f) Install GECM in accordance with paragraph 4-30b, TM5-6115-612-12.

o. Resistor (R1, R2) Replacement. This procedure is applicable to resistors R1 and R2. All other resistors are soldered.

(1) Removal.

(a) Remove GECM in accordance with paragraph 4-30a, TM5-6115-612-12.

(b) Remove screws (1, figure 4-2), lockwashers (2), and controller base (3).

(c) Remove screws (4), lockwashers (5), washers (6), and circuit card (7).

(d) Carefully lift circuit card. Disconnect connector (8).

(e) Tag and disconnect wiring from resistor to be replaced.

(f) Remove screws (4, figure 4-4), lockwashers (5), and resistor (6).

(2) Installation.

(a) Secure resistor (6) with lockwashers (5), and screws (4).

(b) Reconnect wiring to resistor. Remove tags.

(c) plug connector (8, figure 4-2) into circuit card (7).

(d) Place circuit card into position and secure with washers (6), lockwashers (5), and screws (4).

(e) Position controller base (3) on GECM housing and secure with lockwashers (2) and screws (1).

(f) Install GECM in accordance with paragraph 4-30b, TM5-6115-612-12.

p. Wiring Harness Repair and Replacement. If it becomes necessary to repair or replace internal GECM wiring, refer to GECM wiring diagram (FO-11) and TM5-6115-612-24P.

4-3. STARTER ASSEMBLY. Starter repair consists of testing, cleaning, inspecting, and troubleshooting.

a. Testing and Troubleshooting.

(1) Remove starter in accordance with TM 5-6115-612-12, paragraph 4-32b.

(2) Secure starter in bench vise.

(3) Provide test setup as shown in figure 4-5.

WARNING

To prevent injury, stay clear of pinion when power is applied to starter.

(4) Connect starter as shown in figure 4-5. If starter motor energizes, disconnect battery and replace solenoid.

4-3. STARTER ASSEMBLY. (cont)

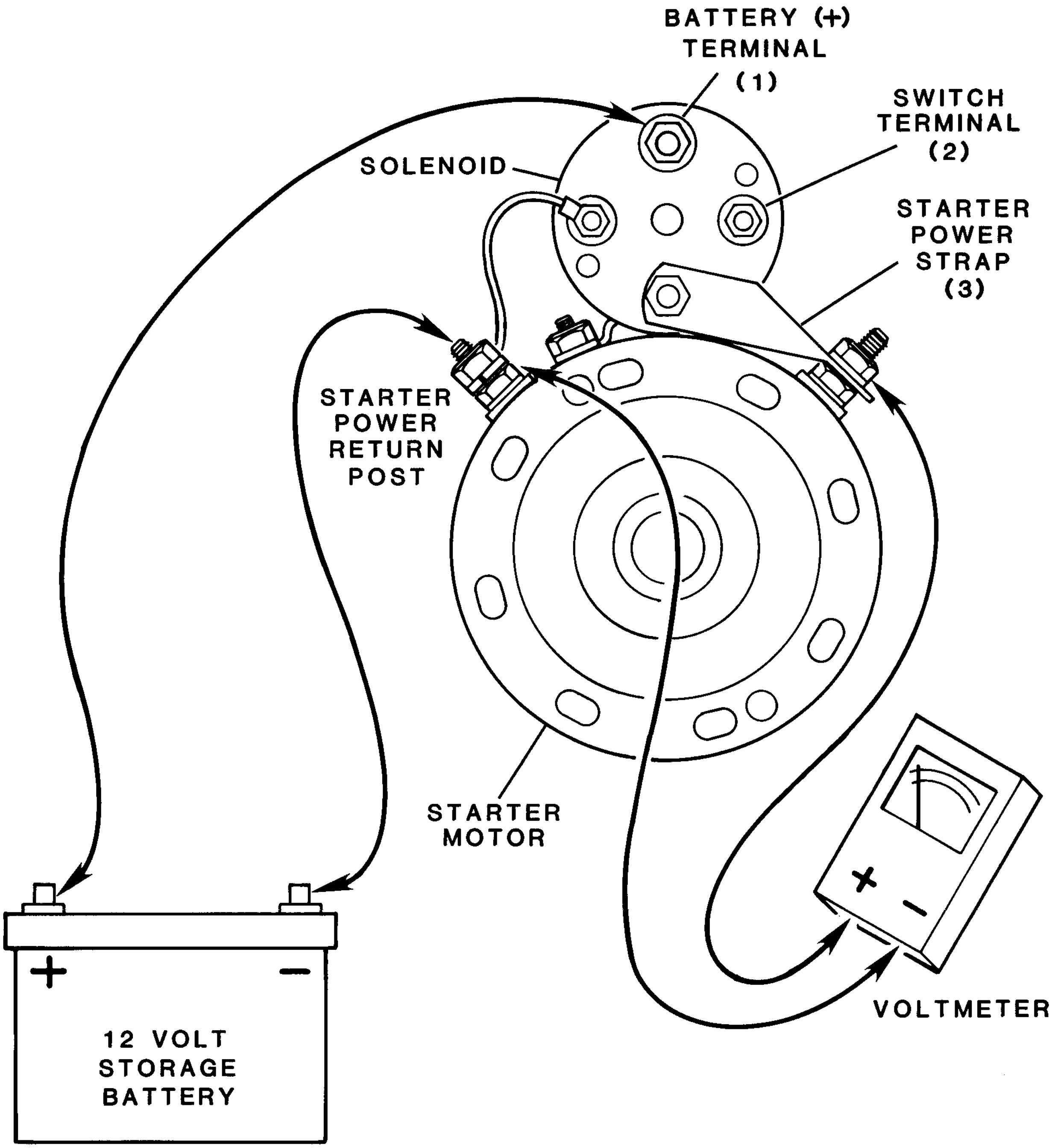


Figure 4-5. Starter Test Setup

4-3. STARTER ASSEMBLY. (cont)

a. Testing and Troubleshooting. (cont)

CAUTION

To prevent damage to the solenoid switch, perform the following test as quickly as possible.

(5) Momentarily attach heavy gauge lead and jump solenoid battery (+) terminal (1) to switch terminal (2). Voltmeter should read not less than +13.5 volts. Pinion should reposition and rotate. Remove test lead.

b. Disassembly.

(1) Remove cotter pin (1, figure 4-6) and link pin (2) to separate clevis (12) from yoke (26).

(2) Remove nut (3) and lockwasher (4) that secure ground wire (5) to solenoid (9).

(3) Remove nut (6) and lockwasher (7) to disconnect switch connector (50) from solenoid (9).

(4) Remove bolts (8) that secure solenoid (9) to frame (59).

(5) Slide moving core assembly (items 10 through 16) out of solenoid.

(6) Remove plunger spring (10) and spring plug (11) from plunger (14).

(7) Remove clevis (12).

(8) Remove washer (13), dust cap (14), and spring (15) from plunger (16).

(9) Remove thru bolts (17), lockwasher (18), commutator end head (19), and thrust washers (20). Number and thickness of thrust washers may vary. Wire together after removal.

(10) Carefully separate pinion housing (25), drive assembly (items 32 through 35), and armature (31) as a unit from frame (59).

(11) Remove screws (21) and washers (22) that secure intermediate bearing plate (29) to pinion housing (25).

(12) Remove cotter pin (23) and yoke pin (24).

(13) Carefully slide drive assembly (items 32 through 35) and armature (31) out of pinion housing (25).

(14) Remove yoke (26) from drive assembly.

(15) Push back pinion retainer (28). Remove and discard retaining ring (27). Remove and discard pinion retainer.

(16) Remove drive assembly, intermediate bearing plate (29), and thrust washer (30) from armature (31).

(17) Push back double shouldered washer (33) and remove retaining ring (32).

(18) Slide double shouldered washer (33) and spring (34) off pinion shaft and bearing (35).

(19) Remove nut (36) and lockwasher (37) to free ground wire (5).

(20) Remove capscrews (38) to free brush plate (39).

(21) Remove nut (40), lockwasher (41), and washer (42).

4-3. STARTER ASSEMBLY. (cont)

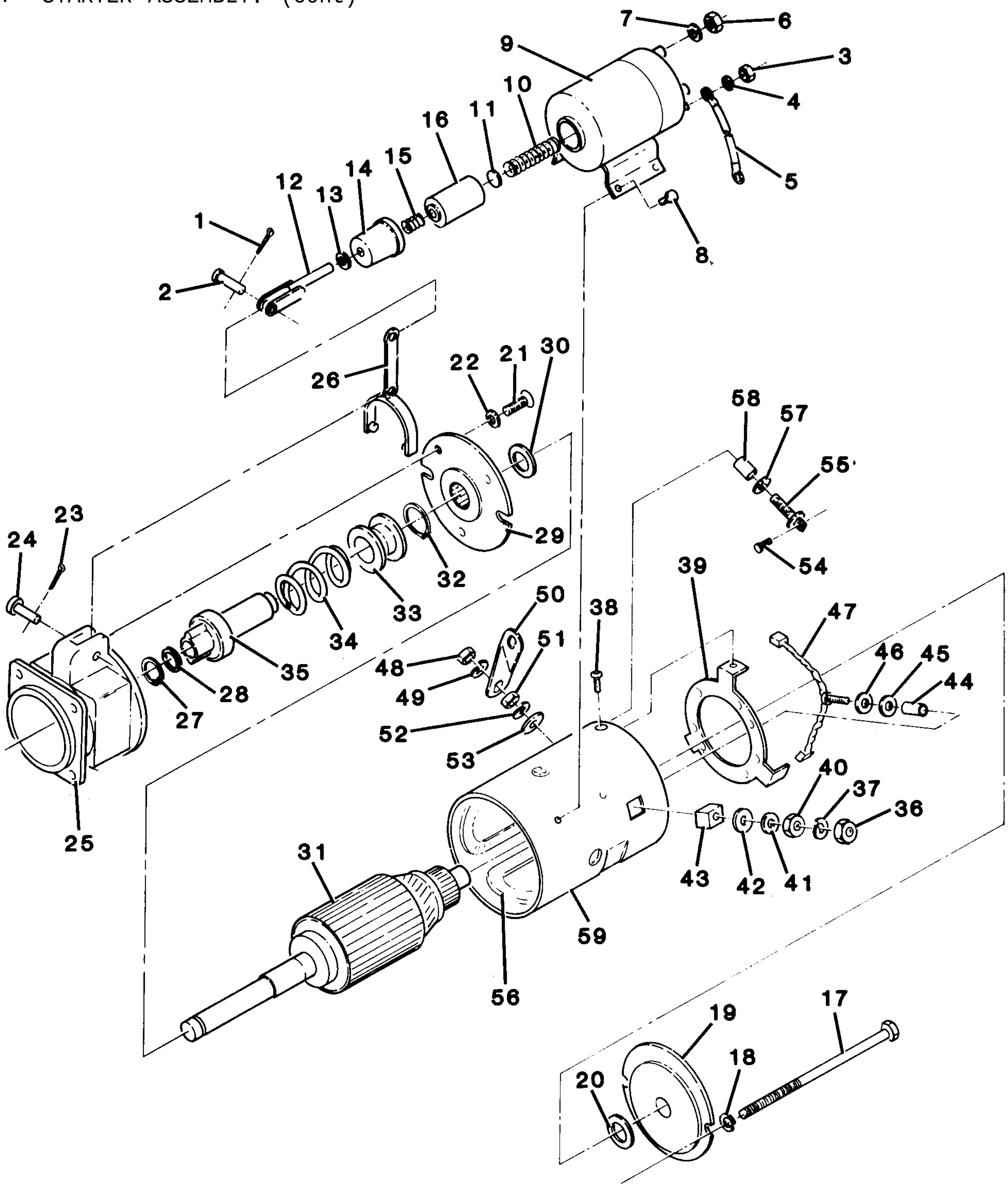


Figure 4-6. Starter Disassembly (Sheet 1 of 2)

4-3. STARTER ASSEMBLY. (cont)

LEGEND

1. COTTER PIN
2. LINK PIN
3. NUT
4. LOCKWASHER
5. GROUND WIRE
6. NUT
7. LOCKWASHER
8. BOLT
9. SOLENOID
10. PLUNGER SPRING
11. SPRING PLUG
12. CLEVIS
13. WASHER
14. DUST CAP
15. SPRING
16. PLUNGER
17. THRU BOLT
18. LOCKWASHER
19. COMMUTATOR END HEAD
20. THRUST WASHER
21. SCREW
22. WASHER
23. COTTER PIN
24. YOKE PIN
25. PINION HOUSING
26. YOKE
27. RETAINING RING
28. PINION RETAINER
29. INTERMEDIATE BEARING PLATE
30. THRUST WASHER
31. ARMATURE
32. RETAINING RING
33. DOUBLE SHOULDERED WASHER
34. SPRING
35. PINION SHAFT AND BEARING
36. NUT
37. LOCKWASHER
38. CAPSCREW
39. BRUSH PLATE
40. NUT
41. LOCKWASHER
42. WASHER
43. INSULATING WASHER
44. TERMINAL INSULATOR
45. INSULATING WASHER
46. WASHER
47. BRUSH AND TERMINAL STUD
48. NUT
49. LOCKWASHER
50. SWITCH CONNECTOR
51. NUT
52. LOCKWASHER
53. INSULATING WASHER
54. SCREW
55. TERMINAL STUD
56. FIELD COIL
57. INSULATING WASHER
58. TERMINAL INSULATOR
59. FRAME

Figure 4-6. Starter Disassembly (Sheet 2 of 2)

4-3. STARTER ASSEMBLY. (cont)

b. Disassembly. (cont)

(22) Remove brush and terminal stud (47) from frame (59).

(23) Remove insulating washer (43) from frame (59).

(24) Remove terminal insulator (44), insulating washer (45), and washer (46) from brush and terminal stud (47).

(25) Remove nut (48), lockwasher (49), and switch connector (50).

(26) Remove nut (51), lockwasher (52), and insulating washer (53).

(27) On inside of frame (59), remove screw (54) that secures terminal stud (55) to field coil (56).

(28) Remove terminal stud (55), insulating washer (57), and terminal insulator (58) from frame (59).

(29) Use the following procedure to replace brushes on brush and terminal stud (47).

(a) Cut original lead off approximately 1/2 inch on each side of welded connection of terminal stud.

(b) Tin remaining section of original lead using resin core solder.

(c) Position new brush lead next to tinned section of original lead. Install and crimp brass strip connectors around both leads.

(d) Solder new brushes in place.

(e) Position new brush leads in place so they do not contact frame (59) or interfere with installation of thru bolts (17).

c. Installation.

(1) Place terminal insulator (58) and washer (57) on terminal stud (55).

(2) From inside of frame (59), install stud (55) in hole provided. Secure terminal stud (55) to field coil (56) with screw (54).

(3) Install insulating washer (53), lockwasher (52), and nut (51) on stud (55).

(4) Install switch connector (50) on terminal stud (55) and secure with lockwasher (49) and nut (48).

(5) Place washer (46), insulating washer (45), and terminal insulator (44) on brush and terminal stud (47).

(6) Insert brushes into slots on brush plate (39).

(7) Install brush plate (39) in frame (59). Aline brush plate mounting holes with holes in frame (59). Insert terminal stud (47) through hole provided in frame (59).

(8) Secure brush plate (39) in frame (59) with capscrews (38).

(9) Install insulating washer (43) on terminal stud (47) and press into frame (59).

(10) Install washer (42), lock-washer (41), and nut (40) on terminal stud (47).

(11) Place ground wire (5) on terminal stud (47) and secure with lockwasher (37) and nut (36).

(12) Place spring (34) and double shouldered washer (33) on pinion shaft and bearing (35).

4-3. STARTER ASSEMBLY. (cont)

c. Installation. (cont)

(13) Push back double shouldered washer (33) and install retaining ring (32) in slot near end of pinion shaft.

(14) Install thrust washer(30), intermediate bearing plate (29), and assembled drive assembly (items 32 through 35) on shaft armature (31).

(15) Install new pinion retainer (28) in shaft of armature (31). Push pinion retainer back and install new retaining ring (27) in slot near end of armature shaft.

(16) Position yoke (26) between lip of double shouldered washer.

(17) Carefully slide assembled drive assembly and armature into pinion housing (25). Ensure that mounting holes in intermediate bearing plate (29) are aligned with those in pinion housing (25).

(18) Secure yoke (26) to pinion housing (25) with yoke pin (24) and cotter pin (23).

(19) Secure intermediate bearing plate (29) to pinion housing (25) with washers (22) and screws (21).

(20) Carefully slide assembled armature, drive assembly, and pinion housing into frame (59).Align groove on pinion housing with alignment pin on frame.

(21) Install thrust washer (20) on commutator end of armature. Adjust number and thickness of thrust washers to provide 0.005 to 0.030 inch of end play.

(22) Position commutator end head (19) on frame and secure complete assembly with lockwasher (18) and thru bolts (17). Ensure that thru bolts fully engage pinion housing (25). Torque to 96 inch pounds (10.9 Nm).

(23) Place spring plug (11) and plunger spring (10) in plunger (16).

(24) Place spring (15) and dust cap (14) on plunger.

(25) Place washer (13) on threaded end of clevis (12). Screw clevis through hole in dust cap and into plunger.

(26) Slide assembled moving core (items 10 through 16) into solenoid (9).

(27) Secure solenoid (9) to frame (59) with bolt (8).

(28) Connect switch connector (50) to solenoid (9) with lockwasher (7) and nut (6).

(29) Attach ground wire (5) to solenoid and secure with lockwasher (4) and nut (3).

(30) Attach clevis (12) to yoke (26) with link pin (2) and cotter pin (1)

(31) Check clearance between pinion retainer (28) and pinion shaft (35). To maintain clearance of 0.09 inch (+0.02 inch) between pinion retainer and pinion shaft, adjust clevis (12) in plunger (16). Have drive assembly pushed toward motor when making adjustments.

4-3. STARTER ASSEMBLY. (cont)

d. Test After Repair

NOTE

Additional power source that can be used is ECU-9/M test stand.

(1) Connect starter as shown in figure 4-5.

CAUTION

To prevent damage to the solenoid starting switch, perform the following test as quickly as possible.

(2) Momentarily attach heavy gauge test lead and jump solenoid battery (+) terminal (1) to switch terminal (2). Voltmeter should indicate not less than +13.5 volts. Pinion should reposition and rotate. Disconnect test lead.

e. Installation. Install starter in generator set in accordance with procedures in paragraph 4-32c, TM 5-6115-612-12.

CHAPTER 5

MAINTENANCE OF ELECTRICAL POWER GENERATION SYSTEM

5-1. GENERAL. The purpose of the generator (figure 5-1) is to convert mechanical energy into electrical energy in the form of direct current. The generator is of brushless design and rated at 10kW, 28 Vdc, 350 amps steady state. Mechanical energy is supplied by the rotating shaft of the turbine engine. The shaft turns a rotor inside the stator housing of the generator. All generators work by causing magnetic lines of force to move across a conductor. This is normally accomplished by moving the magnet or the wire. Most brushless generators work by using a rotary transformer with one winding on the rotor to transfer power to the rotor. This power is rectified and is used to generate the magnetic field in the rotor. As the rotor rotates, the magnetic lines of force cut across the conductor in the output winding of the stator. This generates the output power. Rectifiers are used to change ac into dc when a dc output is desired. This generator is different in that it has no rotating magnets or wires. Both the field winding and output winding are located in the stator. The rotor consists of a slotted cylinder made of a material that conducts magnetic lines of force easily. As the teeth on the rotor aline with those on the stator, the magnetic field takes the path of least resistance and is concentrated in the conductor. As it rotates, the teeth in the rotor aline with the slots in the stator (figure 5-2). Since the resistance to a magnetic field is so

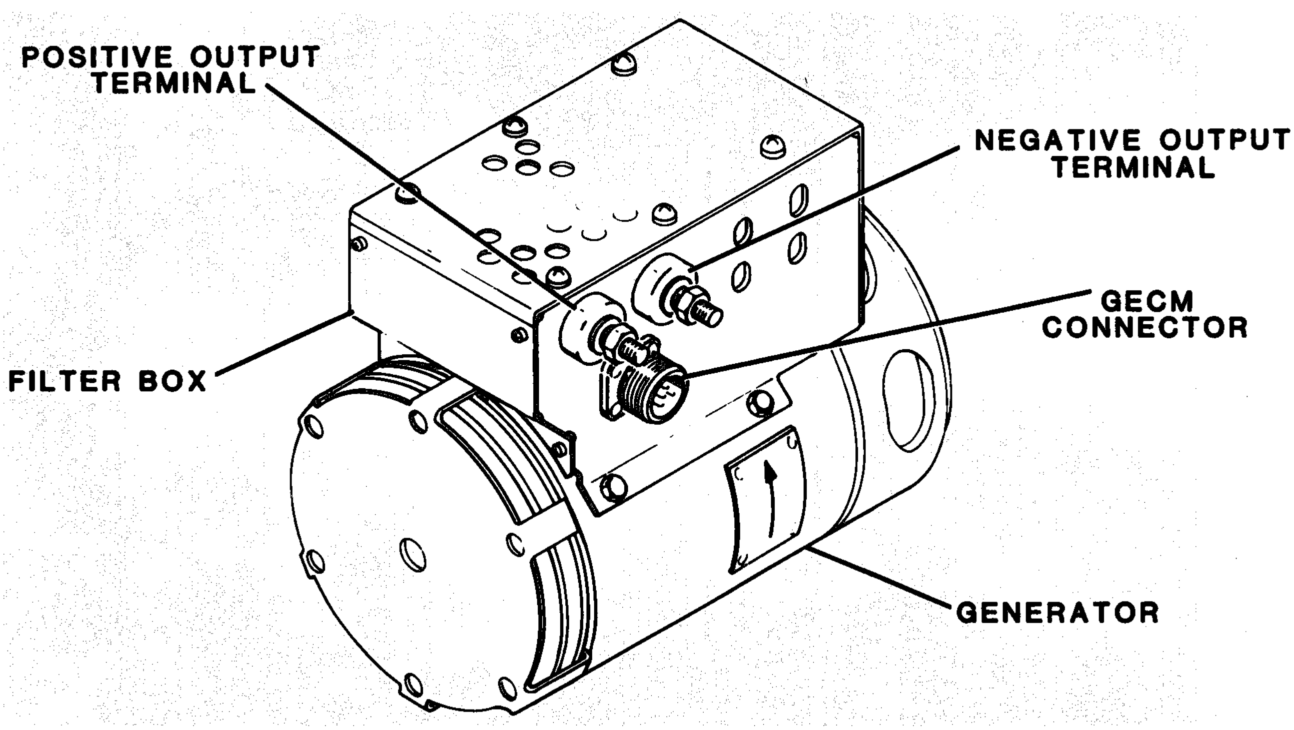


Figure 5-1. Generator and Filter Box

5-1. GENERAL. (cont)

much lower in the conductor, the magnetic field changes so that it spends the maximum distance in the conductor. This causes the lines of magnetic force to move so they pass through the conductors in the stator. As these magnetic lines of force move across the conductors, they generate the output voltage. The output voltage depends on the number of lines per second of magnetic field that move across the conductors. By controlling the speed of the generator (the rate at which the lines move) and the strength of the field (the number of lines), the output voltage is controlled. This is the method used on brushless generators. As shaft and rotor speed increase, alternating current is produced and flows from the stator housing through diodes mounted in the rectifier plate. The diodes and rectifier plate change the alternating current to pulsating direct current. The pulsating direct current then passes through a bus bar to the filter box where the pulses are removed from the pulsating direct current. The resulting current is then ready for use as starting power for aircraft.

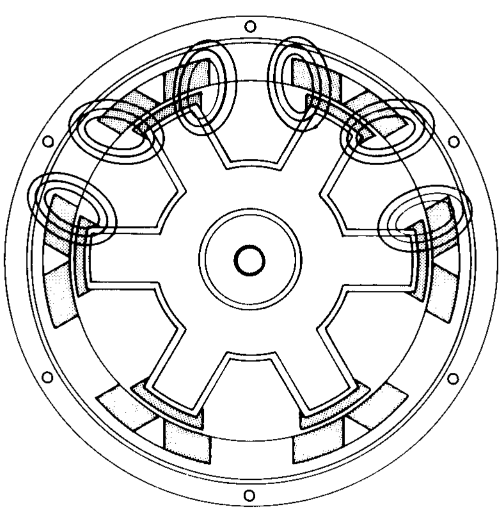
5-2. GENERATOR ASSEMBLY MAINTENANCE.

a. Installed Test.

(1) Ensure that MASTER SWITCH is in OFF position.

WARNING

To prevent injury, ensure that battery is disconnected before performing maintenance on electrical components.


ROTOR AND STATOR TEETH NOT ALIGNED

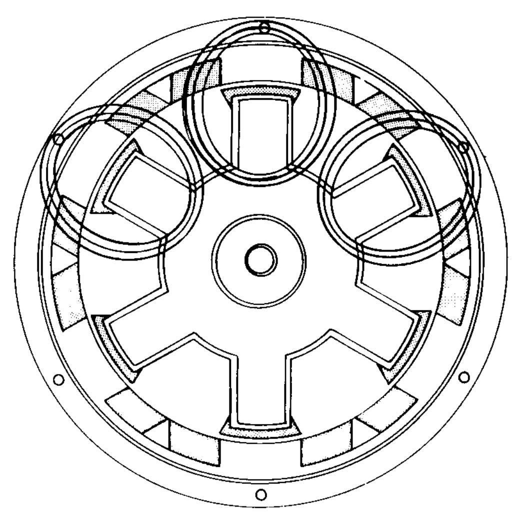

ROTOR AND STATOR TEETH ALIGNED

Figure 5-2. Generator Conduction - Rotor and Stator Alinement

5-2. GENERATOR ASSEMBLY MAINTENANCE. (cont)

a. Installed Test. (cont)

(2) Disconnect battery cable plug connector from battery.

(3) Deleted.

(4) Loosen turnlock fasteners and remove engine housing access cover.

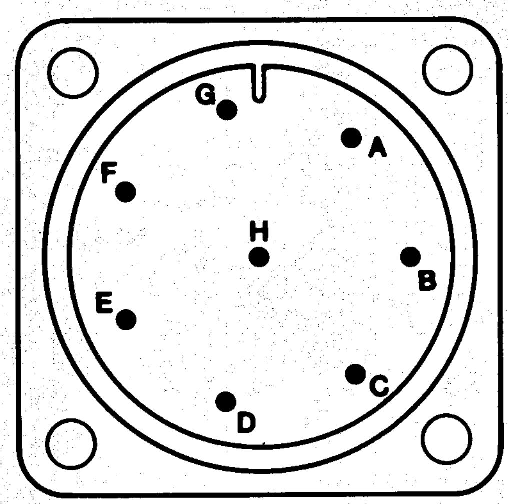
WARNING

To prevent injury, do not perform maintenance on hot components. Allow adequate time for cooling.

(5) Tag and disconnect cables from positive and negative output connectors and from GECM connector.

Table 5-1. GECM Connector Resistance Test

Pin to pin	Reading (±10%)
B-C	1.1 ohm
B-all others	open
C-all others	open
A-E	1/2 scale
E-A	infinity
H-E	1/2 scale
E-H	infinity
Any pin to case	infinity
D-F	1.5 megohm at ambient



PIN LOCATIONS
(Front)

PIN	WIRE
A	W1
B	W9
C	W10
D	W11
E	W2
F	W12
G	W6
H	W5

WIRE CONNECTIONS
(Back)

Figure 5-3. GECM Connector

5-2. GENERATOR ASSEMBLY MAINTENANCE. (cont)

a. Installed Test. (cont)

(6) Using a multimeter set on R1, check resistance on GECM connector (figure 5-3) in accordance with table 5-1.

(7) If any reading is incorrect, replace generator (paragraph 2-6).

(8) Connect cables to positive and negative output connectors and to GECM connector.

(9) Connect battery cable plug connector to battery.

(10) Install engine housing access cover and secure with turnlock fasteners.

b. Removed Test.

WARNING

To prevent injury, do not perform maintenance on hot components. Allow adequate time for cooling.

(1) Remove generator in accordance with paragraph 2-6a.

(2) Attempt to move shaft up and down by hand. If shaft moves up and down, disassemble generator (paragraph 5-2d) and replace bearings.

(3) Rotate generator shaft by hand. If rotor rubs, binds, or makes unusual noise, disassemble generator (paragraph 5-2d) and replace rotor (if damaged) and bearings.

(4) Install generator (paragraph 2-6b).

c. Removal. Remove generator in accordance with paragraph 2-6a.

d. Disassembly.

WARNING

To prevent injury, do not perform maintenance on hot components. Allow adequate time for cooling.

(1) Remove screws (1, figure 5-4) and washers (2). Lift upper access cover (3) off filter box.

WARNING

To prevent injury, ensure that capacitor is discharged to ground before performing maintenance.

(2) Remove nut (4), lockwasher (5), washer (6), and bolt (7) to disconnect bus bar (8) from generator bus bar.

(3) Remove capscrews (9), lockwasher (10), and washers (11) to separate filter box from generator.

(4) Remove bolt (12), lockwasher (13), and washer (14) to disconnect inductor (20) from stator cable.

(5) Remove nut (15) that secures inductor (20) to negative output feedthru connector. Tag and remove wires as necessary.

(6) Remove nuts (16), washers (17), lockwashers (18), and capscrews (19) to disconnect inductor (20) from left and right sides of filter box. Lift inductor out of filter box.

5-2. GENERATOR ASSEMBLY MAINTENANCE.
(cont)

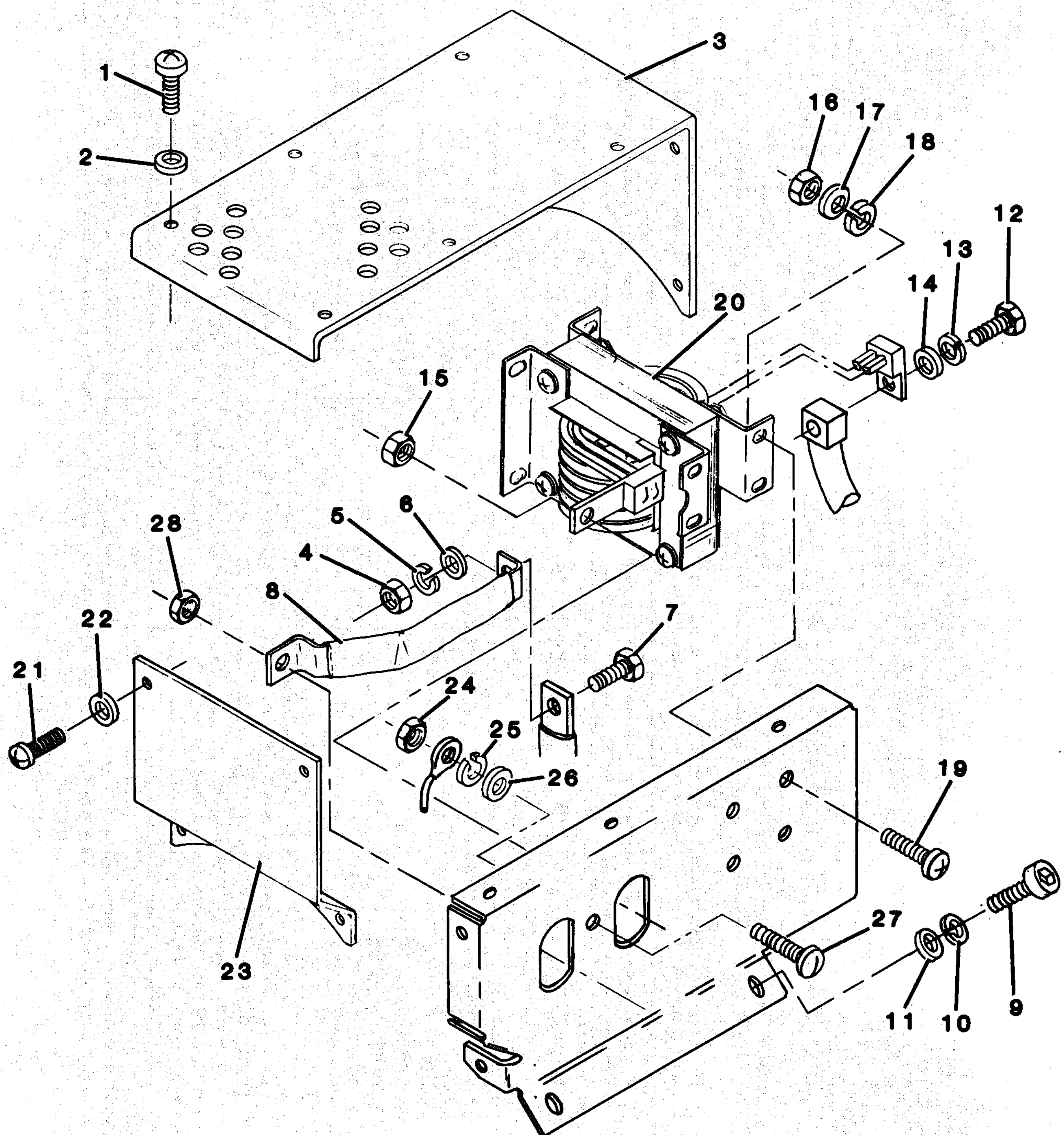


Figure 5-4. Filter Box Assembly (Sheet 1 of 4)

5-2. GENERATOR ASSEMBLY MAINTENANCE. (cont)

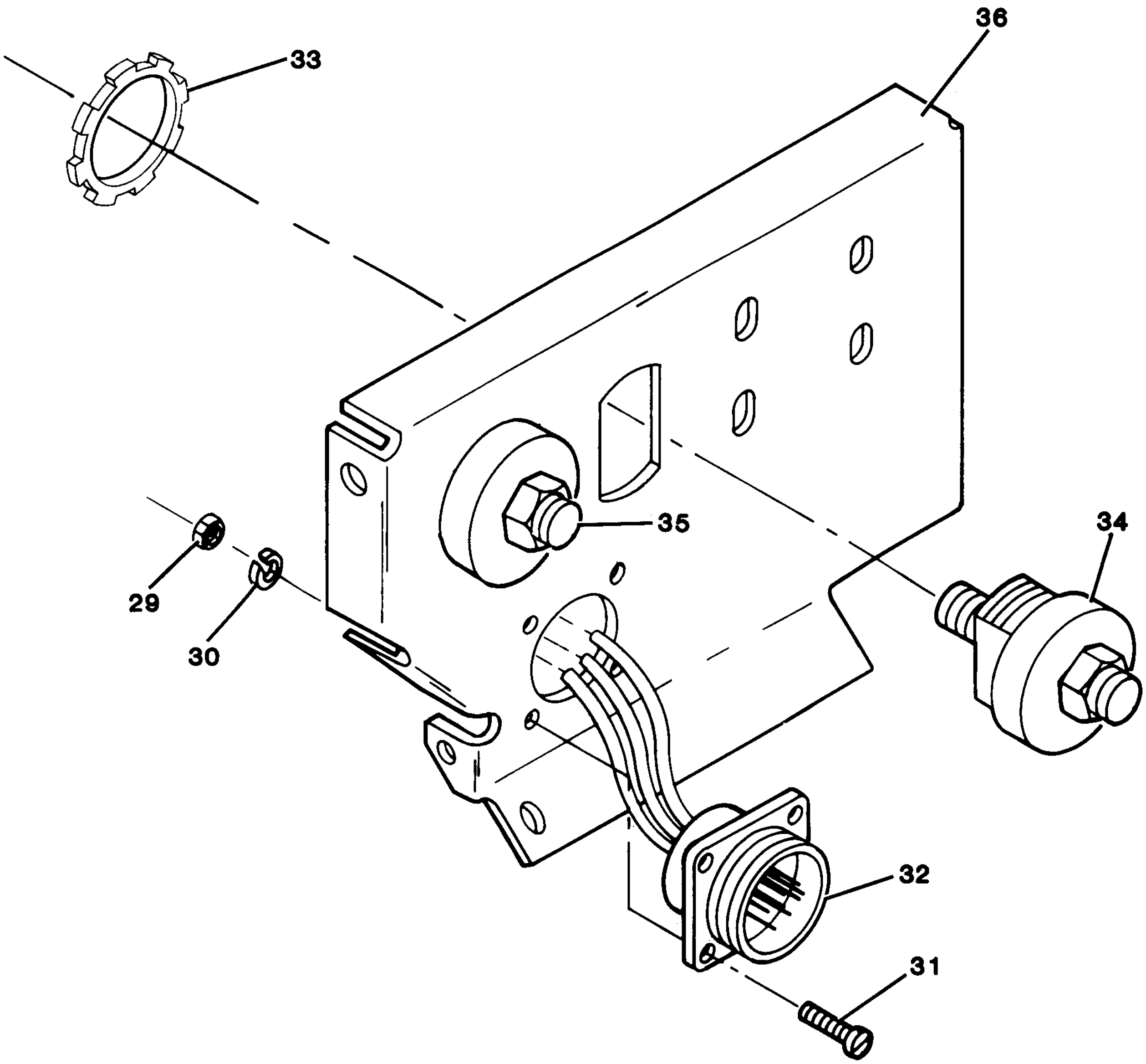


Figure 5-4. Filter Box Assembly (Sheet 2 of 4)

5-2. GENERATOR ASSEMBLY MAINTENANCE.
(cont)

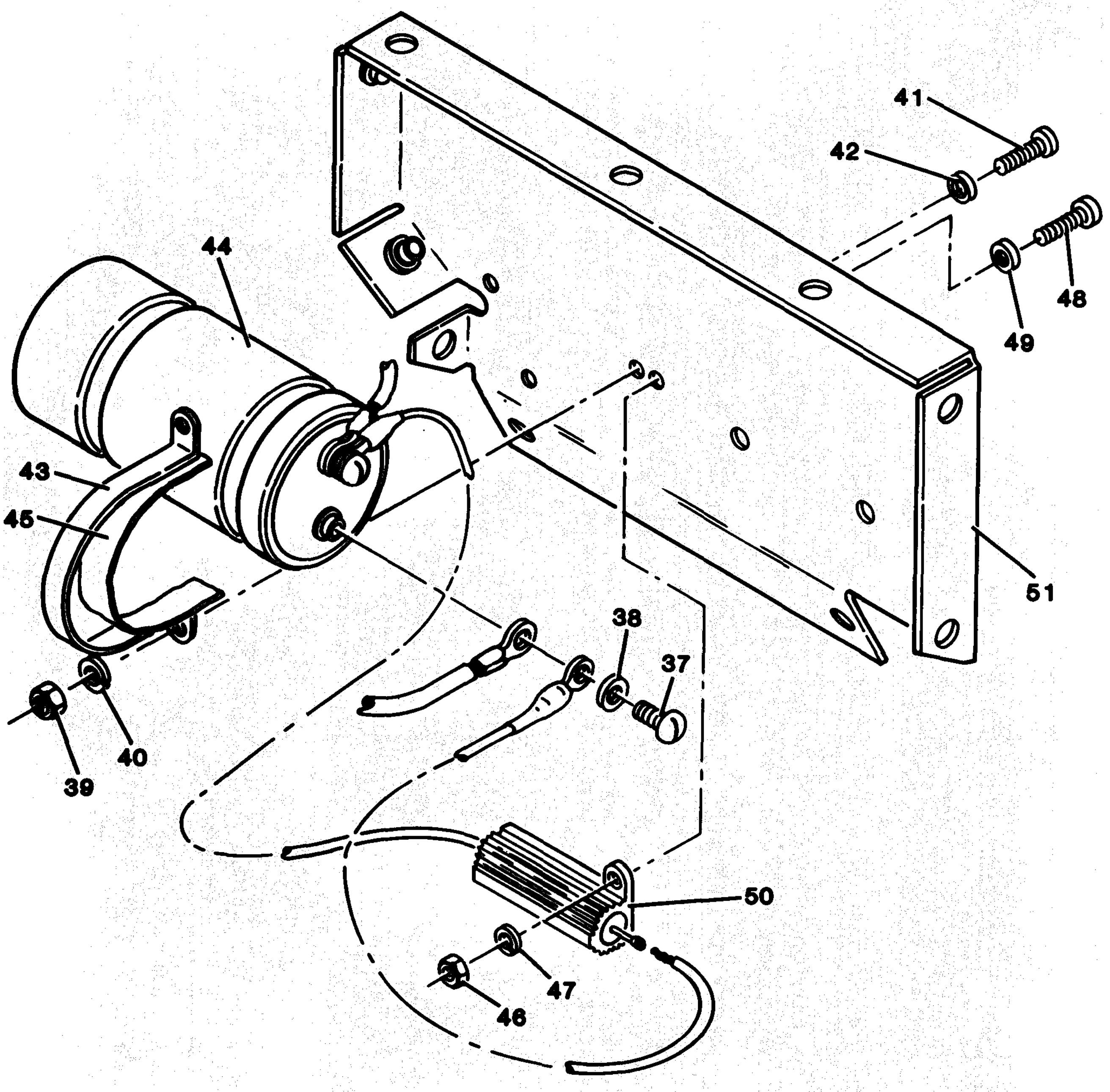


Figure 5-4. Filter Box Assembly (Sheet 3 of 4)

5-2. GENERATOR ASSEMBLY MAINTENANCE. (cont)

LEGEND

1. SCREW
2. WASHER
3. UPPER ACCESS COVER
4. NUT
5. LOCKWASHER
6. WASHER
7. BOLT
8. BUS BAR
9. CAPSCREW
10. LOCKWASHER
11. WASHER
12. BOLT
13. LOCKWASHER
14. WASHER
15. NUT
16. NUT
17. WASHER
18. LOCKWASHER
19. CAPSCREW
20. INDUCTOR
21. SCREW
22. WASHER
23. REAR ACCESS COVER
24. NUT
25. LOCKWASHER
26. WASHER
27. SCREW
28. NUT
29. NUT
30. LOCKWASHER
31. SCREW
32. GECM CONNECTOR
33. SPANNER NUT
34. NEGATIVE OUTPUT CONNECTOR
35. POSITIVE OUTPUT CONNECTOR
36. LEFT SIDE PANEL
37. SCREW
38. LOCKWASHER
39. NUT
40. LOCKWASHER
41. SCREW
42. WASHER
43. RETAINING STRAP
44. CAPACITOR C1
45. CLOTH TAPE
46. NUT
47. LOCKWASHER
48. SCREW
49. WASHER
50. RESISTOR R1
51. RIGHT SIDE PANEL

Figure 5-4. Filter Box Assembly (Sheet 4 of 4)

5-2. GENERATOR ASSEMBLY MAINTENANCE. (cont)

d. Disassembly. (cont)

(7) Remove screws (21), washers (22), and filter box rear access cover (23).

(8) Tag wiring secured to screw (27) between output connectors. Remove nut (24), lockwasher (25), washer (26), and screw (27).

(9) Remove nut (28) that secures bus bar (8) to positive output connector. Tag and remove wires as necessary. Remove bus bar (8) from filter box.

(10) Remove lockwire from GECM connector (32). Remove nuts (29), lockwashers (30), and screw (31). Tag and disconnect Wiring from GECM connector (32). Carefully pull GECM connector (32) and attached wiring out of left side of filter box.

(11) Remove spanner nuts (33), negative output connector (34) and positive output connector (35) from left side panel (36).

(12) Tag wiring connected to capacitor C1 (44). Remove screws (37) and lockwashers (38) that secure wiring to capacitor.

(13) Remove nuts (39), lock-washers (40), screws (41), and washers (42) that secure retaining straps (43) and capacitor C1 (44) to right side panel (51). Remove glass cloth tape (45) from between retaining strap and capacitor.

(14) Remove nuts (46), lockwashers (47), screws (48), and washers (49) that secure resistor R1 (50) to right side panel (51).

(15) If no further disassembly is required, refer to paragraph 5-2e for repair procedures. Reassembly procedures for the filter box begin at step 34, paragraph 5-2f.

CAUTION

To prevent damage and to assist in reassembly, ensure that parts are clearly matchmarked prior to disassembly.

(16) Matchmark fan cover (3, figure 5-5), ring shroud (11), fan end bell (19), stator housing (46), mounting end bell (45), and mounting flange (13).

(17) Remove capscrews (1, figure 5-5), lockwashers (2), and fan cover (3).

(18) Remove cotter pin (4) from nut (5).

(19) Secure shaft of armature (22) to prevent turning.

NOTE

Nut (5) is torqued approximately 480 inch pounds (54.2 Nm).

(20) Remove nut (5) and washer (6).

(21) Slide fan (7) off armature shaft. Woodruff key (8) need not be removed from armature shaft unless it is badly damaged and affects fan fit.

(22) Remove capscrews (9), lockwashers (10), and ring shroud (11).

5-2. GENERATOR ASSEMBLY MAINTENANCE. (cont)

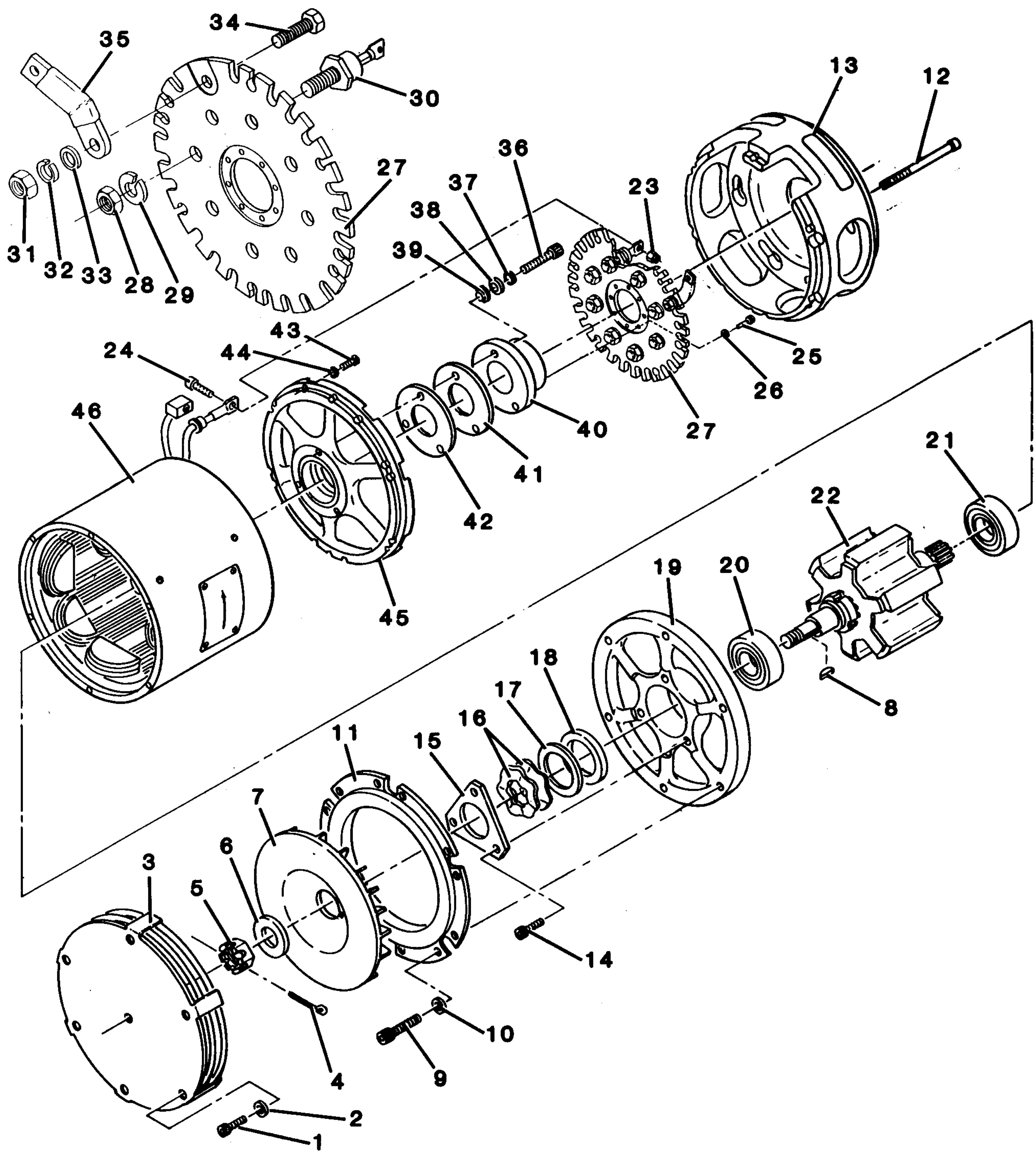


Figure 5-5. 10kW Generator Assembly (Sheet 1 of 2)

5-2. GENERATOR ASSEMBLY MAINTENANCE. (cont)

1. CAPSCREW
2. LOCKWASHER
3. FAN COVER
4. COTTER PIN
5. NUT
6. WASHER
7. FAN
8. WOODRUFF KEY
9. CAPSCREW
10. LOCKWASHER
11. RING SHROUD
12. CAPSCREW
13. MOUNTING FLANGE
14. CAPSCREW
15. RETAINER PLATE
16. SPRING WASHER
17. SHIM
18. RING SPACER
19. FAN END BELL
20. BEARING
21. BEARING
22. ARMATURE
23. NUT
24. CAPSCREW
25. CAPSCREW
26. LOCKWASHERS
27. RECTIFIER RING
28. NUT
29. LOCKWASHER
30. DIODE
31. NUT
32. LOCKWASHER
33. WASHER
34. BOLT
35. BUS BAR
36. CAPSCREW
37. LOCKWASHER
38. WASHER
39. SHOULDER WASHER
40. RECTIFIER MOUNTING FLANGE
41. INSULATING SPACER
42. RETAINING PLATE
43. CAPSCREW
44. WASHER
45. MOUNTING END BELL
46. STATOR HOUSING

Figure 5-5. 10kW Generator Assembly (Sheet 2 of 2)

5-2. GENERATOR ASSEMBLY MAINTENANCE. (cont)

d. Disassembly. (cont)

(23) Remove capscrews (12) and mounting flange (13).

(24) From rectifier ring end of assembly, press out complete armature assembly (items 14 through 22).

(25) Remove capscrews (14) and retainer plate (15).

(26) Remove spring washers (16).

(27) Remove shims (17), if used, and secure together. Measure thickness of each shim to ensure proper stack for reassembly.

(28) Remove ring spacer (18).

WARNING

To prevent injury, ensure that protective gloves are worn when handling hot or cold parts.

CAUTION

To prevent damage, do not remove bearings unless damaged or worn. Once bearings are removed, they cannot be reused.

(29) Heat remaining portion of armature assembly to 350°F (176.6°C) and maintain for a minimum of one hour.

(30) Use a bearing puller and remove fan end bell (19) and bearing (20) from shaft of armature (22). Press bearing out of fan end bell.

(31) Use bearing puller and remove bearing (21) from shaft of armature (22).

CAUTION

To prevent damage and to ensure proper reassembly, it is extremely important to tag each wire and to make note of which slot in the rectifier plate the wire is installed. In addition, each diode must be marked and a note made as to which mounting hole each diode is mated. All wires and diodes must be reinstalled in the exact position from which removed.

(32) Match tag wires, diodes, and rectifier ring slots. Matchmark rectifier ring (27) and rectifier mounting flange (40).

(33) Remove nuts (23) and capscrews (24) to remove wires from diodes (30).

(34) Remove capscrews (25) and lockwashers (26).

(35) Pop plastic grommets and wires out of keyhole slots in rectifier ring (27). Remove rectifier ring.

(36) Remove nuts (28), lockwashers (29), and diodes (30) from rectifier ring.

(37) Remove nut (31), lockwasher (32), washer (33), bolt (34), and bus bar (35) from rectifier ring.

5-2. GENERATOR ASSEMBLY MAINTENANCE. (cont)

d. Disassembly. (cont)

(38) Remove capscrews (36), lockwashers (37), washers (38), and shoulder washers (39).

(39) Remove rectifier mounting flange (40), insulating spacer (41), and retaining plate (42).

(40) Remove capscrews (43), washers (44), and mounting end bell (45) from stator housing (46).

e. Repair and Rebuild. Repair and/or rebuild of the generator is accomplished by replacing damaged components. Inspect all helical inserts for damaged threads and replace as necessary. Refer to TM5-6115-612-24P for correct part numbers. Repair part information for wires in the generator filter box can also be found in TM5-6115-612-24P.

f. Reassembly. During reassembly, ensure that all parts are thoroughly cleaned.

WARNING

To prevent injury, ensure that protective gloves are worn when handling hot or cold parts.

(1) Heat bearings (20, 21, figure 5-5) to 350°F (176.6°C) and maintain for a minimum of one hour.

(2) Clean mating surfaces of armature (22) and bearings (20) and (21).

WARNING

To prevent injury, provide adequate ventilation when using cleaning fluid. Avoid prolonged or repeated breathing of vapor. Do not take internally. Keep away from flames and other ignition sources.

CAUTION

To prevent damage, do not allow sealing compound to enter bearing races.

(3) Apply primer and then sealing compound to bearing seats on armature shaft.

(4) Use tool FT-59735-1 (table 2-3) to press bearing (20) onto armature shaft. Remove all excess primer and sealing compound.

(5) Use tool FT-59735-2 (table 2-3) to press bearing (21) onto armature shaft. Remove all excess primer and sealing compound.

(6) Press fan end bell (19) onto bearing (20).

(7) Carefully install assembled armature (items 19, 20, 21, and 22) into stator housing (46). Ensure that matchmarks on fan end bell (19) and stator housing (46) are alined.

(8) Install mounting end bell (45) on stator housing (46). Ensure that matchmarks are alined.

5-2. GENERATOR ASSEMBLY MAINTENANCE. (cont)

f. Reassembly. (cont)

(9) Apply thread-locking compound to threads of capscrews (43). Secure mounting end bell to stator housing (46) with washers (44) and capscrews (43). Torque capscrews to 27-33 inch pounds (3.1-3.7 Nm).

(10) Place retaining plate (42), insulating spacer (41), and rectifier mounting flange (40) into position on mounting end bell.

(11) Apply thread-locking compound to threads of capscrews (36). Secure rectifier mounting flange to mounting end bell (45) with shoulder washers (39), washers (38), lockwashers (37), and capscrews (36). Torque capscrews to 27-33 inch pounds (3.1-3.7 Nm).

(12) Place ring shroud (11) on fan end bell (19). Ensure that matchmarks are alined. Secure ring shroud to end bell with lockwashers (10) and capscrews (9). Torque to 27-33 inch pounds (3.1-3.7 Nm).

(13) Install ring spacer (18) in fan end bell (19) snug against top of bearing (20).

(14) Measure distance A between top of ring spacer and edge of fan end bell as shown in figure 5-6.

(15) Install shims as required to provide axial distance of 0.078 to 0.092 inch for spring washers between ring spacer and retainer plate.

(16) Install spring washers (16, figure 5-5).

(17) Apply thread-locking compound to capscrews (14).

(18) Install retainer plate (15) on fan end bell and secure with capscrews (14). Torque to 17-23 inch pounds (1.9-2.6 Nm).

(19) Slide fan (7) onto armature shaft. Ensure that woodruff key (8) is engaged in fan.

(20) Install washer (6) and nut (5). Torque nut to 420 - 540 inch pounds (47.5-61 Nm). Ensure that cotter pin hole in nut is alined with hole in armature shaft.

(21) Install cotter pin (4).

(22) Install fan cover (3) and secure with lockwashers (2) and capscrews (1). Torque to 17-23 inch pounds (1.9-2.6 Nm).

(23) Install bus bar (35) on rectifier ring (27) and secure with bolt (34), washer (33), lockwasher (32), and nut (31). Torque nut to 25-30 inch pounds (2.8-3.4 Nm).

(24) Coat mounting surface of diodes (30) with sealing compound.

CAUTION

To prevent damage, it is extremely important that each diode is installed in the same mounting hole from which it was removed.

(25) Install diodes (30) in same mounting hole of rectifier ring (27) from which each was removed during disassembly. Ensure that diode flags are positioned as shown in figure 5-7. This will make attaching diode wires easier.

5-2. GENERATOR ASSEMBLY MAINTENANCE.
(cont)

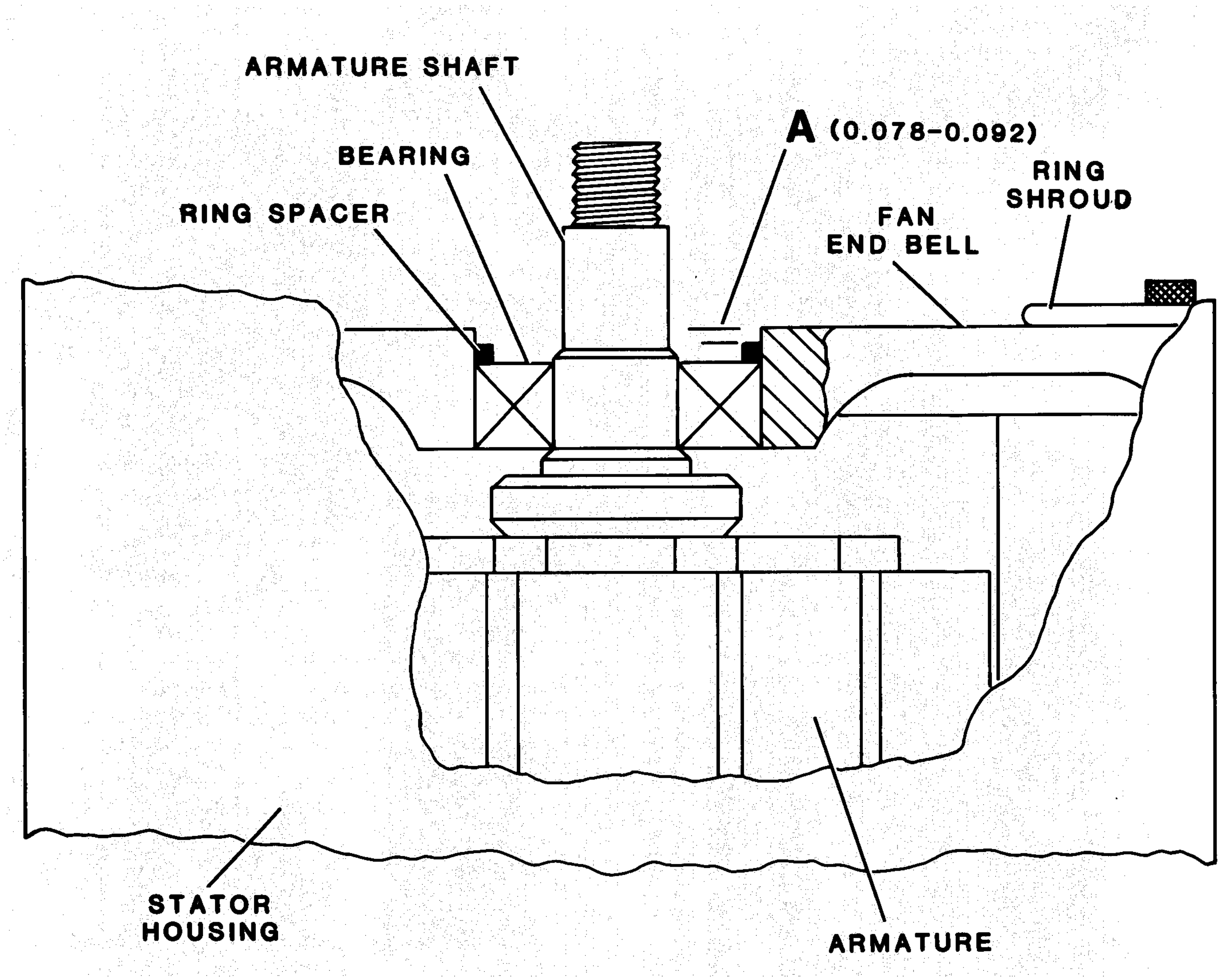


Figure 5-6. Measuring for Spring Washer Axial Distance

5-2. GENERATOR ASSEMBLY MAINTENANCE. (cont)

f. Reassembly. (cont)

(26) Secure diodes in rectifier ring with lockwashers (29, figure 5-5) and nuts (28). Torque to 100-125 inch pounds (11.3-14.1 Nm).

(27) Position rectifier ring on rectifier mounting flange (40). Ensure that matchmarks are alined.

CAUTION

To prevent damage, it is extremely important that each stator wire is installed in the same rectifier ring slot from which removed.

(28) Pop plastic grommets and stator wires into correct keyhole slots in rectifier ring (27). Refer to figure 5-7 for stator to diode wire routing.

(29) Check alinement of matchmarks on rectifier ring and rectifier mounting flange. Secure rectifier ring to flange with lockwashers (26, figure 5-5) and capscrews (25). Torque to 9-15 inch pounds (1.0-1.7 Nm).

CAUTION

To prevent damage, it is extremely important that each stator wire be attached to the same diode from which it was removed.

(30) Attach each stator wire to same diode from which it was removed during disassembly. Secure stator wires to diodes with capscrews (24) and nuts (23). Torque to 17-23 inch pounds (1.9-2.6 Nm).

(31) Position mounting flange (13) on stator housing (46). Ensure that matchmarks are alined. Secure mounting.

(32) Apply thread-locking compound to capscrews (12).

(33) Position mounting flange (13) on stator housing (46). Ensure that matchmarks are alined. Secure mounting flange to stator housing with capscrews (12). Torque to 84-108 inch pounds (9.5-12.2 Nm).

(34) Position resistor R1 (50, figure 5-4) on right side panel (51) and secure with washers (49), screws (48), lockwashers (47), and nuts (46).

(35) Position capacitor C1 (44) on right side panel. Place cloth tape (45) and capacitor retaining straps (43) over capacitor and secure with washers (42), screws (41), lockwashers (40), and nuts (39).

(36) Attach wiring to capacitor with lockwashers (38) and screws (37). Remove tags.

(37) Apply adhesive to mounting surfaces of positive and negative output connectors (34, 35) and install in left side panel (36). Secure with spanner nuts (33). Torque to 130-150 inch pounds (14.7-17.0 Nm).

(38) Slip GECM connector wiring through GECM connector mounting hole in left side panel. Secure connector (32) to left side panel with lockwashers (30), screws (31), and nuts (29). Lockwire as necessary.

5-2. GENERATOR ASSEMBLY MAINTENANCE.
(cont)

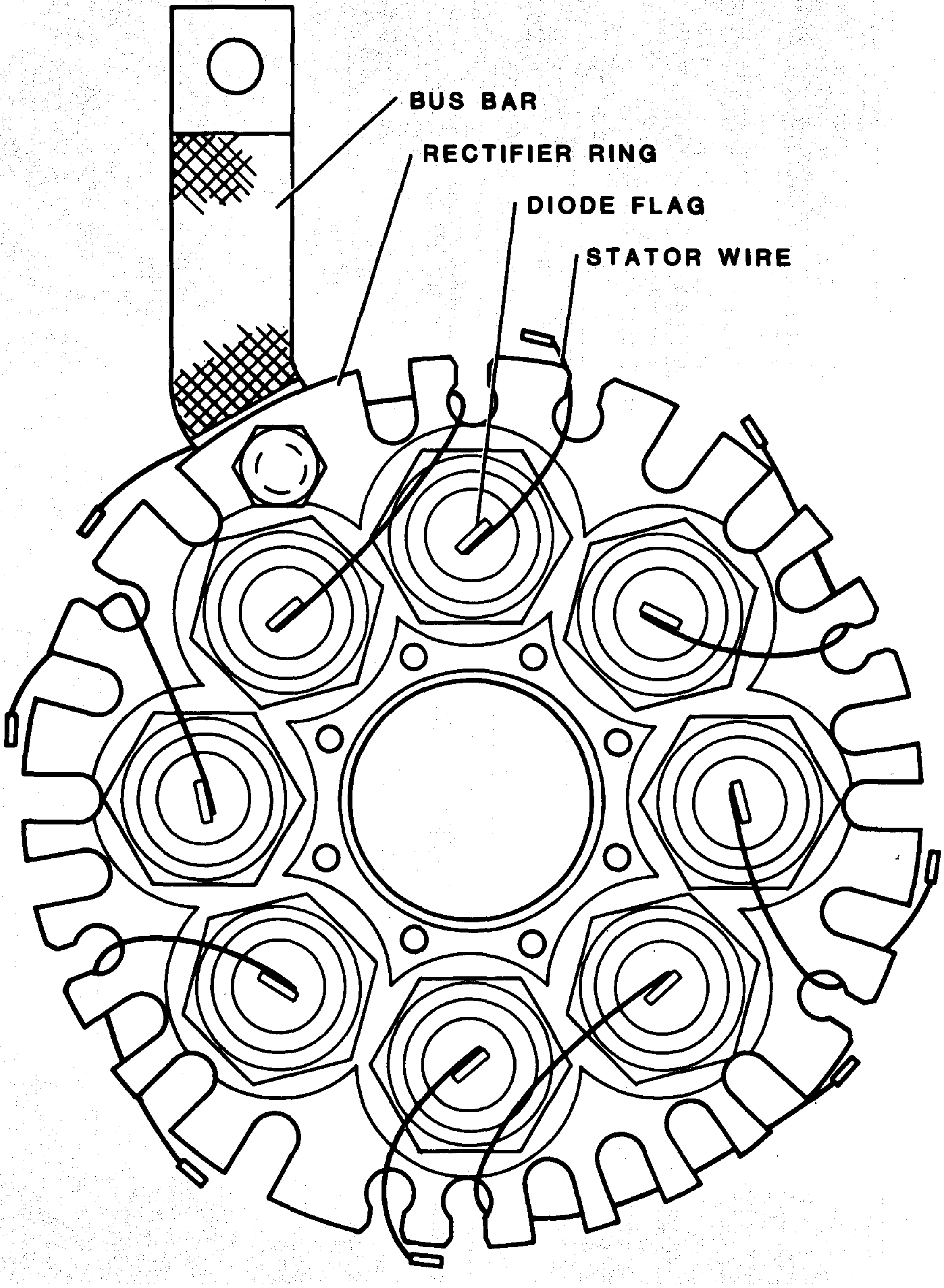


Figure 5-7. Stator to Diode Wire Routing

5-2. GENERATOR ASSEMBLY MAINTENANCE. (cont)

f. Reassembly. (cont)

(39) Position bus bar (8) and wiring on positive output connector (35). Secure with nut (28). Torque to 108-144 inch pounds (12.2-16.3 Nm). Remove tags.

(40) Insert screw (27) in mounting hole between positive and negative connectors. Place tagged wiring on screw and secure with washer (26), lockwasher (25), and nut (24). Remove tags.

(41) Attach rear access cover (23) to left and right side panels with washers (22) and screws (21).

(42) Place tagged wiring on negative output connector.

(43) Place inductor (20) into position with connector on negative output connector. Secure with nut (15) finger tight.

(44) Secure inductor to left and right side panels with washers (18), capscrews (19) lockwasher (17), and nuts (16). Torque to 27-33 inch pounds (3.1-3.7 Nm).

(45) Torque nut (15) to 108-144 inch pounds (12.2-16.3 Nm). Remove tags from wiring.

(46) Place assembled filter box on generator and secure with washers (11), lockwashers (10), and capscrews (9). Torque to 27-33 inch pounds (3.1-3.7 Nm).

(47) Connect bus bar (8) to generator bus bar with washer (6), bolt (7), lockwasher (5), and nut (4). Torque to 108-144 inch pounds (12.2-16.3 Nm).

(48) Connect stator cable to inductor (20) with washer (14), lockwasher (13), and bolt (12). Torque to 108-144 inch pounds (12.2-16.3 Nm).

(49) Place upper access cover on filter box and secure with washers (2) and screws (1).

g. Installation. Install generator in accordance with paragraph 2-6b.

CHAPTER 6

MAINTENANCE OF FUEL SYSTEM

6-1. PURPOSE AND FUNCTION OF FUEL SYSTEM. The fuel system (figure 6-1) is an electronically actuated and controlled system, providing a clean, continuous flow of fuel to the fuel injection nozzle atomizers. The electrical fuel transfer pump provides a continuous fuel flow of 5-7 psi (34-48 Pa) to the primary fuel (fluid) filter. The fuel is filtered in the primary filter, then routed through the secondary fuel (fluid) filter. Changes in engine speed are sensed at the monopole speed sensor and a signal is transmitted to the engine electronic control module (EECM), where fuel quantity is determined and demand signals are set to the electrical high pressure fuel pump. High pressure fuel then goes through the solenoid valve to the fuel injection nozzle atomizers. To prevent carbon and varnish deposits in the turbine engine after engine shutdown, the pressurized fuel supply is stopped and fuel between the solenoid valve and the fuel injection nozzle atomizers is discharged through the solenoid valve outside the generator set.

6-2. ENGINE FUEL TANK. Maintenance of the engine fuel tank (figure 6-2) consists of repairing damaged welds and replacing damaged components.

a. Removal and Disassembly.

(1) Remove fuel tank in accordance with paragraph 4-39d, TM 5-6115-612-12.

(2) Remove fill cap (1) from top of fuel tank.

(3) Loosen and remove fuel tank breather (2).

(4) Loosen and remove fuel level gauge (3) from top of fuel tank.

(5) On bottom of tank, loosen and remove drain valve (4).

(6) Loosen and remove fuel line connector (5).

WARNING

To prevent injury, ensure that correct procedures for welding fuel tanks are adhered to.

b. Repair. Repair damaged welds and replace damaged components as necessary. Hydrostatically test fuel tank to 7-8 psi (48.26-55.16 Pa). Hold pressure for two minutes and make sure there are no leaks and no drop in pressure.

c. Installation.

(1) Apply pipe thread sealant to male threads of fuel line connector. Install connector in bottom of fuel tank.

(2) Apply pipe thread sealant to male threads of drain valve. Install valve in bottom of fuel tank.

(3) Apply pipe thread sealant to male threads of fuel level gauge. Install gauge in top of fuel tank.

(4) Apply pipe thread sealant to male threads of fuel tank breather. Install breather in top of fuel tank.

(5) Install fill cap.

(6) Install fuel tank on generator set in accordance with paragraph 4-39e, TM 5-6115-612-12.

6-1. PURPOSE AND FUNCTION OF FUEL SYSTEM. (cont)

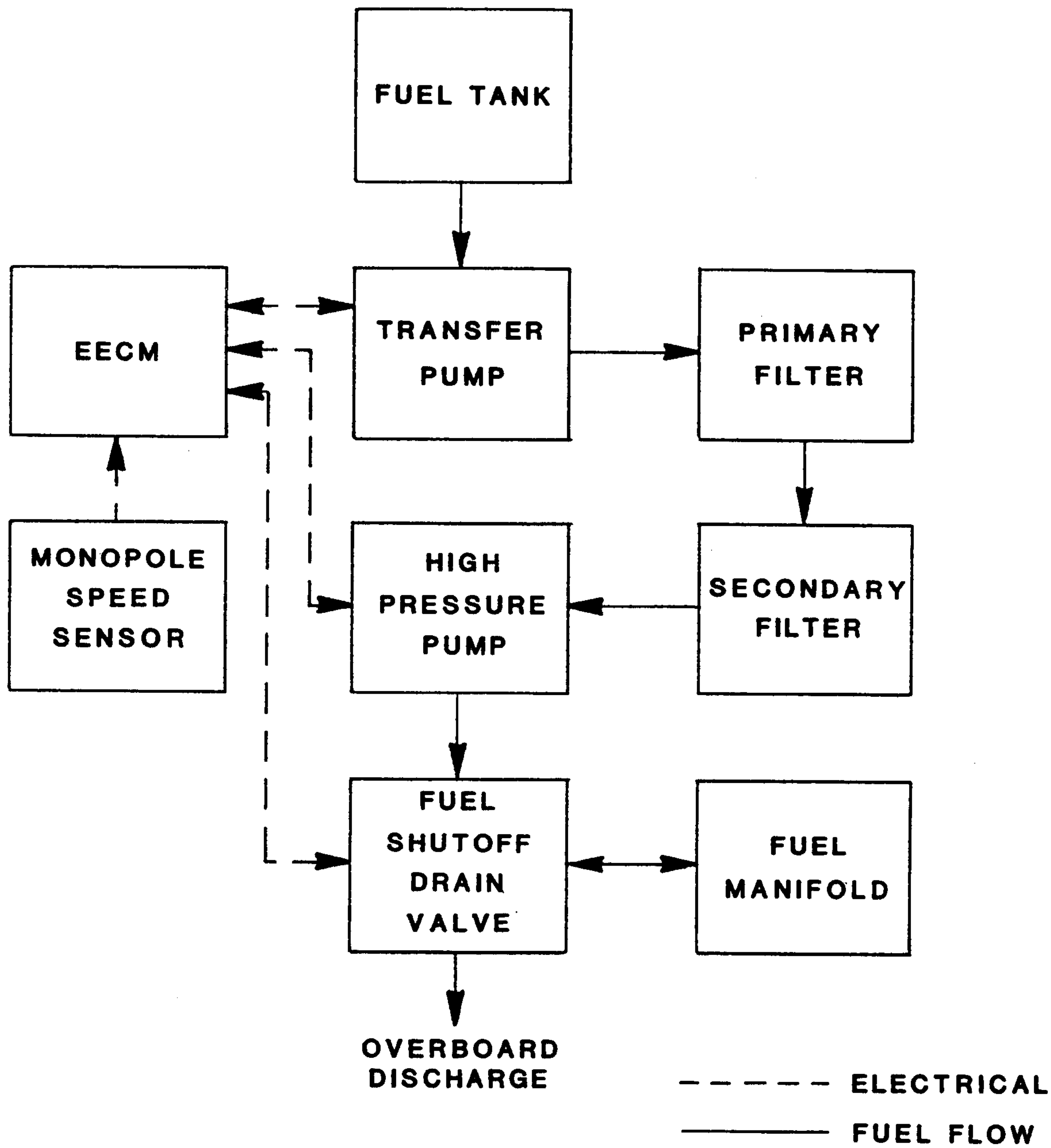


Figure 6-1. Fuel System Block Diagram

6-2. ENGINE FUEL TANK. (cont)

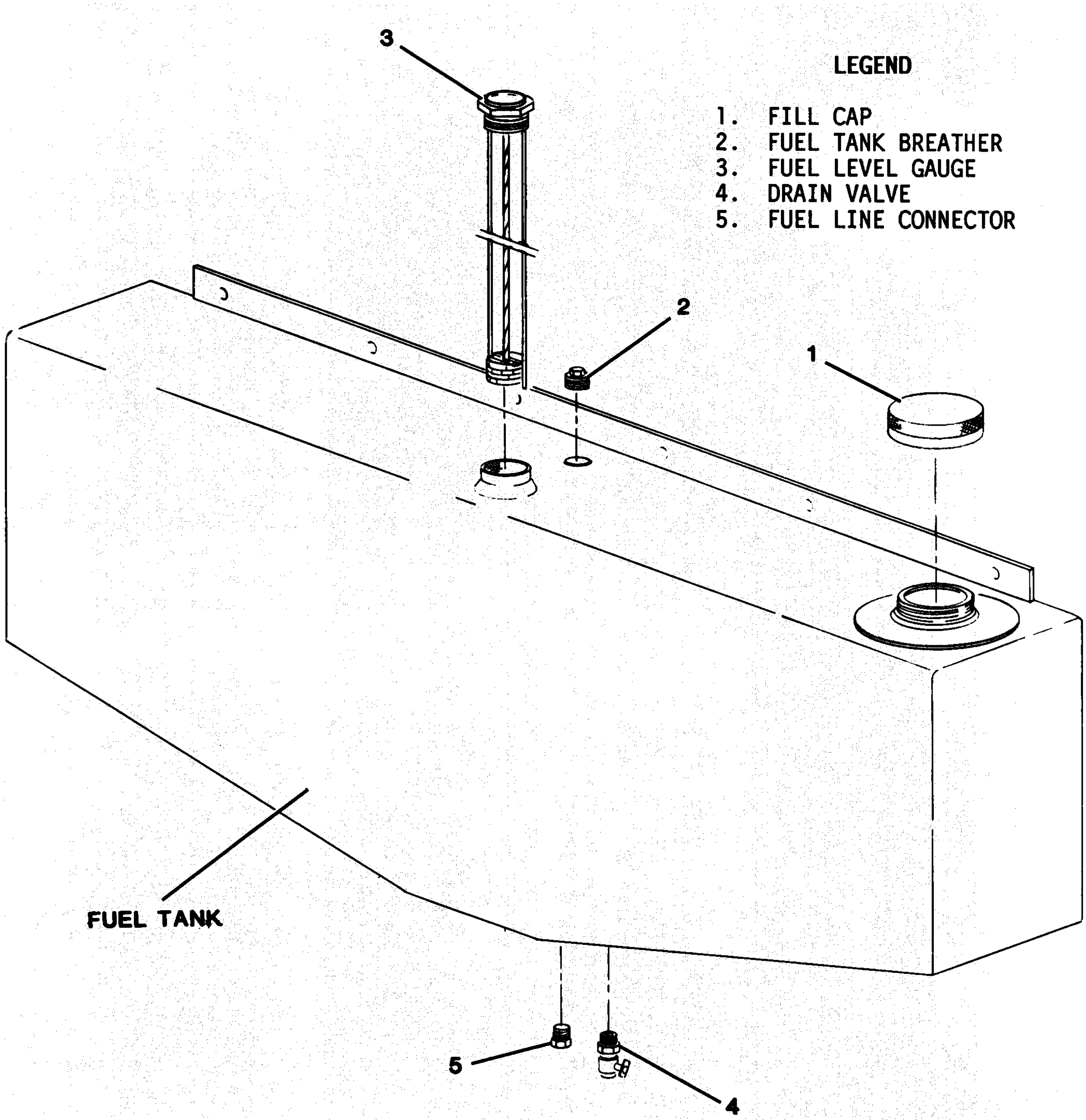


Figure 6-2. Engine Fuel Tank

6-3. ELECTRICAL HIGH PRESSURE FUEL PUMP. Maintenance of the electrical high pressure fuel pump (figure 6-3) consists of testing and repair.

a. Test.

(1) Remove electrical high pressure fuel pump in accordance with paragraph 4-41a, TM 5-6115-612-12.

(2) Connect pump in test setup as shown in figure 6-4.

(3) Open valves (3) and (6).

(4) Apply sufficient voltage to pump (7) to provide 50 psi reading on gage (4). Flowmeter (5) should show fuel flow greater than 46 PPH and voltage should be less than 12 Vdc.

(5) Apply sufficient voltage to pump (7) to provide 200 psi reading on gage (4). Flowmeter (5) should show fuel flow greater than 67 PPH and voltage should be less than 24 Vdc.

CAUTION

To prevent damage, do not allow pump to operate in deadhead condition for extended period of time. Immediately reduce pressure when gage reads in excess of 320 psi.

(6) Turn off power to pump (7) and close valve (6). Apply 12 Vdc to pump. Gage (4) should show pressure in excess of 320 psi. Immediately reduce voltage to pump or open valve (6) to prevent pump from operating under deadhead condition for extended length of time.

(7) Secure from test. If flowmeter and/or pressure gage readings are incorrect, pump is faulty and should be repaired or replaced.

b. Electric Motor Disassembly.

(1) Match mark both end bells with housing.

CAUTION

To prevent damage, maintenance on the electric motor shall be done on a clean, well-lighted surface.

(2) Remove plug (1, figure 6-5) and contact brush (2).

(3) Remove screws (3) and lift off rear end bell (4).

(4) Remove spring shim (5), solid shim set (6), and bearing cover (7). Set aside and keep in correct order.

(5) Match mark front end bell (8) with pump (9).

(6) Remove screws (10) to disconnect pump from front end bell. Pump is not repairable.

(7) Remove end bell and coupling (8.1).

(8) Carefully remove armature (13) from motor stator (12).

(9) Using an arbor press and V-notched wedge, remove ball bearings (14) and (15). Ensure that edges of wedge bear against inner race of bearing.

(10) Remove deflector (16) and shim set (17).

6-3. ELECTRICAL HIGH PRESSURE FUEL PUMP. (cont)

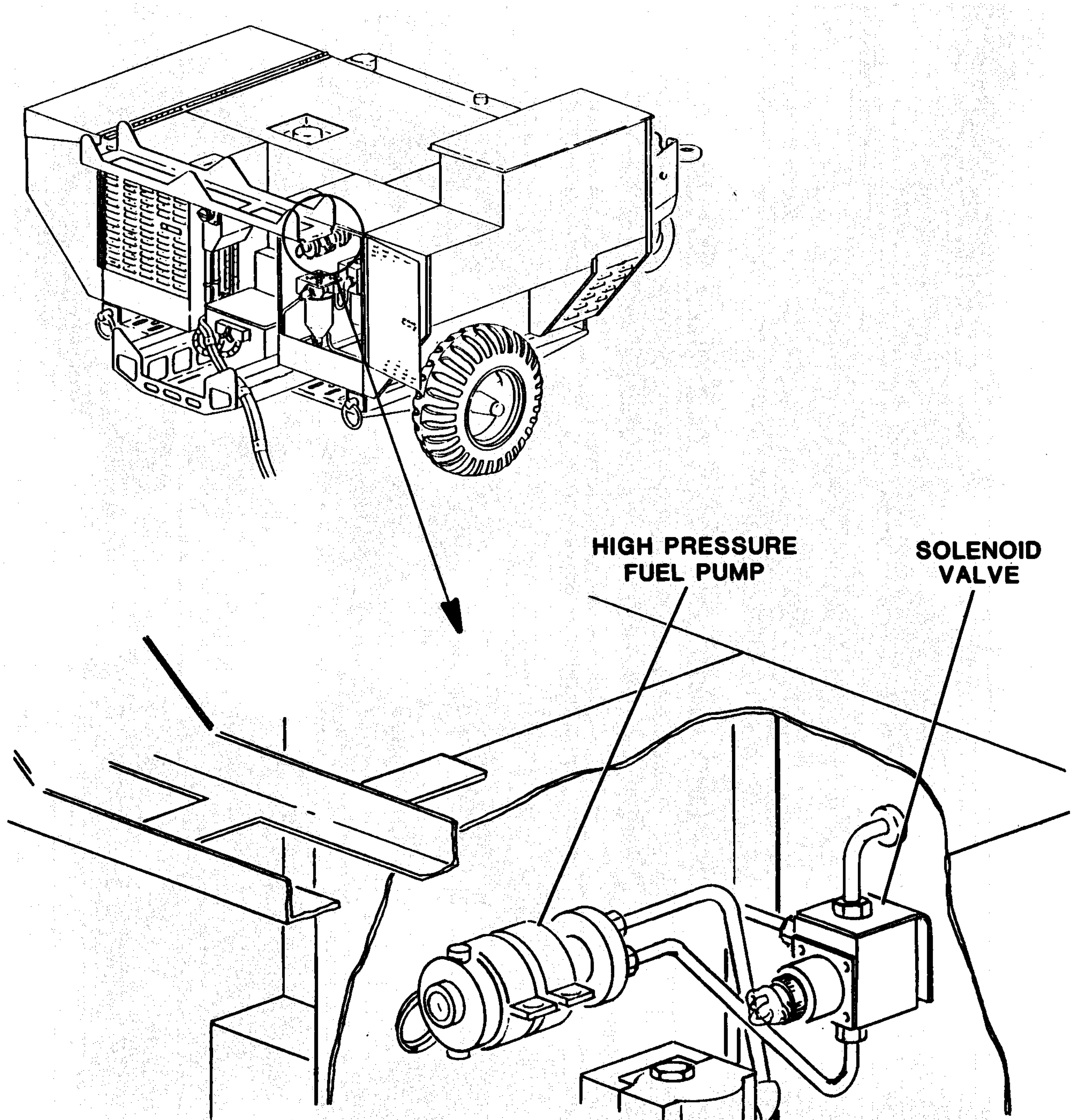
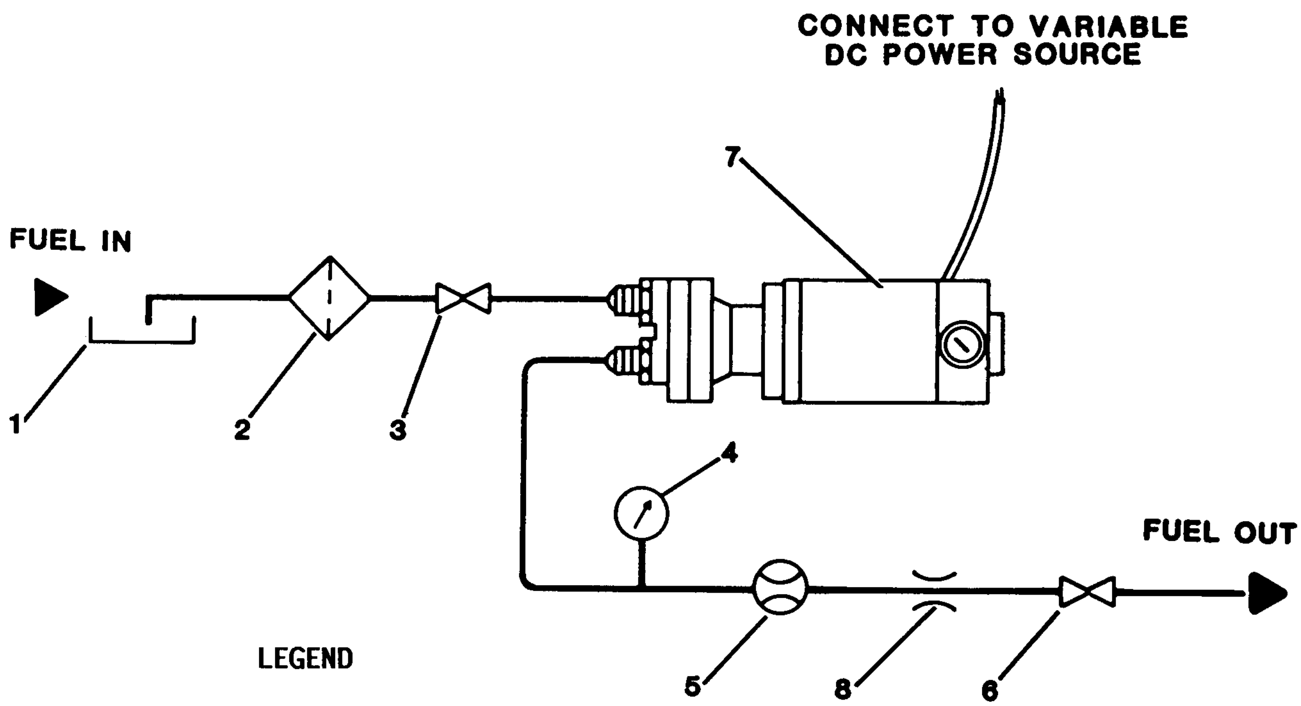


Figure 6-3. Electrical Fuel Pump (High Pressure) and Solenoid Valve

6-3. ELECTRICAL HIGH PRESSURE FUEL PUMP. (cont)

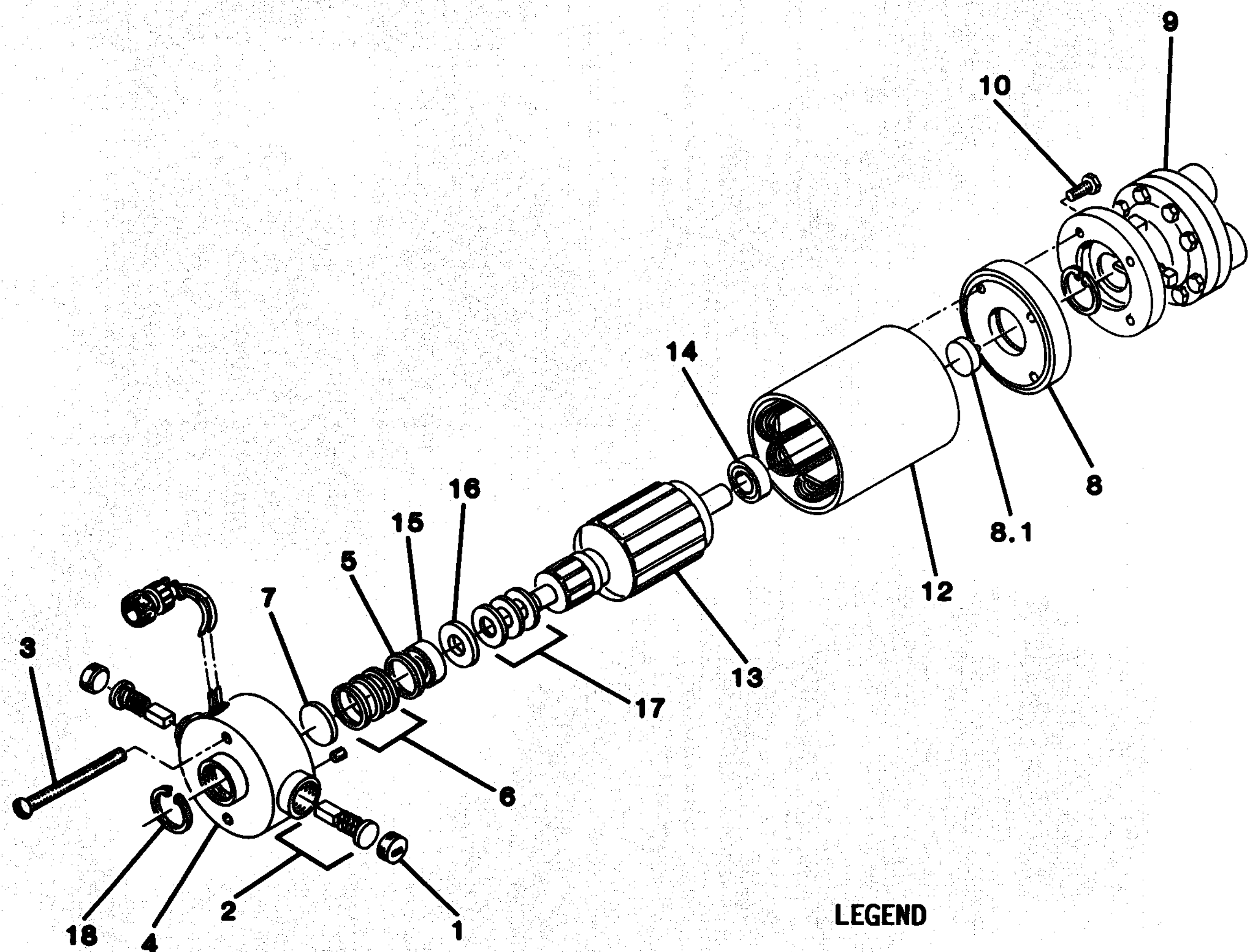


LEGEND

1. TANK
2. FILTER
3. VALVE
4. PRESSURE GAGE
5. FLOWMETER
6. VALVE
7. ELECTRICAL HIGH PRESSURE FUEL PUMP
8. FIXED RESTRICTION - ORIFICE 0.022 inch (0.055cm) DIAMETER

Figure 6-4. Electrical Fuel Pump (High Pressure) Test Setup

6-3. ELECTRICAL HIGH PRESSURE FUEL PUMP. (cont)



LEGEND

1. PLUG	10. SCREW
2. CONTACT BRUSH	11. DELETED
3. SCREW	12. MOTOR STATOR
4. REAR END BELL	13. ARMATURE
5. SPRING SHIM	14. BALL BEARING
6. SHIM SET	15. BALL BEARING
7. BEARING COVER	16. DEFLECTOR
8. FRONT END BELL	17. SHIM (IF REQUIRED)
8.1 COUPLING	18. RETAINING RING
9. PUMP	

Figure 6-5. Electrical Fuel Pump (High Pressure) Electric Motor Disassembly

6-3. ELECTRICAL HIGH PRESSURE FUEL PUMP. (cont)

c. Electric Motor Repair.

(1) Commutator Turning Procedure.

(a) Place commutator end of armature shaft in machine lathe with 1/4-inch collet. Support slotted end with female center.

(b) Set speed at 2000 rpm and turn a smooth finish to a maximum of 16 microinches. A diamond tool will usually give best results. Remove as little stock as is required in order to minimize burrs.

(c) Use stiff-bristled brush to remove any copper chips from commutator slots.

NOTE

If it is necessary to turn commutator to a diameter less than 0.700 inch (1.778 cm), replace armature.

(2) Replacing Broken Brush Guides.

(a) Remove setscrews (1, figure 6-6) from rear end bell (2) to release brush guides (3).

(b) Heat brass insert in brush guide with soldering iron. When solder is soft, pull terminal clip (4) and leadwire assembly (5) out of brush guide.

(c) Ensure that terminal clip is properly attached to leadwire and free of excess solder.

(d) Remove brush guide.

(e) Insert new brush guide. Ensure that set screw hole is alined with hole in rear end bell.

(f) Install set screws and tighten lightly. Put drop of thread-locking compound (MIL-S-46163) on each set screw.

(g) Make sure leadwire assembly is positioned as shown in figure 6-6.

(h) Push terminal clip into brush guide until it snaps into position. Solder in place.

(i) Position red lead against inside wall of rear end bell and secure with drop of silicone rubber.

d. Electric Motor Reassembly.

(1) Press bearing (14, figure 6-5) onto front armature shaft.

(2) Place shim set (17) and deflector (16) on rear armature shaft.

(3) Press bearing (15) onto rear armature shaft.

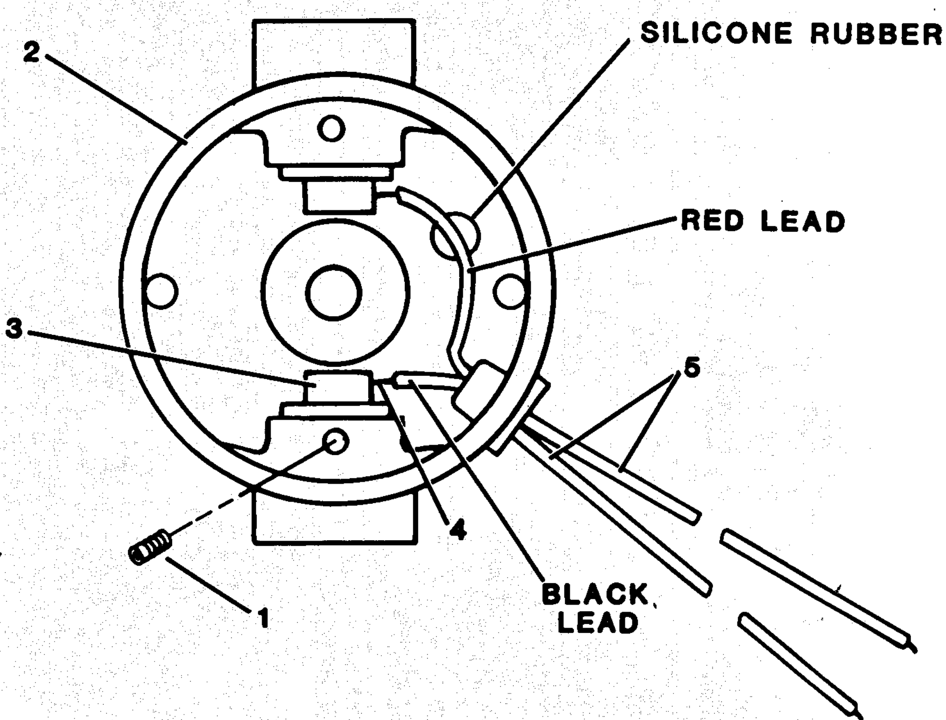
WARNING

To prevent injury, ensure that compressed air is used with caution. Wear eye protection and gloves.

(4) Use compressed air to remove excess carbon dust and other contamination from motor.

(5) Insert armature (13) into motor stator (12). Install coupling (8.1) and front end bell (8). Do not attach pump until after motor test (paragraph 6-3e).

6-3. ELECTRIC HIGH PRESSURE FUEL PUMP. (cont)



LEGEND

1. SETSCREW
2. REAR END BELL
3. BRUSH GUIDE
4. TERMINAL CLIP
5. LEADWIRE ASSEMBLY

Figure 6-6. Replacing Broken Brush Guide

6-3. ELECTRICAL HIGH PRESSURE FUEL PUMP (cont)

d. Electric Motor Reassembly. (cont)

(6) Remove retaining ring (18) from rear end bell.

(7) Place rear end bell (4) over armature and seat rim in housing. Aline match marks. Put drop of threadlock compound (MIL-S-46163) on screws (3). Install and tighten to 11 inch pounds (1.2 Nm).

(8) Place spring shim (5), solid shim set (6), and bearing cover (7) on top of bearing (15) and secure with retaining ring (18). Sharp edges of retaining ring should be toward motor.

(9) Insert contract brush (2). Ensure that the brush is alined properly with commutator.

(10) Install plug (1) and tighten gently. Place drop of staking enamel on each cap.

e. Electric Motor Test.

(1) Apply positive voltage to red lead and negative voltage to black lead. Ensure that motor runs clockwise when looking into shaft end.

(2) If new brushes have been installed, motor must run in at 27Vdc for at least 4 hours.

(3) After completion of test, connect pump to front end bell. Aline match marks and install screws. Torque screws to 32 inch lbs (3.6 Nm).

f. Electrical High Pressure Fuel Pump Installation. Install electrical high pressure fuel pump in fuel housing in accordance with paragraph 4-39b, TM 5-6115-612-12.

6-4. SOLENOID VALVE. Maintenance of the solenoid valve consist of testing and repair. See Figure 6-3 for location.

a. Test.

(1) Remove solenoid valve in accordance with paragraph 4-42a, TM 5-6115 612-12.

(2) Install solenoid valve in test setup as shown in Figure 6-7.

(3) Ensure valves (4 and 6) are closed.

(4) Actuate pump (1) to provide reading of 300psi + one gage (4).

(5) Open valve (4 and 6). No fuel should leak from drain or outlet ports. Gage (4) should still read 300 psi.

(6) Apply 18Vdc to solenoid valve (5). Fuel should flow from outlet port. No fuel should flow from drain port.

(7) Turn off power to solenoid valve. No fuel should flow from drain or outlet ports.

(8) Repeat steps (6) and (7) with 28Vdc.

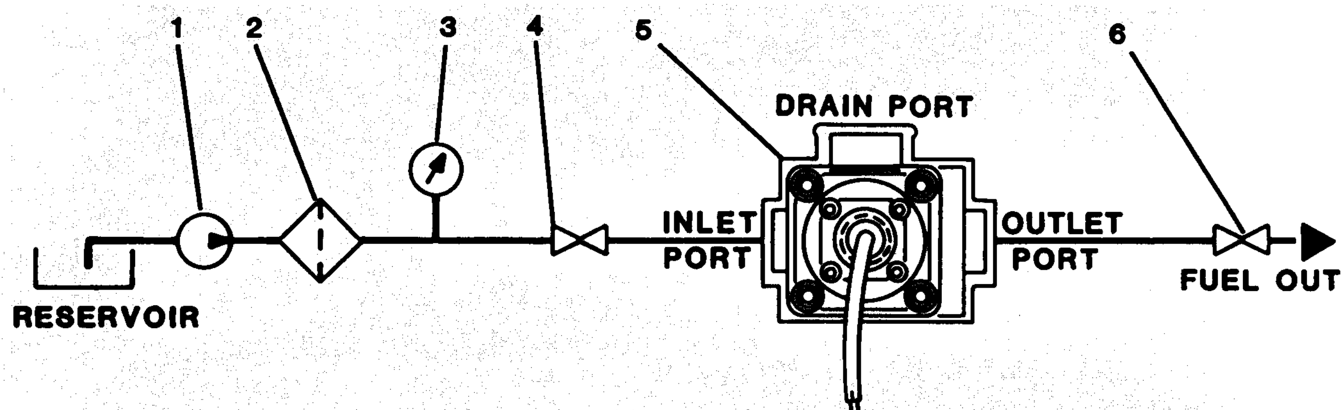
(9) Remove solenoid valve from test setup.

(10) Apply air at 25-30 psi to outlet port. There should be no air flow from either inlet or drain port.

(11) Apply 18Vdc to solenoid valve. Air should flow from drain port.

(12) If solenoid valve fails to operate properly, repair in accordance with paragraph 6-4c.

6-4. SOLENOID VALVE. (cont)



LEGEND

1. PUMP
2. FILTER
3. PRESSURE GAGE
4. VALVE
5. SOLENOID VALVE
6. VALVE

Figure 6-7. Solenoid Valve Test Setup

6-4. SOLENOID VALVE. (cont)

a. Test. (cont)

(13) If solenoid valve operates properly, install in accordance with paragraph 4-42c, TM 5-6115-612-12.

b. Disassembly.

(1) Remove solenoid valve in accordance with paragraph 4-42b, TM 5-6115-612-12.

(2) Remove lockwire, capscrews (1, figure 6-8) and washers (2).

(3) Pull electric receptacle connector (3) away from solenoid housing (7) far enough to expose electrical connection.

(4) Remove shrink tube. Tag and disconnect electrical connections. Remove electric receptacle connector.

(5) Deleted.

(6) Remove capscrews (5) and washers (6).

CAUTION

To prevent damage or loss of parts, use care when separating solenoid housing from valve body.

(7) Carefully separate solenoid housing (7) and valve body (21).

(8) Remove upper poppet (8), armature pin (9), solenoid armature (10), and solenoid plunger (11) from solenoid housing.

(9) Carefully pull housing tube (12) out of solenoid housing. Remove O-ring (13).

(10) Remove solenoid coil (14) from housing tube.

(11) Remove actuating pin (15) from valve seat (16).

(12) Apply low pressure air to inlet port until O-ring on top of valve seat (16) is visible. Pull valve seat out of valve body.

(13) Remove O-rings (17) from valve seat.

(14) Remove lower poppet (18), spring (19), and poppet housing (20) from valve body (21).

c. Repair. Repair is limited to replacing damaged parts or lapping and polishing the poppets and seats.

d. Reassembly.

(1) Ensure that poppet housing (20) is snug against bottom of valve body (21).

(2) Install spring (19) and lower poppet (18) in poppet sleeve.

(3) Lightly lubricate new O-rings (17) and install on valve seat (16).

(4) Press valve seat firmly into valve body until it is snug against poppet sleeve.

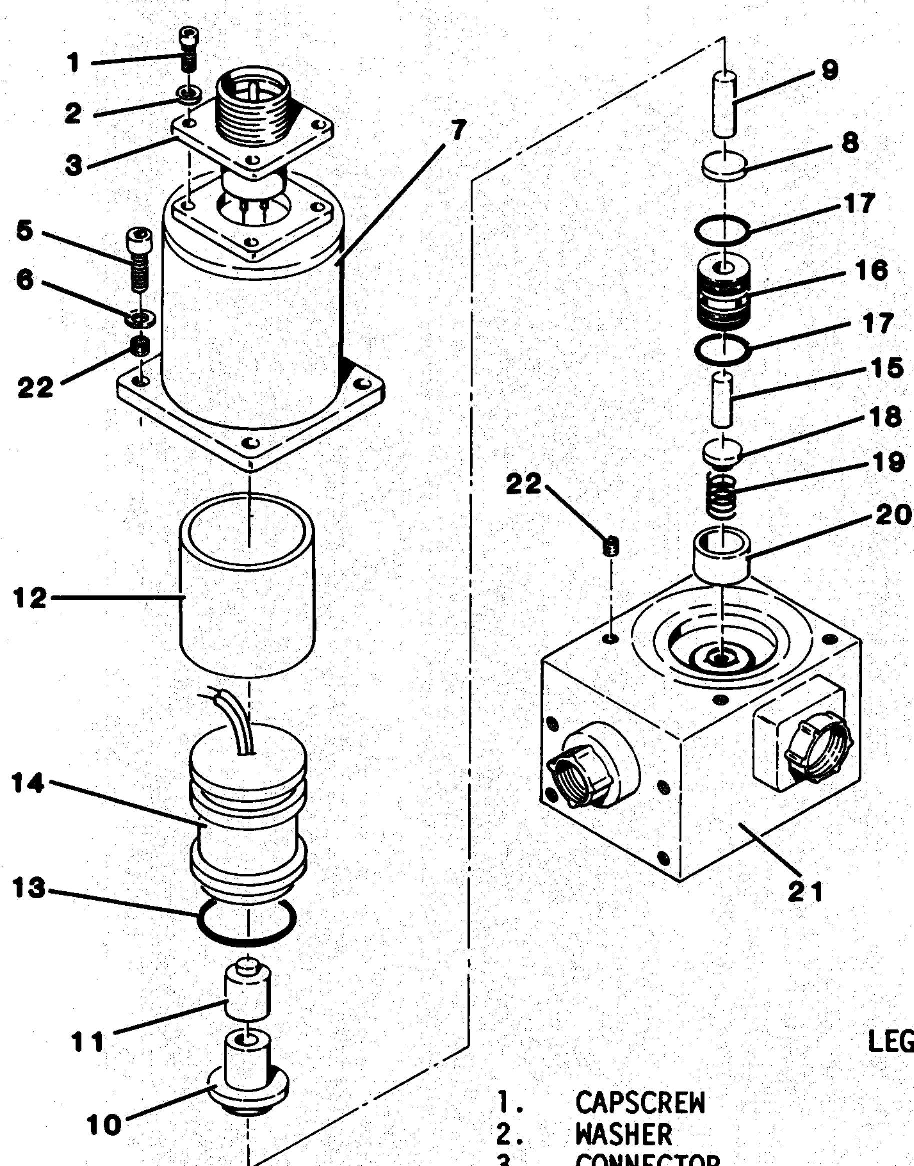
(5) Insert actuating pin (15) into valve seat until it rests on lower poppet.

(6) Install solenoid coil (14) in housing tube (12).

(7) Lightly lubricate new O-ring (13) and install in housing tube.

(8) Apply silicone sealer (RTV-157) to surfaces of valve body and housing tube as shown in figure 6-9.

6-4. SOLENOID VALVE. (cont)



LEGEND

1. CAPSCREW
2. WASHER
3. CONNECTOR
4. DELETED
5. CAPSCREW
6. WASHER
7. SOLENOID HOUSING
8. UPPER POPPET
9. ARMATURE PIN
10. SOLENOID ARMATURE
11. SOLENOID PLUNGER
12. HOUSING TUBE
13. O-RING
14. SOLENOID COIL
15. ACTUATING PIN
16. VALVE SEAT
17. O-RING
18. LOWER POPPET
19. SPRING
20. POPPET HOUSING
21. VALVE BODY
22. HELICAL COIL INSERT

Figure 6-8. Solenoid Valve Disassembly

6-4. SOLENOID VALVE. (cont)

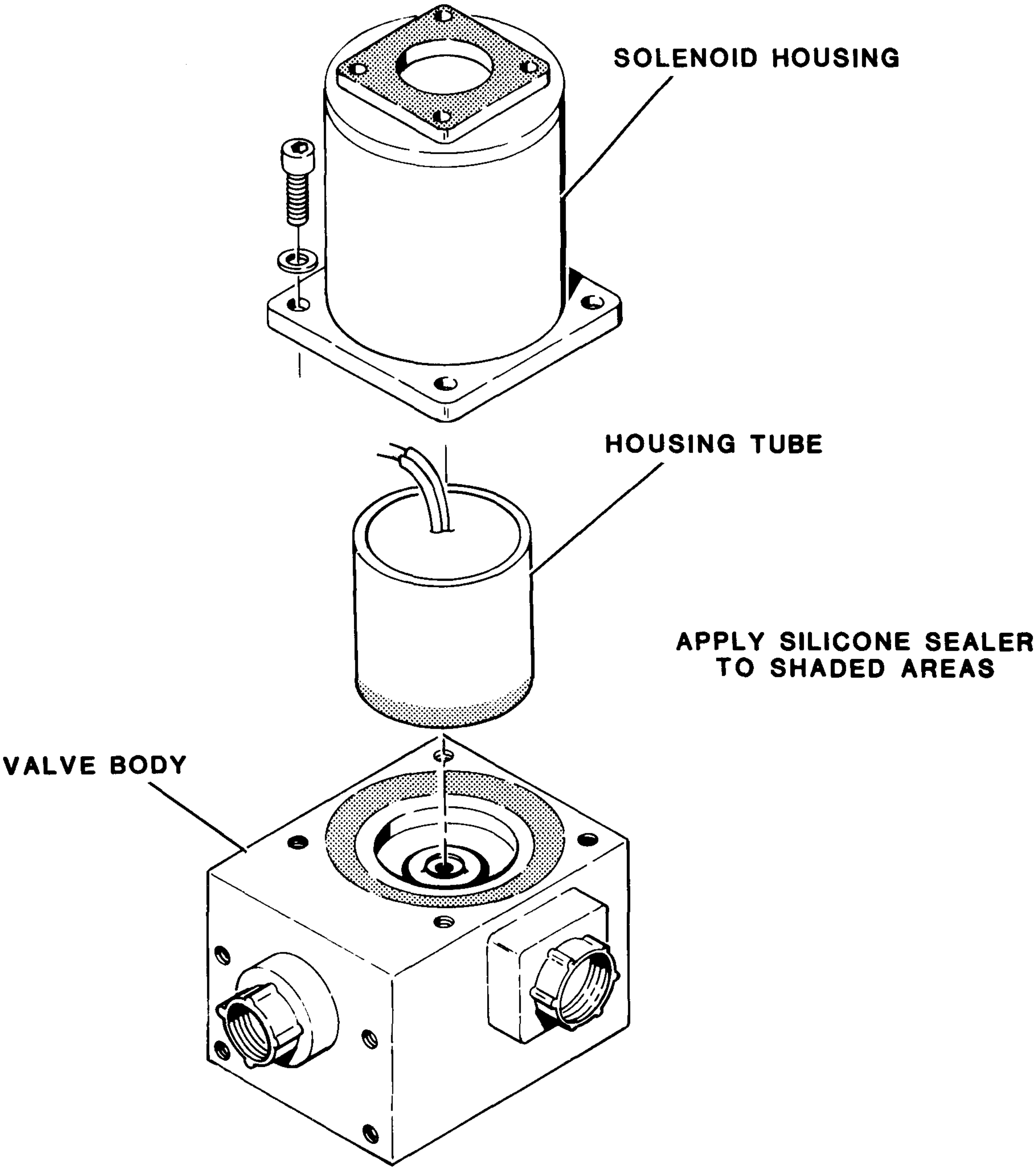


Figure 6-9. Silicone Sealer Application

6-4. SOLENOID VALVE. (cont)

d. Reassembly. (cont)

(8) Press housing tube into solenoid housing (7, figure 6-8). Press firmly to ensure proper mating. Remove any excess sealing material.

(9) In order, place solenoid plunger (11), solenoid armature (10), armature pin (9), and upper poppet (8) in housing tube.

(10) Aline mounting holes of solenoid housing and valve body. Secure with washers (6) and capscrews (5).

(11) Install shrink tube and connect wiring to electric receptacle connector (3).

(12) Apply silicone sealer (RTV-157) to top of solenoid housing as shown in figure 6-9.

(13) Aline mounting holes of electric receptacle connector and solenoid housing. Secure together with washers (2, figure 6-8) and capscrews (1).

(14) Lockwire all capscrews in accordance with MS33540.

(15) Install solenoid valve in accordance with paragraph 4-42c, TM 5-6115-612-12.

6-5. FUEL INJECTION NOZZLES. Maintenance of the fuel injection nozzles is limited to testing the spray quality of the atomizers.

a. Removal.

(1) Remove fuel injection nozzles and fuel manifold in accordance with paragraph 4-43, TM 5-6115-612-12.

(2) Clean nozzles and manifold (paragraph 4-43c, TM 5-6115-612-12).

(3) Reassemble, but do not install, fuel injection nozzles and manifold (paragraph 4-43d, TM 5-6115-612-12).

b. Test.

(1) Install fuel manifold in test setup similar to one shown in figure 6-10. Test setup must be capable of providing fluid at 190-210 psi (1.3-1.5 Mpa) with a flow rate of 20-22 pounds per hour (9.1-10 kg/h). Test fluid shall conform to MIL-C-7024, type II, and shall be kept at 76-84°F (24.4-28.8°C).

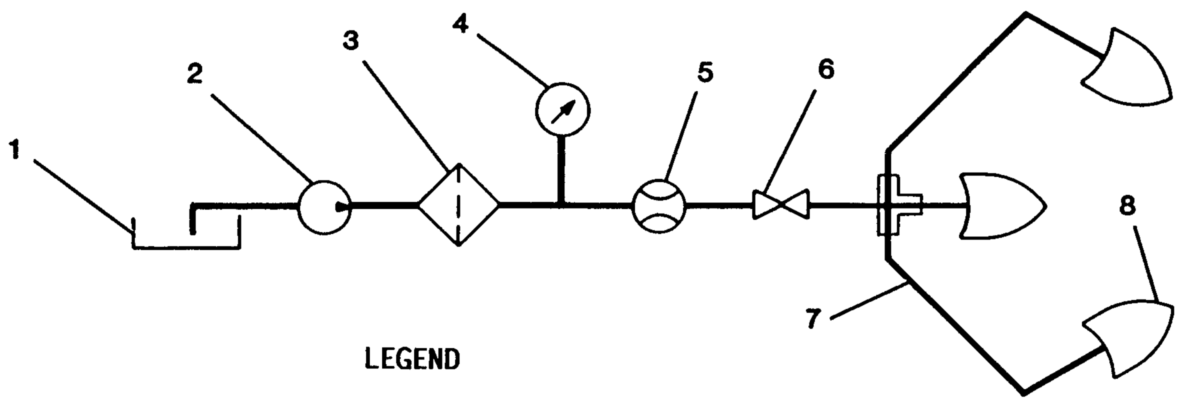
(2) Start test setup and fully open valve. Adjust as necessary to meet psi and flow rate requirements above.

(3) Observe spray patterns at each atomizer. The spray should be finely divided droplets in the form of a cone. Compare spray patterns with those shown in figure 6-11.

(4) If spray patterns do not compare favorably with satisfactory patterns shown in figure 6-11, or if fluid bubbles, runs, or spits from atomizer, replace atomizer (paragraph 4-43, TM 5-6115-612-12).

c. Installation, Install fuel injection nozzles in accordance with paragraph 4-43d, TM 5-6115-612-12.

6-5. FUEL INJECTION NOZZLES. (cont)



LEGEND

1. RESERVOIR
2. PUMP
3. FILTER
4. PRESSURE GAGE
5. FLOWMETER
6. VALVE
7. FUEL MANIFOLD
8. FUEL INJECTION NOZZLE

Figure 6-10. Fuel Injection Nozzle Test Setup

6-5. **FUEL INJECTION NOZZLES.** (cont)

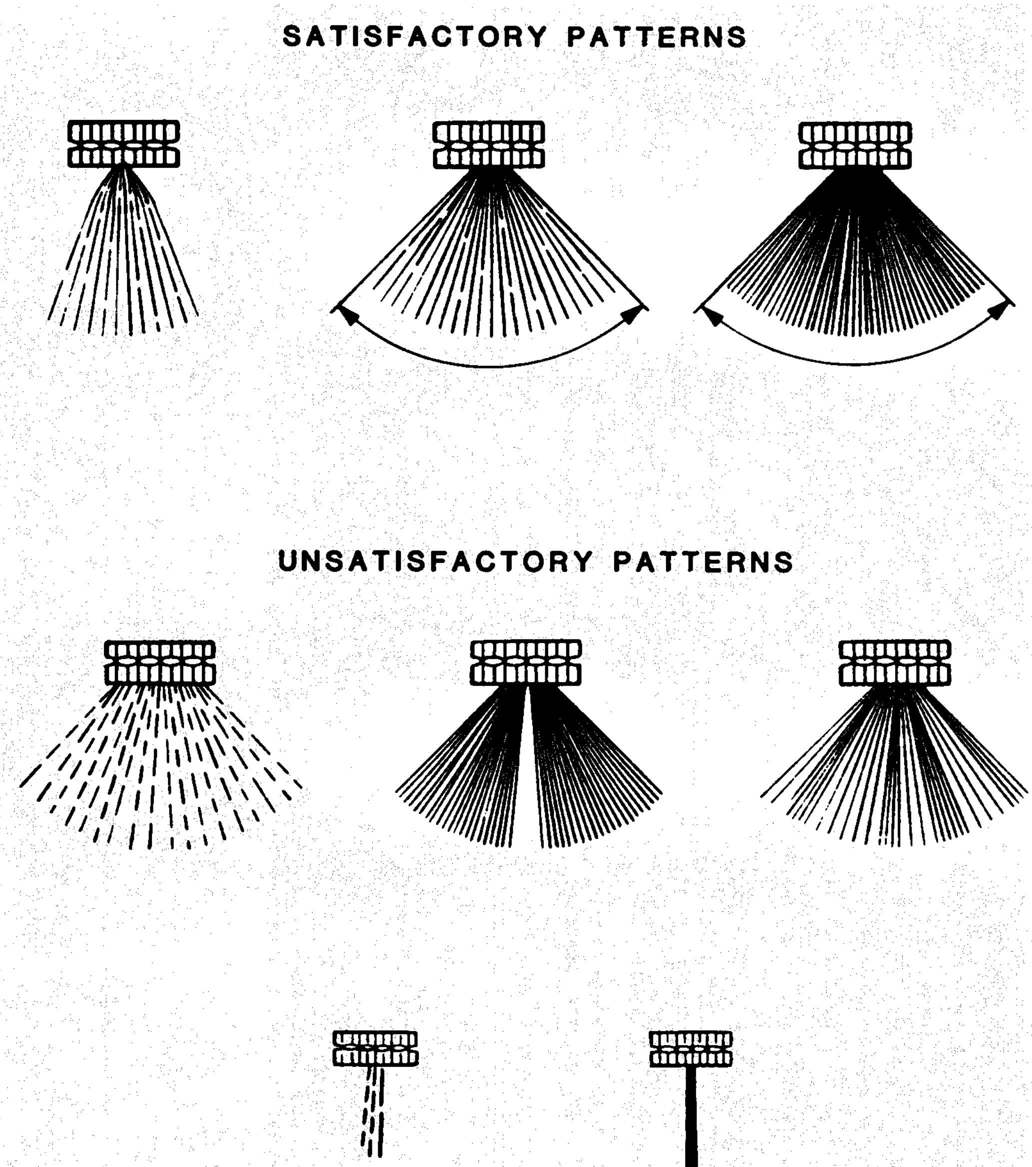


Figure 6-11. Fuel Injection Nozzle Spray Patterns

CHAPTER 7

MAINTENANCE OF LUBRICATION SYSTEM

7-1. PURPOSE AND FUNCTION OF LUBRICATION ASSEMBLY. The lubrication system (figure 7-1) consists of a reservoir, oil filter, pressure relief valve, low pressure switch, oil pump, oil breather, oil cooler and the conneting lines and fittings. Component locations are shown in figure 7-2. The function of the lubrication system is to lubricate the engine bearings and the bearings and gears located inside the gearbox. Lubricating oil is drawn from the gearbox reservoir by the oil pump. The oil passes through the reservoir strainer, the oil pump, past the pressure relief valve to the filter. The oil is filtered then pumped onward where part of it is used to lubricate the engine bearings and the gearbox components and part of it is diverted through the oil cooler and back into the reservoir. After lubricating the turbine bearings, the oil passes through the rear bearing scavenge line and is returned to the reservoir. Oil used to lubricate the internal gearbox components drains directly to the reservoir.

7-2. OIL PRESSURE RELIEF VALVE.

a. Testing. Testing of the oil pressure relief valve (figure 7-3) is normally accomplished during the test cell run. Refer to the engine test cell procedures, paragraph 13-8.

b. Removal.

(1) Loosen turnlock fasteners and remove engine housing access cover.

(2) Bend back tab on tab washer (2) and remove spring clip (1).

(3) Remove and discard tab washer (2).

(4) Screw 10-32 bolt into top of oil pressure relief valve (3). valve out of gearbox.

(5) Remove preformed packing (4) and (5) from valve. Discard preformed packing.

c. Installation.

(1) Install new preformed packing (4) and (5) on pressure relief valve (3).

(2) Press on outer rim of valve; install valve in gearbox.

(3) Install new tab washer (2).

(4) Install spring clip (1).

(5) Bend tab of tab washer up and over spring clip.

(6) Install engine housing access cover and secure with turnlock fasteners.

7-1. PURPOSE AND FUNCTION OF LUBRICATION ASSEMBLY. (cont)

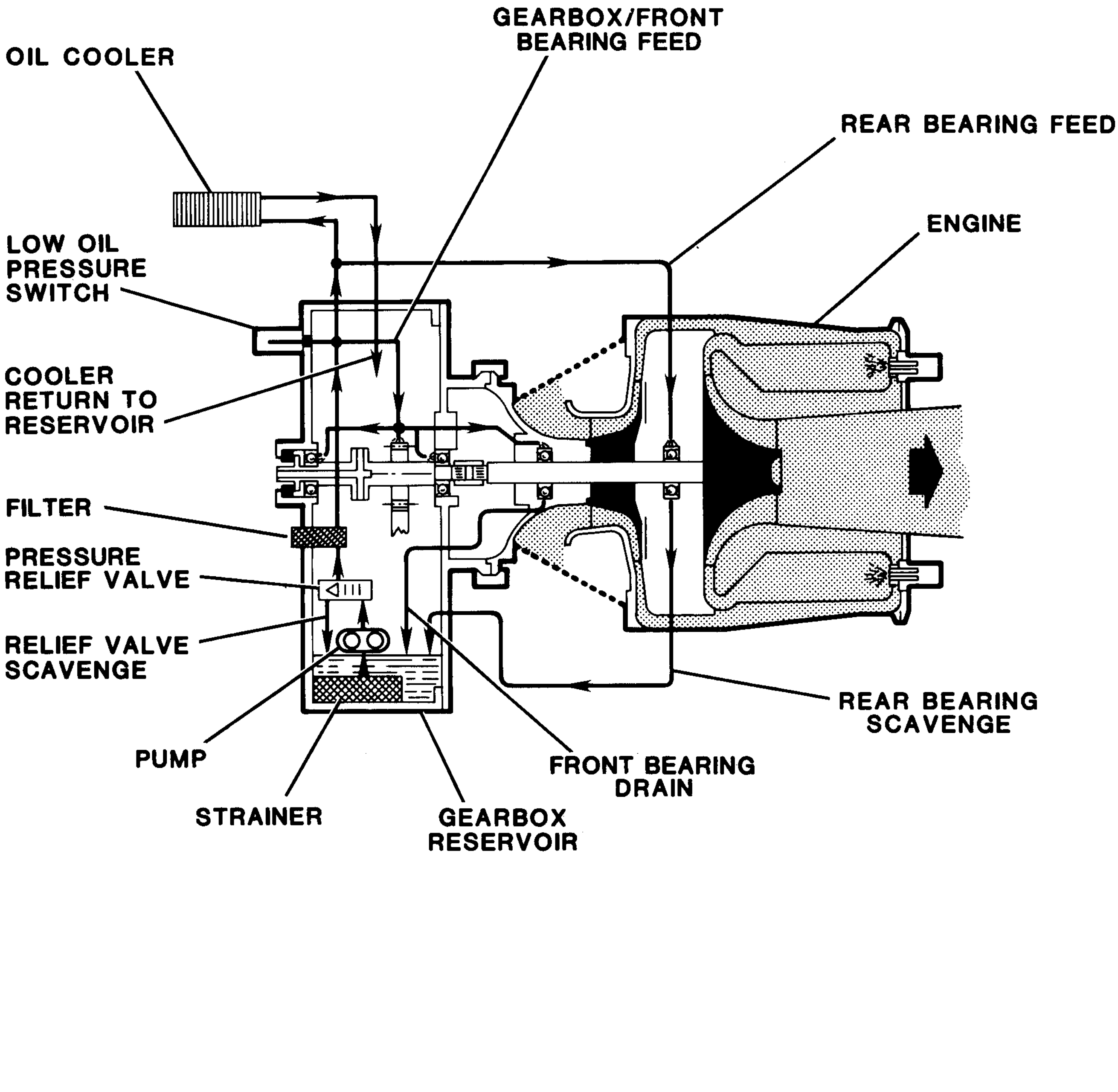


Figure 7-1. Lubrication System

7-1. PURPOSE AND FUNCTION OF LUBRICATION ASSEMBLY. (cont)

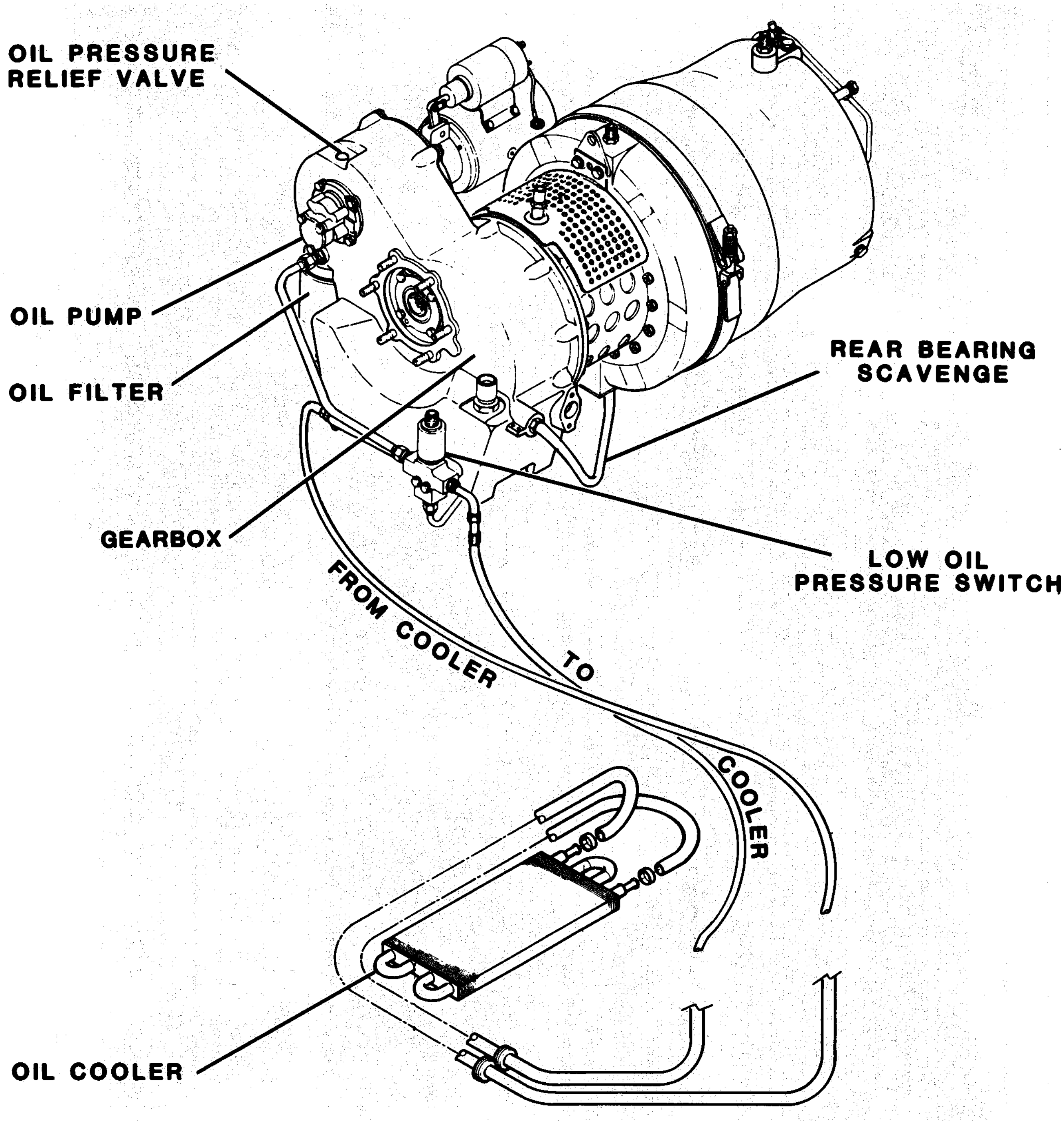


Figure 7-2. Lubrication System Components

7-2. OIL PRESSURE RELIEF VALVE. (cont)

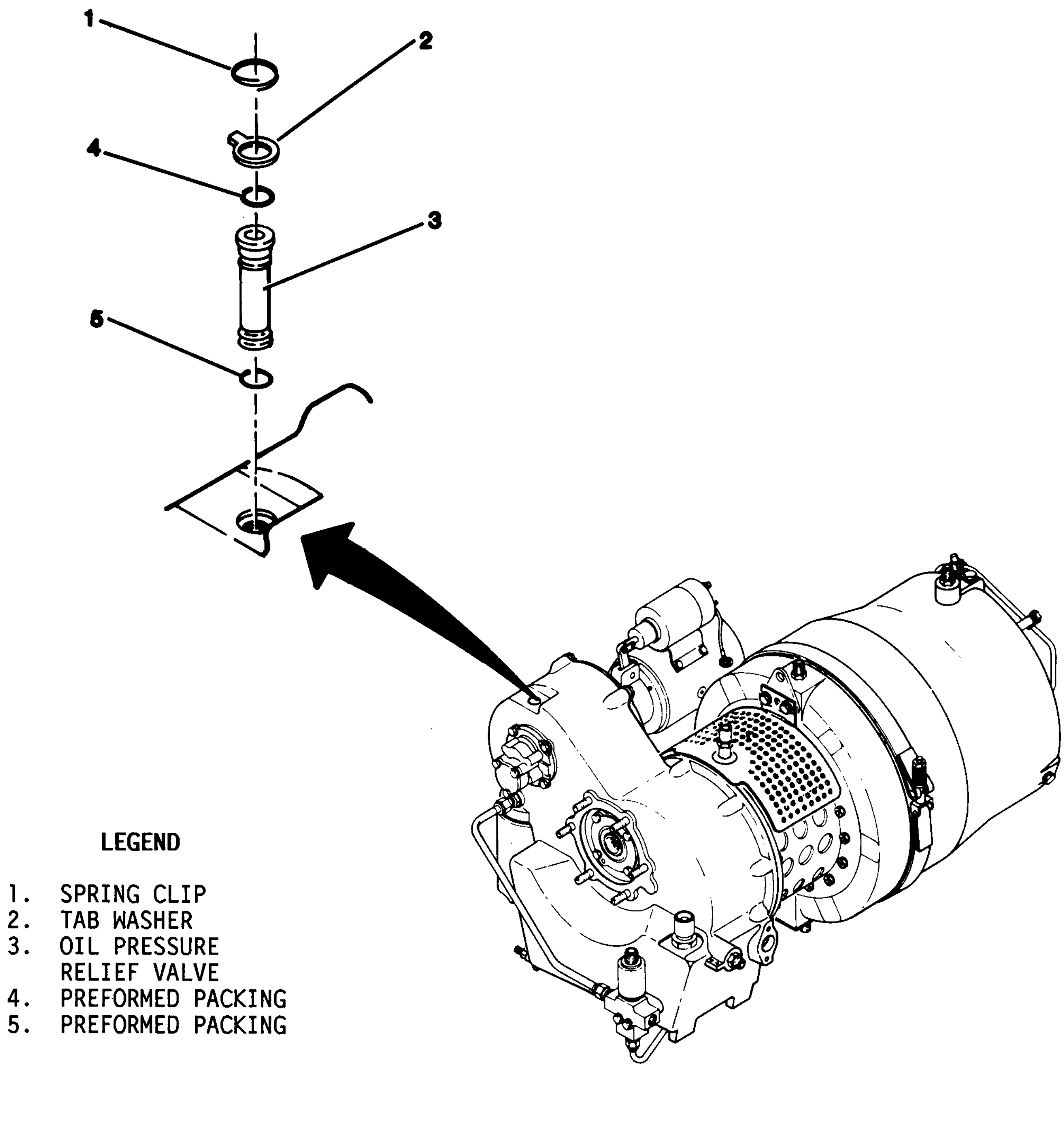


Figure 7-3. Oil Pressure Relief Valve Installation

7-3. OIL COOLER.

a. Removal.

WARNING

To prevent injury, ensure that handbrake is set and wheels are chocked while working under generator set.

(1) Set handbrake and chock both wheels.

(2) Remove screws (1, figure 7-4), washers (2) and oil cooler housing (3).

(3) Remove screws (4) and washers (5) that secure oil cooler mounting brackets (6) to generator set.

(4) Tag, disconnect, and cap oil cooler supply and return lines. Remove oil cooler (7), with mounting brackets attached, from generator set.

b. Installation.

(1) Place oil cooler, with mounting brackets (6) attached, into generator set.

(2) Uncap and connect oil cooler return and supply lines. Remove tags.

(3) Secure oil cooler mounting brackets (6) to generator set with washers (5) and screws (4). Torque to 24-36 inch pounds (2.7-4.1 Nm).

(4) Put oil cooler housing (3) into position and secure with washers (2) and screws (1). Torque to 24-36 inch pounds (2.7-4.1 Nm).

(5) Remove chocks and release handbrake.

7-3. OIL COOLER. (cont)

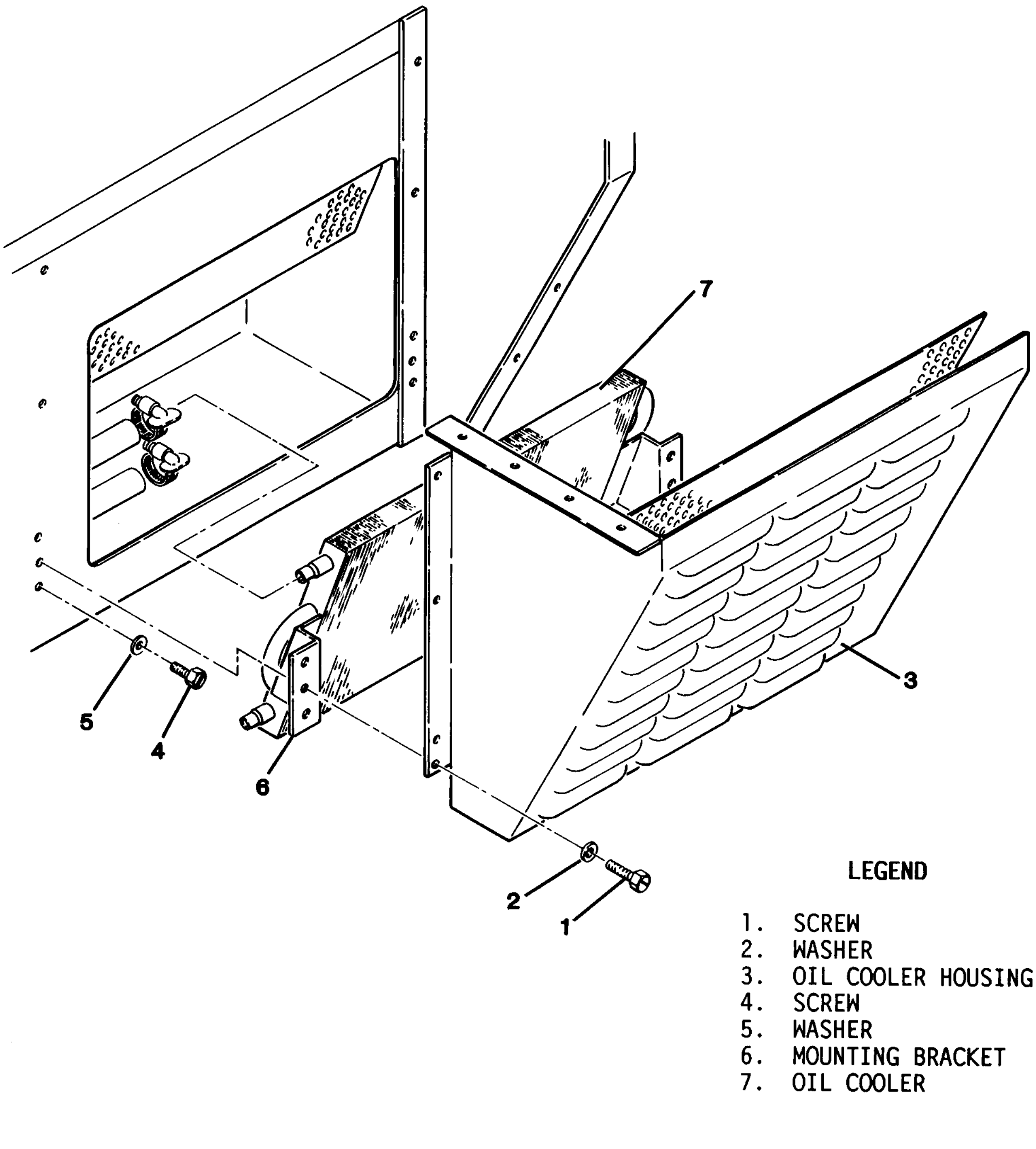


Figure 7-4. Oil Cooler Replacement

7-4. OIL PUMP. Maintenance of oil pump (Figure 7-5) consist of replacement and repair.

a. Removal.

(1) Loosen turnlock fasteners and remove engine housing access cover.

NOTE

DO NOT remove shouldered driveshaft (16) prior to oil pump disassembly if shouldered quill shaft (13) rotates freely by hand.

(2) Remove lockwire, bolts (1) and washer (2). Carefully remove oil pump assembly (3) and performed packings (4 and 5) from gearbox.

(3) Remove capscrews (6) from housing cover (7). On housing cover (7), insert two 1-1/2 inch (3.81 cm) socket head capscrews into the holes provided to be used as jackscrews. Alternately tighten jackscrews to separate cover from oil pump housing (23). If damaged, remove helical coil inserts (8).

NOTE

Housing cover (7) and oil pump housing (23) come as a matched set.

(4) Remove idler spur gear (9) and preformed packing (10) from idler shaft (11).

(5) Remove idler shaft (11) from oil pump housing (23).

(6) Lift pump spur gear (12) off shouldered quill shaft (14).

(7) Remove drive pin (13) from shouldered quill shaft (14). Remove shouldered quill shaft.

(8) Remove shouldered quill shaft (14) from shouldered drive shaft (21).

(9) Remove bolts (15), washers (16), and housing access cover (17) from front of oil pump housing (23).

(10) Remove performed packing (18) from housing access cover (17). Discard packing.

(11) If damaged, remove helical coil inserts (19) from oil pump housing (23).

(12) Pressing on back of shouldered drive shaft (21), remove retaining ring (20).

(13) Remove shouldered drive shaft (21) from oil pump housing (23).

(14) Remove performed packing (22) from oil pump housing (23). Discard packing.

b. Repair. Repair of the oil pump is accomplished by replacing damaged parts.

c. Installation.

NOTE

All parts, excluding preformed packings, should be rinsed in clean alcohol before assembly.

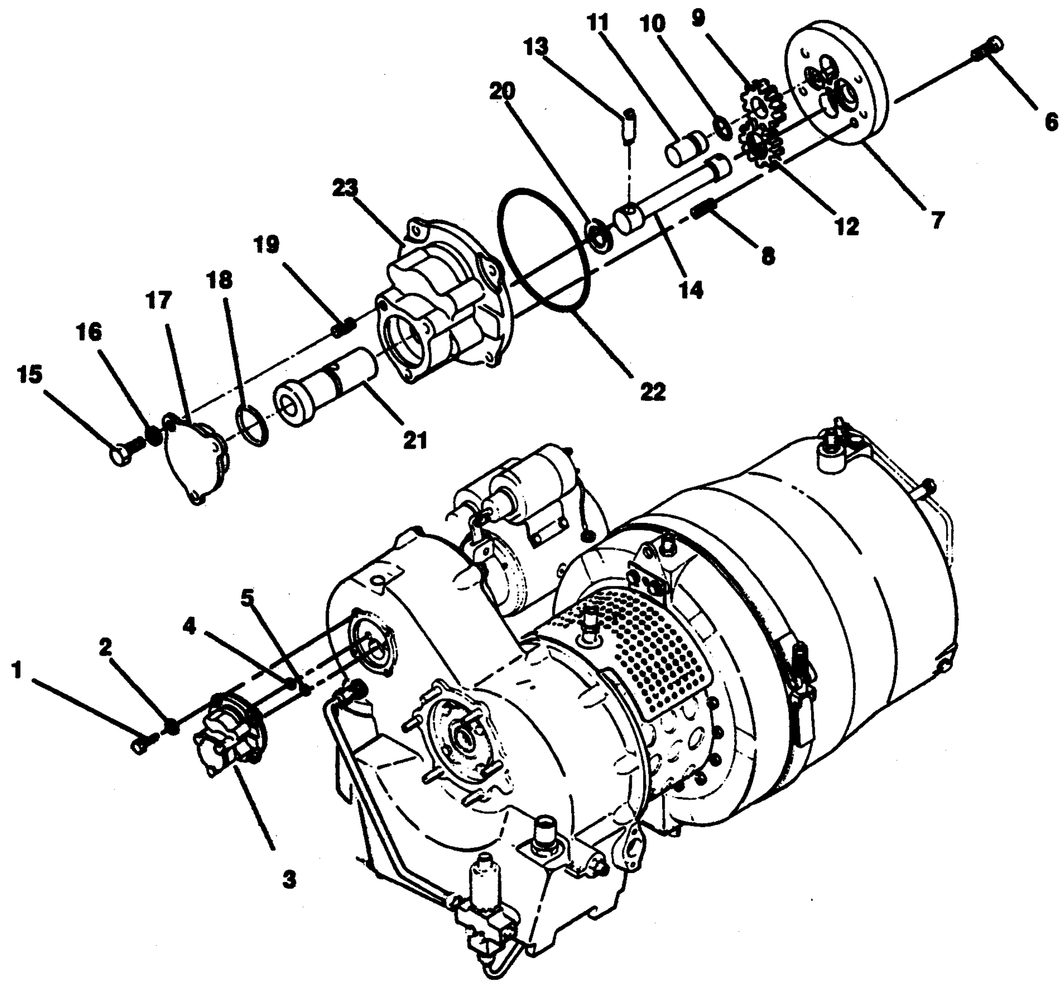
(1) Install performed packing (22) in housing (23). Discard packing.

(2) Carefully place shouldered drive shaft (21) in housing (23).

(3) Pressing on back of shouldered drive shaft (21) and install retaining ring (20).

(4) If removed, install new helical coil insert (19) in oil pump housing (23).

7-4. OIL PUMP. (cont)



LEGEND

1. BOLT
2. WASHER
3. OIL PUMP ASSEMBLY
4. PERFORMED PACKING
5. PERFORMED PACKING
6. CAPSCREW
7. HOUSING COVER
8. HELICAL COIL INSERT
9. IDLER SPUR GEAR
10. PERFORMED PACKING
11. IDLER SHAFT
12. PUMP SPUR GEAR
13. DRIVE PIN
14. SHOULDERED QUILL SHAFT
15. BOLT
16. WASHER
17. HOUSING ACCESS COVER
18. PERFORMED PACKING
19. HELICAL COIL INSERT
20. RETAINING RING
21. SHOULDERED DRIVE SHAFT
22. PERFORMED PACKING
23. OIL PUMP HOUSING

7-4. OIL PUMP. (cont)

c. Installation. (cont)

(5) Install performed packing (18) on housing access cover (17).

(6) Install housing access cover (17), washers (16), and bolts (15). Torque bolts to 20-25 inch pounds (2.3-2.8 Nm).

(7) Carefully install shouldered quill shaft (14) in shouldered drive shaft (21) with slotted end out. Secure shafts together with drive pin (13).

NOTE

Gear is slotted to fit over drive pin.

(8) Install pump spur gear (12) on shouldered drive shaft (14)

(9) Install idler shaft (11) in oil pump housing (23).

(10) Install new preformed packing (10) and idler spur gear (9) on idler shaft (11).

(11) If removed, install new helical coil inserts (8).

NOTE

Housing cover (6) and oil pump housing (23) come as a matched set.

NOTE

It may be necessary to cool housing cover (7) approximately 10-15 minutes in an alcohol and dry ice solution to ease installation.

(12) Install housing cover (7) in housing (23) with capscrews (6). Torque capscrews to 15-18 inch pounds (1.7 -2.0 Nm).

(13) Install new performed packings (4 and 5) * in gearbox.

NOTE

Insure shaft rotates freely by hand prior to installation.

(14) Carefully place assembled oil pump assembly (3) in gearbox and secure with washers (2) and bolts (1). Torque bolts to 27-30 inch pounds (3.1-3.4 Nm).

(15) Install engine housing access cover and secure with turnlock fasteners.

CHAPTER 8

MAINTENANCE OF ENGINE

8-1. GENERAL. The gas turbine engine consists of the combustion chamber case assembly, turbine assembly, and the gearbox. The engine is a single-shaft design with the compressor and turbine wheels mounted on a common shaft. Power produced by the turbine wheel is transmitted by the shaft to the generator and oil pump drive assemblies in the gearbox.

a. Combustion Chamber Case Assembly. During engine operation, air is drawn in through the compressor air inlet, compressed by the vanes of the compressor impeller, and distributed to the outer chamber of the combustion chamber case. The compressed air then passes through holes in the combustion chamber and through three fuel injection nozzles spaced evenly around the chamber. Fuel is atomized in the fuel injection nozzles, mixed with the compressed air, and injected into the combustion chamber where it is ignited by the spark igniter. Once combustion has started, the igniter is deenergized and combustion is self-sustaining.

b. Turbine Assembly. The burning fuel in the combustion chamber expands rapidly and is forced through the vanes of the turbine nozzle and against the vanes of the turbine wheel. This causes the turbine wheel to rotate. This rotary motion is transmitted to the shaft which then transmits it to the accessory drives located in the gearbox.

c. Gearbox Assembly. The generator shouldered shaft imparts rotary power to the generator and oil pump drive assemblies in the gearbox. The rotary power is picked up by a pinion spur gear that turns the output spur gear. The output spur gear transmits the power to the generator shouldered shaft and to the starter spur gear. The starter spur gear transmits the power to a quill shaft that drives the oil pump gear.

d. Overhaul. The overhaul procedures follow the methods and use the specifications recommended by the manufacturer for the successful overhaul of the major components of the gas turbine engine. Due to the precision fit of components, all tolerance specifications and torque values should be strictly followed. Long engine life and efficient operation depend on the care and precision with which inspections, repairs, and adjustments are made. Terminology used in relation to general defects is defined in table 8-1.

(1) Note the following:

(a) The inspection area must be thoroughly clean and the air should be constantly filtered.

(b) The area must be well lighted.

(c) Cover inspection tables with clean, dry paper. Keep special gages and indicators in cabinet lockers when not in use.

(d) Openings uncovered during inspection and repair shall be closed with appropriate covers, plugs, or caps. DO NOT USE TAPE.

(e) Inspection limits set forth in this manual are manufacturing and normal wear limits. Before condemning a part, check the specifications for operating limits with the mating part. In many instances, mating or seating surfaces for ball or roller bearings, oil seals, and friction bearings on

8-1. GENERAL. (cont)

d. Overhaul. (cont)

Table 8-1. General Defect Definitions

Term	Definition	Probable cause
Abrasion	A roughened area. Can be defined as light to heavy dependent upon amount of rework necessary to restore surface.	Foreign particles between moving parts.
Blistering	Raised areas indicating separation of the surface from the base. Usually found on plated or painted surface.	Imperfect bond with base, usually aggravated by presence of moisture, gas, heat, pressure, or chemicals.
Brinelling	Indentations sometimes found on surfaces of ball or roller bearing parts. NOTE Bearings which do not have full constant rotation and are subjected to shock loading have brinelling tendencies.	Improper assembly or disassembly technique, such as removing or installing a roller or ball bearing by pressure on free race.
Burning	Damage to surfaces by excessive heat. Evidenced by discoloration or sometimes by flow or loss of metal.	Improper clearances or lack of lubrication due to plugged oil passages, etc.
Burrs	A sharp projection or rough edge.	Careless handling or improper machining.

8-1. GENERAL. (cont)

d. Overhaul. (cont)

Table 8-1. General Defect Definitions - (Continued)

Term	Definition	Probable Cause
Chafing	A rubbing action between two parts having limited relative motion.	Improper assembly techniques, improper fits.
Chipping	Breaking out of small particles of metal.	Careless handling, concentration of stresses due to shock, nicks, scratches, etc.
Corrosion	Breakdown or pitting of surface by chemical action.	Improper surface treatment, wear or damage on treated surfaces.
Cracks	A partial failure.	Excessive stress due to shock, overloading or faulty processing, extension of a nick or scratch, defective material, overheating.
Dents	Small, smoothly rounded hollow in surface.	Careless handling.
Erosion	Carrying away of material by the flow of hot gases, grit, or chemical.	Blow-by, flow of corroding liquids, hot gases, grit-laden oil water, or sand.
Flaking	Breaking away of pieces of a plated or painted surface.	Incomplete bond, excessive load, blistering.
Galling	A transfer of metal from one surface to another.	Severe chafing action, metal particles from relative parts are embedded in opposite surfaces.

8-1. GENERAL. (cont)

d. Overhaul. (cont)

Table 8-1. General Defect Definitions - (Continued)

Term	Definition	Probable Cause
Grooving	Smooth, rounded furrows, such as score marks whose sharp edges have been polished off.	Concentrated wear, parts out of alinement, foreign particles in unit during operation.
Metal Buildup	Forming of high spots between stationary and rotating parts.	Misalinement of rotating parts.
Nicks	A sharp indentation.	Careless handling or fine foreign particles in unit during operation.
Peening	Deformation of surface.	Repeated impact of foreign object.
Scoring	Deep scratches.	Presence of foreign particles between loaded surfaces having relative motion.
Scratches	Narrow, shallow marks on surface.	Careless handling.

shafts and shaft gears worn beyond limits specified in the manual can be economically restored to a serviceable condition by grinding and plating in accordance with QQ-C-320, or metalizing and grinding to standard blueprint dimensions. Stationary parts with cracks or elongated inserts, bolt or stud holes, eroded or otherwise damaged surfaces may be repaired by sleeving, bushing, welding, nickel brazing, or metalizing and machining to blueprint dimensions. All welding, nickel brazing, and metalizing shall be performed by certified operators. The metallurgical bond shall be certified as being serviceable for the assigned functions of the part to which the metal has been applied. The metallurgical bond shall be checked on all parts

8-1. GENERAL. (cont)

d. Overhaul. (cont)

manufactured of materials not previously proven in service and on proven parts in sufficient quantities to assure good quality control on the process being used. No flame or arc welding shall be used on rotating parts such as turbine wheels, compressor wheels, shafts, or gears. Unless specifically forbidden by other portions of this manual, the above procedures shall be applied toward repair of all parts applicable to this engine.

(f) During both removal and disassembly procedures, check parts and components for wear and damage before cleaning. Fine metallic particles present in a lubricant are evidence of wear that would be lost during cleaning operations.

(g) Parts shall be inspected by experienced personnel using good shop practice. A careful visual inspection should precede any detail check to eliminate unnecessary inspection procedures and to determine the extent of further checking. Inspection requirements in this section are provided as the basis for setting up inspection procedures.

CAUTION

To prevent damage, do not use lead or wax base pencils for marking on high temperature alloy parts. Carbon/wax in pencils is detrimental to parts. Use red ink felt pens or grease base pencils.

(h) Check all micrometers, gages, indicators, and other measuring instruments periodically. Calibrate in accordance with MIL-STD-120 or with applicable manufacturer instructions.

(i) Good shop practices include complete and accurate inspection records. Records not only simplify reworking of the equipment, but also ensure a complete and thorough overhaul. Inspection records should be based upon the requirements outlined in this section. Parts needing rework or replacement should be so tagged, and a notation of the disposition of these parts should be entered on the inspection records. The same method should be followed for parts needing special treatment, such as magnetic or fluorescent inspections, painting, cadmium plating, and similar treatments.

8-2. CONBUSTION CHAMBER CASE ASSEMBLY.

a. Removal.

NOTE

See table 2-3, Fabricated Tools and Equipment, for fabricating dimensions and specifications for all FT-21XXX numbers referenced in the text.

(1) Remove engine, gearbox assembly, generator, starter, and engine support assembly as a unit, from the generator set in accordance with paragraph 2-7a.

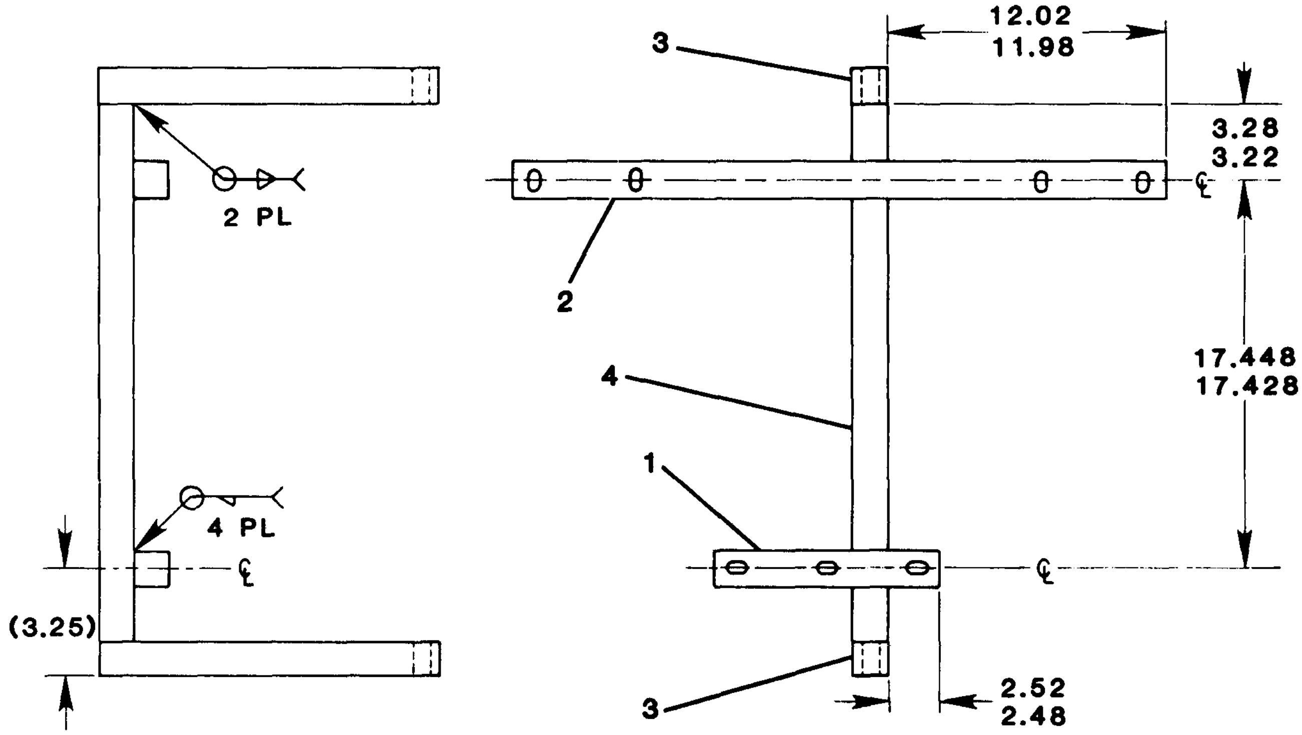
(2) Suspend engine and gearbox assembly in disassembly fixture. The disassembly fixture should have the mounting dimensions specified in table 8-2.

NOTE

For ease of disassembly the fixture should be able to rotate through 360°.

8-2. COMBUSTION CHAMBER CASE ASSEMBLY. (cont)

Table 8-2. Engine Disassembly Fixture



NOTES

MATERIAL: 1.50 x 1.50 x 0.188 WALL
CARBON STEEL TUBING

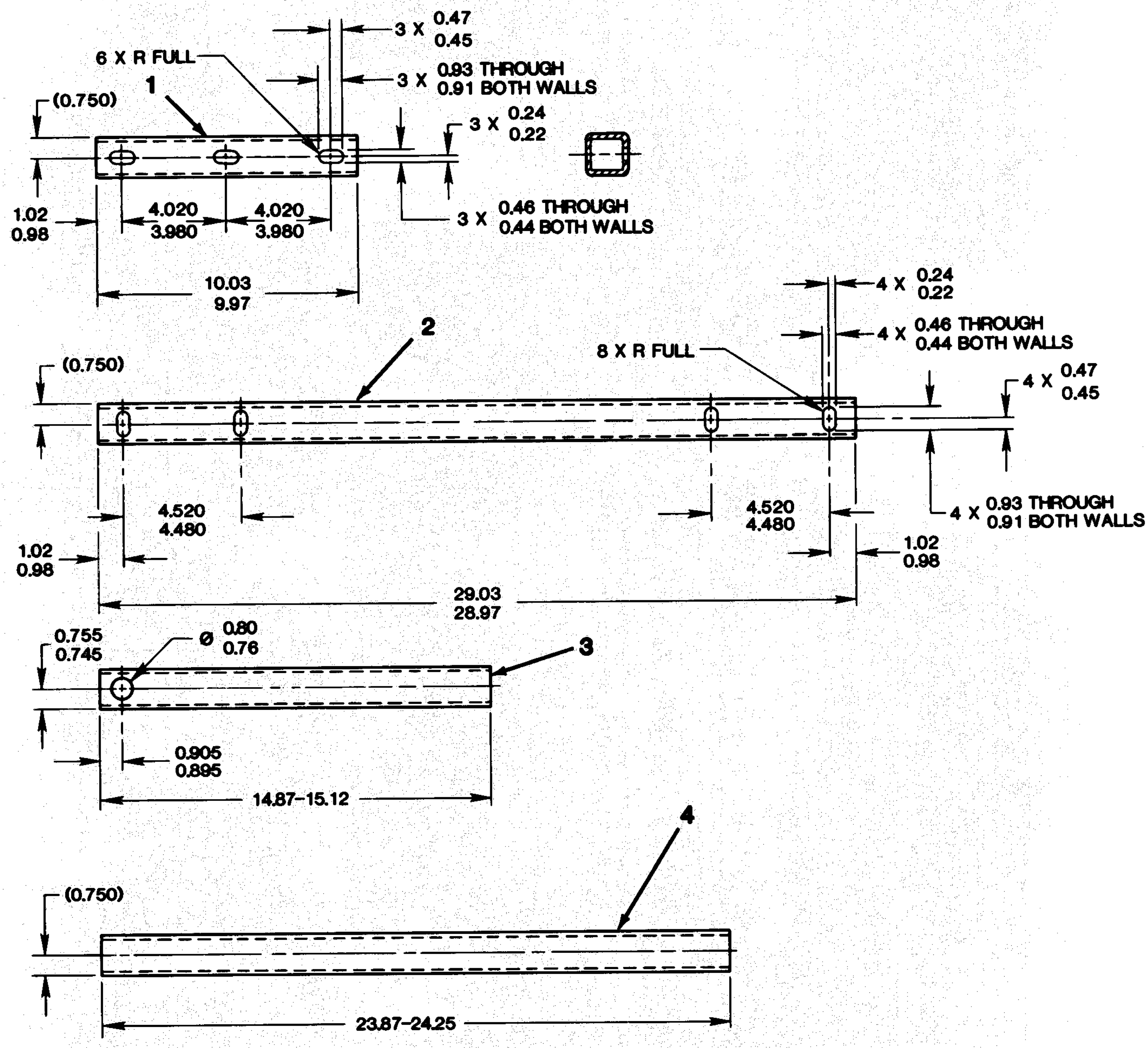
BREAK EDGES 0.015 MAX.
CAP ALL TUBE ENDS

LEGEND

1. SHORT SUPPORT
2. LONG SUPPORT
3. ARMS (2 REQ)
4. CROSSMEMBER

8-2. COMBUSTION CHAMBER CASE ASSEMBLY. (cont)

Table 8-2. Engine Disassembly Fixture - Continued



8-2. COMBUSTION CHAMBER CASE ASSEMBLY. (cont)

a. Removal. (cont)

(3) Remove starter (paragraph 4-32b, TM 5-6115-612-12).

CAUTION

To prevent damage, support gearbox.

(4) Insert block of wood (3/4 in. by 1-1/2 in. by 4 in.) under gearbox.

(5) Remove capscrew (1, figure 8-1), lockwasher (2), and rear spacer (3).

CAUTION

To prevent loss or damage, tag and wire together spring washers.

(6) Remove nut (4), washer (5), and spring washers (6). Wire together spring washers in same order as removed.

(7) Remove washer (7), spacer (8), and rim clenching clamp (9).

CAUTION

To prevent damage, do not use lead or wax-base pencils for marking on high temperature alloy parts. Carbon/wax in pencils can damage parts. Use felt pens or grease-base pencils.

(8) Matchmark combustion chamber case (10) to compressor inlet housing (11).

(9) In disassembly fixture, rotate engine to a vertical position.

(a) Attach fabricated tool FT-21519 (figure 8-2) to exhaust flange using exhaust rim clenching clamp.

(b) Grasp movable weight and push weight vigorously into stop at top of tool. Repeat until case separates from compressor inlet.

(10) Disassemble combustion chamber case assembly (paragraph 8-2c).

b. Cleaning and Inspection. Disassemble combustion chamber case assembly in accordance with paragraph 8-2c.

(1) Soak combustion chamber case in soap solution and steam clean.

(2) Soak combustion chamber in soap solution, steam clean, and glass bead.

(3) Check rim clenching clamp for cracks and integrity of all spot welds. Replace clamp if any faults are found.

(4) Check T-bolt of rim clenching clamp for distortion. Replace T-bolt if distorted.

(5) Check dimensions of combustion chamber case in accordance with table 1-1. Replace combustion chamber case if dimensions are outside acceptable tolerance.

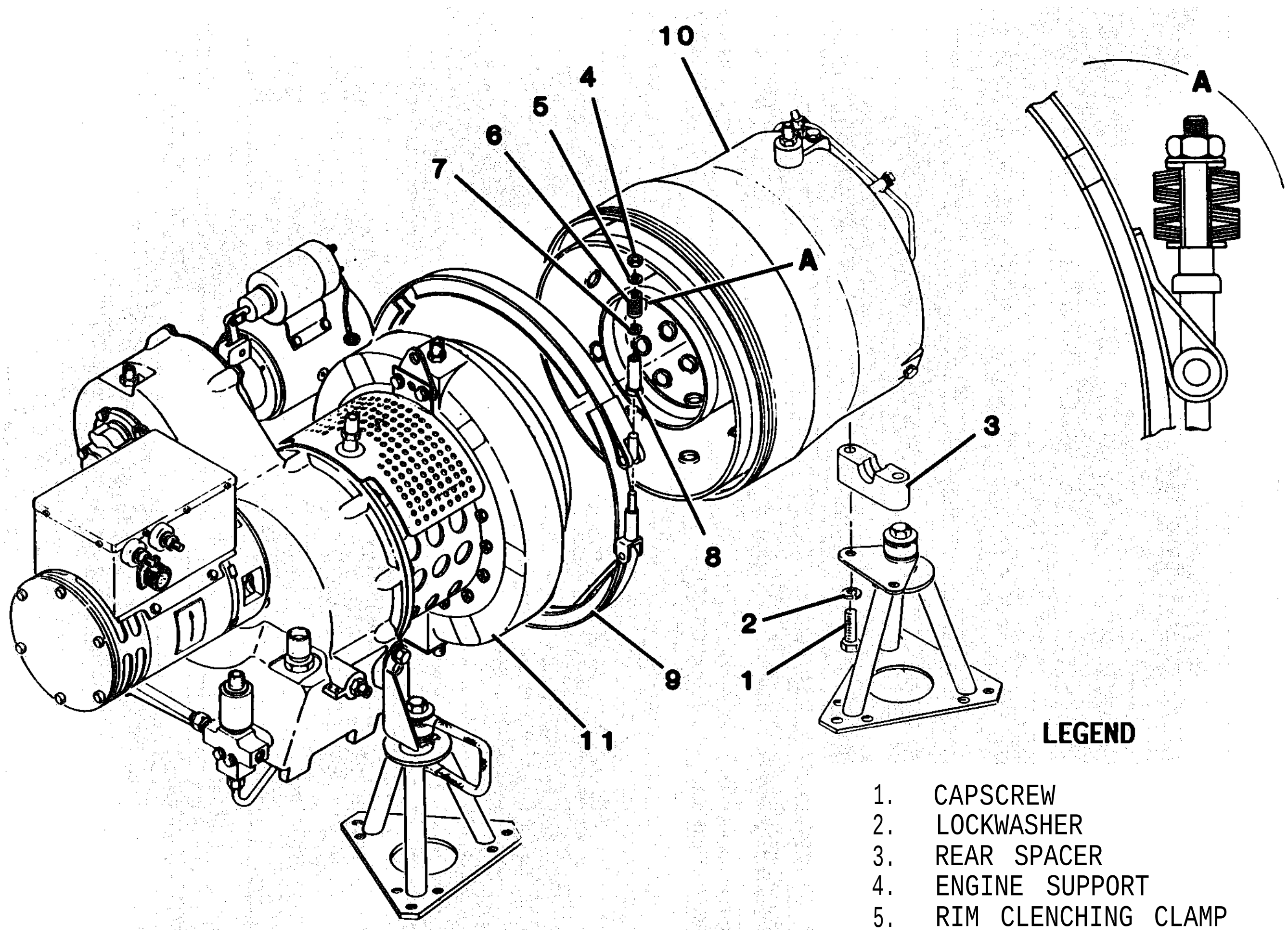
(6) Check both flanges of combustion chamber case for warpage.

(7) Check for cracks, nicks, dents, or evidence of chafing on combustion chamber case.

(8) Check exhaust duct area of combustion chamber case for deformation of sealing face.

(9) Check for damaged threads on combustion chamber case.

8-2. COMBUSTION CHAMBER CASE ASSEMBLY.
(cont)



LEGEND

1. CAPSCREW
2. LOCKWASHER
3. REAR SPACER
4. ENGINE SUPPORT
5. RIM CLENCHING CLAMP
6. NUT
7. WASHER
8. SPRING WASHERS
9. WASHER
10. SLEEVE SPACER
11. COMBUSTION CHAMBER CASE
12. COMPRESSOR INLET HOUSING

Figure 8-1. **Combustion Chamber Case Assembly Removal**

8-2. COMBUSTION CHAMBER CASE ASSEMBLY.
(cont)

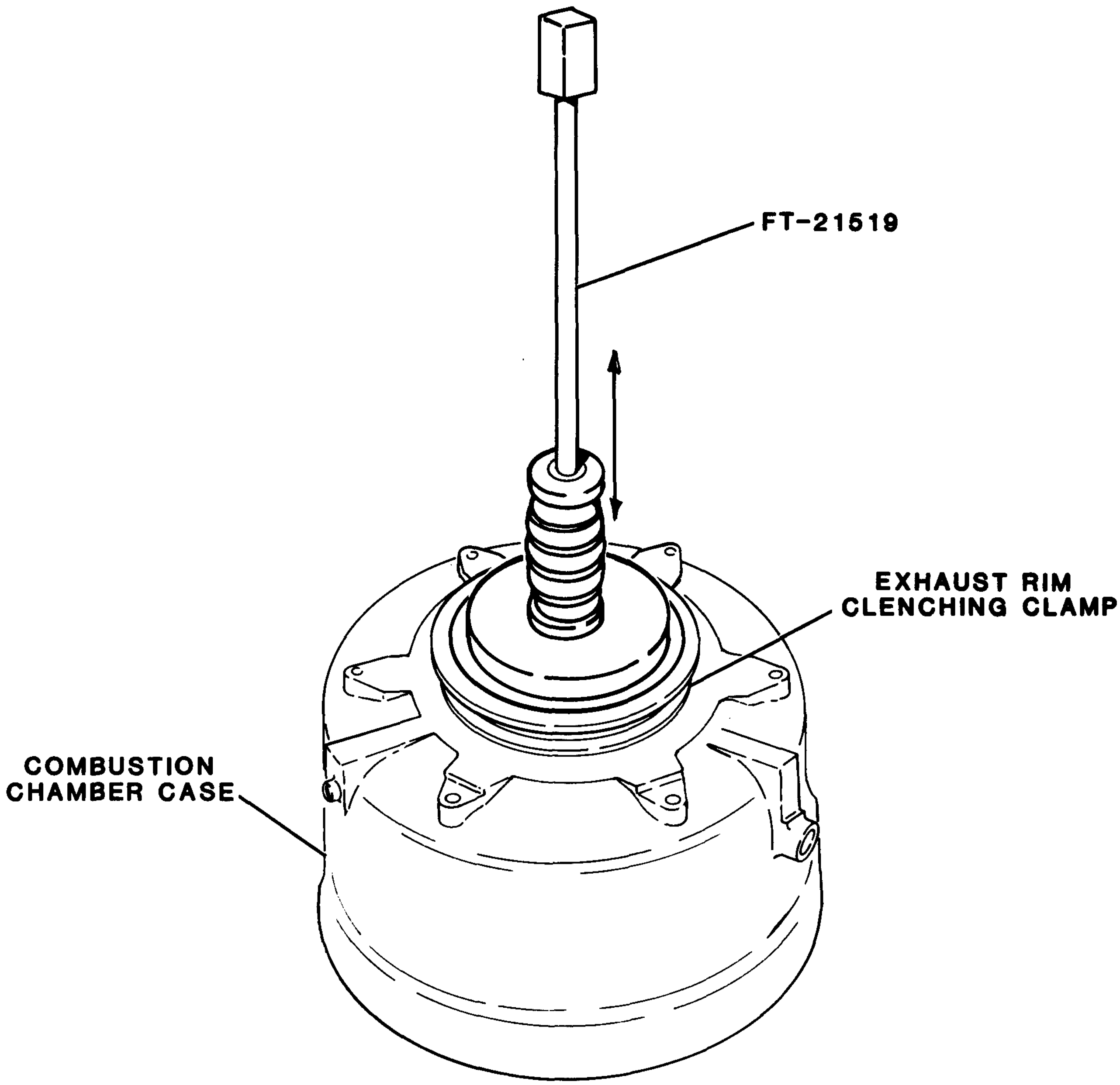


Figure 8-2. Removing Combustion Chamber Case Using Fabricated Tool FT-21519

8-2. COMBUSTION CHAMBER CASE ASSEMBLY. (cont)

b. Cleaning and Inspection. (cont)

(10) Refer to Table 8-3. Perform nondestructive test on combustion chamber case. Replace case if defects are noted.

(11) Check dimensions of combustion chamber in accordance with Table 1 -1. Replace combustion chamber if dimensions are outside acceptable tolerance.

(12) Check combustion chamber for carbon deposits. Clean as necessary.

(13) Check combustion chamber for cracks and erosion. Replace combustion chamber if defects are noted.

(14) Check combustion chamber for warped areas due to local overheating. Replace chamber if warped.

(15) Check attitude of deflector tabs.

(16) Check that washers and washer retainer are in place at fuel nozzles and ignitor positions.

c. Overhaul.

(1) Remove combustion chamber case assembly in accordance with paragraph 8-2a.

(2) Remove ignitor (1, Figure 8-3), gasket (2), and washer (2.1).

(3) Remove exhaust gas temperature (EGT) thermocouple (3) from combustion chamber case.

(4) Remove bolts (1, Figure 8-4), washers (2), fuel manifold tube (3), loop clamps, (4), and sleeve spacers (5).

(5) Remove bolts (6) and washers (7).

(6) Remove fuel injection nozzles (8), fuel atomizer (9), and fuel injection nozzle covers (10).

(7) Remove three alinement bolts (4, Figure 8-3) and washers (5).

(8) Remove combustion chamber (6) from combustion chamber case (7). If combustion chamber does not slip out easily, use puller on internal lip (8). Cautiously remove combustion chamber. Exercise care not to damage lip.

(9) Inspect combustion chamber case and combustion chamber in accordance with paragraph 8-2b and Table 8-1.

(a) Replace combustion chamber case if either or both flanges are warped.

(b) Inspect combustion chamber case for cracks. Replace case if cracks are noted.

(c) Replace combustion chamber case if deformation of sealing face of exhaust duct is noted.

(d) Repair threaded sections of combustion chamber case with threaded inserts.

(e) Refer to Table 8-3. Perform nondestructive test on combustion chamber case. Replace case if defects are noted.

8-2. COMBUSTION CHAMBER CASE ASSEMBLY.
(cont)

Table 8-3. Nondestructive Test Inspection Data

Part Name	Type of Inspection	Method	*Acceptable defects
Cover, Starter Mounting	Flourescent penetrant	30 minutes penetration	None
Diffuser	Fluorescent penetrant	30 minutes penetration (bearing area)	None
Gear, Output Spur	Magnetic particle	B-2000 E-500 (base of gear teeth)	None
Gear, Pump	Magnetic particle	B-1200 E-400 (base of gear teeth slots)	None
Gear, Starter Spur	Magnetic particle	B-1000 E-400 (base of gear teeth)	None
Housing Bearing	Fluorescent penetrant	30 minutes penetration (bearing bore)	None
Housing, Compressor Inlet	Fluorescent penetrant	30 minutes penetration (bearing carrier bore)	None
Housing, Gearbox	Flourescent penetrant	30 minutes penetration	None
Case, Combustion Chamber	Fluorescent penetrant	30 minutes penetration (atomizer openings)	None
Bolts	Fluorescent penetrant	30 minutes penetration	None
Nozzle, Turbine	Fluorescent penetrant	30 minutes penetration (nozzle vanes)	None

8-2. COMBUSTION CHAMBER CASE ASSEMBLY.
(cont)

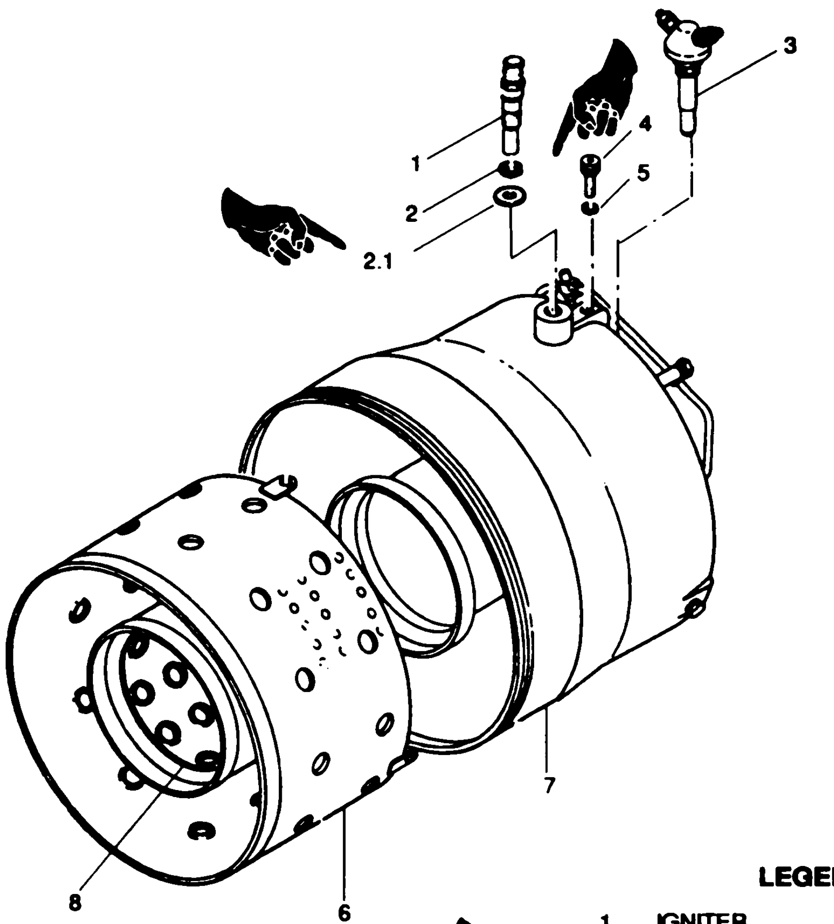
Table 8-3. Nondestructive Test Inspection Data - Continued

Part Name	Type of Inspection	Method	*Acceptable defects
Retainer, Seal	Flourescent penetrant	30 minutes penetration	None
Gear, Starter (Matched Set)	Magnetic particle	8-1500 E-500	None
Gear, Pinion Spur	Magnetic particle	B-1000 C-500 (base of gear teeth)	None
Shaft, Generator Shouldered	Flourescent penetrant	30 minutes pentration	None
Wheel, Compressor	Fluorescent penetrant	30 minutes penetration	None
Wheel, Turbine	Fluorescent penetrant	30 minutes penetration	None

(Recommended penetrant is MIL-I-25135, Type I Method B.)

*Interpret defects in accordance with MIL-I-6866 amd MIL-I-6868.

82. COMBUSTION CHAMBER CASE ASSEMBLY. (cont)

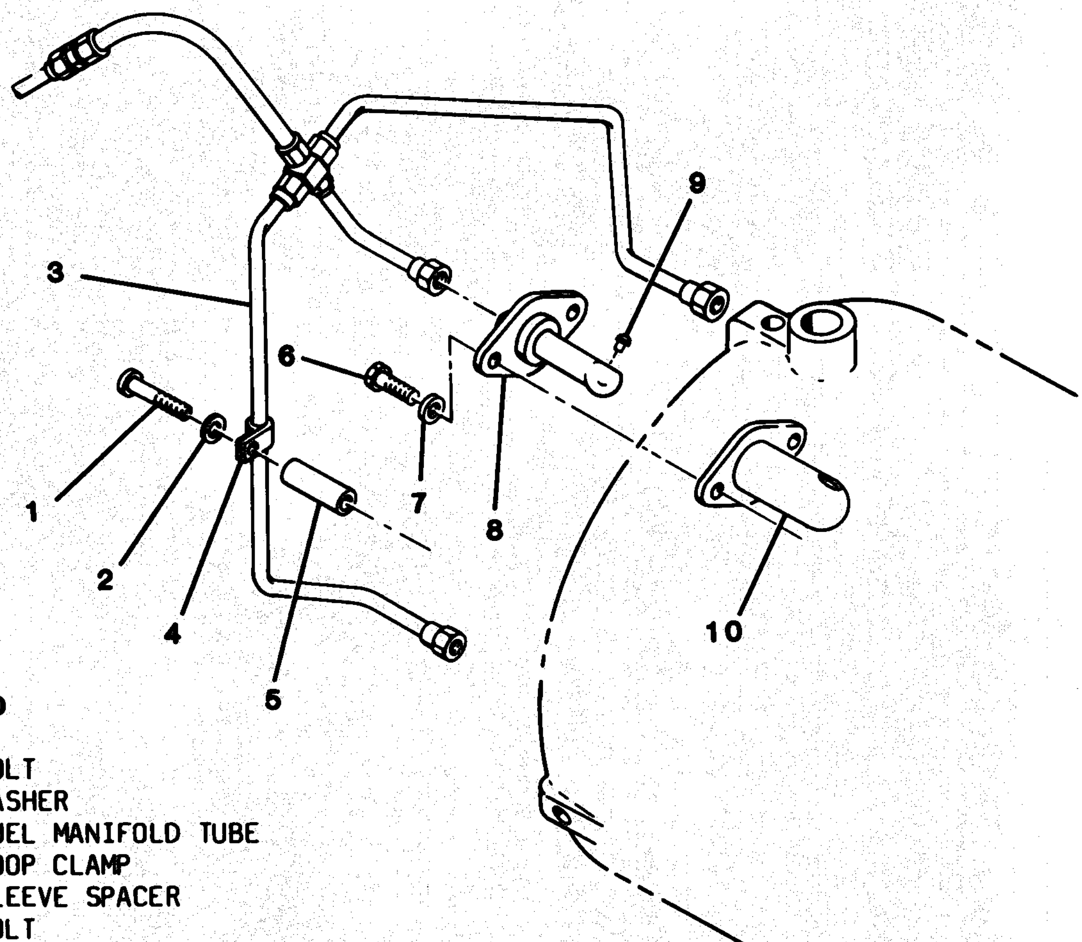


LEGEND

1. IGNITER
2. GASKET
2.1. WASHER
3. EGT THERMOCOUPLE
4. ALINEMENT BOLT
5. WASHER
6. COMBUSTION CHAMBER
7. COMBUSTION CHAMBER CASE
8. INNER LIP

Figure 8-3. Combustor Housing Disassembly

8-2. COMBUSTION CHAMBER CASE ASSEMBLY.



LEGEND

1. BOLT
2. WASHER
3. FUEL MANIFOLD TUBE
4. LOOP CLAMP
5. SLEEVE SPACER
6. BOLT
7. WASHER
8. FUEL INJECTION NOZZLE
9. FUEL ATOMIZER
10. FUEL INJECTION NOZZLE COVER

Figure 8-4. Combustor Housing Disassembly - Fuel Injection Nozzle Removal

8-2. COMBUSTION CHAMBER CASE ASSEMBLY. (cont)

c. Overhaul (cont)

(f) Inspect combustion chamber for carbon deposits. Clean in accordance with paragraph 8-2b.

(g) Inspect combustion chamber for cracks. Replace if cracks are found.

(h) Bend deflector tabs of combustion chamber back to position (I) Replace combustion chamber if tabs or washers are missing or broken.

(k) Install combustion chamber on turbine nozzle. The fit should be snug all around. If not, replace liner (k) Install combustion chamber in combustion chamber case. Chamber should fit snugly on exhaust port. If chamber rotates easily, replace chamber.

(10) Inspect and overhaul related combustion chamber case components.

(a) Inspect and replace or overhaul the fuel injection nozzles in accordance with Chapter 5.

(b) Replace igniter if threads are damaged beyond repair or if insulator is burned, chipped, or cracked.

(c) Replace EGT thermocouple if threads of terminals are damaged beyond repair or if thermocouple has been broken insulators or a bent sheath.

(11) Reassemble the combustion chamber case assembly.

NOTE

Pay particular attention to detail during assembly. Maintain all fits and tolerances. If the unit is to be left for even a short period in a partially disassembled state cover, cap, or plug all openings. Before assembling any part, make certain the parts is thoroughly clean. Wipe all parts and surfaces with a clean, lint-free cloth.

(a) Aline ignitor openings on combustion chamber and combustion chamber case.

(b) Slide combustion chamber (6, Figure 8-3) into combustion chamber case (7).

(c) Coat threads of alinement bolts (4) with anti-seize compound, MIL-A-907. Insert washers (5) and bolts (4) in combustion chamber case. Torque to 25 35 inch pounds (2.83 3.96 Nm).

(d) Apply anti-seize compound, MIL-A907, to ignitor (1). Install washer (2.1), gasket (2), and ignitor (1) in combustion chamber case.

(e) Coat threads of EGT thermocouple (3) with anti-seize compound, MIL-A-907, and install thermocouple (3).

(f) Coat threads of bolts (6, Figure 8-4) with anti-seize compound, MIL-A-907. Install nozzle covers (1 0) and fuel nozzles (8). Secure with washers (7) and bolts (6). Torque to 20 25 inch pounds (2.26 2.83 Nm) and lockwire bolts using MS20995-C20 and lockwire nuts using MS20995-C32.

8-2. COMBUSTION CHAMBER CASE ASSEMBLY. (cont)

c. Overhaul. (cont)

(g) Connect fuel manifold tube (3) to fuel nozzles. Install washers (2) and bolts (1) through loop clamps (4) and sleeve spacers (5). Torque to 10-15 inch pounds (1.1-1.7 Nm).

d. Installation.

(1) Aline matchmarks and install assembled combustion chamber case and chamber assembly on compressor inlet housing. Tap into place with non-metallic hammer, if necessary.

(2) Install rim clenching clamp (9, figure 8-1), sleeve spacer (8), and washer (7).

CAUTION

To prevent damage and to ensure proper operation, spring washers must be installed as shown in figure 8-1, inset A.

(2.1) Refer to inset A of figure 8-1. Install spring washers (6) as shown.

(2.2) Install washer (5) and nut (4). Tap clamp into place with non-metallic hammer. Torque nut to 30-35 inch pounds (3.4-4.0 Nm).

(3) Secure combustion chamber case to engine support with rear spacer (3), lockwasher (2), and capscrew (1). Torque to 50-70 inch pounds (5.6-7.9 Nm).

(4) Remove block of wood from under gearbox.

(5) Install starter (TM 5-6115-612-12, paragraph 4-32c).

8-3. MAINTENANCE OF TURBINE ASSEMBLY.

a. Removal.

(1) Remove combustion chamber case assembly in accordance with 8-2a above.

(2) Remove lockwire and, on bottom of compressor inlet housing, disconnect oil supply tube (1, figure 8-5), oil drain tube (2), and fuel drain line (3).

(3) Remove lockwire, nuts (4), washers (5), and turbine assembly (6).

(4) Remove preformed packing (7) and shouldered output shaft (8). Discard preformed packing.

(5) Cover gearbox (9).

(6) On bottom of compressor inlet housing, remove lockwire, bolts (10), washers (11), and retaining plate (12).

(7) To remove oil supply fitting (13), place a nut on fitting and use pliers to remove fitting from compressor inlet housing. Remove and discard preformed packings.

(8) Remove fuel drain fitting (14) and oil drain fitting (15). Remove and discard all preformed packings.

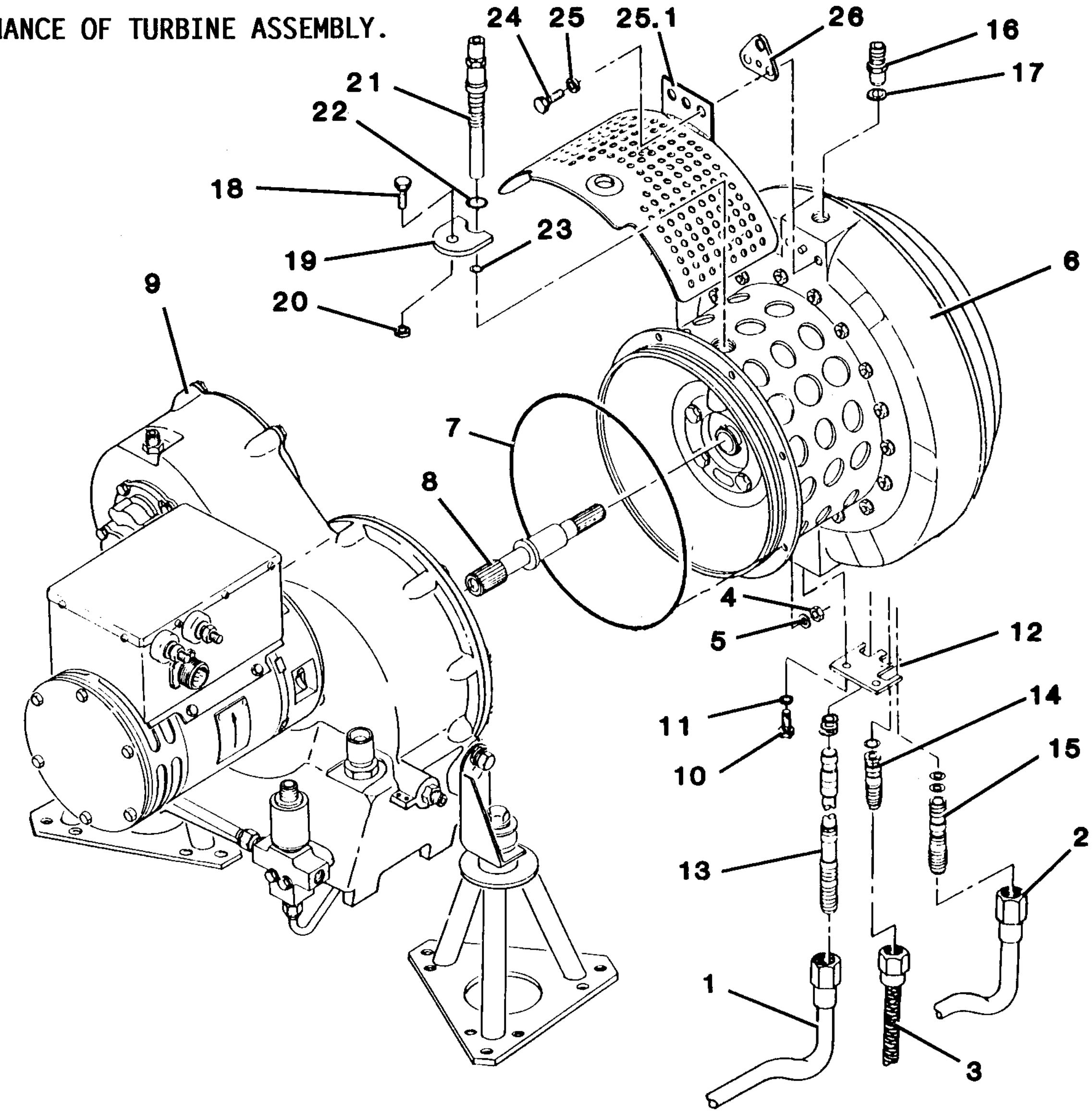
(9) Remove bleed air connector (16) and preformed packing (17). Discard packing.

(10) Remove lockwire, bolt (18), speed sensor clip (19), and washer (20).

(11) Remove speed sensor (21), shim (22), and preformed packing (23).

(12) Remove bolt (24), washer (25), foreign object deflector (25.1) and padeye (26).

8-3. MAINTENANCE OF TURBINE ASSEMBLY. (cont)



LEGEND

1. OIL SUPPLY TUBE
2. OIL DRAIN TUBE
3. FUEL DRAIN LINE
4. NUT
5. WASHER
6. TURBINE ASSEMBLY
7. PREFORMED PACKING
8. SHOULDERED OUTPUT SHAFT
9. GEARBOX
10. BOLT
11. WASHER
12. RETAINING PLATE
13. OIL SUPPLY FITTING
14. FUEL DRAIN FITTING
15. OIL DRAIN FITTING
16. BLEED AIR CONNECTOR
17. PREFORMED PACKING
18. BOLT
19. SPEED SENSOR CLIP
20. WASHER
21. SPEED SENSOR
22. SHIM
23. PREFORMED PACKING
24. BOLT
25. WASHER

25.1 FOREIGN OBJECT DEFLECTOR

26. PADEYE

Figure 8-5. Turbine Assembly Removal

8-3. MAINTENANCE OF TURBINE ASSEMBLY. (cont)

b. Inspection.

(1) The turbine assembly is disassembled and inspected in accordance with paragraphs 8-4a and 8-4c.

(2) Inspect oil supply and oil drain tubes for cracks, leaking, or bends. Inspect flares on tubing for integrity. Replace tubing if damaged.

(3) Pressure test oil supply line to 60 psi.

(4) Inspect fuel drain line for fraying or damage Replace if damaged.

(5) Inspect oil supply fittings and fuel and oil drain fittings for damage threads, visible cracks, and flaws in the mating surfaces. Replace fittings if damaged.

(6) Inspect bleed air connector for nicks, burrs, and worn or damaged threads. Replace if damaged.

(7) Inspect speed sensor for broken threads, burned insulation, or other damage. Replace if damaged.

(8) Inspect speed sensor clip for damage. Replace if damaged.

(9) Inspect padeye for cracks. Replace if cracked.

8-4. OVERHAUL OF TURBINE ASSEMBLY.

a. Disassembly.

NOTE

See Table 2-3, Fabricated Tools and Equipment for fabricating dimensions and specifications for all FT-21XXX numbers referenced in the text.

(1) Remove combustion chamber case assembly in accordance with paragraph 8-2a.

(2) Remove turbine assembly in accordance with paragraph 8-3a.

CAUTION

To prevent damage, DO NOT use lead or wax base pencils for marking on high temperature alloy parts. Carbon/wax in pencils Is detrimental to parts. Use red ink felt pens or grease base pencils.

(3) Matchmark turbine nozzle (1, Figure 8-6) to diffuser (2).

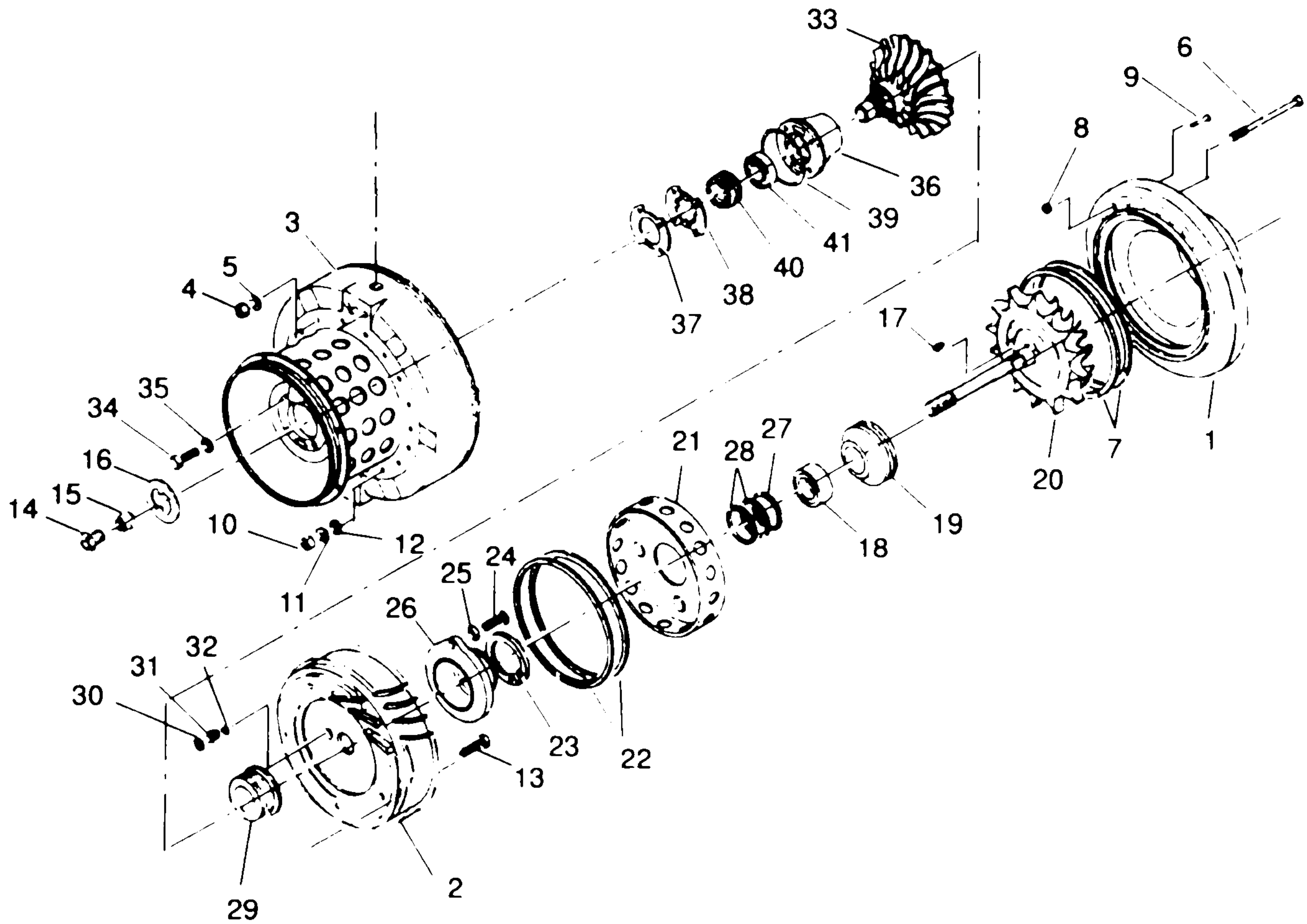
(4) On front of compressor inlet housing (3) remove lockwire, nuts (4), and washers(5) that hold bolts (6)in the 2, 3, 5, 6, 8, 9, 11, 12, 14, 15, and 17 positions. (See Figure 8-7.) Remove bolts (6, Figure 8-6) from turbine nozzle (1).

NOTE

Knock bolts out with nylon rod and hammer or nonmetallic hammer, if necessary.

(5) Pry off turbine nozzle (1) with roll head pry bars, if necessary and remove shim set (7). Measure and record thickness of shim set. Remove six nuts (8) and six bolts (9). Separate turbine nozzle assembly (1)

8-4. OVERHAUL OF TURBINE ASSEMBLY.
(cont)



LEGEND

1 TURBINE NOZZLE	15 RETAINER NUT	29. LABYRINTH SEAL
2 DIFFUSER	16 KEY WASHER	30. RETAINING RING
3. COMPRESSOR INLET HOUSING	17 ANTIROTATION PIN	31 OIL PASSAGE PLUG
4. NUT	18 BEARING	32 PERFORMED PACKING
5. WASHER	19 LABYRINTH SEAL	33. COMPRESSOR WHEEL
6. BOLT	20 TURBINE WHEEL	34. BOLT
7. SHIM SET	21. TURBINE BACKSHROUD	35. WASHER
8. NUT	22. SHIM SET	36. BEARING HOUSING
9. BOLT	23. PISTON RING	37. SHIM SET
10. NUT	24. BOLT	38. TAB WASHER
11. WASHER	25. KEY LOCKWASHER	39. PERFORMED PACKING
12. WASHER	26. DIFFUSER CAP	40. BEARING RETAINER NUT
13. BOLT	27. WAVE WASHER	41. BEARING
14. SPEED PICKUP NUT	28. SHIM SET	

Figure 8-6. Turbine Assembly Disassembly

8-4. OVERHAUL OF TURBINE ASSEMBLY. (cont)

a. Disassembly (cont).

(6) Place turbine assembly in fabricated tool (FT-21616, Figure 8-8). This will secure the turbine wheel (20, Figure 8-6) to prevent rotation.

(7) On front of compressor inlet housing (3), remove nut (10) and washers (11 and 12) that secure bolts in the 1, 4, 7, 10, 13, and 16 positions (see Figure 8-7) Remove bolts (13, Figure 8-6) from diffuser (2).

WARNING

To prevent injury, ensure that insulated gloves are worn when handling dry Ice and cold parts.

(8) If necessary, place dry ice in diffuser. Wait approximately ten minutes or until diffuser is well frosted. Use soft flame to heat outside of compressor inlet housing Carefully pull diffuser out of housing.

CAUTION

Care should be taken not to damage shaft. Once drill penetrates nut, **STOP DRILLING!**

(9) Using a 0.125 inch (32 cm) drill bit, drill out staked portion of nut.

NOTE

Speed pickup nut is staked in place. Once removed, it is NOT reusable.

(**10)** Using fabricated tool (FT-21368, Figure 8-9) remove and discard speed pickup nut (14, Figure 8-6)

CAUTION

To remove the turbine wheel, it may be necessary to use a non-metallic hammer Damage to the turbine wheel may occur.

NOTE

The turbine wheel assembly consist of turbine wheel (20), labyrinth seal (19), and bearing (18)

(11) Remove and discard retainer nut (15) and key washer (16) Remove turbine wheel assembly from compressor inlet housing (3)

(12) Remove two antirotation pins (17) from turbine wheel assembly

(13) Using a bearing puller, remove bearing (18) from turbine wheel (20) Discard bearing

(14) Using a bearing puller, remove labyrinth seal (19) from turbine wheel (20) Inspect labyrinth seal (19) for damage.

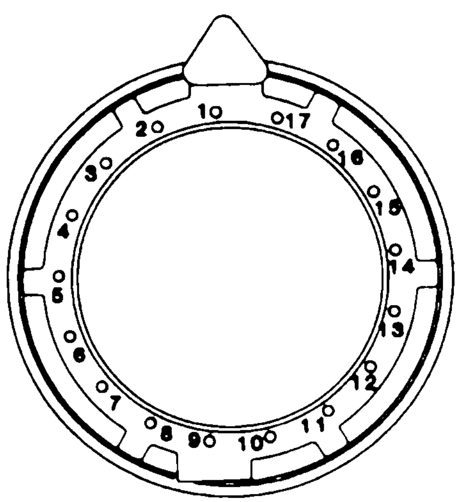


Figure 8-7. Compressor Inlet Housing Bolt Patter

8-4. OVERHAUL OF TURBINE ASSEMBLY. (cont)

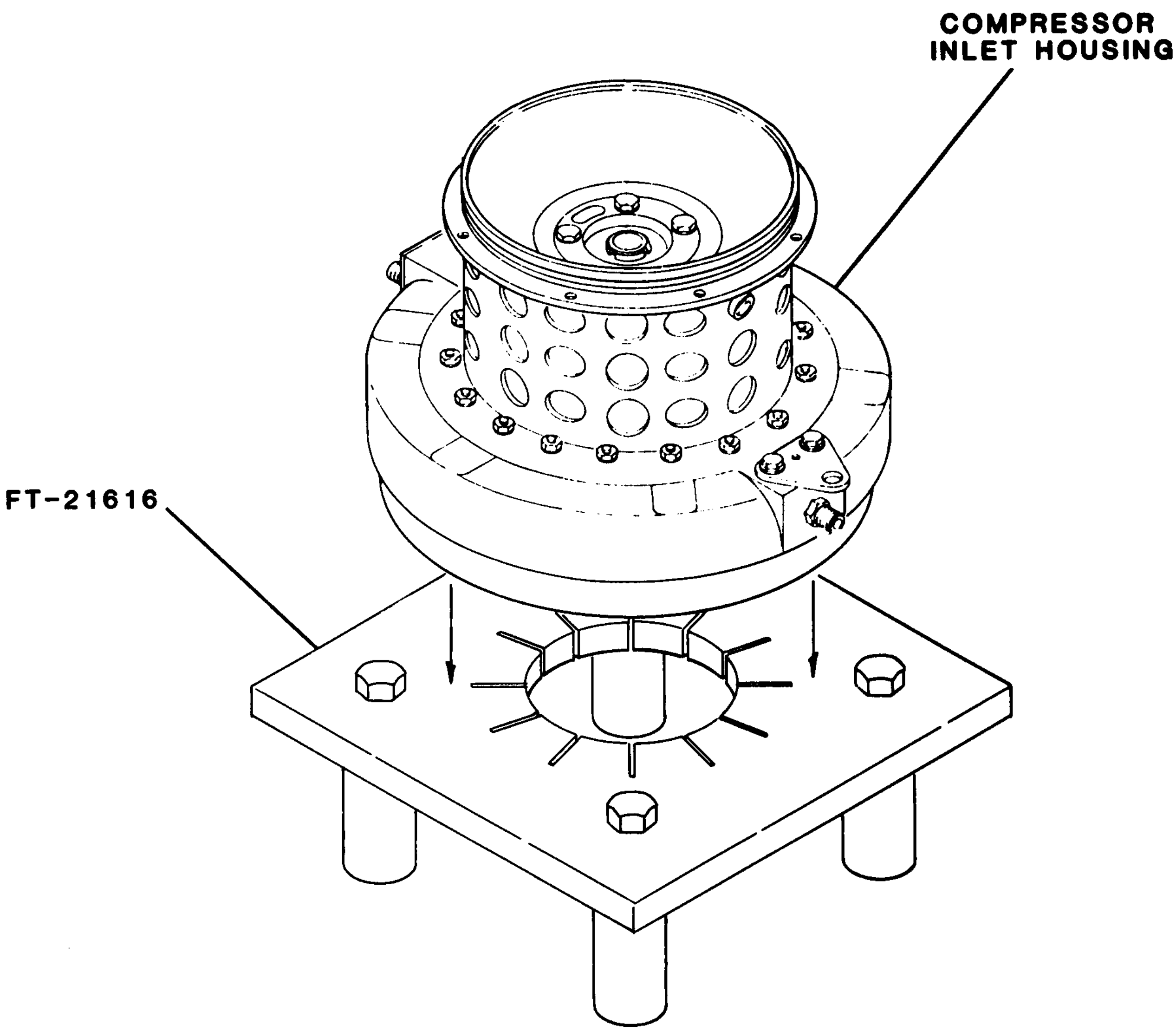


Figure 8-8. Using Turbine Wheel Assembly Fixture, Fabricated Tool FT-21616

8-4. OVERHAUL OF TURBINE ASSEMBLY.
(cont)

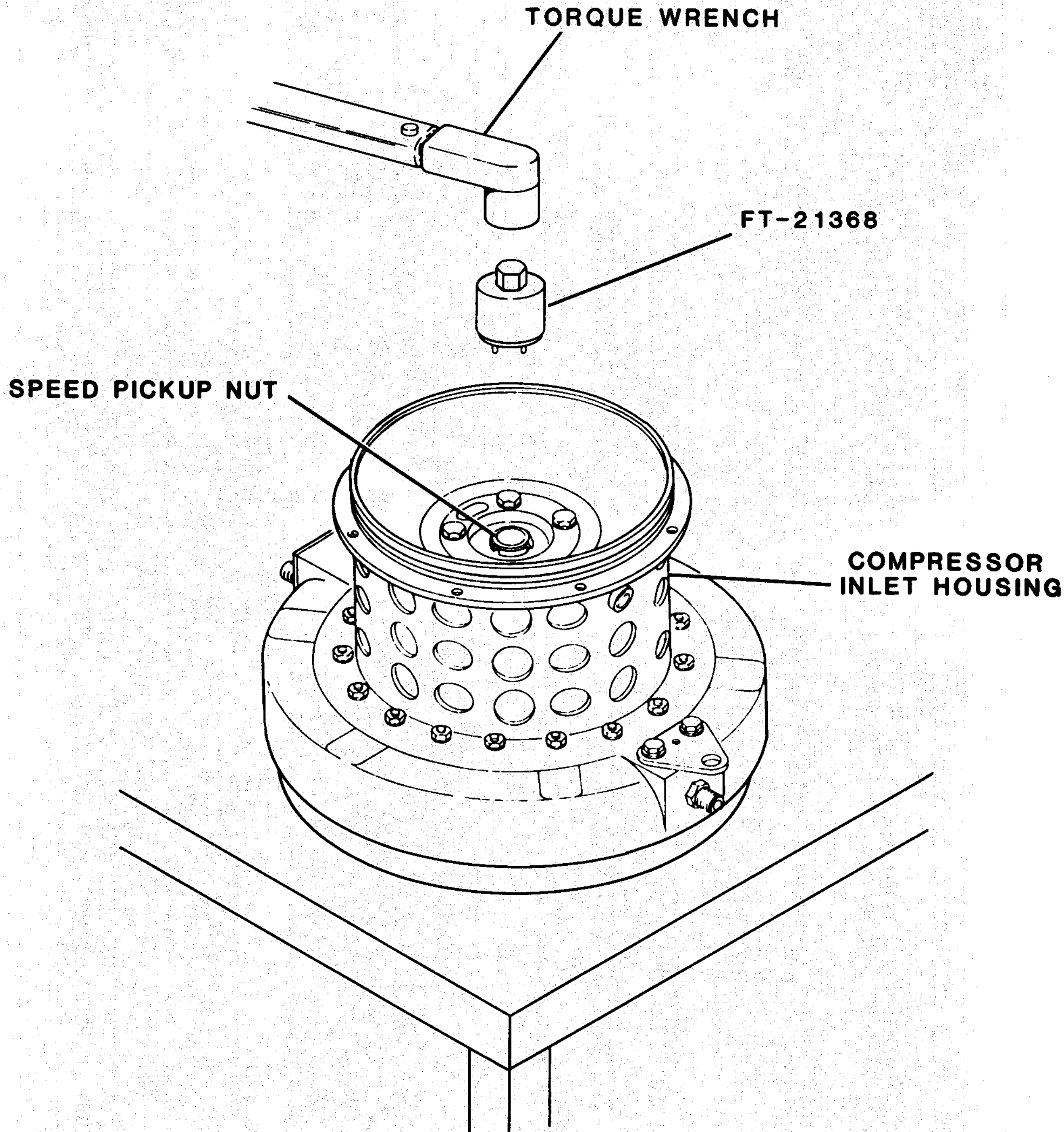


Figure 8-9. Removing/Installing Speed Pickup Nut
Using Fabricated Tool FT-21368

8-4. OVERHAUL OF TURBINE ASSEMBLY. (cont)

a. Disassembly (cont)

(15) Remove turbine backshroud (21) and shim set (22), if present, from diffuser (2). Measure and record thickness of shim set, if present .

(16) Remove piston ring (23)

NOTE

If diffuser cap (26) is tight, use jackscrews to remove.

(17) Remove screws (24), key lockwashers (25), and diffuser cap (26) Discard key washers

(18) Remove wave washer (27) and shim set (28) from diffuser (2) Measure and record thickness of shim set Discard wave washer.

(19) Remove labyrinth seal (29) from back of diffuser (2)

(**20)** Remove retaining ring (30), oil passage plug (31), and performed packing (32) from diffuser (2) Discard performed packing.

(21) Remove compressor wheel (33) on shaft as a unit

(22) On front of compressor Inlet housing (3), remove lockwire, bolts (34) and washers (35)

(23) Install two jackscrews In opposite bolt holes of compressor inlet housing (3) Tap jack-screws lightly to free bearing housing (36) from inlet housing. Remove jackscrews.

(24) Remove shim set (37) and tab washer (38) Measure and record thickness of shim set.

(25) Remove preformed packing (39). Discard performed packing.

(26) Place bearing housing (36) in fabricated tool (FT-21498, Figure 8-10) and secure

(27) Using fabricated tool (FT-21583), remove bearing retainer nut.

(28) Remove bearing housing from fabricated tool (FT-21498)

(29) Remove bearing (41, Figure 8-6)) from bearing housing If necessary, heat bearing housing with soft flame to free bearing.

8-4. OVERHAUL OF TURBINE ASSEMBLY. (cont)

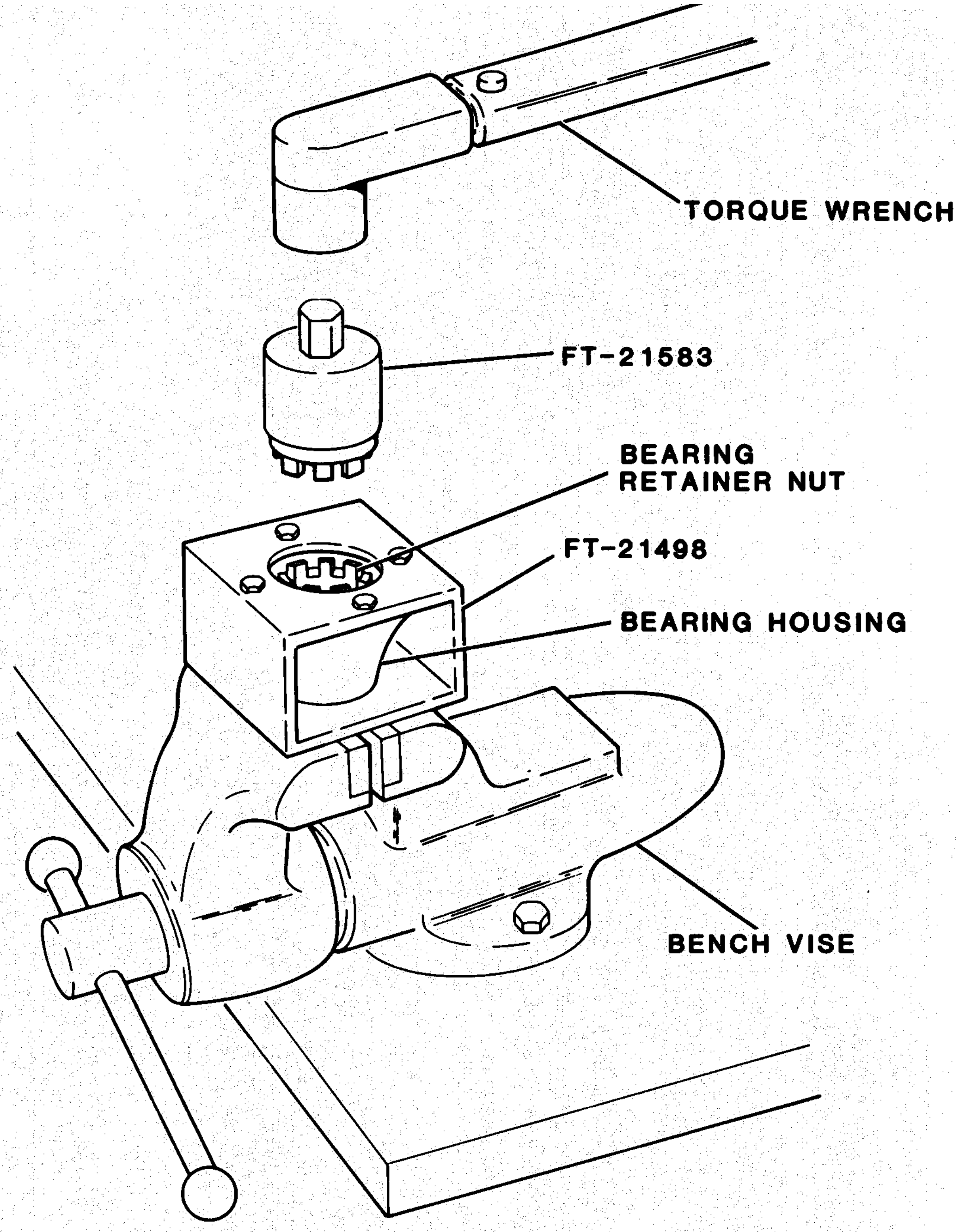


Figure 8-10. Removing/Installing Bearing Retainer Nut Using Fabricated Tools FT-21498 and FT-21583

8-4. OVERHAUL OF TURBINE ASSEMBLY. (cont)

b. Cleaning.

CAUTION

To prevent subsequent problems with components, use caution in cleaning so as not to remove evidence of damage. Inspect both before and after cleaning.

(1) Steam clean oil supply and oil drain tubes.

(2) Soak in soap solution and steam clean oil supply, oil drain, and fuel drain fittings.

(3) Soak in soap solution and steam clean bleed air connector.

(4) Soak in soap solution and steam clean bolts (6, figure 8-6).

(5) Soak turbine nozzle in soap and carbon removal compound (MIL-C-25107).

CAUTION

To prevent damage to the turbine wheel, no abrasive blasting is allowed.

(6) Hand clean turbine wheel with bristle brush in alcohol.

(7) Chemically clean turbine backshroud with P-D-680 Type I solvent.

(8) Vapor degrease, chemically clean with P-D-680 Type I solvent, and steam clean diffuser.

(9) Chemically clean with P-D-680 Type I solvent and steam clean compressor wheel.

(10) Vapor degrease and steam clean bearing housing.

(11) Chemically clean with P-D-680 Type I solvent and vapor degrease compressor inlet housing.

c. Inspection.

(1) Inspect bolts (6, figure 8-6) for cracking, stretching, distortion, necking, and damaged threads. Inspect bolt heads for hollows. Refer to table 8-3 and perform nondestructive test on bolts.

(2) Inspect turbine nozzle for nicks, scratches, and erosion damage at vane passages.

(3) Visually check turbine nozzle for cracks, signs of turbine wheel rub, warps, or other visible damage.

(4) Refer to table 8-3. Perform nondestructive test on turbine nozzle.

(5) Check dimensions of turbine nozzle in accordance with table 1-1.

(6) Check all shims for distortion or pinching.

(7) Inspect turbine wheel for cracks and broken, missing, or cracked blades.

(8) Inspect turbine wheel shaft for worn or stripped threads, cracks, and scoring.

(9) Check internal splines of turbine wheel for wear and damage. Refer to table 1-1 for acceptable wear limits.

8-4. OVERHAUL OF TURBINE ASSEMBLY. (cont)

c. Inspection. (cont)

(10) Refer to table 8-3. Perform nondestructive test on turbine wheel.

(11) Check dimensions of turbine wheel in accordance with table 1-1.

(12) Check dimensions of bearing journal in accordance with table 1-1.

(13) Check for smooth bearing rotation in bearing journal.

(14) Check bearing journal for out of round and undersize in accordance with table 1-1.

(15) Check dimensions of labyrinth seals in accordance with table 1-1.

(16) Check that Metco 101 spray is intact on labyrinth seals and that no knives are split or damaged.

(17) Inspect turbine backshroud for nicks, cracks, burrs, and erosion.

(18) Check dimensions of turbine backshroud in accordance with table 1-1.

(19) Inspect diffuser for cracked or broken vanes and erosion.

(20) Inspect diffuser vanes for nicks or scratches deeper than 0.0005 inch (0.0013 cm).

(21) Refer to table 8-3. Perform nondestructive test on diffuser.

(22) Check dimensions of diffuser in accordance with table 1-1.

(23) Inspect oil pasasge to ensure it is free of obstruction.

(24) Inspect oil passage for wear or erosion of orifice.

(25) Inspect compressor wheel for cracks, nicks, dings, erosion, bent blades, and for evidence of foreign object damage.

(26) Inspect compressor wheel shaft for worn or stripped threads, cracks, and scoring.

(27) Check that Metco 101 spray is intact on labyrinth seal on compressor wheel and that no knives are split or damaged.

(28) Refer to table 8-3. Perform nondestructive test on compressor wheel and shaft.

(29) Inspect bearing housing for cracks, internal and external damage, and excessive wear.

(30) Check dimensions of bearing housing in accordance with table 1-1.

(31) Refer to table 8-3. Perform nondestructive test on bearing housing.

(32) Inspect compressor inlet housing for cracks, nicks, scoring, damaged threads, and signs of compressor wheel rub.

(33) Check threaded areas of compressor inlet housing for damage.

(34) Refer to table 8-3. Perform nondestructive test on compressor inlet housing.

(35) Check dimensions of compressor inlet housing in accordance with table 1-1.

8-4. OVERHAUL OF TURBINE ASSEMBLY. (cont)

d. Repair. Repair or replace the turbine assembly components as follows:

(1) Replace bolts if signs of stretching, distortion, necking, or damaged threads are present. Replace bolts if heads have hollows.

(2) Replace bolts if cracks are visible or are revealed by nondestructive testing. Repair of bolts is not permitted.

(3) Replace the turbine nozzle if cracks are visible or are revealed by nondestructive testing.

(4) Replace turbine nozzle if nicks, scratches, or erosion damage is present at vane passages.

(5) Replace turbine nozzle if visibly warped or if there is turbine rub damage.

(6) Replace turbine nozzle if dimensions as defined in table 1-1 are outside acceptable tolerance.

(7) Replace all shims that show distortion or signs of pinching.

(8) Replace turbine wheel if vanes are broken, missing, or cracked.

(9) Replace turbine wheel if cracks are visible or are revealed by nondestructive testing.

(10) Replace turbine wheel if shaft is worn or damaged.

(11) Replace wheel if shaft is cracked or scored, or if threads are stripped.

(12) Replace turbine wheel if dimensions as defined in table 1-1 are outside acceptable tolerance.

(13) Replace wheel if bearing journal is out of round and undersize.

(14) Replace labyrinth seals if defects are found.

(15) Replace turbine backshroud if cracks, erosion, or nicks exceed acceptable limits.

(16) Replace backshroud if dimensions as defined in table 1-1 are outside acceptable tolerance.

(17) Remove burrs and surface defects by grinding. Blend ground areas into surrounding surface using crocus cloth, P-C-458.

(18) Replace diffuser if defects are visible or are revealed by nondestructive testing.

(19) Replace diffuser if vanes are broken or erosion exists, and if nicks or scratches are deeper than acceptable limits.

(20) Replace diffuser if dimensions exceed acceptable tolerance.

(21) Using a fine abrasive stone and following original contour, remove surface defects on diffuser by grinding. Polish ground area using crocus cloth, P-C-458.

8-4. OVERHAUL OF TURBINE ASSEMBLY. (cont)

d. Repair. (cont)

WARNING

To prevent injury, ensure that protective gloves are worn when handling hot or cold parts.

(22) Replace oil passage plug. Replace retaining ring if damaged. Replace preformed packing. Pressure check oil passage plug for correct targeting. If targeting is incorrect, remove plug, fill passage, rechill, and reinsert plug.

(23) Machine out seal material on diffuser and diffuser cap and replace material.

(24) Replace compressor wheel if blades are nicked, eroded or bent, or if other evidence of damage exists.

(25) Replace compressor wheel if threads are worn or stripped, if shaft is cracked or scored, or if cracks are visible or are revealed by nondestructive testing.

(26) Replace compressor wheel if labyrinth seal is damaged.

(27) Replace bearing housing if cracks are visible or are revealed by nondestructive testing.

(28) Replace bearing housing for internal and external damage, excessive wear, or if dimensions are outside acceptable tolerance.

(29) Machine off seal material on bearing housing and replace material.

(30) Replace bearing housing if dimensions exceed acceptable tolerances.

(31) Replace compressor inlet if cracks are visible or are revealed by nondestructive testing.

(32) Replace inlet housing if there are nicks and scoring or if there is excessive turbine rub damage.

(33) Replace inlet housing if dimensions exceed acceptable tolerance.

e. Assembly and Balance of Rotating Group Assembly.

CAUTION

If rotating group assembly has been completely disassembled, follow all assembly and balancing steps given, below. If only partial disassembly has been made, proceed with the assembly and balance procedure at the appropriate step. Be sure all grinding dust, chips, and burrs created by balancing operations are removed before each step of assembly. Failure to remove dust, chips, or burrs will create excessive runout when parts are assembled, and may lead to rotating group damage during engine operation.

CAUTION

To prevent damage, handle turbine wheel by blades only.

8-4. OVERHAUL OF TURBINE ASSEMBLY. (cont)

e. Assembly And Balance of Rotating Group Assembly. (cont)

WARNING

To prevent injury, ensure that Insulated gloves are worn when handling dry Ice and cold parts

NOTE

See Table 2-3, Fabricated Tools and Equipment, for fabricating dimensions and specifications for all FT-21XXX numbers referenced in the text.

(1) Place turbine wheel (20, Figure8-6) in dry Ice and alcohol for 20-30 minutes.

(2) Place turbine wheel (20) In fabricated tool (FT-21616, Figure 8-11)

NOTE

First dummy bearing fabricated tool (FT-21538) is used In place of bearing (18, Figure 8-6) In this procedure.

(3) Heat labyrinth seal (19) and dummy bearing fabricated tool (FT-21538, Figure 8-11) to 250-350° F (121 1-176 60 C), approximately 20-30 minutes

(4) Install labyrinth seal (19, Figure 8-6) and on turbine wheel (20, Figure 8-6) shaft Secure with antirotation pins (17).

(5) Place labyrinth seal (29) on back of compressor wheel (33).

(6) Assemble compressor wheel (33) on turbine wheel (20) shaft. Ensure that splines aline.

NOTE

Second dummy bearing fabricated tool, (FT-21538, Figure 8-11) is used in place of bearing (18, Figure 8-6) in this procedure.

(7) Coat dummy bearing fabricated tool, (FT-21538, , Figure 8-11) with turbine oil and Install without heat.

(8) Put turbine oil under retainer nut (15, Figure 8-6) Using fabricated tools (FT-21570, FT-21571, Figure 8-11) and torque wrench, torque retainer nut (15, Figure 8-6) to 300 inch pounds (33 90 Nm)Back off and re-torque to 50 Inch pounds (5 65 Nm)

(9) Place fabricated tool (FT-21 540, Figure 8-12) over assembly. Place fabricated tool (FT-21565) on top of the turbine wheel shaft Take a base reading from top of fabricated tool (FT-21565) to top of fabricated tool (FT-21540) using depth micrometer Note the reading The shaft must be stretched 0 007 to 0 009 Inch (0 018-0 023 cm) from the original reading Remove fabricated tools (FT-21540 and FT-21565)

(10) Using fabricated tools (FT-21570 and FT-21571, Figure 8-11) but without torque wrench, tighten retainer nut Remeasure shaft length as described In step (9), above Repeat procedure until 0 007 to 0 009 inch stretch has be achieved

8-4. OVERHAUL OF TURBINE ASSEMBLY.
(cont)

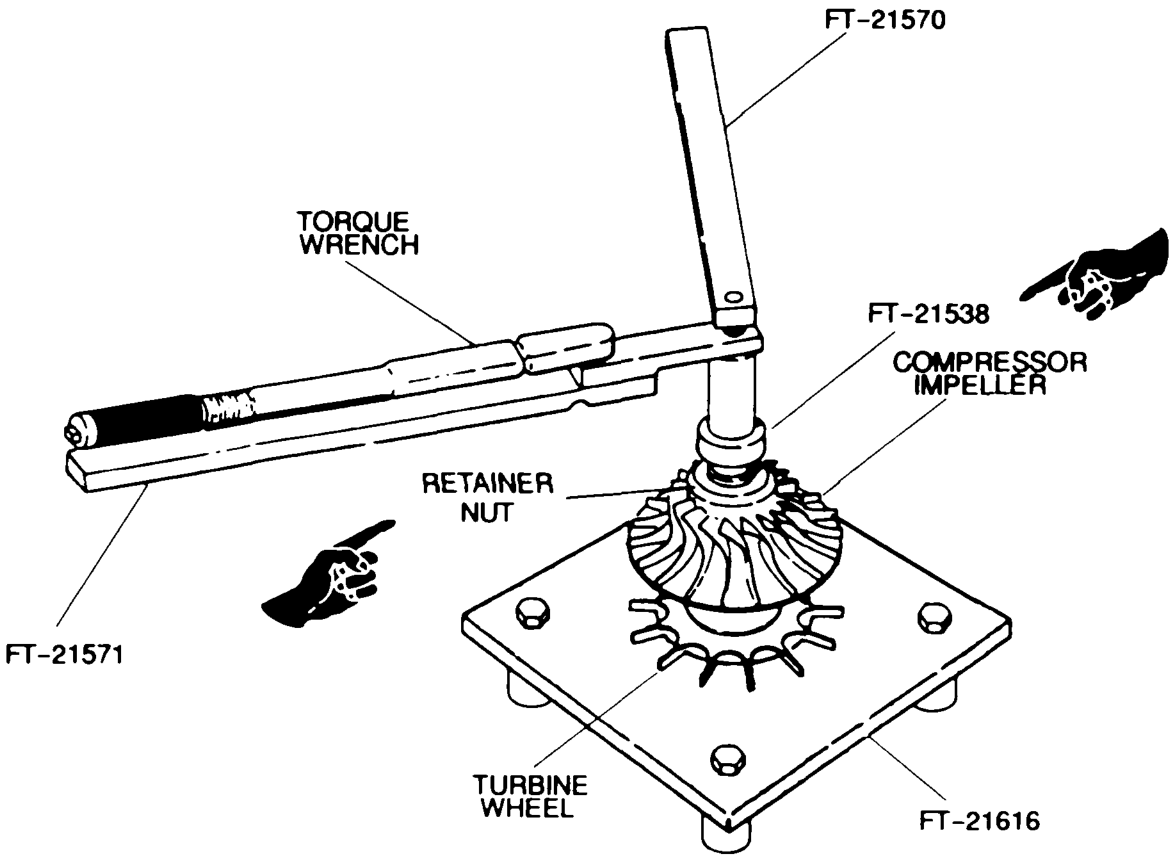


Figure 8-11. Removing/Installing Retainer Nut Using Fabricated Tools FT-21538, FT-21570, and FT-21571

8-4. OVERHAUL OF TURBINE ASSEMBLY.
(cont)

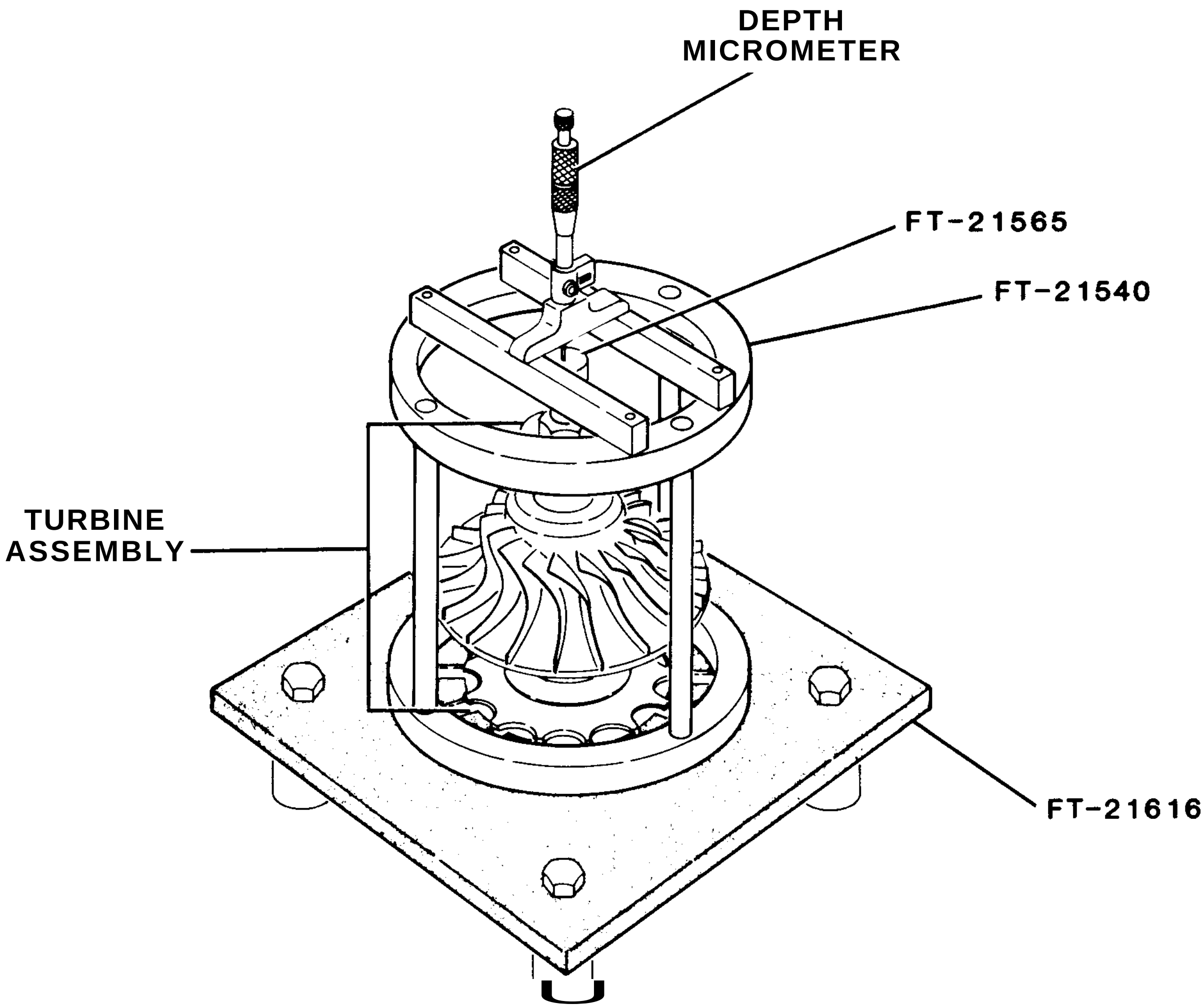


Figure 8-12. Obtaining Reading for Turbine Shaft Stretch Using Fabricated Tools FT-21540 and FT-21565

8-4. OVERHAUL OF TURBINE ASSEMBLY. (cont)

e. Assembly and Balance of Rotating Group Assembly. (cont)

(11) Install assembly in bench center Maintain 0.002 inch (0 005 cm) runout on total stackup, points A thru J on Figure 8-13 Remove assembly from bench center.

NOTE

Half bearings for the balancing fixture will need to be fabricated. The inside dimensions of the half bearings are the same as the outside dimensions of the dummy bearings fabricated tool (FT-21538) See Table 2-3 for dimensions. The outside dimensions of the half bearings will need to be supplied by the overhauler to suit the balancing equipment used.

(12) Install assembly in balancing fixture using half bearings. Use dummy bearings as carrying surfaces.

CAUTION

To prevent damage to the turbine assembly, prevent thrust from pulling assembly off fixture (13) Balance turbine assembly to 0.14 GRM inches in planes "A" and "B".

CAUTION

To prevent damage, DO NOT use lead or wax base pencils for marking on high temperature alloy parts Carbon/wax in pencils is detrimental to parts. Use red ink felt pens or grease base pencils.

(14) Matchmark top of turbine wheel (20, Figure 8-6) shaft, top of compressor wheel (33) shaft, labyrinth seal (29), bottom of compressor wheel (33) shaft, labyrinth seal (19), and turbine wheel (20).

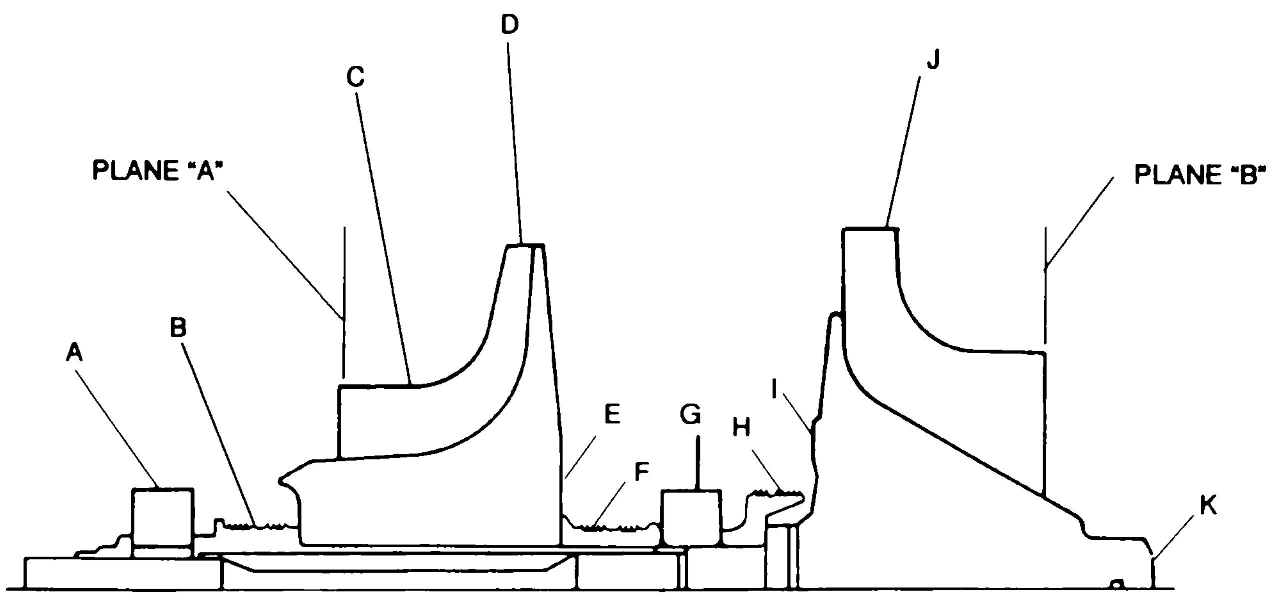


Figure 8-13. Obtaining Reading for Turbine Shaft Stretch Using Fabricated Tools FT-21540 and FT-21565

8-4. OVERHAUL OF TURBINE ASSEMBLY. (cont)

e. Assembly and Balance of Rotating Group Assembly. (cont)

(15) Disassemble stackup down to labyrinth seal (19) and thoroughly clean components with alcohol

f. Reassembly

NOTE

To establish proper shimming of the compressor wheel It is necessary to complete steps (1) thru (8) checking the clearances as described In step (9) These steps may need to be repeated several times until the proper clearances are established Until the proper shimming Is achieved, use an old bearing (41, Figure 8-6) DO NOT install a new bearing (41) until shimming is correct.

(1) Install bearing (41) in bearing housing (36).

(2) Install fabricated tool (FT-21498, Figure 8-10) In bench vise Place bearing housing (36, Figure 8-6) in fabricated tool (FT-21498, Figure 8-10) and bolt In place

(3) Install bearing retainer nut (40, Figure 8-6) Use fabricated tool (FT-21583, Figure 8-10) and torque nut to 600 inch pounds (67 8 Nm).

(4) Remove bearing housing from fabricated tool (FT-21498).

NOTE

Both tab washer (38, Figure 8-6) and shims (37) can be Installed in one direction only.

(5) Install jackscrews In bearing housing (36). Install tab washer (38) and shim set (37) on jack screws The shim set (37) should be the thickness measured on tear-down for the first attempt Modify shim set thickness per measurements in step (9)

CAUTION

To prevent damage to throat of compressor inlet housing (3), insert bearing carrier into inlet housing carefully.

(6) Using jackscrews as a guide and to keep shims In place, place bearing housing (36) In compressor inlet housing (3) Secure with washers (35) and bolts (34) Torque bolts to 70-88 Inch pounds (7 91-9 04 Nm)

CAUTION

To ensure proper balance of turbine assembly, make sure that matchmarks on all parts of rotating group assembly aline.

(7) Install compressor wheel (33)

CAUTION

If jam nut Is too tight, distortion of bearing and improper shimming will result.

(8) Place compressor inlet housing containing bearing carrier and compressor wheel on fabricated tool (FT-21360, Figure 8-14). Add dummy lab seal and Inner race of bearing to back of compressor Impeller Tighten jam nut just light enough to ensure that inserting wire gages does not tip compressor wheel.

84. OVERHAUL OF TURBINE ASSEMBLY. (cont)

f. Reassembly (cont)

(9) Use wire gage and check clearance between compressor wheel blade tips and inlet housing. Adjust shim set (step (5) above) as necessary to attain clearance of 0 014-0 016 inch (0 036-0 041 cm)

Type of Shim/Washer	Thickness	Part No	Qty
Bearing Shim	0 024 Inch	101444-1	
Metallic Shim	0 002 Inch	101414-4	4 ea
Metallic Shim	0 005 Inch	101414-5	3 ea
Metallic Shim	0 020 Inch	101414-6	2 ea
Wave Washer		101437-1	

(10) When correct clearance is attained, install production bearing (37, Figure 8-6) in step (1) Repeat steps (2) and (3) Ensure that bearing retainer nut (40) is positioned to allow tabs of tab washer (38) to be bent Repeat steps (4) thru (5) Install preformed packing (39). Coat outside diameter of bearing housing at packing and mating surface of compressor inlet housing with petrolatum, VV-P-236

CAUTION

DO NOT bend tabs on washers (35)

(11) Using jackscrews as a guide and to keep shims in place, place correct shim stack (37) and bearing housing (36) in compressor inlet housing (3). Secure with washers (35) and bolts (34). Torque bolts to 70-88 inch pounds (7.91-9 04 Nm). Bend tabs on tab washer (38). Lockwire using MS20995-C32 lockwire.

(12) Install labyrinth seal (29) on back of compressor wheel (33)

WARNING

To prevent injury, ensure that insulated gloves are worn when handling dry Ice and cold parts

CAUTION

To prevent engine failure, ensure that retaining ring (30) that secures oil passage plug (31) is correctly Installed

(13) Install preformed packing (32) on oil passage plug (31) Secure in place in diffuser (2) with retaining ring (30) Ensure that retaining ring is under retaining groove

CAUTION

If diffuser (2) drops into place without heating and cooling, replace diffuser

(14) Place diffuser (2) In solution of dry ice and alcohol for approximately 15 minutes. Use soft flame and heat outside of inlet housing.

(15) Remove diffuser from solution and Install in compressor inlet housing (3) Ensure that oil tube holes and bolt holes are alined.

(16) Install bolts (13) in the 1, 4, 7, 10, 13, and 16 positions. (See Figure 8-7.) Secure with washers (11 and 12, Figure 8-6) and nuts (10). Torque to 74-79 Inch pounds (8.36-8.93 Nm)

8-4. OVERHAUL OF TURBINE ASSEMBLY.
(cont)

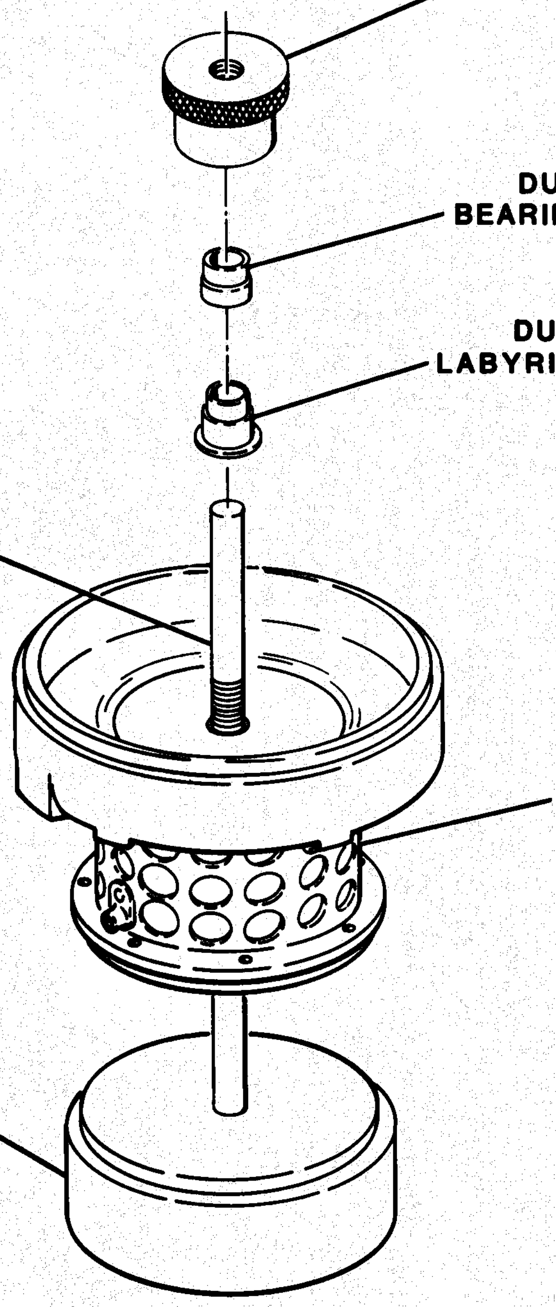


Figure 8-14. Measuring Compressor Impeller Vane Clearance Using Fabricated Tool FT-21360

84. OVERHAUL OF TURBINE ASSEMBLY. (cont)

f. Reassembly (cont)

(9) Use wire gage and check clearance between compressor wheel blade tips and inlet housing. Adjust shim set (step (5) above) as necessary to attain clearance of 0 014-0 016 inch (0 036-0 041 cm)

Type of Shim/Washer	Thickness	Part No	Qty
Bearing Shim	0 024 Inch	101444-1	
Metallic Shim	0 002 Inch	101414-4	4 ea
Metallic Shim	0 005 Inch	101414-5	3 ea
Metallic Shim	0 020 Inch	101414-6	2 ea
Wave Washer		101437-1	

(10) When correct clearance is attained, install production bearing (37, Figure 8-6) in step (1) Repeat steps (2) and (3) Ensure that bearing retainer nut (40) is positioned to allow tabs of tab washer (38) to be bent Repeat steps (4) thru (5) Install preformed packing (39). Coat outside diameter of bearing housing at packing and mating surface of compressor inlet housing with petrolatum, VV-P-236

CAUTION

DO NOT bend tabs on washers (35)

(11) Using jackscrews as a guide and to keep shims in place, place correct shim stack (37) and bearing housing (36) in compressor inlet housing (3). Secure with washers (35) and bolts (34). Torque bolts to 70-88 inch pounds (7.91-9 04 Nm). Bend tabs on tab washer (38). Lockwire using MS20995-C32 lockwire.

(12) Install labyrinth seal (29) on back of compressor wheel (33)

WARNING

To prevent injury, ensure that insulated gloves are worn when handling dry Ice and cold parts

CAUTION

To prevent engine failure, ensure that retaining ring (30) that secures oil passage plug (31) is correctly Installed

(13) Install preformed packing (32) on oil passage plug (31) Secure in place in diffuser (2) with retaining ring (30) Ensure that retaining ring is under retaining groove

CAUTION

If diffuser (2) drops into place without heating and cooling, replace diffuser

(14) Place diffuser (2) In solution of dry ice and alcohol for approximately 15 minutes. Use soft flame and heat outside of inlet housing.

(15) Remove diffuser from solution and Install in compressor inlet housing (3) Ensure that oil tube holes and bolt holes are alined.

(16) Install bolts (13) in the 1, 4, 7, 10, 13, and 16 positions. (See Figure 8-7.) Secure with washers (11 and 12, Figure 8-6) and nuts (10). Torque to 74-79 Inch pounds (8.36-8.93 Nm)

8-4. OVERHAUL OF TURBINE ASSEMBLY. (cont)

f. Reassembly. (cont)

(17) On bottom of compressor inlet housing, install oil supply fitting (13, Figure 8-5), fuel drain fitting (14), oil drain fitting (15), and associated preformed packings.

(**18)** Install retaining plate (12) and secure with washers (11) and bolts (10) Torque to 20-25 inch pounds (2-26-2.83 Nm) and lockwire

NOTE

To ensure 50 lb of thrust, it is necessary to collapse the wave washer to 0.090 inch (0.229 cm) against the outer race of the bearing.

(19) Refer to Figure8-15. Measure and record distance from A to B. Measure and record distance from A to C. To obtain gap, subtract A to C distance from A to B distance. Add the remainder from the calculation, 0.090 inch (0.229 cm), and the end play of the bearing together to obtain gap to be filled. Measure height of wave washer and subtract from gap. Add shims to wave washer to fill gap

(20) Install shim set (28, Figure 8-6) to thickness derived in step (17).

(21) Install wave washer (27).

(22) Install diffuser cap (26), key lockwashers (25), and screws (24) Bend tabs on key lockwashers. Torque to 70-80 inch pounds (7.91-9.04 Nm)

(23) Maintain clearance of 0.040-0.070 inch (0 122-0 178 cm) between backshroud and back of turbine

NOTE

Generally, no shim is required. Clearance Is maintained by machining of mating surfaces If necessary, shim to .070 inch

(24) Ensure that matchmark are alined Secure with antirotation pins (17).

(25) Wash down turbine wheel, labyrinth seal, and bearing assembly with alcohol. Re-oil bearing with turbine oil

(26) Carefully install assembled turbine wheel In compressor inlet housing.

(27) Put turbine oil under retainer nut (15). Install key washer (16) prior to installing bearing retainer nut (40). Use fabricated tool (FT-21570, Figure 8-11) with torque wrench and torque nut to 300 inch pounds (33.90 Nm). Back off and retorque to 50 inch pounds (5 65 Nm).

8-4. OVERHAUL OF TURBINE ASSEMBLY.
(cont)

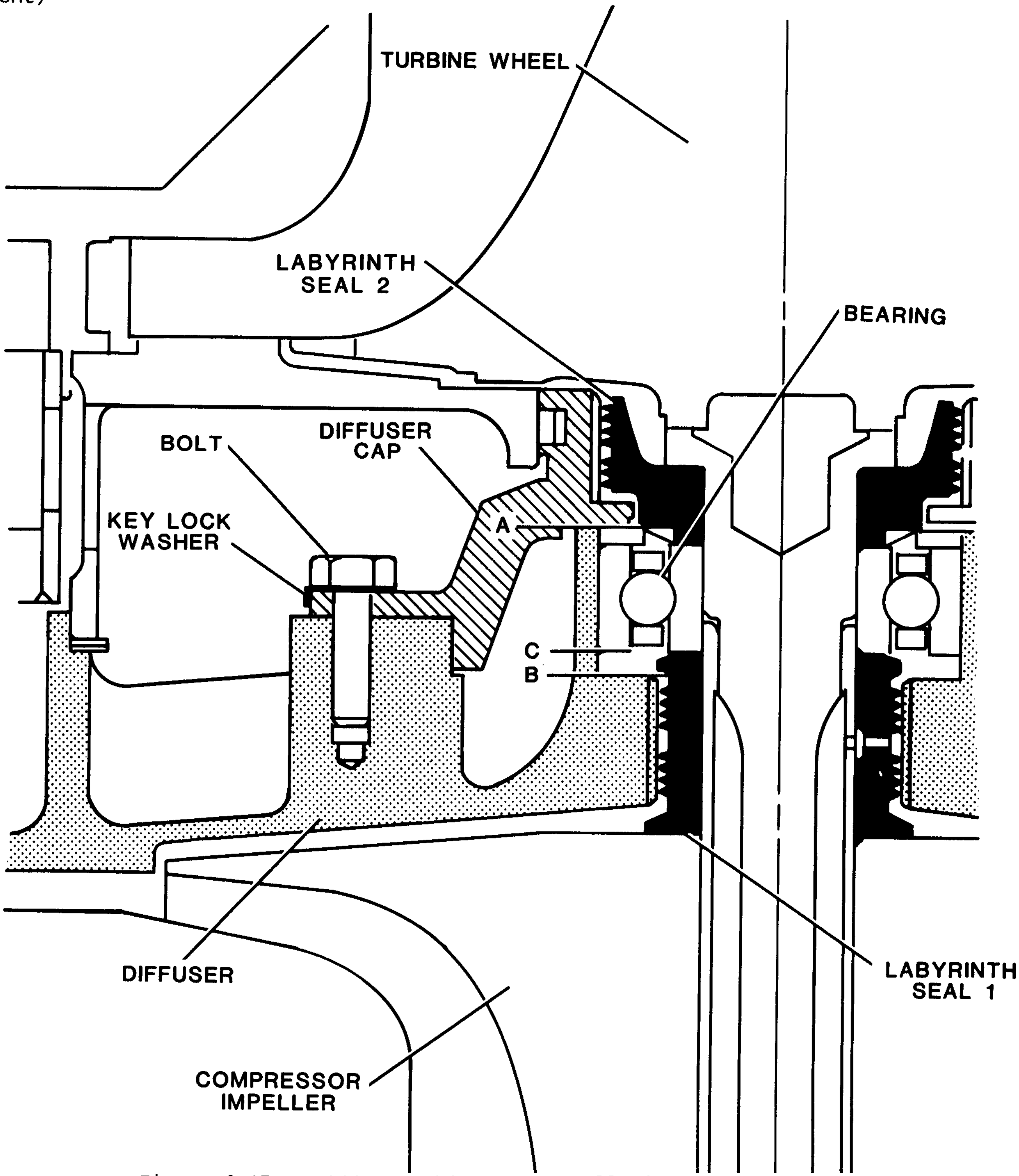


Figure 8-15. Diffuser Shim Set Installation - Measurement Points

8-4. OVERHAUL OF TURBINE ASSEMBLY. (cont)

f. Reassembly. (cont)

(28) Place fabricated tool (FT-21565, Figure 8-16) on top of turbine shaft Place fabricated tool (FT-21539) on top of compressor inlet housing Center hole over fabricated tool (FT-2156) Take a base reading from the top of shaft to top of fabricated tool (FT-21539) using depth micrometer Note the reading. The shaft must be stretched 0.007- 0.009 inch (0.018-0.023 cm) from the original reading.

(29) Tighten nut and remeasure shaft length Repeat procedure until 0.007-0.009 inch (0.018-0.023 cm) stretch has been achieved

CAUTION

Be sure all grinding dust, chips, and burrs created by balancing operations are removed before each step of assembly. Failure to remove dust, chips, and burrs will create excessive runout when parts are assembled and may lead to rotating group damage during engine operation.

(30) Install assembly in bench center On two center points, maintain runout at 0 002 inch (0 005 cm) at point K, Figure 8-13

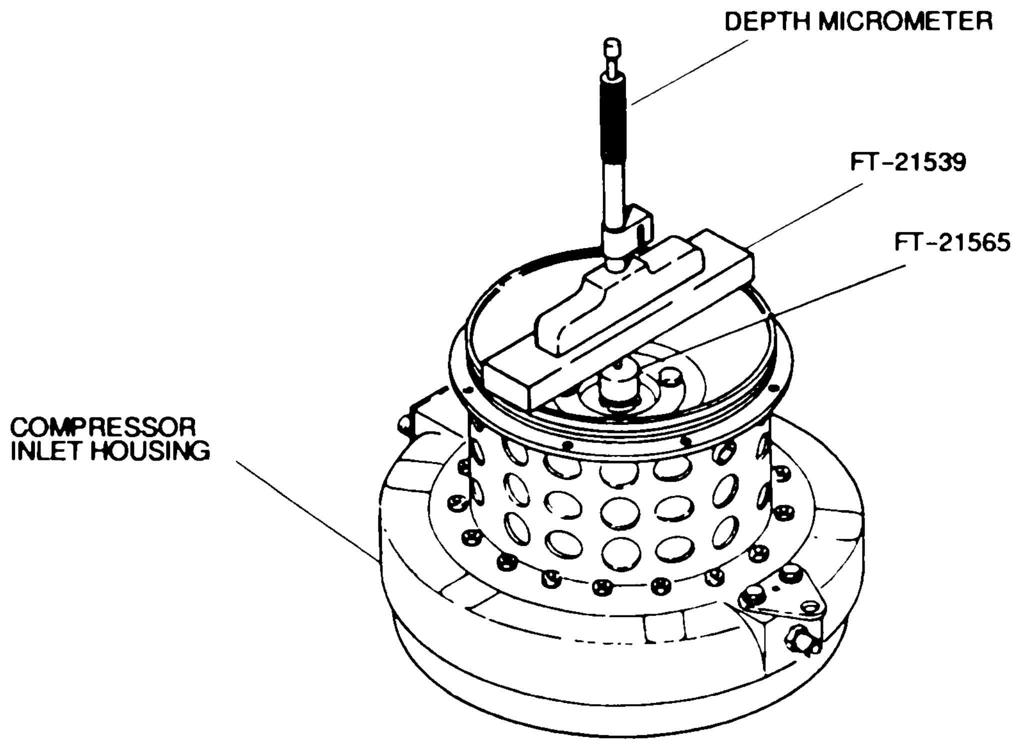


Figure 8-16. Obtaining Reading for Turbine Wheel Shaft Stretch for Final Assembly Using Fabricated Tools FT-21539 and FT-21565

8-4. OVERHAUL OF TURBINE ASSEMBLY. (cont)

f. Reassembly (cont)

(31) Torque retainer nut to 475-600 inch pounds (53.67-67 80 Nm).

NOTE

Speed pickup nut is a 100% replaceable item and should not be reused.

(32) Install new speed pickup nut (9, Figure 8-6) Use fabricated tool (FT-21368) with torque wrench and stake speed pickup nut into grooves on sides of turbine wheel shaft using a center punch Carefully remove any metal particles from area around retainer nut and speed pickup nut using a vacuum cleaner. Flush area with alcohol followed by clean turbine oil Flush entire area generously with oil.

(33) Install both halves of turbine nozzle assembly (1, Figure 8-6) and secure with six washers (9) and bolts (8) Torque to 40 inch pounds (4 52 Nm)

(34) Install shims (7) to depth measured on disassembly.

(35) Begin to install turbine nozzle (1) Ensure that matchmarks on turbine nozzle and diffuser are alined.

(36) Drop bolts into positions 2, 3, 5, 6, 8, 9, 11, 12, 14, 15, and 17 See Figure 8-7 Ensure that bolts drop through holes to outside of compressor inlet housing (3, Figure 8-6)

(37) Complete installation of turbine nozzle by lightly tapping nozzle into position using a non-metallic hammer.

NOTE

Reverse safety wire, inlet compressor, and back shroud bolts.

(38) Install washers (5) and nuts (4) on bolts (6) Torque in crisscross pattern to 40 inch pounds (4.52 Nm). Lockwire using MS20995-C3 after shim set clearance is accomplished.

(39) Use wire gage to measure clearance between turbine wheel and turbine nozzle. Adjust shim set (7) to maintain clearance of .022-.026 inch (0.056-0.066 cm)

g. Installation.

CAUTION

Maintain clearance of 0.014-0.058 inch (0 036-0 147 cm) between speed pickup nut and speed sensor.

(1) Install shim (22, Figure 8-5) and speed sensor (21).

(2) Install washer (20) and speed sensor clip (19) Secure with bolt (18).

(3) Install preformed packing (17) and bleed air connector (16).

(4) Install shouldered output shaft (8) and preformed packing (7).

(5) Install turbine assembly (6) and secure with washers (5) and nuts (4). Lockwire using M520995-C32.

(6) On bottom of compressor inlet housing, connect fuel drain line (3), oil drain tube (2), and oil supply tube (1)

(7) Install combustion chamber case in accordance with paragraph 8-2d.

(8) Install padeye (26) and foreign object deflector (25 1) Secure with washer (25), and bolt (24). Torque to 50-70 inch pounds (5.7-7 9 Nm).

(9) Install preformed packing (23).

8-5. OVERHAUL OF GEARBOX ASSEMBLY.

a. Removal.

(1) Remove engine, gearbox assembly, generator, starter, and engine support assembly as a unit from the generator set in accordance with paragraph 2-7a. See figure 8-17.

(2) Suspend engine and gearbox assembly in disassembly fixture. See table 8-2 for mounting dimensions of disassembly fixture.

NOTE

For ease of disassembly, the fixture should be able to rotate through 360°.

(3) Remove starter (paragraph 4-30b, TM 5-6115-612-12).

(4) Remove generator (paragraph 2-6).

CAUTION

To prevent damage, support gearbox and compressor inlet housing.

(5) Insert block of wood (1 inch x 2 inches x 4 Inches) between gearbox housing and engine support assembly and under compressor inlet housing.

(6) Tag, disconnect, and remove oil supply tube (1, figure 8-5), oil drain tube (2), and fuel drain line (3).

(7) At rear of engine, remove capscrews (1, figure 8-17), lockwashers (2), and rear spacer (3) to separate engine from rear engine support (4).

(8) Remove lockwire, nuts (5), and washers (6) that secure compressor inlet housing (7) to gearbox assembly (8).

(9) Remove engine (9) from gearbox assembly (8).

(10) Remove shouldered shaft (11).

(11) Remove capscrews (12) and lockwashers (13) to free front engine supports (10) from each side of gearbox.

(12) Remove gearbox assembly (8).

8-5. OVERHAULOF GEARBOX ASSEMBLY. (cont)

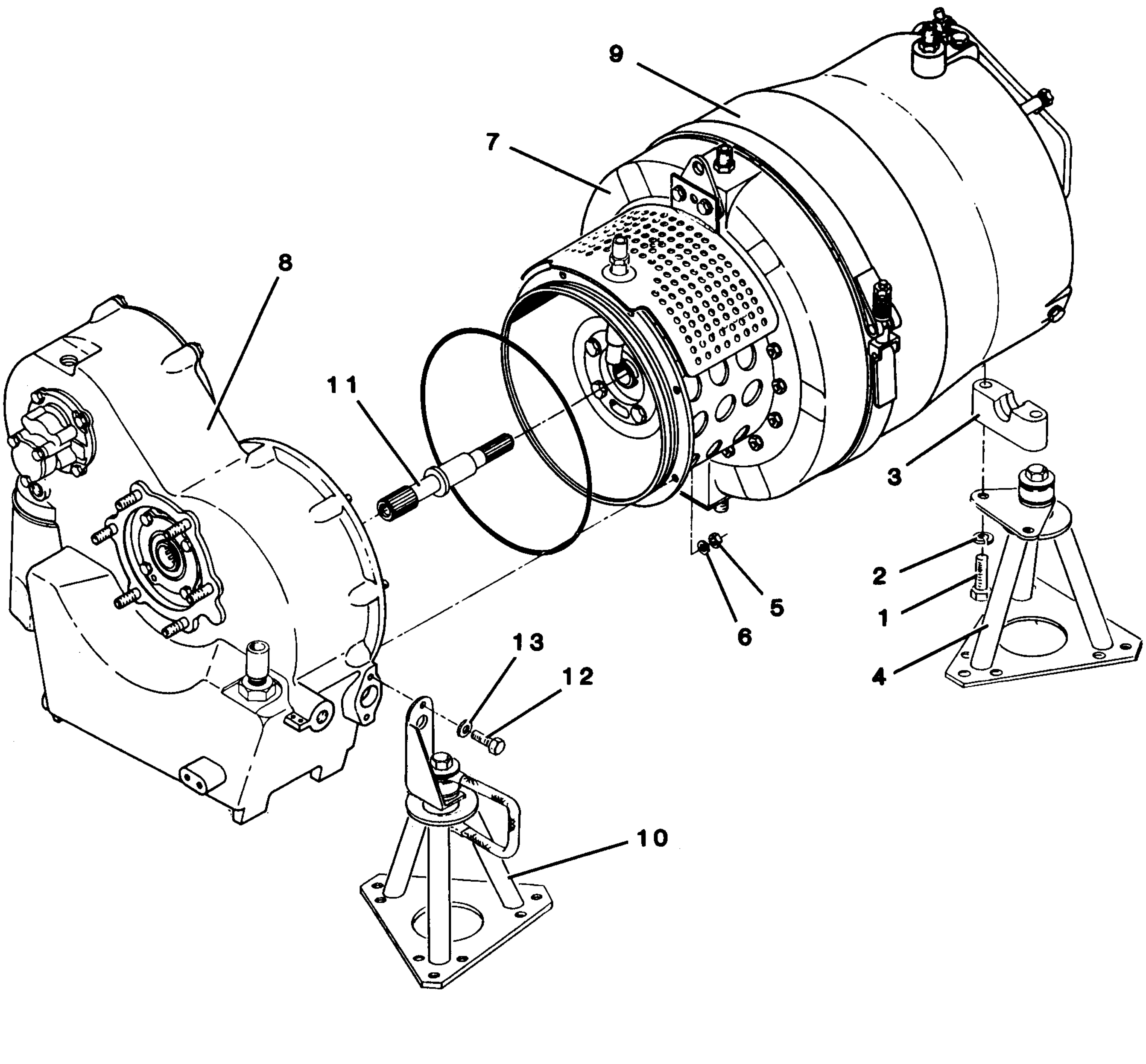


Figure 8-17. Gearbox Removal (Sheet 1 of 2)

8-5. OVERHAUL OF GEARBOX ASSEMBLY. (cont)

LEGEND

1. CAPSCREW
2. LOCKWASHER
3. REAR SPACER
4. REAR ENGINE SUPPORT
5. NUT
6. WASHER
7. INLET HOUSING
8. GEARBOX
9. ENGINE
10. FRONT ENGINE SUPPORT
11. SHOULDERED SHAFT

Figure 8-17. Gearbox Removal (Sheet 2 of 2)

85. OVERHAUL OF GEARBOX ASSEMBLY. (cont)

b. Disassembly.

NOTE

See Table 2-3, Fabricated Tools and Equipment, for fabricating dimensions and specifications for all FT-21XXX numbers referenced in the text.

(1) Install gearbox assembly in mount fix-ture, fabricated tool (FT-21343, Figure 8-18), for dis-assembly

(2) Drain gearbox cavity of excess oil

(3) Remove retaining ring (1, Figure8-19), key washer (2), preformed packing (3), and oil sediment strainer (4) from gearbox. Discard packing.

(4) Remove retaining ring (5), key washer (6), preformed packing (7), oil pressure relief valve (8), and preformed packing (9). Discard packings.

(5) Remove all external oil tubes, plugs, and fittings. Discard preformed packings.

(6) Remove all external safety wire.

(7) Remove bolts (1, Figure 8-20), washers (2), and gently pry off starter mounting cover (3). Discard preformed packing (4) Using arbor press, remove seal (5) from starter mounting cover Discard seal.

(8) Remove starter gear assembly (6), spring washer (7), and bearing shim (8). Discard spring washer.

CAUTION

DO NOT remove pipe plug from spur gear (12) It is installed when manufactured and Is not designed to be removed. If removed, damage to spur gear or pipe plug may occur.

(9) Using puller set, remove bearings (9) and (10) and pin (11) from starter spur gear (12) Discard.

(10) Remove bolts (10, Figure 8-19) and washers (11) that secure oil pump (12) to gearbox.

(11) Using small nylon punch, tap out oil pump from starter mounting side of gearbox. Remove preformed packing (13, 13.1, and 13.2).

(12) Remove union (15), preformed packing (15.1), oil filter (16), oil filter adapter (17) and washer (18).

8-5. OVERHAUL OF GEARBOX ASSEMBLY.
(cont)

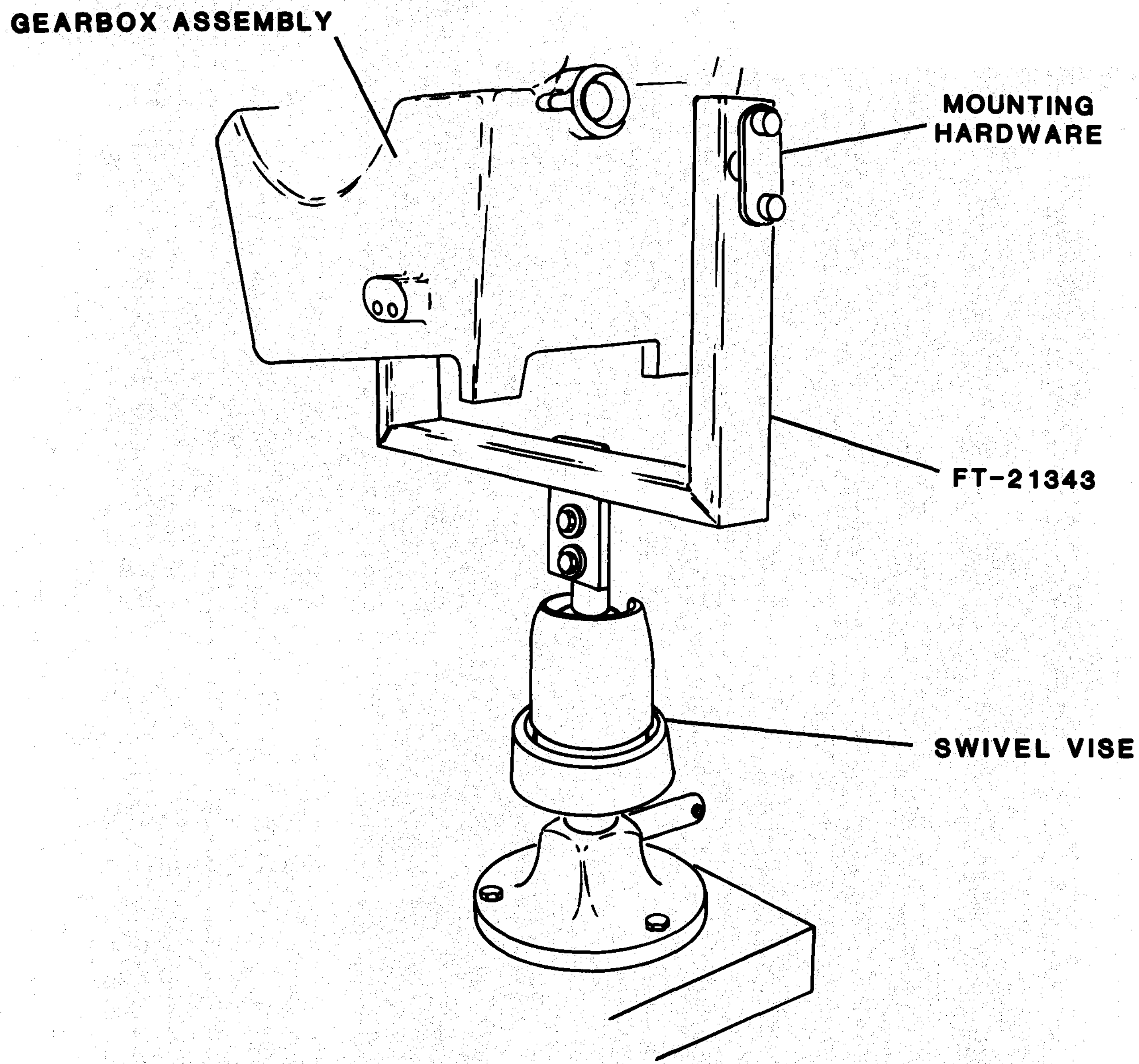
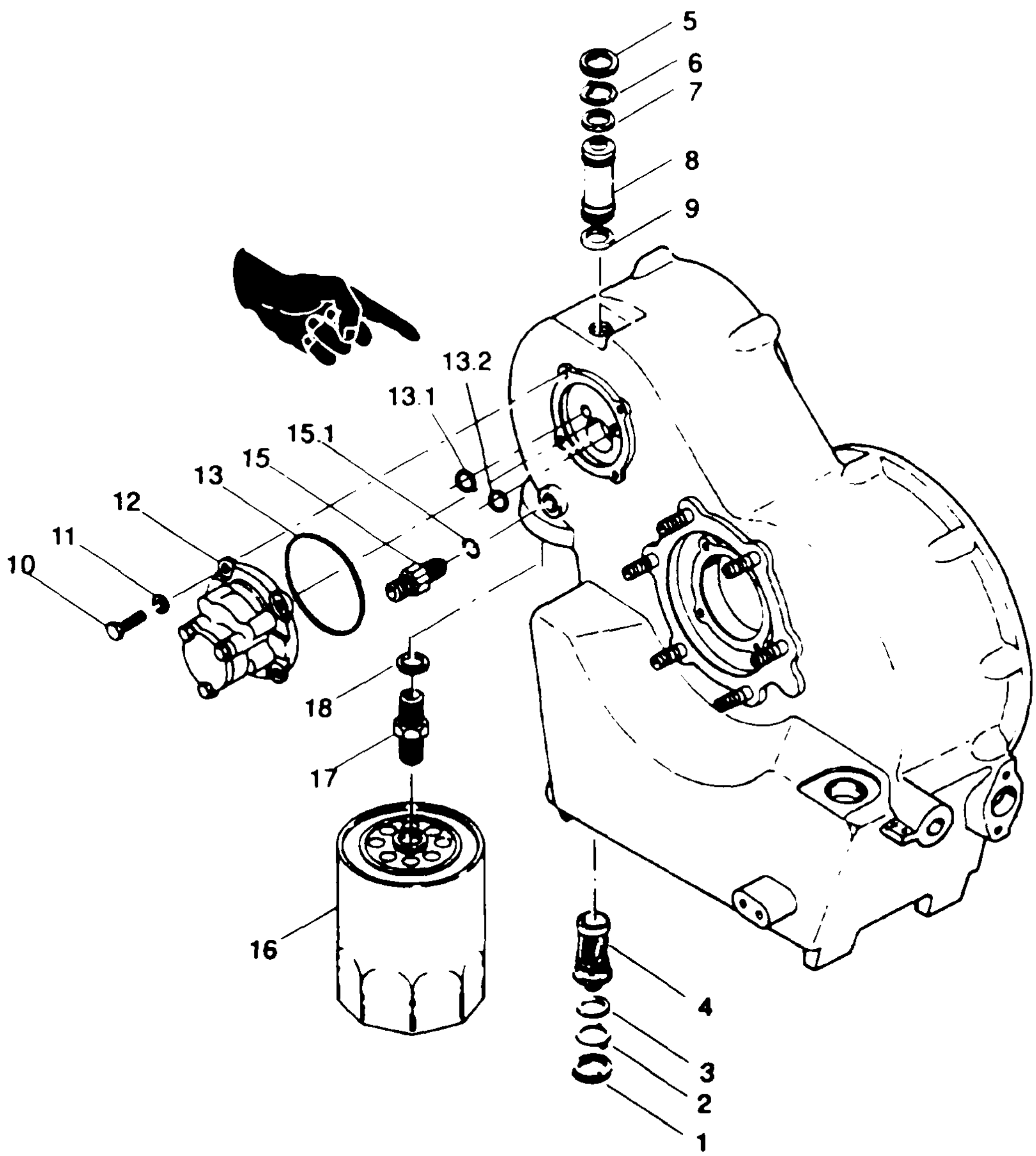


Figure 8-18. Preparing Gearbox Assembly for Disassembly Using Fabricated Tool FT-21343

8-5. OVERHAUL OF GEARBOX ASSEMBLY.
(cont)



LEGEND

1. RETAINING RING
2. KEY WASHER
3. PERFORMED PACKING
4. OIL SEDIMENT STRAINER
5. RETAINING RING
6. KEY WASHER
7. PREFORMED PACKING
8. OIL PRESSURE RELIEF VALVE
9. PERFORMED PACKING
10. PERFORMED PACKING
11. WASHER

12. OIL PUMP
13. PERFORMED PACKING
13.1. PERFORMED PACKING
132. PERFORMED PACKING
14. DELETED
15. UNION
15.1. PERFORMED PACKING
16. OIL FILTER
17. OIL FILTER ADAPTER
18. WASHER

Figure 8-19. Preparing Gearbox Assembly for Disassembly Using Fabricated Tool FT-21343

8-5. OVERHAUL OF GEARBOX ASSEMBLY.

b. Disassembly.

(13) Remove bolt (13, Figure 8-20), washer (14) and washers (15) securing loop clamp (16) and tube assembly (17) to gearbox housing.

(14) Remove bolts (18) and washers (19) that secure tube fitting (19.1) to gearbox Remove and discard preformed packing (20, 20 1, 20.2)

(15) Remove bolt (21), washer (22), sleeve spacer (23), and washer (23 1) securing loop clamp (24) and tube assembly (25)

(16) Remove capscrews (26) and washers (27) securing tube assembly stackup (28). The tube assembly stackup consists of tube assembly (25), preformed packing (29), tube assembly (30), preformed packing (31), tube assembly (31 1), preformed packing (32), plate spacer (33), preformed packing (34), and tube assembly (35). Remove and discard all preformed packings

(17) Remove bolts (36) and washers (37).

(18) Insert bolts (36) In jackscrew holes in seal retainer (38)Turn jackscrews to remove seal retainer.

(19) Using arbor press, remove seal (39). Remove preformed packing (40), shim (41), and spring washer (42). Discard packing and seal.

CAUTION

Shoulder shaft nut (45) has left-handed threads. Loosen in a clockwise direction to avoid damage to equipment

(20) Secure generator shoulder shaft (43) in holding fixture, fabricated tool (FT-21322, Figure 8-21) Bend down tabs on key washer (44). Using fabricated tool (FT-21369), remove nut (45) from shaft Remove from holding fixture. Discard key washer.

(21) Place gearbox assembly on gearbox support base, fabricated tool FT-21589 Place gearbox assembly plus fixture on arbor press. Using bearing removal tool, fabricated tool FT-21325, press generator shouldered shaft (43) through bearing (46) and output spur gear (47) Remove assembly from arbor press See Figure 8-22.

(22) Remove bearing (48) from generator shouldered shaft (43) using bearing puller Dis-card bearing/

(23) Remove retaining ring (49) from generator shouldered shaft.

(24) Remove output spur gear (47) and bearing (46) from gearbox housing Discard bearing.

(25) Remove bolts (50) and washers (51) securing bearing retainer (52) to gearbox housing (59). Remove bearing retainer (52), pinion spur gear assembly (53), spring washer (54), and shim (55)

(26) Using puller set, remove bearings (56) and (57) from pinion spur gear (58) Discard bearings
.

85. OVERHAUL OF GEARBOX ASSEMBLY.

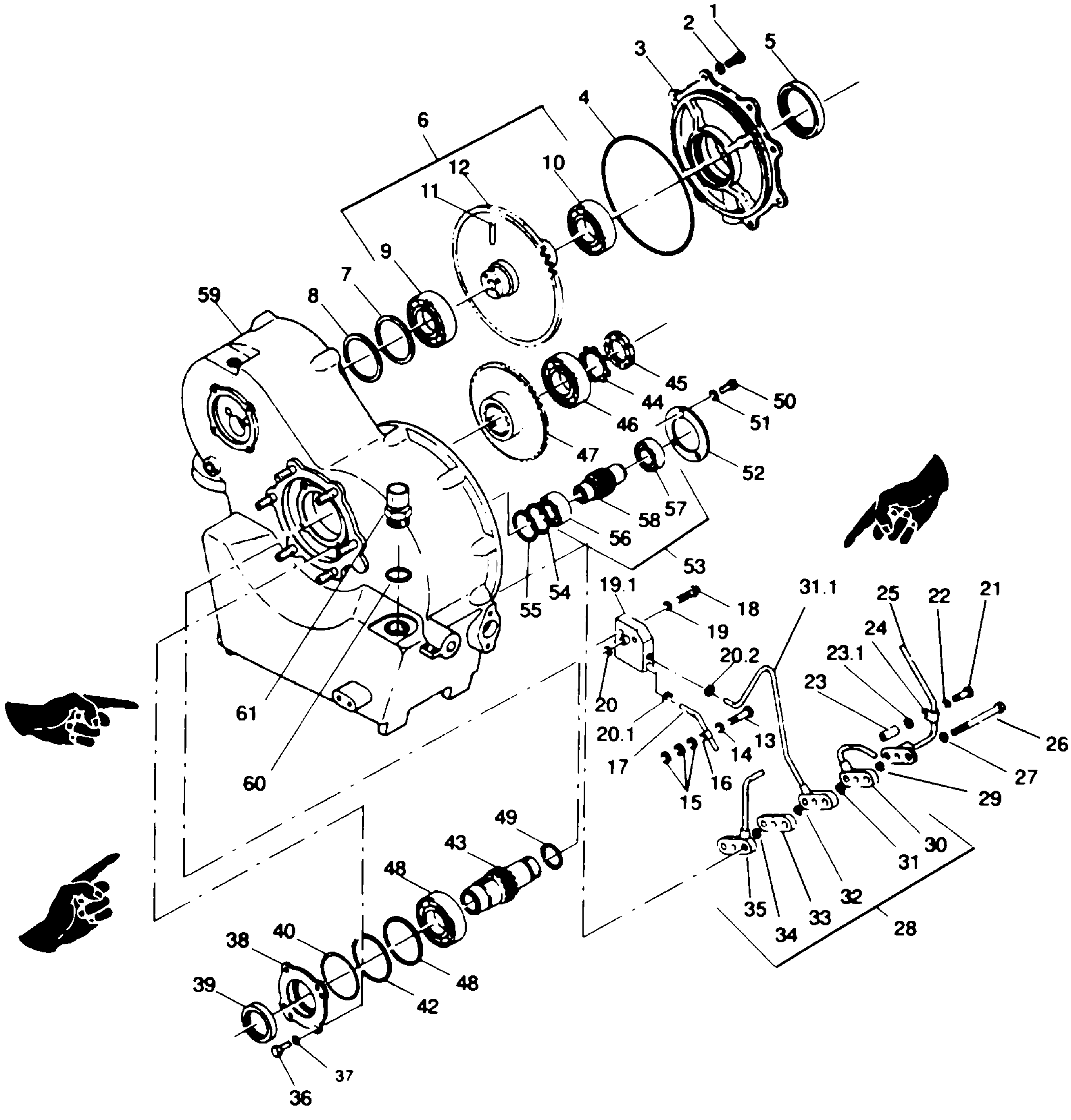


Figure 8-20. Gearbox Disassembly (Sheet 1 of 2)

8-5 OVERHAUL OF GEARBOX ASSEMBLY.

LEGEND

1	BOLT	**30**	TUBE ASSEMBLY
2	WASHER	**31**	PERFORMED PACKING
3	STARTER MOUNTING COVER	**31.1**	PERFORMED PACKING
4	PERFORMED PACKING	**32**	PERFORMED PACKING
5	SEAL	**33**	PLATE SPACER
6	STARTER SPUR GEAR ASSEMBLY	**34**	PERFORMED PACKING
7	SPRING WASHER	**35**	TUBE ASSEMBLY
8	SHIM	**36**	BOLT
9	BEARING	**37**	WASHER
10	BEARING	**38**	SEAL RETAINER
11	PIN	**39**	SEAL
12	STARTER SPUR GEAR	**40**	PERFORMED PACKING
13	BOLT	**41**	SHIM
14	WASHER	**42**	SPRING WASHER
15	WASHER	**43**	GENERATOR SHOULDERED SHAFT
16	LOOP CLAMP	**44**	KEY WASHER
17	TUBE ASSEMBLY	**45**	NUT, LEFT HANDED THREADS
18	BOLT	**46**	BEARING
19	WASHER	**47**	OUTPUT SPUR GEAR
19.1	TUBE FITTING	**48**	BEARING
20	PERFORMED PACKING	**49**	RETAINING RING
20.1	PERFORMED PACKING	**50**	BOLT
20.2	PERFORMED PACKING	**51**	WASHER
21	BOLT	**52**	BEARING RETAINER
22	WASHER	**53**	PINION SPUR GEAR ASSEMBLY
23	SLEEVE SPACER	**54**	SPRING WASHER
23.1	WASHER	**55**	SHIM
24	LOOP CLAMP	**56**	BEARING
25	TUBE ASSEMBLY	**57**	BEARING
26	CAPSCREW	**58**	PINION SPUR GEAR
27	WASHER	**59**	GEARBOX HOUSING
28	TUBE ASSEMBLY STACKUP	**60**	PERFORMED PACKING
29	PERFORMED PACKING	**61**	PERFORMED PACKING

Figure 8-21. Gearbox Disassembly (Sheet 2 of 2)

8-5. OVERHAUL OF GEARBOX ASSEMBLY. (cont)

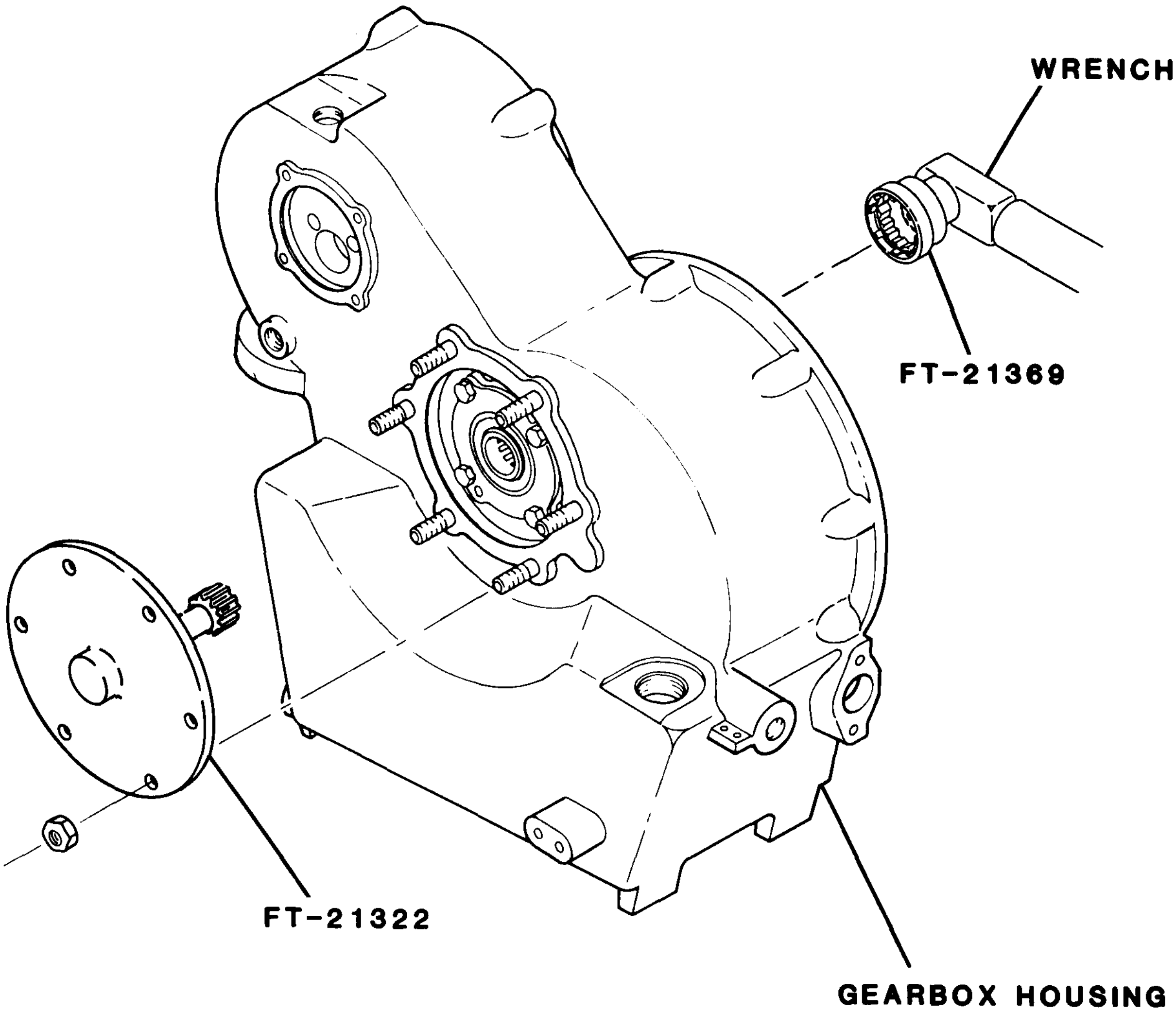


Figure 8-21. Securing Generator Shouldered Shaft and Removing Nut Using Fabricated Tools FT-21322 and FT-21369

8-5. OVERHAUL OF GEARBOX ASSEMBLY. (cont)

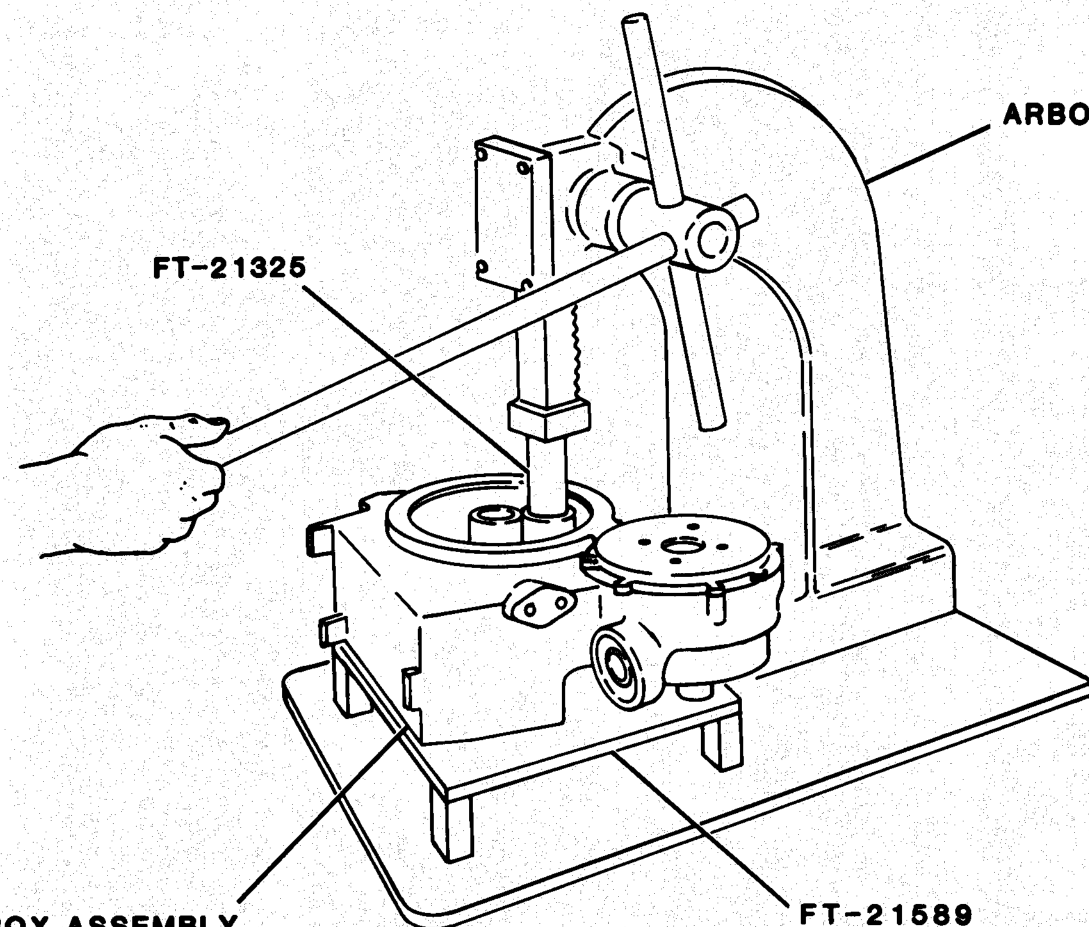


Figure 8-22. Removing Bearing and Output Spur Gear Using Fabricated Tools FT-21589 and FT-21325

8-5. OVERHAUL OF GEARBOX ASSEMBLY. (cont)

c. Cleaning.

CAUTION

To prevent subsequent problems with components, use caution in cleaning so as not to remove evidence of damage. Inspect both before and after cleaning.

(1) Vapor degrease and steam clean all oil tubes and fittings.

(2) Vapor degrease and steam clean starter mounting cover.

(3) Vapor degrease and steam clean starter spur gear.

(4) Vapor degrease and steam clean seal retainer, generator shouldered shaft, and output spur gear.

(5) Vapor degrease and steam clean pinion spur gear and gearbox housing.

d. Inspection.

(1) Inspect oil tubes for wear, chafing, cracks, or other damage.

(2) Measure openings in ends of oil tubes with wire gage. Opening in tube must be 0.030-0.040 inch (0.076-0.102 cm).

(3) Inspect starter mounting cover for cracks, wear, corrosion, or other damage.

(4) Refer to table 8-3. Perform nondestructive test on starter mounting cover.

(5) Check dimensions of starter mounting cover in accordance with table 1-1.

(6) Inspect starter spur gear for cracks, wear, broken teeth, and other damage.

(7) Check dimensions of starter on spur gear in accordance with table 1-1.

(8) Refer to table 8-3. Perform nondestructive test on starter spur gear.

(9) Inspect seal retainer for galling, broken ears, and other damage.

(10) Refer to table 8-3. Perform nondestructive test on seal retainer.

(11) Inspect generator shouldered shaft for nicks, scratches, broken or deformed splines, and for excessive wear.

(12) Check dimensions on generator shouldered shaft in accordance with table 1-1.

(13) Refer to table 8-3. Perform nondestructive test on generator shouldered shaft.

(14) Inspect output spur gear for cracks, wear, broken teeth, and other damage.

(15) Refer to table 8-3. Perform nondestructive test on output spur gear.

(16) Inspect pinion spur gear for nicks, scratches, broken or deformed splines, and for excessive wear.

(17) Check dimensions on pinion spur gear in accordance with table 1-1.

(18) Refer to table 8-3. Perform nondestructive test on pinion spur gear.

8-5. OVERHAUL OF GEARBOX ASSEBLY. (cont)

d. Inspection. (cont)

(19) Inspect gearbox housing for cracks, nicks, excessive wear on mounting surfaces, damaged threaded areas, damaged mounting studs, corrosion, and other damage.

(20) Check dimensions of bearing bores on gearbox housing in accordance with table 1-1.

(21) Refer to table 8-3. Perform nondestructive teat on gearbox housing.

e. Repair and Replacement.

(1) Replace all worn or damaged bolts, screws, washers, sleeve spacer nuts, loop clamps, seals, pins, and shims.

(2) Replace all damaged tube assemblies that do not meet requirementa of paragraph 8-5d (2).

(3) Remove corrosion. Replace cover if cracked or damaged. Replace cover if defects discovered during nondestructive test.

(4) Replace starter mounting cover if dimensions, as defined in table 1-1, are outside acceptable tolerance.

(5) Replace starter spur gear if damaged or if defects discovered during nondestructive test.

(6) Replace starter spur gear if dimensions, as defined in table 1-1, are outside acceptable tolerance.

(7) Replace seal retainer if damaged or defects discovered during nondestructive test.

(8) Remove small nicks and scratches from generator shouldered shaft. Replace shaft if badly nicked or scratched, splines are broken or deformed, or if shaft is badly worn. Replace shaft if defects discovered during nondestructive test.

(9) Replace generator shouldered shaft if dimensions, as defined in table 1-1, are outside acceptable tolerance.

(10) Replace output spur gear if damaged or if defects discovered during nondestructive test.

(11) Replace pinion spur gear if nicked or scratched, splines are broken or deformed, or if shaft is badly worn. Replace gear if defects discovered in nondestructive test.

(12) Replace pinion spur gear if dimensions, as defined in table 1-1, are outside acceptable tolerance.

(13) Replace gearbox housing if cracks are discovered. Remove nicks, scratches, and corrosion. Replace housing if mounting surfaces are badly worn or if mounting studs are damaged. Repair threaded areas with threaded inserts according to standard procedure. Replace housing if defects discovered during nondestructive test.

(14) Replace gearbox housing if dimensions of bearing bores as defined in table 1-1 are outside acceptable tolerance.

8-5. OVERHAUL OF GEARBOX ASSEMBLY. (cont)

f. Reassembly.

WARNING

To prevent injury, ensure that insulated gloves are worn when handling dry ice and cold parts.

(1) Soak pinion spur gear (58, figure 8-20) in dry ice and alcohol for minimum of one hour. Install gearbox on mount fixture, fabricated tool FT-21343. See figure 8-l8.

CAUTION

To prevent damage, ensure that annular bearings are correctly installed.

CAUTION

To prevent damage, do not install different styles of bearings on the same shaft.

(2) Ensure that annular bearings are positioned as shown in figure 8-23. Exert pressure on inner race only. Use arbor press and fabricated tool FT-21326 and install bearings (56) and (57) on pinion spur gear.

(3) Lubricate shim (55), spring washer (54), and pinion spur gear assembly (53) with clean engine oil and install in gearbox housing. Use heat gun to heat bearing bores if necessary.

(4) Position bearing retainer (52) over pinion spur gear assembly. Install washers (51) and bolts (50) in 8 o'clock and 12 o'clock positions. Torque to 27-30 inch pounds (3.l-3.4 Nm).

(5) Install retainer ring (49) into generator shouldered shaft (43).

WARNING

To prevent injury, ensure that insulated gloves are worn when handling dry ice and cold parts.

(6) Soak generator shouldered shaft (43) in dry ice and alcohol for minimum of one hour.

(7) Using bearing installation tool, fabricated tool FT-21324, and arbor press, install bearing (48) on generator shouldered shaft.

(8) Place generator shouldered shaft assembly in-dry ice and alcohol while steps (9) thru (11) are performed.

(9) Lubricate output spur gear (47) bearing (46), spring washer (42), and shim (41) with clean engine oil.

(10) Insert bearing (46) into bearing journal of gearbox housing.

(11) Remove gearbox from mount fixture FT-21343. Heat output spur gear (47) in 300°F oven for 15 minutes. Place gear on top of bearing (46).

(12) Place gearbox housing on assembly fixture, fabricated tool FT-21590.

(13) Remove generator shouldered shaft assembly from dry ice and alcohol. Place assembly into bearing bore, alining splines of generator shouldered shaft with internal gears of pinion spur gear.

8-5. OVERHAUL OF GEARBOX ASSEMBLY. (cont)

f. Reassembly (cont)

CAUTION

To prevent damage, ensure that annular bearings are property installed.

CAUTION

To prevent damage, do not install different styles of bearings on the same shaft.

(14) Using bearing installation tool, fabricated tool FT-21324, and arbor press, ensure that generator shouldered shaft is seated into output spur gear (47) and bearing (46) See Figure 8-24.
Remove gearbox housing from fabricated tool (FT-21590).

(15) Install gearbox in fabricated tool FT-21343

(16) Install fabricated tool (FT-21322,) output shaft torque tool, and secure to generator shouldered shaft (43, Figure 8-20) with two speed nuts.

(17) On nut (45) spray fast cure primer.
Spread threadlocking compound evenly on threads.

(18) Place key washer (44) an nut (45) on shaft Using fabricate tool (FT-21369) and torque wrench, torque nut to 600 ±50 Inch pounds (67 8 ±5.7 Nm) See Figure 8-21 Work torque within limits to aline slots on nut to tabs on key washer.

(19) Bend key washer tab into slot on nut. Remove output shaft torque tool (FT-21322).

(20) Spray bearings (46 and 48, Figure 8-20) with alcohol Dry bearings with low pressure air and relubricate bearings with clean engine oil.

(21) Deleted

(22) Deleted

(23) Deleted

(24) Lubricate preformed packings with silicone grease or petrolatum (VV-P236A) and install as follows:

(a) Packing (61) and breather adapter (60).

(b) Packing (20.1) into tube assembly (17).

(c) Packing (20.2 and 32) into tube assembly (31.1).

(d) Packing (29 and 31) into tube assembly (30).

(e) Packing (34) into plate spacer (33)

(25) Work tube assembly (17) into position Form tube assembly stackup (28) by placing tube assembly (35) and plate spacer (33) under tube assembly (17).On top of tube assembly (17) place tube assembly (30) and tube assembly (25).

**8-5. OVERHAUL OF GEARBOX ASSEMBLY.
(cont)**

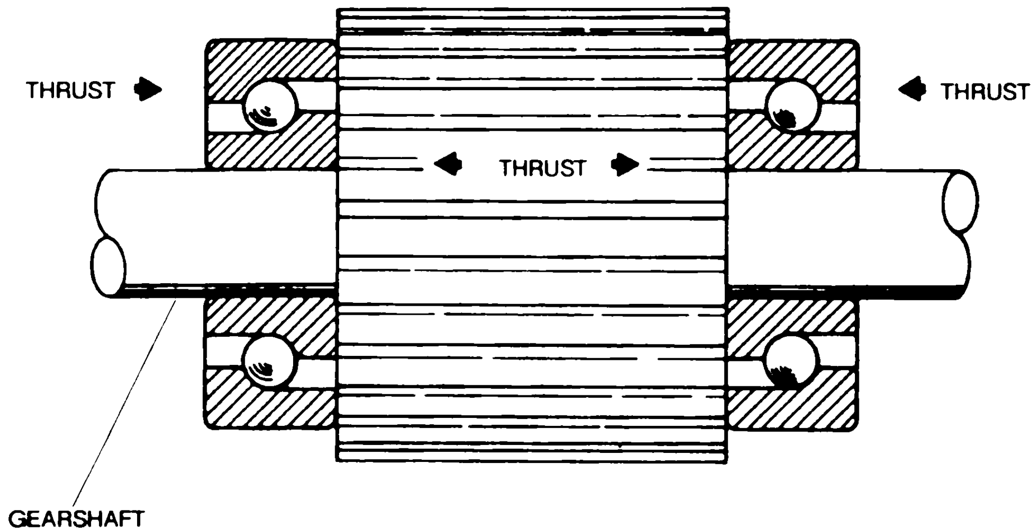


Figure 8-23. Angular Bearing Installation

8-5. OVERHAUL OF GEARBOX ASSEMBLY. (cont)

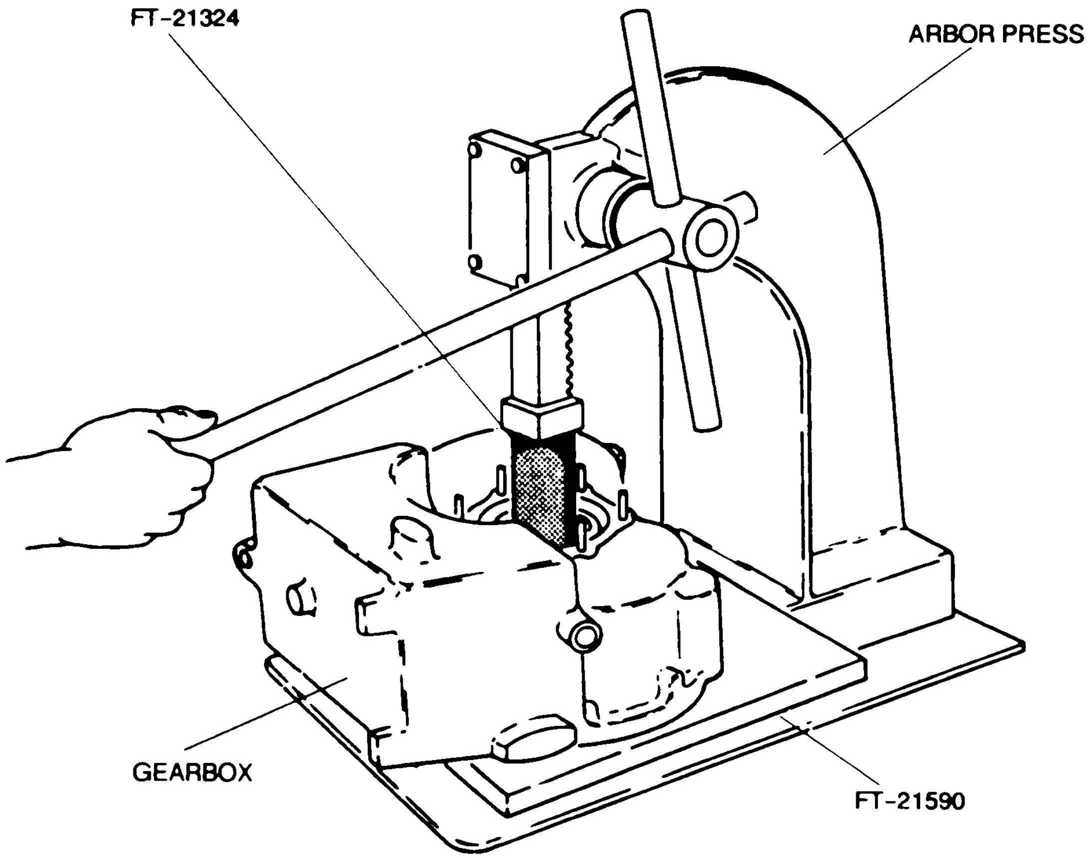


Figure 8-24. Installing Generator Shouldered Shaft Using Fabricated Tools FT-21590 and FT-21324

85. OVERHAUL OF GEARBOX ASSEMBLY. (cont)

f Reassembly (cont)

(26) Place washers (27) on capscrews (26) Work capscrews through stackup to aline tube assemblies Before securing stackup with caps- crews, ensure that tube assembly (25) is positioned with oil hole directed at bearings (46) and (57).

(27) Secure tube assembly (25) with sleeve spacer (23), washer (23 1), loop clamp (24), washer (22), and bolt (21) Torque bolt to 27-30 Inch pounds (3.1-3.4 Nm)

(28) Ensure that entire tube assembly stack- up (28) is alined and tighten capscrews (26).
Torque to 27-30 inch pounds (3.1-3.4 Nm).

(29) Install preformed packing (20, 20.1) into tube fitting (19.1) Install tube fitting and secure with washers (19) and bolts (18) Torque to 27-30 Inch pounds (3.1-3.4 Nm).

(30) Install three washers (15), loop clamp (16), washers (14), and bolt (13) Torque to 27-30 Inch pounds (3 1-3.4 Nm).

(31) Lubricate retaining ring (5, Figure 8-24.1), key washer (6), oil pressure relief valve (8), and preformed packing (7 and 9) Install packings on oil pressure relief valve (8).

(32) Install oil pressure relief valve (8) and key washer (6) in gearbox housing Secure with retaining ring (5) and bend down tab on key washer.

(33) Lubricate performed packing (3) and install on oil sediment strainer (4).

(34) Install oil sediment strainer (4) and key washer (2) in gearbox housing Secure with retaining ring (1) and bend down tab on key washer

(35) Lubricate performed packing (16) and install on oil supply union (15) Install oil supply opening Torque to 70-80 inch pounds (7.9-9.0 Nm)

(36) Install washer (18) and oil filter adapter (17) Torque to 300-400 Inch pounds (33 9-45.2 Nm)

(37) Install gearbox housing assembly in oil Impingement test stand, fabricated tool FT-21600 (See Figure 8-25).

(38) Install test oil filter and dummy oil pump.
Attach hose to dummy oil pump Turn on test stand motor

CAUTION

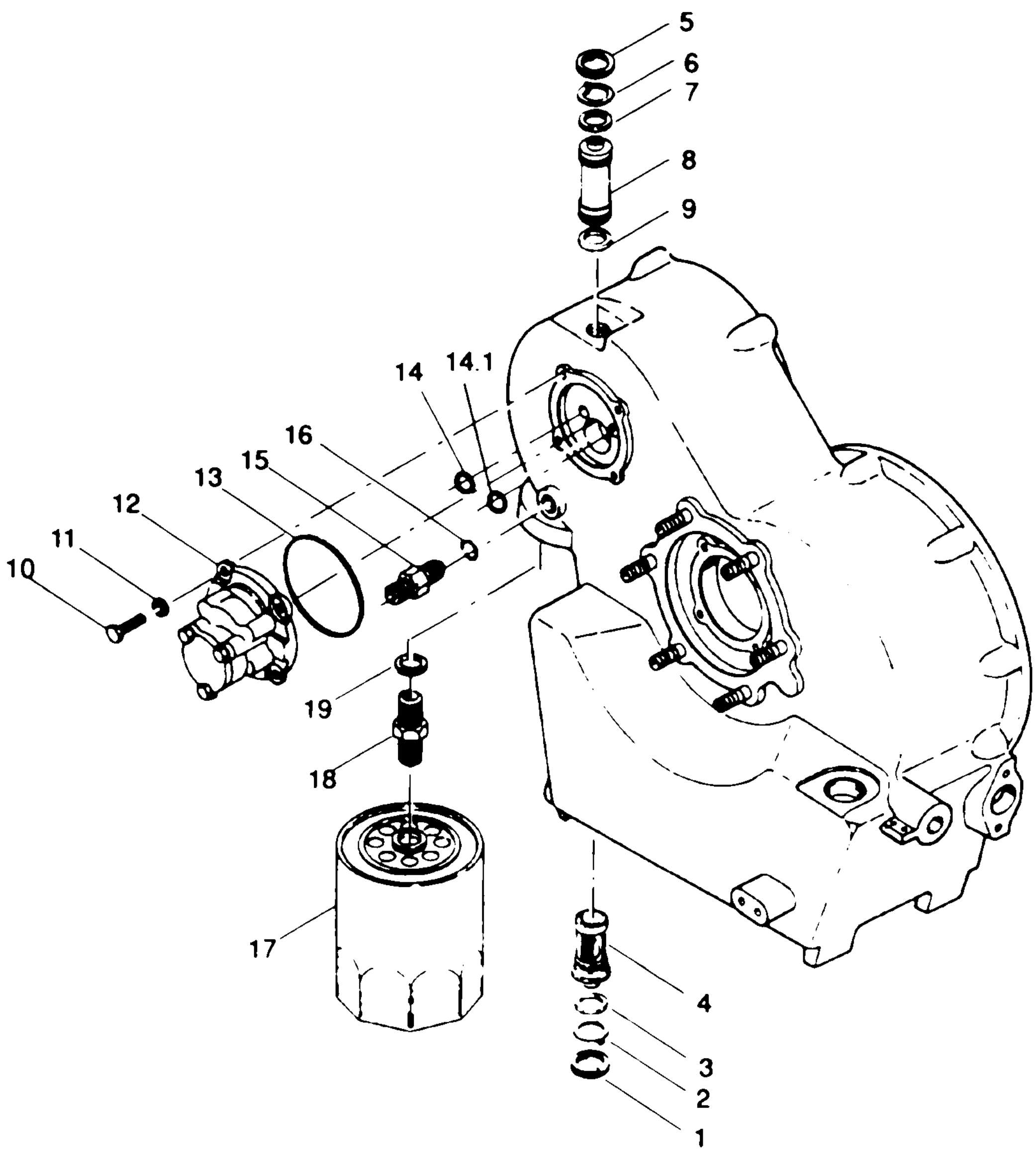
To prevent damage to gearbox assembly, ensure that all lubrication points are receiving adequate lubrication.

NOTE

Targeting of the tubing can be adjusted by loosening the bolts that secure the tubing and making adjustments to the tube positions.

(39) Check lubrication at bearing (57, Figure 8-20) and turbine bearing The stream of oil 1800 opposite one aimed at bearing (57) will oil turbine bearing Check internal spline on gear (58) for stream of oil from tube (35) Check area of spline of gear (47) and gear (58) for heavy runoff stream of oil.

8-5. OVERHAUL OF GEARBOX ASSEMBLY.
(cont)



LEGEND

1. RETAINING RING	11. WASHER
2. KEY WASHER	12. OIL PUMP
3. PERFORMED PACKING	13. PERFORMED PACKING
4. OIL SEDIMENT STRAINER	14. PERFORMED PACKING
5. RETAINING RING	14.1. PERFORMED PACKING
6. KEY WASHER	15. UNION
7. PREFORMED PACKING	16. PERFORMED PACKING
8. OIL PRESSURE RELIEF VALVE	17. OIL FILTER
9. PERFORMED PACKING	18. OIL FILTER ADAPTER
10. PERFORMED PACKING	19. WASHER

Figure 8-24.1 Preparing Gearbox Assembly for Disassembly Using Fabricated Tool FT-21343

8-5. OVERHAUL OF GEARBOX ASSEMBLY. (cont)

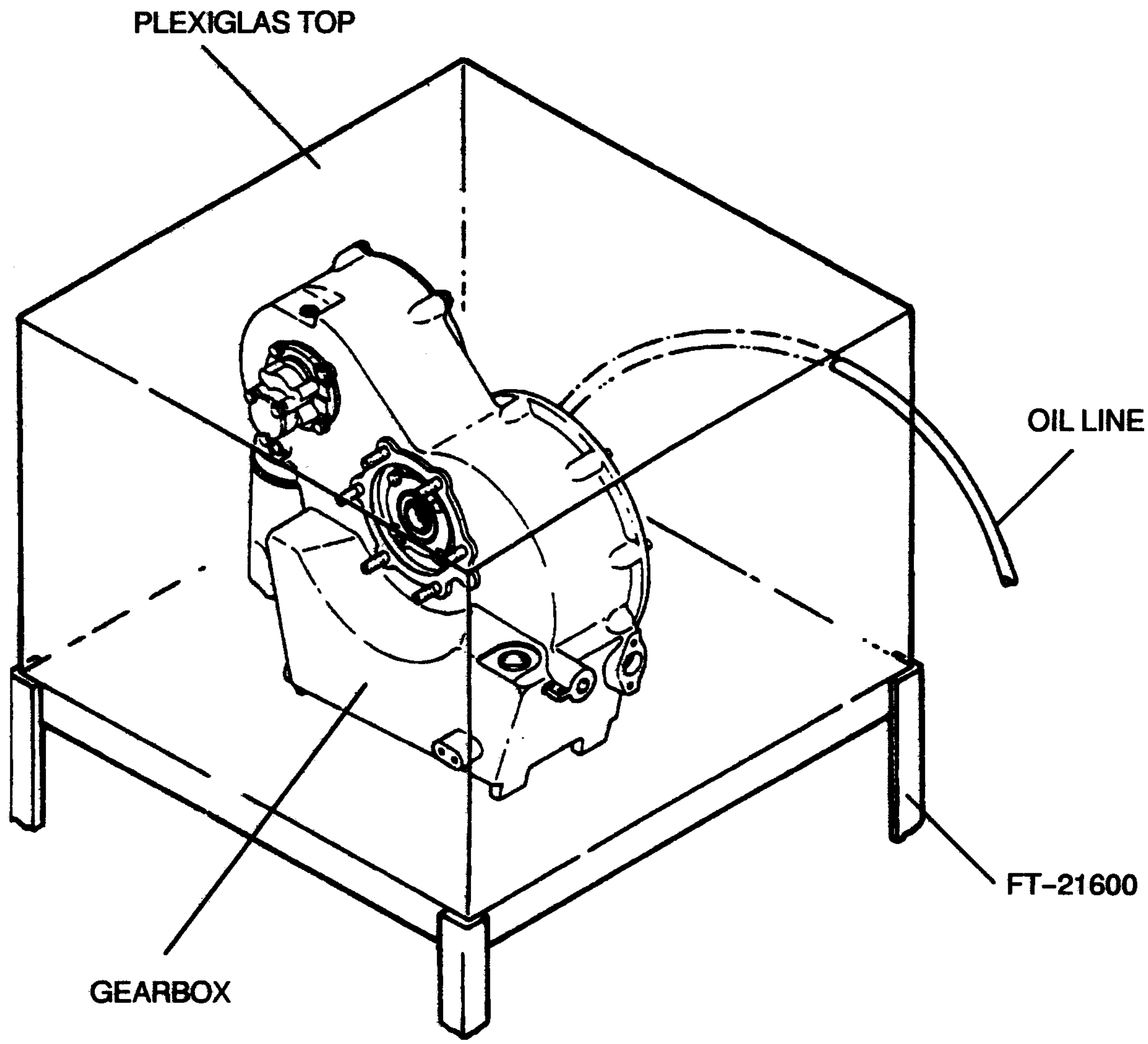


Figure 8-25. Using Oil Impingement Test Stand, Fabricated Tools FT-21600

8-5. OVERHAUL OF GEARBOX ASSEMBLY. (cont)

f Reassembly (cont)

(40) Check lubrication of internal spline on generator shouldered shaft (43) and bearing (46). Check targeting on bearing (46) for proper lubrication.

(41) Check lubrication at mesh point of gears (47) and (12) This point receives oil from center of tube assembly (17).

(42) Visually check lubrication flow to bearing (48) to ensure it is receiving adequate oil flow.

(43) Turn off test stand motor and remove hose from dummy oil pump Remove dummy oil pump and test oil filter Ensure that all oil is drained from gearbox housing.

(44) Install gearbox in FT-21343 and install pin (11) in starter spur gear (12).

(45) After oil test is over, perform the follow- ing:

(a) Lubricate preformed packing (4) and seal (39) with clean engine oil Using arbor press, ensure that seal is seated into seal retainer (38) and install preformed packing (40).

(b) Install spring washer (42) against bearing (48) Install shim (41).

(c) Install seal retainer (38) and secure with washers (37) and bolts (36) Torque to 27-30 inch pounds (3.1-3.4 Nm) Lockwire bolts in pairs using MS20995-C32.

WARNING

To prevent injury, ensure that insulated gloves are worn when handling dry ice or cold parts,

(46) Soak starter spur gear (12) in dry ice and alcohol for a minimum of one hour.

CAUTION

To prevent damage, ensure that annular bearings are properly installed.

CAUTION

To prevent damage, do not install different styles of bearings on the same shaft.

(47) Using bearing installation tool, fabricated tool FT-21325, and arbor press, install bearings (9) and (10) on starter spur gear.

(48) Lubricate starter spur gear assembly (6), spring washer (7), and shim (8) with clean engine oil and install in gearbox housing.

(49) Lubricate preformed packing (4) and seal (5) with clean engine oil Using arbor press, install seal with packing in starter mounting cover (3).

(50) Install starter mounting cover (3) on gearbox housing and secure with washers (2) and bolts (1)Torque bolts to 27-30 inch pounds (3.1-3.4) Lockwire bolts in pairs using MS20995-C32 lockwire.

CHAPTER 9

MAINTENANCE OF ENGINE EXHAUST

9-1. GENERAL. The engine exhaust (figure 9-1) provides the means for exhaust gases to be discharged from the generator set. It consists of an insulated exhaust duct and an exhaust nozzle mounted in the exhaust fender of the generator set. The exhaust nozzle is secured to the engine exhaust with a clamp and extends from the engine exhaust to the lower entrance of the exhaust duct. The nozzle directs exhaust gases from the engine into the exhaust duct. As the hot exhaust gas passes from the nozzle into the exhaust duct, a vacuum is created that draws cooler air from outside the generator set through the oil cooler housing and the exhaust fender louvers. The cooler air mixes with the exhaust and lowers the temperature. The exhaust then travels up the exhaust duct, out the exhaust door, and into the atmosphere. The exhaust duct has two baffles and is lined with sound/thermal insulation that lowers exhaust noise and reduces exhaust fender temperatures.

9-2. EXHAUST DUCT ASSEMBLY.

a. Removal.

WARNING

To prevent injury, do not perform maintenance on hot components. Allow adequate time for cooling.

(1) Remove screws (1, figure 9-2) and lockwashers (2), exhaust door (3).

(2) Remove screws (4), washers (5), lockwashers (6), and exhaust fender panel (7).

(3) Remove screws (8), washers (9), and exhaust duct liner (10) from exhaust fender.

(4) Remove bolts (11), washers (12), lockwashers (13), and exhaust duct end panel (14). Remove sound/ thermal insulation (15).

(5) Remove bolts (16), washers (17), lockwashers (18), and exhaust duct inner side panel (19). Remove sound/ thermal insulation (20).

(6) Remove bolts (21), washers (22), lockwashers (23), and exhaust duct outer side panel (24). Remove sound/ thermal insulation (25).

(7) Remove bolts (26), washers (27), lockwashers (28), and outer exhaust baffle (29).

b. Inspection and Repair.

(1) Inspect exhaust duct for damage. Remove dents and weld cracks as necessary.

(2) Inspect sound/thermal insulation and replace if badly torn, compacted, or otherwise damaged.

c. Installation.

(1) Install outer exhaust baffle (29). Secure with lockwashers (28), washers (27), and bolts (26).

(2) Install sound/thermal insulation (25) on front of exhaust liner. Install exhaust duct outer side panel (24). Secure with lockwashers (23), washers (22), and bolts (21).

9-2. EXHAUST DUCT ASSEMBLY. (cont)

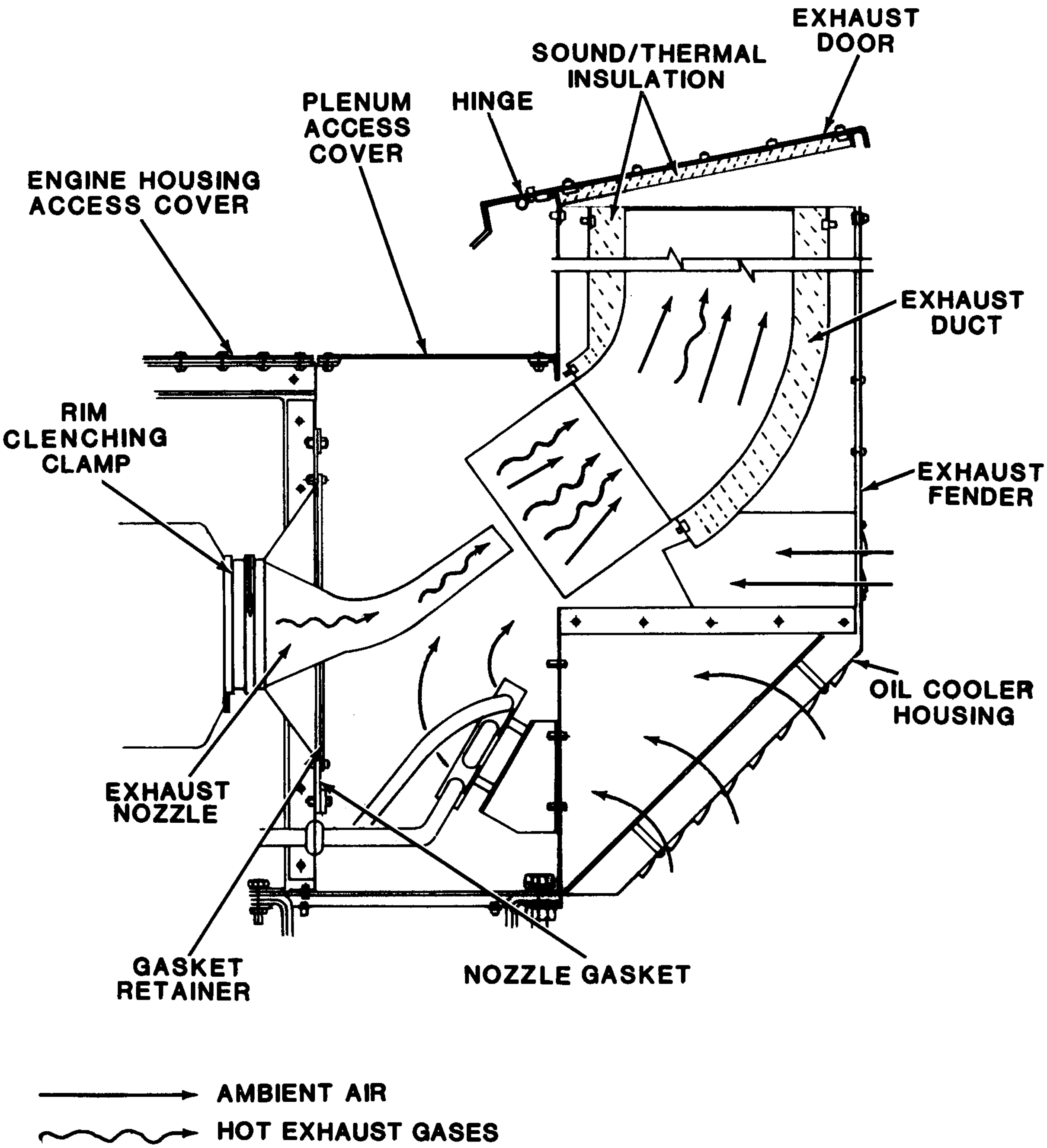


Figure 9-1. Engine Exhaust System

9-2. EXHAUST DUCT ASSEMBLY. (cont)

c. Installtion. (cont)

(3) Install sound/thermal insulation (20) on back of exhaust liner. Install exhaust duct inner side panel (19). Secure with lockwashers (18), washers (17), and bolts (16).

(4) Install sound/thermal insulation (15) on side of exhaust liner. Install exhaust duct end panel (14). Secure with lockwashers (13), washers (12), and bolts (11).

(5) Carefully place assembled exhaust duct liner (10) into exhaust fender. Secure with washers (9) and screws (8).

(6) Install exhaust fender panel (7). Secure with lockwashers (6), washers (5), and screws (4). Torque to 36-40 inch pounds (4.1-4.5 Nm).

(7) Install exhaust door (3) and secure with lockwashers (2) and screws (1).

9-3 EXHAUST RIM CLENCHING CLANP.

a. Inspection.

(1) Loosen turnlock fasteners and remove engine housing access cover.

WARNING

To prevent injury, do not perform maintenance on hot components. Allow adequate time for cooling.

(2) Inspect clamp (32, figure 9-2) for damage. Replace if damaged.

(3) Ensure that clamp (32) is securely in position and nut (33) is tight. Torque to 30-35 inch pounds (3.4-4.0 Nm).

(4) Install engine housing access cover and secure with turnlock fasteners.

b. Removal.

(1) Loosen turnlock fasteners and remove engine housing access cover.

WARNING

To prevent injury, do not perform maintenance on hot components. Allow adequate time for cooling.

(2) Loosen clamp nut (33) until clamp latch can be lifted.

(3) Remove clamp (32).

c. Installation.

(1) Aline engine exhaust flange and exhaust nozzle flange.

(2) Install clamp (32) around engine flange and nozzle flange.

(3) Close clamp latch. Torque nut (33) to 30-35 inch pounds (3.4-3.95 Nm).

(4) Install engine housing access cover and secure with turnlock fasteners.

9-2. EXHAUST DUCT ASSEMBLY. (cont)

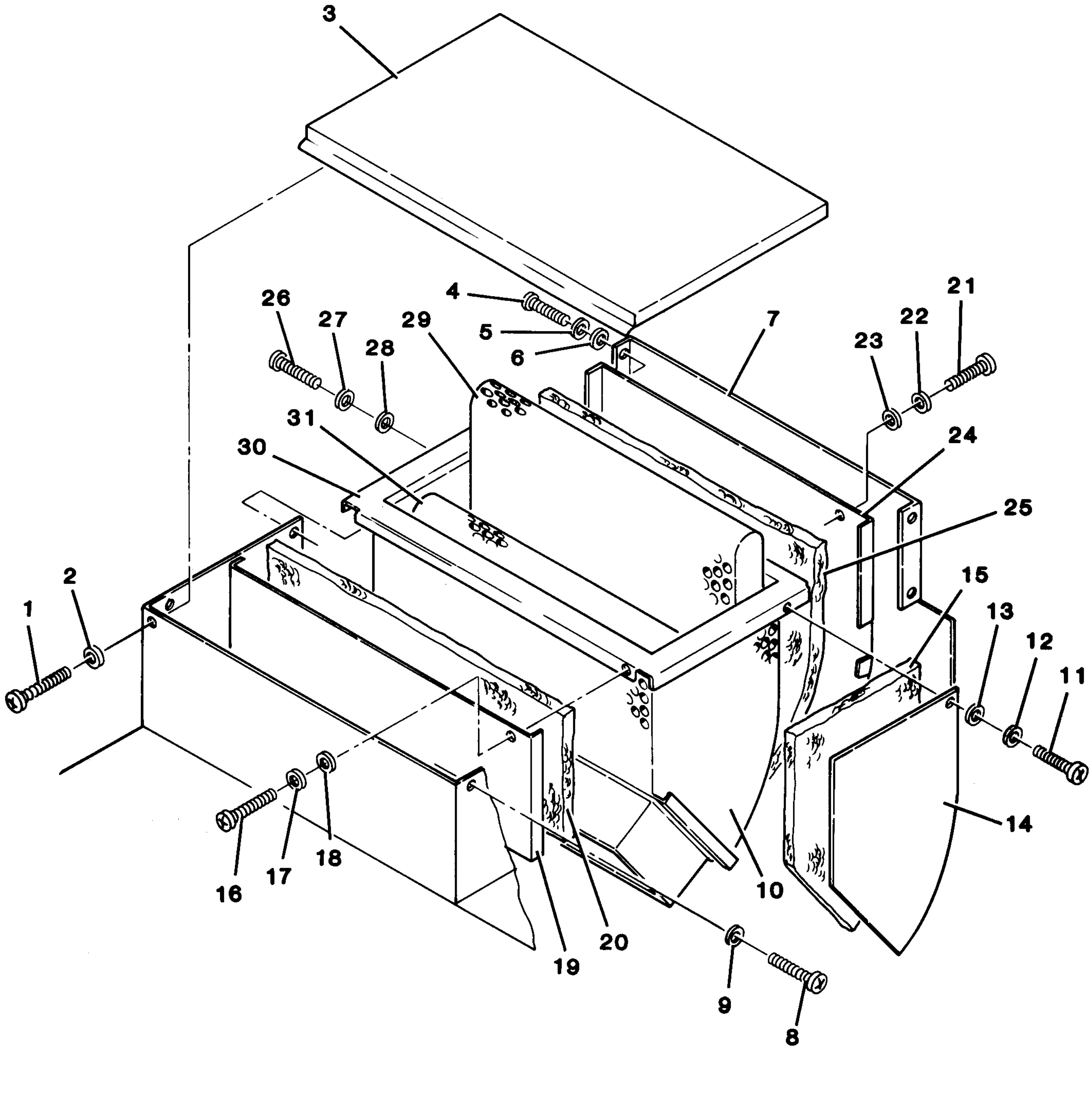
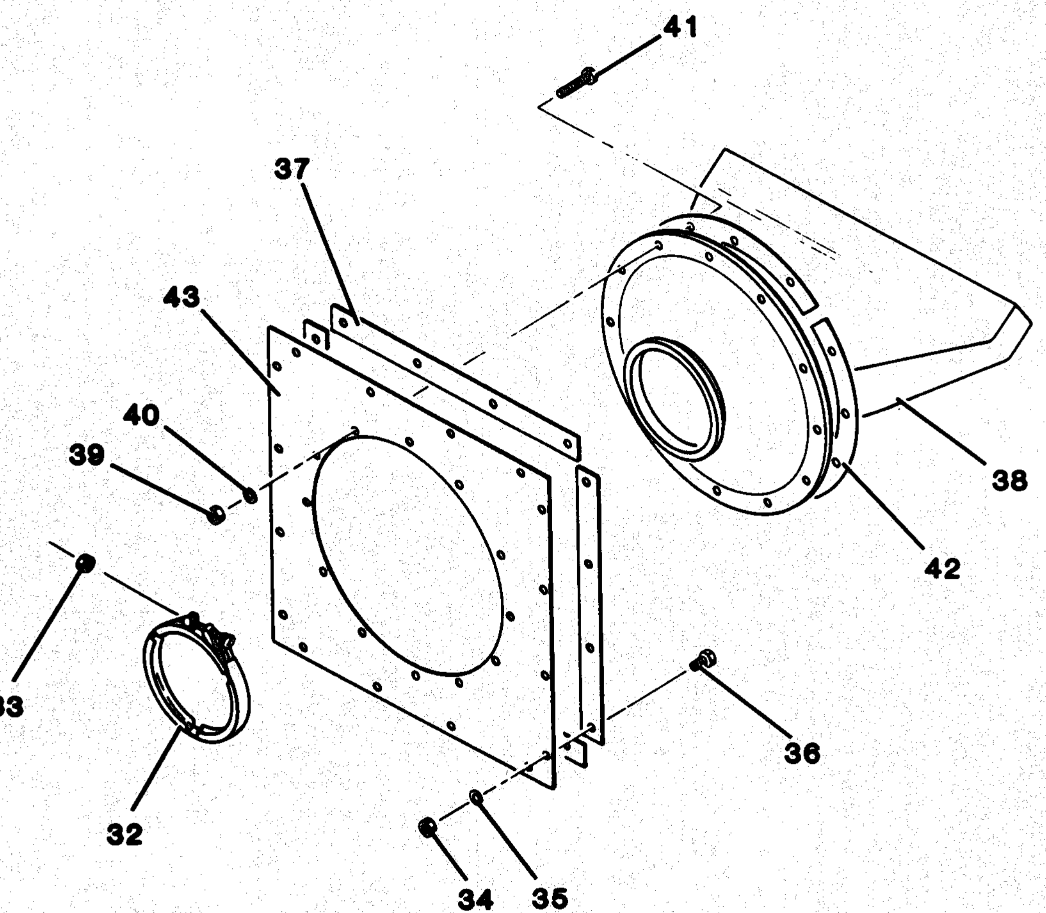


Figure 9-2. Exhaust System Components Replacement (Sheet 1 of 2)

9-2. EXHAUST DUCT ASSEMBLY. (cont)



LEGEND

1. SCREW
2. LOCKWASHER
3. EXHAUST DOOR
4. SCREW
5. WASHER
6. LOCKWASHER
7. FENDER PANEL
8. SCREW
9. WASHER
10. DUCT LINER
11. BOLT
12. WASHER
13. LOCKWASHER
14. END PANEL
15. INSULATION
16. BOLT
17. WASHER
18. LOCKWASHER
19. INNER SIDE PANEL
20. INSULATION
21. BOLT
22. WASHER
23. LOCKWASHER
24. OUTER SIDE PANEL
25. INSULATION
26. BOLT
27. WASHER
28. LOCKWASHER
29. OUTER EXHAUST BAFFLE
30. EXHAUST LINER
31. INNER EXHAUST BAFFLE
32. RIM CLENCHING CLAMP
33. CLAMP NUT
34. SELF-LOCKING NUT
35. WASHER
36. CAPSCREW
37. GASKET RETAINER
38. EXHAUST LINER
39. SELF-LOCKING NUT
40. WASHER
41. SCREW
42. GASKET RETAINER RING
43. NOZZLE GASKET

Figure 9-2. Exhaust System Components Replacement (Sheet 2 of 2)

9-4 EXHAUST NOZZLE.

a. Inspection.

(1) Loosen turnlock fasteners and remove plenum access cover.

(2) Loosen turnlock fasteners and remove engine housing access cover.

WARNING

To prevent injury, do not perform maintenance on hot components. Allow adequate time for cooling.

(3) Ensure that exhaust nozzle (38, figure 9-2) is securely attached to engine exhaust. Torque to 30-35 inch pounds (3.4-4.0 Nm).

(4) Ensure that nozzle is securely attached to gasket retainer ring (42) and nozzle gasket (43). Torque rim clenching clamp nut (33) to 36-40 inch pounds (4.1-4.5 Nm).

(5) Inspect nozzle and gasket for damage. Repair or replace as necessary.

(6) Istall engine housing access cover and secure with turnlock fasteners.

(7) Install plenum access cover and secure with turnlock fasteners.

b. Removal.

(1) Loosen turnlock fasteners and remove plenum access cover.

(2) Loosen turnlock fasteners and remove engine housing access cover.

(3) Remove exhaust duct in accordance with paragraph 9-2a.

CAUTION

To prevent damage, exhaust nozzle must be supported. Failure to do so could result in torn/damaged nozzle gasket.

(4) Place support (block of wood or other sturdy material) under exhaust nozzle (38).

NOTE

Remove top section of nozzle gasket retainer last. This section provides support to the exhaust nozzle during disassembly.

(5) Remove self-locking nuts (34), washers (35), capscrews (36), and four-section nozzle gasket retainer (37).

(6) Disconnect and remove rim clenching clamp (32).

(7) Carefully slide exhaust nozzle out through exhaust fender.

(8) Remove self-locking nuts (39), washers (40), and screws (41).

(9) Remove both sections of gasket retainer ring (42).

(10) Remove and discard nozzle gasket (43).

9-4. EXHAUST NOZZLE. (cont)

c. Repair.

(1) Remove dents and weld cracks.

(2) Thoroughly clean away deposits and foreign material.

(3) Replace missing or damaged attaching parts.

d. Installtion.

(1) Install nozzle gasket (43).

(2) Install both sections of gasket retainer ring (42) and secure with screws (41), washers (40), and self-locklng nuts (39). Torque to 36-40 inch pounds (4.1-4.5 Nm).

(3) Carefully slide exhaust nozzle (38) into generator set through exhaust fender.

(4) Position exhaust nozzle on engine exhaust flange. Install rim clenching clamp (32) and torque nut (33) to 30-35 inch pounds (3.4-4.0 Nm).

(5) Install top section of nozzle gasket retainer (37) and secure with capscrews (36), washers (35), and self-locking nuts (34). Torque to 74-82 inch pounds (8.4-9.3 Nm).

(6) Install remaining section of gasket retainer (37) and secure with capscrews (36), washers (35), and self-locking nuts (34). Torque to 74-82 inch pounds (8.4-9.3 Nm).

(7) Install exhaust duct in accordance with paragraph 9-2c.

(8) Install engine houdsing access cover and secure with turnlock fasteners.

(9) Install plenum access cover and secure with turnlock fasteners.

CHAPTER 10

MAINTENANCE OF ENGINE AND GENERATOR CONTROLS AND INSTRUMENTS

10-1. PURPOSE AND FUNCTION OF ENGINE AND GENERATOR CONTROLS AND INSTRUMENTS. This chapter provides information to maintain the engine and generator controls and instruments at the direct and general support, and depot maintenance levels. Included are removal/replacement procedures for the circuit cards in the EECM, and references to applicable paragraphs in TM 5-6115-612-12 covering test and repair of the control panel.

a. Purpose. The purpose of this subsystem is to provide operator control and monitoring capabilities of both the engine and generator from a single location. Operator control and monitoring of engine and generator performance are effected through the controls and indicators on the control panel which are electrically connected to the engine electronic control module (EECM) and generator electronic control module (GECM). Circuits within the EECM provide the actual control and monitoring of the engine and generator through a microprocessor and associated software.

b. Functional Theory of Operation. FO-9 is a detailed block diagram of the engine and generator controls and instruments. This theory of operation is keyed to the detailed block diagram and describes system operation in sequence from the time power is first applied, through the application of generator set power to the load, and then to system shutdown. Reference is made to control panel assembly controls and indicators to show their relationship to the functions they control or display. A discussion of the power supply card is provided separately at the beginning of the overall discussion. The reader should be familiar with the basic theory of operation discussed in Chapter 4, Section XIV of TM 5-6115-612-12 before reading further.

(1) Power supply card. FO-9, sheet 1, is a block diagram of the EECM power supply circuit card. This supply is an integrated circuit switching regulator with two sections; one +5 Vdc power supply, and one ±12 Vdc power supply. Prime input power at +24 Vdc enters the card and is filtered before being distributed to other card circuits. The filter output is applied across a crowbar circuit to two pass transistors, +5 Vdc control circuitry, and the +12 Vdc control circuitry. In the +5 Vdc control circuit, the +24 Vdc is regulated down to a level that supplies the pass transistors sufficient drive to provide +5 volts at the pass transistor output. This voltage is filtered to become the +5 Vdc level at the card output that supplies logic power to the IC devices in the EECM. This control circuitry also provides automatic overcurrent shutdown to the pass transistors should current demand on the +5 Vdc line exceed a set limit. In the +12 Vdc supply section, the ±12 Vdc control circuitry regulates the +24 Vdc prime power down to a voltage signal that supplies drive to a set of switching transistors. The control circuitry, transistors, and transformer form a dc-to-ac converter. As the transistors alternately turn on and off, they cause current to flow in the windings of the transformer. When current flows in the

10-1. PURPOSE AND FUNCTION OF ENGINE AND GENERATOR CONTROLS AND INSTRUMENTS. (cont)

b. Functional Theory of Operation. (cont)

transformer, an ac voltage is induced at the transformer output and applied to rectifier/filter circuitry. After rectification of the ac, it is filtered to supply both +12 Vdc and -12 Vdc levels to EECM circuits and also fed back to the control circuitry. If the voltage level on the +5 Vdc output line increases above about 6.2 volts, the crowbar control line passes this voltage to the crowbar control circuit. In response, the crowbar trips, shorting the prime input lines together. The resulting short across the +24 Vdc prime power line causes the control panel circuit breaker to trip and remove power from the generator set.

(2) Initial power application. Refer to FO-9, sheet 2. The DC CIRCUIT BREAKER on the control panel controls application of +24 volt battery power from the battery to the control panel and the EECM. Input prime power from the battery enters the control panel through TB1, passes through the CIRCUIT BREAKER (when closed), and is distributed on the panel. When the PANEL LIGHTS switch is closed, the two panel illumination lamps receive the +24 Vdc and are lighted. Prime power is also placed on the center pole of the MASTER SWITCH and CONTACTOR switch. Additionally, it passes through the battery line to the EECM where it is connected to the center pole of one set of relay contacts. To apply power to the EECM circuits, the operator places the MASTER SWITCH in the RUN position. This places power on the +24 Vdc line from the control panel to the EECM. In the EECM, this voltage is distributed to various EECM circuits is also applied to the power supply circuit card. This supply in turn generates +5 Vdc and ±12 Vdc levels to power EECM logic and the microprocessor as explained in paragraph 10-1b(1) above. The microprocessor on the microprocessor circuit card is the controlling and decision-making device for the entire engine and generator controls and instruments. Stored within it is the software program that controls exactly how and in what sequence events are to happen that lead up to engine start and contactor enable. It also monitors various status lines to determine if faults have occurred, and makes decisions as to whether or not the generator set should be shut down -. if the fault occurs. When the microprocessor receives operating power on the +5 Vdc line from the power supply card, it enters a startup sequence that eventually leads to engine ignition and startup. The first step in the startup sequence sets the fault output from the microprocessor. This level is buffered and sent to the switch circuit card where it is applied to a relay driver and a set of eight latches. In the latches, the fault level causes any latch input to be routed directly to a corresponding latch output without being altered. The microprocessor begins to monitor the speed signal from the monopole speed sensor signal from the exhaust gas temperature (EGT) thermocouple. The speed signal consists of a series of pulses from the monopole speed sensor such that more pulses are received when the engine is turning faster and vice versa. Any pulses on the speed signal line are clipped by the digital-to-TTL shifter so that output pulse levels from the shifter are compatible with TTL logic levels required by the microprocessor.

10-1. PURPOSE AND FUNCTION OF ENGINE AND GENERATOR CONTROLS AND INSTRUMENTS. (cont)

b. Functional Theory of Operation. (cont)

These signals are then gated through a switch card exclusive OR gate and then buffered before being applied to the microprocessor. The signal from the EGT thermocouple is an analog voltage signal that varies in proportion to the temperature sensed by the EGT probe. It enters the EECM on connector P5 and is applied to one side of a resistance bridge on the microprocessor card. The bridge is also supplied with a reference voltage. The output of the bridge is an analog voltage that varies according to the temperature-induced voltage flowing through the EGT. An amplifier converts the bridge output to a very linear O to +5 Vdc signal that is again proportional to the temperature sensed by the EGT thermocouple. Because the microprocessor cannot accept an analog input, this signal is changed to an 8-bit digital signal in an analog-to-digital converter. The resulting output is applied to the microprocessor as the digital equivalent of the analog temperature sensed by the EGT thermocouple.

(3) Engine startup sequence. To begin a start sequence, the operator momentarily places the MASTER SWITCH in the START position and then releases it back to the RUN position. This creates a start signal which makes a logic-level transition as the MASTER SWITCH is placed in the START and then the RUN positions. The pulse generated by this transition is routed to the switch card where it is shifted in an analog-to-TTL shifter circuit to provide a TTL level to the microprocessor. The resulting modified start signal is buffered and applied to the microprocessor. Reception of this signal initiates an automatic startup sequence that is controlled by the stored software program in the microprocessor. The series of steps in this sequence is described below.

(a) Ignition and engine start. As the fuel pump is activated, the microprocessor checks the speed signal and EGT thermocouple line inputs to ensure that the engine is not already running. If not, an ignition enable signal is output from the microprocessor, buffered and level shifted, and used to turn on a driver transistor. When the transistor turns on, it generates the igniter drive level to the engine so that electrical ignition power is supplied in preparation for starting. Next, microprocessor software generates a starter enable signal which is buffered, sent to the switch card, and modified in a buffer/level shifter circuit. The resulting output of this circuit turns on a driver transistor which then generates the starter signal. Reception of this signal by the engine causes the starter to engage to start the gas turbine engine.

(b) Fuel pump control. The microprocessor checks the speed signal input as described in (2) above. If there are pulses on this input, meaning that the engine is turning, the microprocessor generates a signal on one of its four status/control outputs to the switch card fuel valve enable line. The signal activates a driver circuit, placing a control signal on the fuel

10-1. PURPOSE AND FUNCTION OF ENGINE AND GENERATOR CONTROLS AND INSTRUMENTS. (cont)

b. Functional Theory of Operation. (cont)

valve signal line to the engine. Fuel valve signal being in this state opens the engine fuel valve and allows fuel to flow to the engine in preparation for startup. Next, the EECM microprocessor software places a series of pulses on the drive output to a digital-to-analog converter. Conversion of the digital microprocessor output to an analog signal is necessary for compatibility with inputs required by a pulse width modulator. The level of the resulting analog signal from the converter causes the pulse width modulator to output a duty-cycle-varying square wave on the fuel pump drive line to the engine. For startup, the duty cycle is set at a fixed level to drive the fuel pump at the rate necessary to supply fuel to the engine so that it can be started.

(c) Status monitoring/automatic shutdown. Five seconds after the starter signal is generated, the microprocessor program samples the speed signal line to count pulses from the monopole speed sensor. At the same time, it monitors the EGT line. The rate of the pulses on the speed signal line should indicate that the engine has reached 10 percent of full operating speed. If not, the microprocessor starts a shutoff routine, because it is assumed that the engine is not running properly or has not started. If all indications are normal, no action is taken by the microprocessor and the engine is allowed to accelerate. If, however, an abnormal speed or temperature condition is sensed, the automatic shutdown sequence is entered. This routine first disables the ignition and starter outputs from the microprocessor which in turn disable the starter signal and igniter drive signals to the engine. The microprocessor next outputs a signal to the switch circuit card on one of the status/control lines. After buffering, this signal on the valve enable line is applied to a driver that disables the fuel valve signal line to the engine. This shuts off fuel flow to the engine to keep it from starting.

(d) Completion of startup sequence. The EECM microprocessor continues to monitor engine speed during stratup. When 60 percent speed is sensed, the ignition enable and starter enable lines to the switch circuit card are disabled, shutting off ignition and starter levels to the engine. The engine is considered to be successfully started and is now allowed to accelerate by itself.

(e) Fuel flow control. The EECM controls fuel flow to the engine at all times after startup to ensure that the proper amount of fuel is flowing. It makes adjustments to the fuel flow as necessary to provide optimum fuel delivery regardless of fuel temperature, viscosity, or load. To determine proper flow, the microprocessor monitors the speed signal line and counts the rate at which pulses occur. This rate is compared to values stored in the microprocessor that represent ideal speeds for the engine at various times during its acceleration. If the measured pulse rate over time does not compare to the ideal speed/time rate, the micoprocessor adjusts fuel feed accordingly. This is accomplished through the drive output from the

10-1. PURPOSE AND FUNCTION OF ENGINE AND GENERATOR CONTROLS AND INSTRUMENTS. (cont)

b. Functional Theory of Operation. (cont)

microprocessor. Drive is converted into an analog signal that controls a pulse width modulator. If the speed value is too high, the drive signal is decreased and the pulse width modulation output duty cycle decreases.

(4) Contactor enabling Contactor enabling is the process by which generated power is supplied to the load. As the engine continues to accelerate, its speed is monitored by the EECM microprocessor until 100 percent speed is reached. The fact that 100 percent speed has been reached is determined by the microprocessor which compares a stored value for 100 percent speed with the actual value on the speed signal line. When that point is reached, the engine is turning the generator at a rate where the generator power output is sufficient to supply the load (start the aircraft). At 100 percent power, the microprocessor outputs a level on one of the four status/control lines to the switch card. After buffering, this becomes the generator enable signal which actuates a lamp driver circuit. Generator enable is also sent off the card through connector P4 to the GECM to enable the GECM to control the generator. The lamp driver generates the ready to load signal that is routed from the EECN to the control panel causing the READY TO LOAD lamp to come on. When the operator sees the READY TO LOAD lamp come on, he places the CONTACTOR switch momentarily in the CLOSED position, then releases it back to the normal center position. This places +24 Vdc on the (Contactor On) line to the switch card where it is shaped, then used to set a latch on the switch circuit card. The set output of the latch is applied to a contactor gate and buffer where it is gated with a contactor enable output that the microprocessor generates at this time. The resulting gate output drives a contactor relay driver which in turn outputs an enabling contactor enable level. After routing this signal through and out of the control panel unaltered, it becomes the contactor enable level to the output contactor. This level energizes the contactor relay, allowing power to flow from the generator through the closed contactor relay contacts to the aircraft being started. To show the operator that the relay is closed, closure of another set of relay contacts applies +24 Vdc through control panel terminal board TB1 to the CONTACTOR CLOSED lamp. The lamp comes on to verify that the contactor relay is energized.

(5) Output power control. The operator can monitor the voltage and current being supplied to the aircraft. He is also able to regulate the voltage output of the generator. Voltage is displayed on the control panel VOLTAGE meter, while current is shown on the OUTPUT CURRENT meter. Output voltage is controlled by turning the control panel VOLTAGE ADJUST knob. The changing resistance caused by turning the knob is routed to the GECM to regulate the generator voltage adjust level. The operator adjusts the knob while watching the VOLTAGE meter until the meter reading is correct. Additionally, the HOURMETER is connected across the VOLTAGE meter so that it accumulates the number of hours that voltage has been generated by the generator set.

10-1. PURPOSE AND FUNCTION OF ENGINE AND GENERATOR CONTROLS AND INSTRUMENTS. (cont)

b. Functional Theory of Operation. (cont)

(6) Battery charging monitor. The control panel BATTERY CHARGING meter allows the operator to see that the generator set batteries are being charged while the engine is running. Signal lines are routed directly to the control panel and connected to the BATTERY CHARGING ammeter.

(7) Status monitoring and control. Both engine and generator status are monitored by the EECM while the engine is running and the generator is supplying power. If a malfunction is detected, the EECM either attempts to correct the problem or automatically removes power from the contactor (if the contactor is energized) and shuts down the engine. To make these decisions, the EECM microprocessor monitors the engine monopole speed sensor, EGT thermocouple, and oil pressure. For the generator, the EECM microprocessor monitors the overload, undervoltage, overvoltage, and temperature status via signals sent to it from the GECM. A detected fault is monitored for three-fourths of a second to see if it corrects itself before the microprocessor software program takes any action. In general, with the exception of a minor overspeed condition, any detected fault results in display of the fault on one of the control panel MALFUNCTION lamps, removal of starting power to the aircraft by a disabling of the contactor relay, and an automatic shutdown of the engine.

(a) Engine fault detection and shutdown. An engine fault consists of an overspeed, overtemperature, or low oil pressure condition. Overspeed is monitored via the speed signal line to the EECM, overtemperature is monitored via the EGT line to the EECM, and oil pressure is monitored via the oil pressure and signal line to the EECM. The only fault that does not cause an immediate shutdown is an overspeed condition between 100 and 109 percent of full rated engine speed. If frequency of pulses on the speed signal line indicates such a condition, fuel flow to the engine is decreased as discussed. If speed increases above 109 percent, or any of the other three possible faults occur, the microprocessor initiates an automatic shutdown routine. First, the microprocessor disables the contactor to prevent current from flowing to the aircraft being started. This is done by disabling the contactor enable line from the microprocessor to the contactor gate and buffer on the switch card. This switches the gate output to disable the contactor relay driver and disable the output contactor signal. When this occurs, the generator set contactor relay deenergizes to remove power from the aircraft. Deenergizing the contactor relay also removes +24 Vdc from the control panel CONTACTOR CLOSED lamp, turning it off. At the same time, the microprocessor places one or more signals on the status/control output lines to the switch circuit card. Regardless of where the fault lies, the generator enable signal is always disabled which turns off the lamp driver circuit. The READY TO LOAD line is thereby disabled, turning out the READY TO LOAD lamp and stopping the HOURMETER. Other signals are also output on any one of the status control lines to indicate where the fault is occurring. If the fault is determined

10-1. PURPOSE AND FUNCTION OF ENGINE AND GENERATOR CONTROLS AND INSTRUMENTS. (cont)

b. Functional Theory of operation. (cont)

to be an overspeed condition, the overspeed acknowledge line is enabled. If the fault is an overtemperature, the engine overtemperature line is disabled. Knowledge is passed through an overspeed gate to become the overspeed signal to one input of a set of eight latches. The ENGINE OVERTEMP line is connected directly to one of the other latch inputs. The other possible engine fault, low oil pressure, is monitored by the microprocessor at the same time that the signals on these lines are buffered and applied to two other latch inputs on the switch card. Normally, the fault signal from the microprocessor to the latches enables any signal present on a latch input to be passed to the latch output unchanged. However, when a fault is sensed, fault changes logic status and latches whatever signals are on the latch inputs into the latch. Changes on the latch input lines no longer affect the latch outputs; they are now locked in the logic status they were in when fault changed logic levels. Each latch output is applied to a lamp driver, buffered, and routed to the control panel. Only that line signifying a malfunction will be in a different logic state from the others. Whichever line carries the fault status signal causes the appropriate lamp on the control panel to come on and indicate the source of trouble to the operator. As the fault is being indicated on the control panel, the automatic engine shutdown routine is being followed. This consists of shutting off the fuel pump drive and closing the engine fuel valve via the fuel pump drive and fuel valve signal lines from the EECM to the engine.

(b) Generator fault detection. Generator faults consist of overload, undervoltage, overvoltage, and overtemperature. These conditions are sensed by the EECM microprocessor as it monitors the overload, undervoltage, overvoltage, and generator overtemp lines from the generator electronic control module (GECM). Each line is routed to the EECM switch card and placed on a latch input. Each line is also an input to a generator fault gating circuit. Any fault, with one exception, causes the microprocessor software to initiate an automatic shutdown procedure. The one exception is a simultaneous undervoltage and overload, which is not treated as a fault because it is instead detected by the GECM and appropriate steps taken by circuits in the GECM. If any other fault is sensed, the output of the generator fault gating is enabled to send a fault signal to the microprocessor on the generator fault line. Reception of generator fault causes the fault signal to latch the latches, shut off the fuel supply to the engine, and reenergize the contactor relay.

(8) Manual contactor disabling. Manual contactor disabling is different from automatic contactor disabling in that this is an operator-controlled process initiated because of a malfunction. To disable the contactor and stop power from flowing to the load, the operator places the CONTACTOR switch on the control panel momentarily in the OPEN position. The operator then releases it back to the center position. As the switch moves to the OPEN position, +24 Vdc from the switch

10-1. PURPOSE AND FUNCTION OF ENGINE AND GENERATOR CONTROLS AND INSTRUMENTS. (cont.)

b. Functional Theory of Operation. (cont)

position. As the switch moves to the OPEN position, +24 Vdc from the switch are briefly placed on the contactor open line to the EECM. This voltage pulse resets the shapers and latch circuit so that the latch set output changes state. The state change deactivates the contactor relay drive, the contactor line switches status, and the contactor relay deenergizes. This prevents power from the generator set from passing to the output cable, but has no effect on generator or engine operation. The READY TO LOAD lamp remains on to show that placing the CONTACTOR switch in the CLOSED position will again route power to the load.

(9) Manual shutdown. A manual shutdown is initiated by the operator. To manually shut down the generator set, the operator places the MASTER SWITCH in the OFF position. This removed 24 Vdc from the EECM, shutting down the generator set.

10-2. ENGINE ELECTRONIC CONTROL MODULE (EECM). Maintenance of the EECM consists of testing and repair procedures. The test procedures are intended to be the first step in troubleshooting, and are to be used before proceeding to the EECM troubleshooting procedures.

a. Test. The following procedures determine the operating condition of the EECM. They are performed either to locate the source of a fault in a malfunctioning EECM or, after repair of a faulty EECM, to ensure that the fault has been corrected. In each step of this procedure where the operator is told to make a measurement or observe an indication, if the proper response is not noted, refer to the troubleshooting procedures of table 2-4. After the fault is repaired, the test procedure should be repeated to ensure that the problem has been corrected and that no other fault exist. In this procedure, it is assumed that the EECM has been removed from the generator set and is in a repair area with its connectors accessible. All references to controls and indicators are to those on the test fixture front panel. (See table 23).

(1) EECM continuity check. Set multimeter on high ohms (200K ohms scale) and check continuity of EECM circuitry as follows: Power Supply board etc,; Diodes and interconnecting circuitry as follows:

From	To	Readings
J6-N	J6-M	10k ohms
J6-M	J6-N	1 megohm
J6-N	J6-R	1 megohm
J6-R	J6-N	1 megohm
J6-N	35–P	1 ohm
J6-N	J5-E	1 ohm
J6-N	35–H	1 ohm
J6-N	J5–B	1 ohm
J6-N	F5–T	1 ohm
J6-N	F5–J	1 ohm
J6-N	J4–E	1 ohm
J6-N	J4-G	2k ohms
J6-N	J5-K	1 megohm
J6-N	J5–L	2k ohms
J6-N	J5-M	10k ohms
J6-N	J5-C	1 megohm
J6-N	J5–D	10k ohms
J6-N	J5-N	5k ohms
J6-N	J5-A	5k ohms

Repair or replace damaged wires and connections as necessary.

(2) Preliminary test procedure

(a) Fabricate an EECM test fixture. An illustration, parls list, and schematic are provided in table 2-3. Table 10–1 lists additional equipment required for EECM testing.

(b) Connect test equipment provided in table 10-1 and EECM as shown in figure 10-1.

NOTE

The oscilloscope is required only for the Fuel Pump Control Test, test step (17).

(c) Turn external power supply on and adjust voltage to 24–28 Vdc.

10-2. ENGINE ELECTRONIC CONTROL MODULE (EECM). (cont)

NOTE

Ensure that the 28Vdc power supply does not create line interference on the function generator.

(d) Adjust frequency of function generator to 250-300 Hz. Set amplitude 9.6-10 volts peak to peak (sine wave).

NOTE

EECM electronics requires a minimum ± 5 volt wave form.

(e) Adjust millivolt power source to 0.96-1.20 millivolts (K-type thermocouple equivalent output).

Table 10-1. EECM Test Equipment

NOMENCLATURE	MFR and MODEL	QTY	NSN
DIGITAL MULTIMETER (0-20 Mega Ω ± 1% (0-40 Vdc ± 1%)	AN/PSM-45 Simpson Model 467 or equivalent	1	6625-01-139-2512
DIGITAL MULTIMETER (0-60 millivolts dc (± 0.5 millivolts)	AN/GSM-64D Fluke Model 8840 A/AF or equivalent	1	6625-01-221-9367
EECM Test Fixture	Fabricated	1	Part No. 101810 (CAGE 51225)
FUNCTION GENERATOR (0-4 KHZ, Sine Wave 10 volts peak to peak)	SG-1133/U HP Model 3312 A (or SG-1288/G Wavetek Model 288) (or HP Model 200 CD or equivalent	1	6625-01-026-4989 (6625-01-276-9421) (6625-00-518-4659)
OSCILLOSCOPE (AC/DC to 100 MHz)	AN/USM-488 Model 2235 w/opt 1 (or OS-288/G Textronics, Model 2465A) or equivalent	1	6625-01-187-7847 (6625-01-159-3106)
POWER SUPPLY (0-28 Vdc ± 0.5 V 10 Amps)	Kepco, Inc. Model ATE36-15M or equivalent	1	6130-01-143-5967
POWER SUPPLY (Millivolt Source 0-60 millivolts dc ± 0.5 millivolts)	Use 10-turn potentiometer (30K ohm), with BA 3090/U Battery (9 Vdc) or equivalent	1	6130-00-000-0000
TIMING DEVICE	Stopwatch/Digital Counter or equivalent	1	- - -
UNIVERSAL COUNTER (0-4 KHz at 10 V ± 1%	Fluke Model 7261 A-132, 331 or equivalent NOTE: OPTIONAL EQUIPMENT - Not required if Function Generator has three digit resolution.	OPT.	6625-01-106-0453

10-2. ENGINE ELECTRONIC CONTROL MODULE (EECM). (cont.)

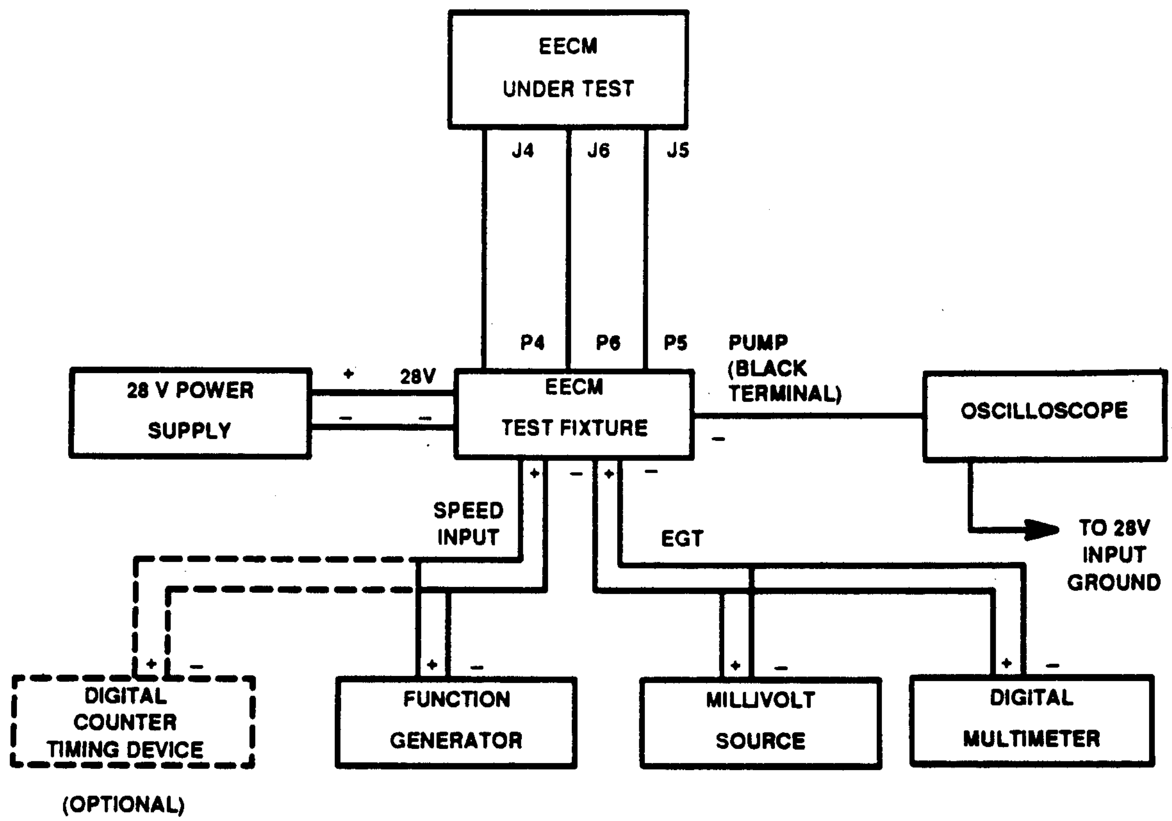
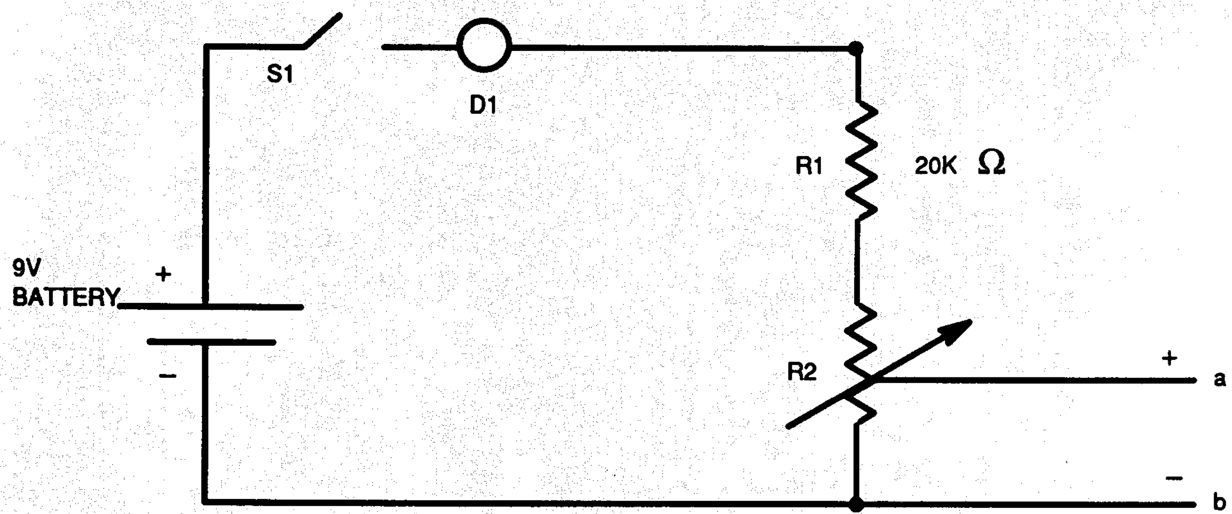


Figure 10-1. EECM Test Setup.



S1 — SWITCH

D1 — DIODE

R1 — 20 KILO OHM RESISTER

R2 — 20 KILO OHM RESISTER VARIABLE OUTPUT TAKING BETWEEN a & b

Figure 10-1.1 Sample Millivolt Power Supply

10-2. ENGINE ELECTRONIC CONTROL MODULE (EECM). (cont)

a. Test. (cont)

NOTE

A power source less than 0.95 millivolts will give false results. It is necessary to insure that this power supply ground is independent of all other power suppfies. (i.e. 10-turn potentiometer with 9 Vdc Battery.)

NOTE

There are various time out functions and sampling rates used by the EECM Microprocessor, As a result some procedures are required to be performed in 5-15 second time frame or false fault indications will occur.

(f) Move all EECM test fixture switches to OFF position.

(g) Move MASTER SWITCH to RUN position and allow one minute for warmup.

(3) Open thermocouple test.

(a) With MASTER SWITCH in RUN position, disconnect one lead from millivolt source. The engine OVERTEMP light should come on and all other lights should be off.

(b) Reconnect lead to millivolt source. Then reset the MASTER SWITCH by moving it to the OFF position then RUN position. The engine OVERTEMP fight should go off.

(c) Move MASTER SWITCH to OFF position All lights should go off.

(d) Any discrepancy noted during the above procedure indicates failure in the EECM engine overtemperature circuit. Refer to table 2-4, Malfunction 4.

(4) Excessive starter speed test.

(a) Adjust function generator starting at 0 Hz and adjust to a frequency between 400 and 450 Hz.

(b) Move MASTER SWITCH to RUN position. All malfunction lights should be off.

(c) Move MASTER SWITCH to START position. All lights should be off.

(d) Move MASTER SWITCH to OFF position. All malfunction lights should be off.

(e) Any discrepancy noted during the above procedure indicates failure in the EECM engine overspeed circuit. Refer to Table 2-4, Malfunctions.

(5) No speed indication test.

(a) Adjust function generator to a frequency between 0 to 200 Hz.

(b) Move MASTER SWITCH to RUN position. All malfunction lights should be off.

(c) Move MASTER SWITCH to START position. Start timing device. The STARTER light should come on.

(d) When STARTER light goes off, stop timing device. It should register between 5 and 14 seconds. The STARTER light should go off. Engine OVERSPEED light should come on.

(e) Move MASTER SWITCH to OFF position. All lights should be off.

(f) Any discrepancy noted during the above procedure indicates failure in the EECM engine overspeed circuit. Refer to Table 2-4, Malfunction 5.

(6) Overtemperature acceleration test.

(a) Adjust function generator to a frequency between 0 and 200 Hz and adjust millivolt source to 96 to 1.20 millivolts.

NOTE

EECM electronics requires a frequency below 200 Hz.

(b) Move MASTER SWITCH to RUN position. All lights should be off.

NOTE

Read step (c) completely before performing step (c).

10-2. ENGINE ELECTRONIC CONTROL MODULE (EECM). (cont)

(c) Move MASTER SWITCH to START position. The STARTER light should come on. Quickly increase function generator to a frequency between 2900 and 3200 Hz before EECM timeout. During frequency increase IGNITION and FUEL lights will come on and then STARTER and IGNITION lights will go off.

(d) Slowly increase millivolt source until OVERTEMP light comes on. This should happen between 29.8 and 32.2 millivolts. The FUEL light should go out when the OVERTEMP light goes on.

(e) Move MASTER SWITCH to OFF position. All lights should be off.

(f) Any discrepancy noted during the above procedure indicates a failure in the EECM overtemperature circuit. Refer to Table 2-4, Malfunction 4.

(7) Engine overtemperature test.

(a) Adjust function generator to a frequency between 0 and 200 Hz and adjust millivolt source to 96 to 1.20 millivolts.

NOTE

EECM electronics requires a frequency below 200 Hz.

(b) Move MASTER SWITCH to RUN position. All lights should be off.

NOTE

Read step (c) completely before performing step (c).

(c) Move MASTER SWITCH to START position. The STARTER light should come on. Quickly increase function generator to a frequency between 2900 and 3200 Hz before EECM timeout. During frequency increase IGNITION and FUEL lights will come on and then STARTER and IGNITION lights will go off. The FUEL light should remain on.

(d) Continue to increase function generator frequency until READY TO LOAD light comes on. This happens between 3300 to 3500 Hz.

(e) Increase millivolt source until engine OVERTEMP light comes on. This should happen between 27.5 and 28.6 millivolts. The FUEL and READY TO LOAD lights should be off.

(f) Move MASTER SWITCH to OFF position. All lights should remain off.

(g) Any discrepancy noted during the above procedure indicates a failure in the EECM overfemperature circuit. Refer to Table 2-4, Malfunction 4.

(8) Sixty percent switch test.

(a) Adjust. function generator to a frequency between 0 and 200 Hz and adjust millivolt source to 96 to 1.20 millivolts.

NOTE

EECM electronics requires a frequency below 200 Hz.

(b) Move MASTER SWITCH to RUN position. All lights should be off.

NOTE

Read steps (c) and (d) completely before continuing and performing steps (c) and (d).

(c) Move MASTER SWITCH to START position. The STARTER light should come on.

(d) Quickly increase function generator to between 1400 and 1800 Hz. IGNITION and FUEL lights should come on.

10-2. ENGINE ELECTRONIC CONTROL MODULE (EECM). (cont.)

a. Test. (cont.)

(e) Quickly increase frequency generator to a frequency between 1965 and 2059 Hz. STARTER and IGNITION lights should go off and FUEL light should remain on.

(f) Move MASTER SWITCH to OFF position. All lights should go off.

(g) Any discrepancy noted during the above procedure indicates a failure in the EECM. Refer to table 2-4, Malfunction 3.

(9) One hundred percent switch test.

(a) Adjust function generator to a frequency between 0 and 200 Hz and adjust millivolt source to .96 to 1.20 millivolts.

NOTE

EECM electronics requires a frequency below 200 Hz.

(b) Move MASTER SWITCH to RUN position. All lights should be off.

NOTE

Read step (c) completely before performing step (c).

(c) Move MASTER SWITCH to START position. The STARTER light should come on. Immediately increase function generator frequency until READY TO LOAD light comes on. This should happen between 3287 and 3421 Hz. Do not take longer than 15 seconds to complete step (c). During frequency increase. IGNITION and FUEL lights will come on. When READY TO LOAD light comes on the STARTER and IGNITION lights should have gone off and the FUEL light remain on.

(d) Move MASTER SWITCH to OFF position. All lights should go off.

(e) Any discrepancy noted failure in the EECM generator enable circuit. Refer to Table 2-4, Malfunction 6.

(10) Contactor enable test.

(a) Adjust function generator to a frequency between 0 and 200 Hz and adjust millivolt source to .96 to 1.20 millivolts.

NOTE

EECM electronics requires a frequency below 200 Hz.

(b) Move MASTER SWITCH to RUN position. All lights should be off.

NOTE

Read step (c) completely before performing step (c).

(c) Move MASTER SWITCH to START position. The STARTER light should come on. Immediately increase function generator frequcny until READY TO LOAD light come on. This should happen between 3287 and 3421 Hz. Do not take longer than 15 seconds to complete step (c). During frequency increase, IGNITION and FUEL lights will come on. When READY TO LOAD light comes on, the STARTER and IGNITION lights should have gone off and the FUEL light remain on.

(d) Move CONTACTOR switch mememtarily to CLOSED position. CONTACTOR ENABLE light should come on.

(e) If CONTACTOR ENABLE light does not come on, refer to Table 2-4, Malfunction 9.

(f) Move CONTACTOR ENABLE SWITCH momentarily to OPEN position. CONTACTOR ENABLE light should go off and the READY TO LOAD and FUEL Lights should remain on.

(g) Move MASTER SWITCH to OFF position. All lights should be off.

10-2. ENGINE ELECTRONIC CONTROL MODULE (EECM). (cont.)

a. Test. (cont.)

(h) Any discrepancy noted during above procedure indicates a failure in EECM contractor enable circuit. Refer to Table 2-4, Malfunction 9, step 2.

(11) Overspeed test.

(a) Adjust function generator to a frequency between 0 and 200 Hz and adjust millivolt source to .96 to 1.20 millivolts.

(b) Move MASTER SWITCH to RUN position. All lights should be off.

NOTE

Read step (c) completely before performing step (c).

(c) Move MASTER SWITCH to START position. The STARTER light should come on. Quickly increase function generator frequency until READY TO LOAD light comes on. This should happen between 3287 and 3421 Hz. The FUEL light should be on and the STARTER light should have gone off.

(d) Slowly increase function generator frequency until engine OVERSPEED light comes on. This should happen between 3615 and 3763 Hz. All other lights should be off.

(e) Move MASTER SWITCH to OFF position. OVERSPEED light should go to off.

(f) Any discrepancy noted during the above procedure indicates a failure in the EECM overspeed circuit. Refer to Table 2-4, Malfunction 5.

(12) Low oil test.

(a) Adjust function generator to a frequency between 0 and 200 Hz and adjust millivolt source to .96 to 1.20 millivolts.

NOTE

EECM electronics requires a frequency below 200 Hz.

(b) Move MASTER SWITCH to RUN position. All lights should be off.

NOTE

Read step (c) completely before performing step (c).

(c) Move MASTER SWITCH to START position. The STARTER light should come on. Quickly increase function generator to a frequency between 2900 and 3200 Hz before EECM timeout. During frequency increase IGNITION and FUEL lights will come on and then STARTER and IGNITION lights will go off. (This should happen between 1965 and 2059 Hz). The FUEL light should remain on.

(d) Continue to increase function generator frequency slowly until READY TO LOAD light comes on. This should happen between 3287 to 3421 Hz.

(e) Move LOW OIL switch to ON position. LOW OIL PRESSURE light should come on. Start timing device. Stop timing device when all other lights go off. This should happen between 0.5 and 2.0 seconds.

(f) Move LOW OIL switch to OFF position. The LOW OIL PRESSURE light should stay on.

(g) Move MASTER SWITCH to OFF position. All lights should be off.

(h) Any discrepancy noted during the above procedure indicates a failure in the EECM low oil pressure circuit. Refer to Table 2-4, Malfunction 7.

(13) Generator over temperature fault test.

(a) Adjust function generator to a frequency between 0 and 200 Hz and adjust millivolt source to .96 to 1.20 millivolts.

10-2. ENGINE ELECTRONIC CONTROL MODULE (EECM). (cont.)

a. Test. (cont.)

(b) Move MASTER SWITCH to RUN position. All lights should be off.

NOTE

Read step (c) completely before performing step (c).

(c) Move MASTER SWITCH to START position. The STARTER light should come on. Quickly increase function generator to a frequency between 2900 and 3200 Hz before EECM timeout. During frequency increase IGNITION and FUEL lights will come on and then STARTER and IGNITION lights will go off. The FUEL light should remain on. This should happen between 1965 and 2059 Hz.

(d) Increase function generator frequency slowly until READY TO LOAD light comes on, FUEL light should remain on. This should happen between 3287 to 3421 Hz.

(e) Move CONTACTOR switch momentarily to the CLOSED position CONTACTOR ENABLE light should come on.

(f) Move OVERTEMP switch to ON position. The GEN OVERTEMP light should come on and all other lights should go off.

(g) Move OVERTEMP switch to OFF position. The GEN OVERTEMP light should remain on.

(h) Move MASTER SWITCH to OFF position. All lights should go off.

(i) Any discrepancy noted during the above procedure, Refer to Table 2-4, Malfunction 8.

(14) Generator overvoltage fault test.

(a) Adjust function generator to a freauency between 0 and 200 Hz and adjust millivolt source to .96 to 1.20 millivolts.

(b) Move MASTER SWITCH to RUN position. All lights should be off.

NOTE

Read step (c) completely before performing step (c).

(c) Move MASTER SWITCH to START position. The STARTER light should come on. Quickly increase function generator to a frequency between 2900 and 3200 Hz before EECM timeout. During frequency increase, IGNITION and FUEL lights will come on and then STARTER and IGNITION lights will go off. The FUEL light should remain on. This should happen between 1965 and 2059 Hz.

(d) Increase function generator frequency slowly until READY TO LOAD light comes on and FUEL light should remain on. This should happen between 3287 to 3421 Hz.

(e) Move CONTACTOR switch momentarily to the CLOSED position. CONTACTOR ENABLE light should come on.

(f) Move OVERVOLT switch to ON position. The OVERVOLT light should come on and all other lights should go off.

(g) Move OVERVOLT switch to OFF position. The OVERVOLT light should remain on.

(h) Move MASTER SWITCH to OFF position. All lights should go off.

(i) Any discrepancy noted during the above procedure, Refer to Table 2-4, Malfunction 8.

(15) Generator overload fault test.

(a) Adjust function generator to a frequency between 0 and 200 Hz and adjust millivolt source to .96 to 1.20 millivolts.

10-2. ENGINE ELECTRONIC CONTROL MODULE (EECM). (cont.)

a. Test. (cont.)

(b) Move MASTER SWITCH to RUN position. All lights should be off.

NOTE

Read step (c) completely before performing step (c).

(c) Move MASTER SWITCH to START position. The STARTER light should come on. Quickly increase function generator to a frequency between 2900 and 3200 Hz before EECM timeout. During frequency increase, IGNITION and FUEL lights will come on and then STARTER and IGNITION lights will go off. The FUEL light should remain on. This should happen between 1965 and 2059 Hz.

(d) Increase function generator frequency slowly until READY TO LOAD light comes on and FUEL light should remain on. This should happen between 3287 and 3421 Hz.

(e) Move CONTACTOR switch momentarily to the CLOSED position. CONTACTOR ENABLE light should come on.

(f) Move OVERLOAD switch to ON position. The OVERLOAD light should come on and all other lights should go off.

(g) Move OVERLOAD switch to OFF position. The OVER LOAD light should remain on.

(h) Move MASTER SWITCH to OFF position. All lights should go off.

(i) Any discrepancy noted during the above procedure, Refer to Table 2-4, Malfunction 8.

(16) Generator undervoltage fault test.

(a) Adjust function generator to a frequency between 0 and 200 Hz and adjust millivolt source to .96 to 1.20 millivolts.

(b) Move MASTER SWITCH to RUN position. All lights should be off.

NOTE

Read step (c) completely before performing step (c).

(c) Move MASTER SWITCH to START position, The STARTER light should come on. Quickly increase function generator to a frequency between 2900 and 3200 Hz before timeout. During frequency increase, IGNITION and FUEL lights will come on and then STARTER and IGNITION lights will go off. The FUEL light should remain on. This should happen between 1965 and 2059 Hz.

(d) Increase function generator frequency slowly until READY TO LOAD light comes on and FUEL light should remain on. This should happen between 3287 to 3421 Hz.

(e) Move CONTACTOR switch momentarily to the CLOSED position CONTACTOR ENABLE light should come on.

(f) Move UNDERVOLT switch to ON position. The UNDERVOLT light should come on and all other lights should go off.

(g) Move UNDERVOLT switch to OFF position. The UNDERVOLT light should remain on.

(h) Move MASTER SWITCH to OFF position. All lights should go off.

(i) Any discrepancy noted during the above procedure. Refer to Table 2-4, Malfunction 8.

(17) Fuel pump control test.

(a) Adjust function generator to a frequency between 0 and 200 Hz and adjust millivolt power source to .96 to 1.20 millivolts (K-type thermocouple equivalent output). Connect Oscilloscope to EECM test fixture (pump output terminal Fig 10-1).

(b) Move MASTER SWITCH to RUN position. All lights should be off.

NOTE

Read steps (c) and (d) completely before performing steps (c) and (d).

10-2. ENGINE ELECTRONIC CONTROL MODULE (EECM). (cont.)

a. Test. (cont.)

(c) Move MASTER SWITCH to START position. The STARTER light should come on. Quickly increase function generator frequency until STARTER and IGNITION lights go off and FUEL light goes on. This should happen between 1965 and 2059 Hz.

(d) Continue to increase function generator frequency until READY TO LOAD light comes on. Should happen between 3287 and 3421 Hz.

(e) Set functional generator frequency at 3500 Hz. Monitor fuel pump output waveform on oscilloscope while tuning function generator frequency between 3500 and 3000 Hz. The waveform pulse width should vary inversely proportional to frequency being applied and be of an amplitude of 20-28 Vdc peak to peak to 8-10 Vdc peak to peak.

NOTE

Disregard the leading edge spike on this DC pulse. The vertical pulse shown on the oscilloscope is the fuel pump off-time. As the frequency is tuned between 3500 to 3000 Hz the vertical pulse will also vary in width and height. The highest voltage and pulse width will occur at the highest frequency. This indicates that the pump will be off the greatest amount of time since the EECM is reducing the fuel to the turbine. Inversely, the smallest pulse will occur at the lower frequency when the EECM is maximizing the fuel pump on-time to increase the fuel to the turbine.

(f) Move MASTER SWITCH to OFF position. All lights should go off.

(g) Any discrepancy noted during the above procedure indicates a failure in the EECM pump control circuit. Refer to Table 2-4, Malfunction 6.

b. Circuit Card Replacement.

(1) Removal.

(a) Place EECM so that bottom cover faces up.

(b) Remove screws (1, figure 10-2), washers (2), and bottom cover (3).

(c) Tag and disconnect connector (4).

CAUTION

To prevent damage to jumper cable (8), use care when removing circuit cards.

(d) Remove screws (5) and lockwashers (6).

(e) Carefully lift switch circuit card (7) and disconnect jumper cable (8). Remove card and jumper.

(f) Tag and disconnect connector (9).

(g) Remove screws (10) and washers (11).

(h) Remove spacer posts (12), microprocessor circuit card (13), hex spacer posts (14), and lockwashers (15).

(i) Tag and disconnect connector (16).

(j) Remove screws (17), lockwashers (18), and power circuit card (19).

(k) Remove screws (20), lockwashers (21), hex spacer posts (22), and washers (23).

(2) Installation.

(a) Place lockwashers (21) on screws (20) and install in EECM.

(b) Place washers (23) on exposed threads of screws (20). Add hex spacer posts (22) and torque to 10-12 inch pounds (1.1-1.4 Nm).

(c) Position power circuit card (19) on hex spacer posts (22) and secure with lockwashers (18) and screws (17). Torque to 10-12 inch pounds (1.1-1.4 Nm).

(d) Insert connector (16) into power circuit card.

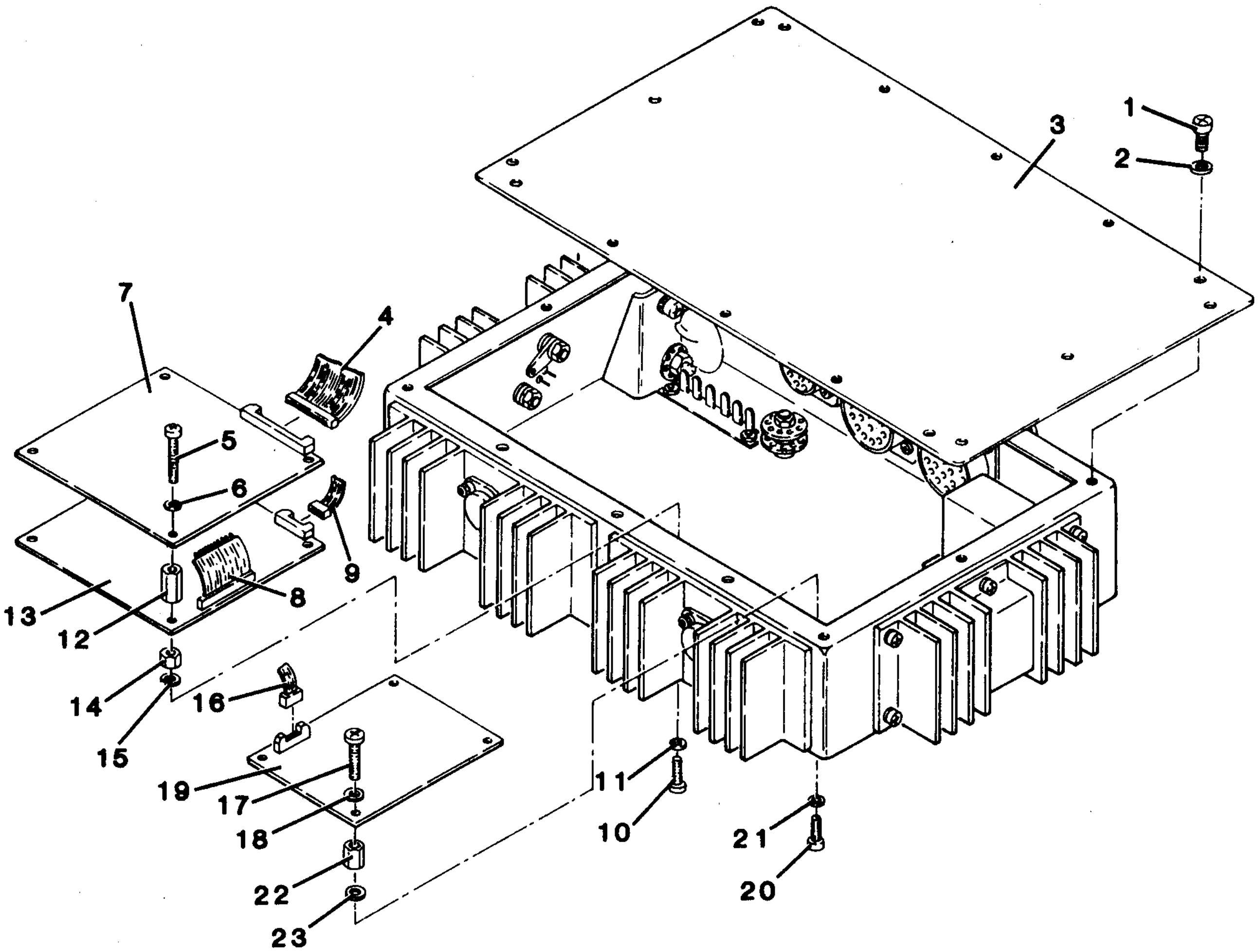
(e) Place washers (11) on screws (10) and install in EECM.

(f) Place lockwashers (15) on exposed threads of screws (10). Add hex spacer posts (14) and torque to 10-12 inch pounds (1.1-1.4 Nm).

(g) Position microprocessor circuit card (13) on hex spacer posts (14) and install hex spacer posts (12).

(h) Insert connector (9) into microprocessor circuit card.

10-2. ENGINE ELECTRONIC CONTROL MODULE (EECM). (cont)



LEGEND

1. SCREW
2. WASHER
3. COVER
4. CONNECTOR
5. SCREW
6. LOCKWASHER
7. SWITCH CIRCUIT CARD
8. JUMPER CABLE
9. CONNECTOR
10. SCREW
11. WASHER
12. HEX SPACER POST
13. MICROPROCESSOR CIRCUIT CARD
14. HEX SPACER POST
15. LOCKWASHER
16. CONNECTOR
17. SCREW
18. LOCKWASHER
19. POWER CIRCUIT CARD
20. SCREW
21. LOCKWASHER
22. HEX SPACER POST
23. WASHER

Figure 10-2. EECM Circuit Card Replacement

*U.S. Government Printing Office:1990-754-029/20216 PIN:060188-001

10-2. ENGINE ELECTRONIC CONTROL MODULE (EECM). (cont)

b. Circuit Card Replacement. (cont)

(i) Position switch circuit card (7) on hex spacer posts (12) while connecting jumper cable (8). Secure with lockwashers (6) and screws (5). Torque to 10-12 inch pounds (1.1-1.4 Nm).

(j) Insert connector (4) into switch circuit card.

(k) Position bottom cover (3) on EECM and secure with washers (2) and screws (1). Torque to 10-12 inch pounds (1.1-1.4 Nm).

c. Transistor Replacement.

(1) Removal.

(a) Place EECM so that bottom cover faces up.

(b) Remove screws (1, figure 10-2), washers (2), and bottom cover (3).

(c) Tag and disconnect wiring from back of transistor (16, figure 10-3) and from terminal lug (6).

(d) Remove screws (1), lockwashers (2), and transistor cover (3).

(e) Remove screw (4), nut (5), terminal lug (6), washer (7), mounting pad (8), and washer (9).

(f) Remove screws (10), nut (11), lockwasher (12), washer (13), mounting pad (14), and washer (15).

(g) Remove transistor (16) and plate insulator (17).

(2) Installation.

(a) Place washer (15) on screw (10) and washer (9) on screw (4).

(b) Install assembled screws and washers into transistor (16) and plate insulator (17).

(c) Position assembled transistor on EECM.

(d) Place mounting pad (8), washer (7), terminal lug (6), and nut (5) on threads of screws (4). Torque to 8.5-11.5 inch pounds (1.0-1.3 Nm).

(e) Place mounting pad (14), washer (13), lockwasher (12), and nut (11) on threads of screw (10). Torque to 8.5-11.5 inch pounds (1.0-1.3 Nm).

(f) Install transistor cover (3) and secure with lockwashers (2) and screws (1). Torque to 6-8 inch pounds (0.7-0.9 Nm).

(g) Connect wires to back of transistor and to terminal lug.

(h) Position bottom cover (3, figure 10-2) and secure with washers (2) and screws (1). Torque to 10-12 inch pounds (1.1-1.4 Nm).

d. EECM Connector Replacement.

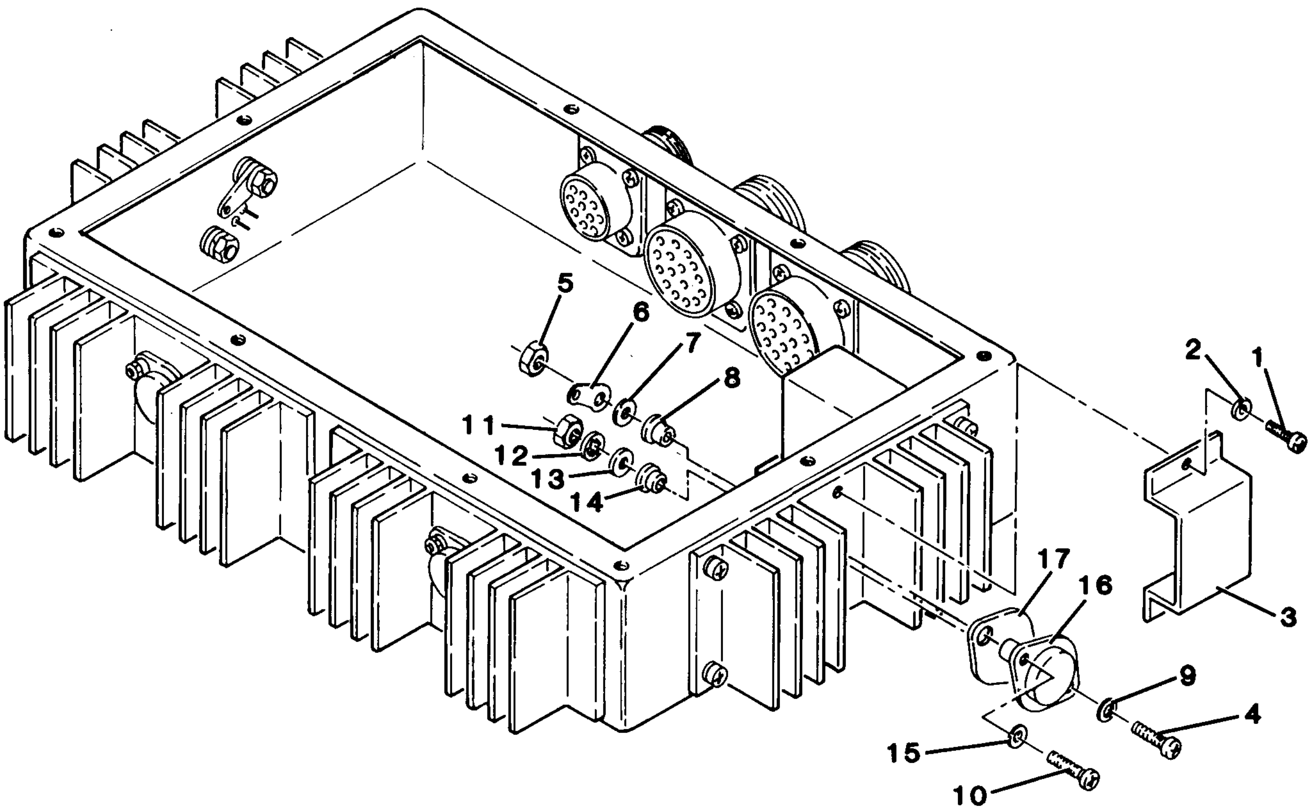
(1) Removal.

(a) Place EECM so that bottom cover is up.

(b) Remove screws (1, figure 10-2), washers (2), and cover (3).

(c) Tag and disconnect wiring from back of damaged connector.

10-2. ENGINE ELECTRONIC CONTROL MODULE (EECM). (cont)



LEGEND

1. SCREW
2. LOCKWASHER
3. TRANSISTOR COVER
4. SCREW
5. NUT
6. TERMINAL LUG
7. WASHER
8. MOUNTING PAD
9. WASHER
10. SCREW
11. NUT
12. LOCKWASHER
13. WASHER
14. MOUNTING PAD
15. WASHER
16. TRANSISTOR
17. PLATE INSULATOR

Figure 10-3. EECM Transistor Replacement

10-2. ENGINE ELECTRONIC CONTROL MODULE **(EECM).** (cont)

d. EECM connector Replacement. (cont)

(d) Remove lockwire, screws (1, figure 10-4), nuts (2), and washers (3).

(e) Remove connector (4) and gasket (5). Discard gasket.

(2) Installation.

(a) Slip new gasket (5) over threaded end of connector (4).

(b) Position connector in EECM and secure with screws (1), washers (3), and nuts (2). Torque to 6-7 inch pounds (0.7-0.8 Nm). Install lockwire.

(c) Figure 10-5 is provided to assist in proper wire disconnect reconnect. Reconnect wiring to back of connector and remove tags.

(d) Install bottom cover (3, figure 10-2) and secure with washers (2) and screws (1). Torque to 10-12 pounds (1.1-1.4 Nm).

e. Terminal Board Replacement.

(1) Removal.

(a) Place EECM so that bottom cover faces up.

(b) Remove screws (1, figure 10-2), washers (2), and bottom cover (3).

(c) Tag and disconnect wiring from terminal board (4, figure 10-6).

(d) Remove screws (1), nuts (2), washers (3), and terminal board (4).

(2) Installation.

(a) Position terminal board in EECM and secure with screws (1), washers (3), and nuts (2). Torque to 8.5-11.5 inch pounds (1.0-1.3 Nm).

(b) Connect wiring to terminal board. Remove tags.

(c) Place bottom cover (3, figure 10-2) on EECM and secure with washers (2) and screws (1). Torque to 10-12 inch pounds (1.1-1.4 Nm).

f. Multiple Ground Terminal Replacement.

(1) Removal.

(a) Place EECM so that bottom cover faces up.

(b) Remove screws (1, figure 10-2), washers (2), and bottom cover (3).

(c) Tag and disconnect wiring to multiple ground terminals (9, figure 10-6).

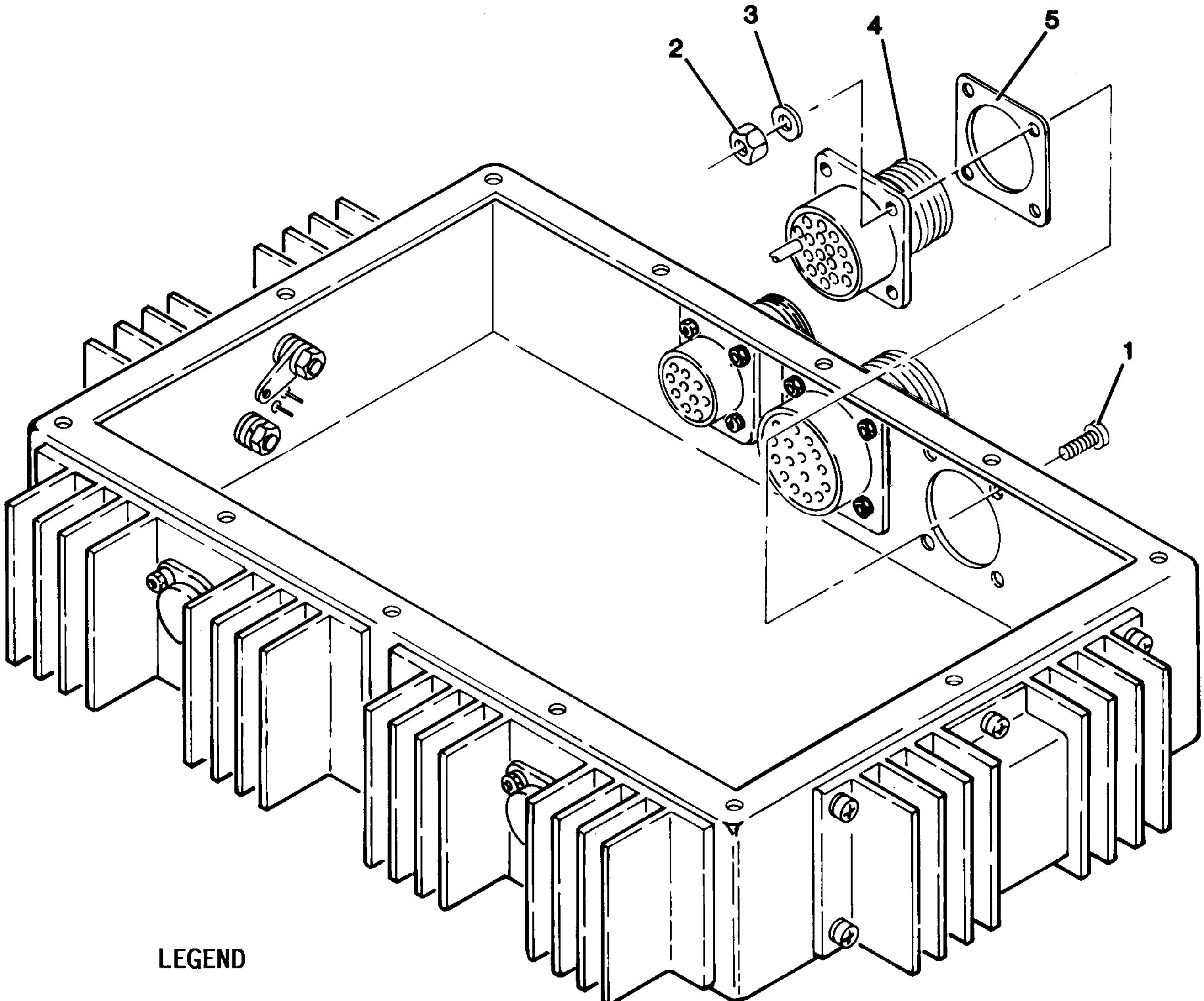
(d) Remove screw (5), washer (6), and nut (7), shouldered washer (8), and multiple ground terminals (9).

(2) Installation.

(a) Place washer (6) on screw (5). Insert screw through mounting hole in EECM.

(b) Position multiple ground terminals (9) and shouldered washer (8) on threaded end of screw (5). Secure with nut (7). Torque to 8.5-11.5 inch pounds (1.0-1.3 Nm).

10-2. ENGINE ELECTRONIC CONTROL MODULE (EECM). (cont)



LEGEND

1. SCREW
2. NUT
3. WASHER
4. CONNECTOR
5. GASKET

Figure 10-4. EECM Connector Replacement

10-2. ENGINE ELECTRONIC CONTROL MODULE (EECM). (cont)

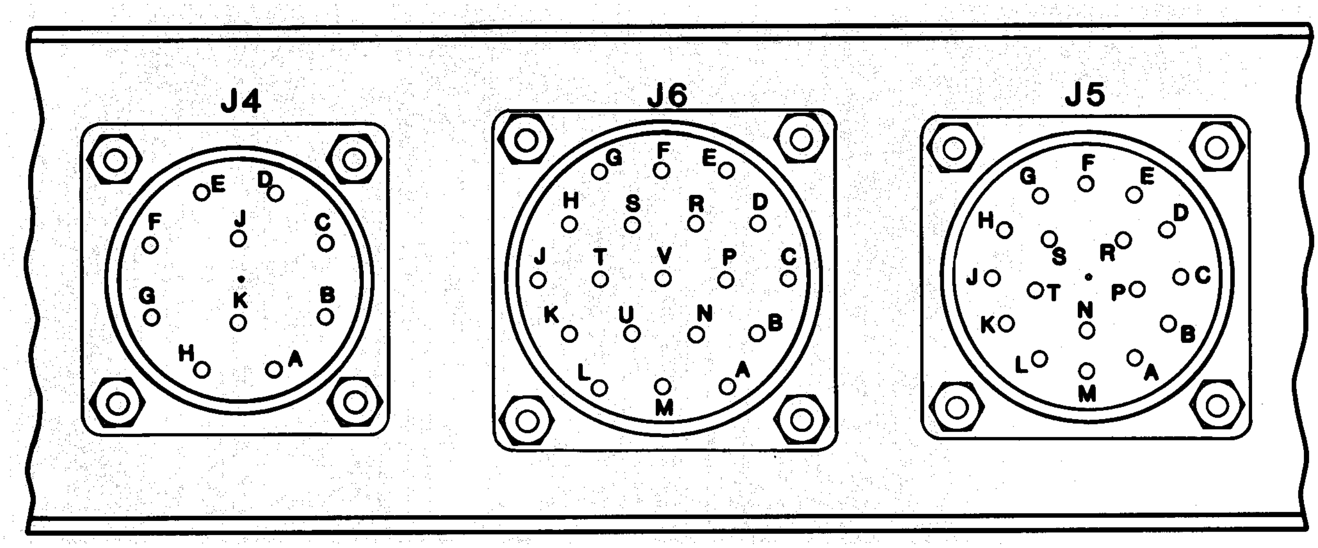


Figure 10-5. EECM Connectors (Back) Wire Connections

(c) Connect wiring to multiple ground terminals. Remove tags.

(d) Place bottom cover (3, figure 10-2) on EECM and secure with washers (2) and screws (1). Torque to 10-12 inch pounds (1.1-1.4 Nm).

g. Contactor Replacement.

(1) Removal.

(a) Place EECM so that bottom cover faces up.

(b) Remove screws (1, figure 10-2), washers (2), and cover (3).

(c) Remove screws (1, figure 10-7), washers (2), and contactor cover (3).

(d) Remove screws (4), lockwashers (5), and washers (6) that secure contactor (7) in contactor cover.

(e) Pull contactor out of cover. Tag and disconnect wiring from contactor.

(f) Remove diode CR2 (8).

(g) Remove grommet (9) if damaged.

(2) Installation.

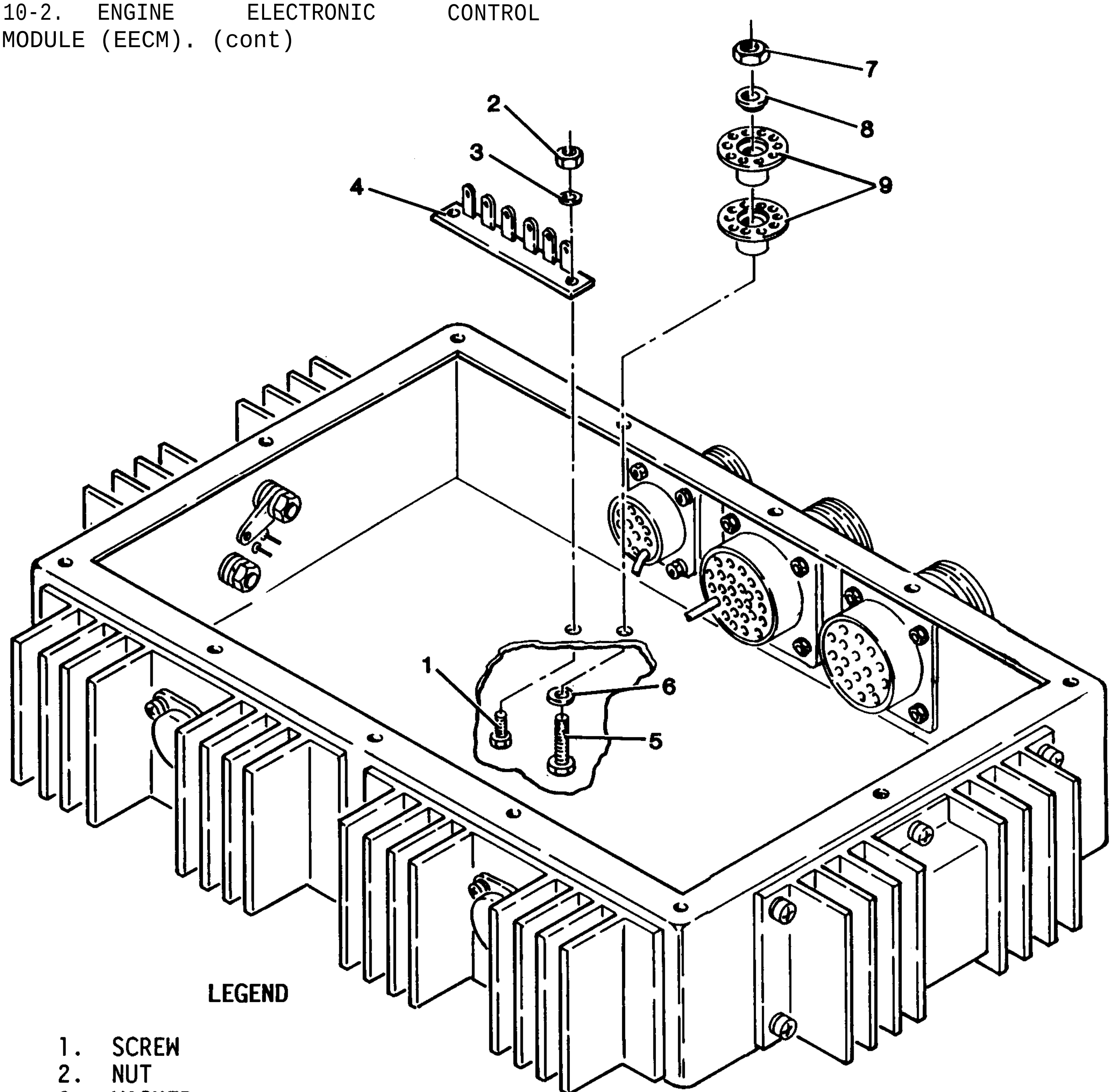
(a) Press grommet (9) into contactor cover (3).

(b) Install diode CR2 (8).

(c) Connect wiring to contactor (7). Remove tags.

(d) Position contactor in contactor cover and secure with washers (6), lockwashers (5), and screws (4). Torque to 3-4 inch pounds (0.3-0.5 Nm).

10-2. ENGINE ELECTRONIC CONTROL MODULE (EECM). (cont)



LEGEND

1. SCREW
2. NUT
3. WASHER
4. TERMINAL BOARD
5. SCREW
6. WASHER
7. NUT
8. SHOULDERED WASHER
9. MULTIPLE GROUND TERMINAL

Figure 10-6. Terminal Board/Multiple Ground Terminal Replacement

10-2. ENGINE ELECTRONIC CONTROL MODULE (EECM). (cont)

g. Contactor Replacement. (cont)

(e) Install contactor cover in EECM and secure with washers (2) and screws (1). Torque to 10-12 inch pounds (1.1-1.4 Nm).

(f) Place bottom cover (3, figure 10-2) on EECM and secure with washers (2) and screws (1). Torque to 10-12 inch pounds (1.1-1.4 Nm).

h. Diode Replacement.

(1) Removal.

(a) Place EECM so that bottom cover faces up.

(b) Remove screws (1, figure 10-2), washers (2), and bottom cover (3).

(c) Tag and disconnect wiring to diode mounting assembly.

(d) Disconnect and remove diode CR3 (10, figure 10-7).

(e) Disconnect and remove resistor VR1 (11).

(f) Disconnect and remove capacitor C1 (12).

(g) Disconnect and remove diode CR6 (13).

(h) Remove screws (14) and washers (15) that secure mounting bracket (32) in EECM.

(i) Remove screw (16), washer (17), nut (18), shouldered washer (19), multiple ground terminal (20), and shouldered washer (21) from mounting bracket (32).

(j) Remove transistor Q4 (22), terminal lug (23), nut (24), and lockwasher (25) from mounting bracket (32).

(k) Remove diode CR5 (26), shouldered washer (27), nut (28), washer (29), terminal lug (30), and insulated washer (31) from mounting bracket (32).

(2) Installation.

(a) Place shouldered washer (27) on diode CR5 (26) and install in mounting bracket (32).

(b) Install insulated washer (31), terminal lug (30), and washer (29) on threaded end of diode. Secure with nut (28). Torque to 24-36 inch pounds (2.7-4.1 Nm).

(c) Place terminal lug (23) on transistor Q4 (22) and install in mounting bracket. Secure with washer (25) and nut (24). Torque to 8.5-11.5 inch pounds (1.0-1.3 Nm).

(d) Place washer (17) on screw (16) and install in mounting bracket.

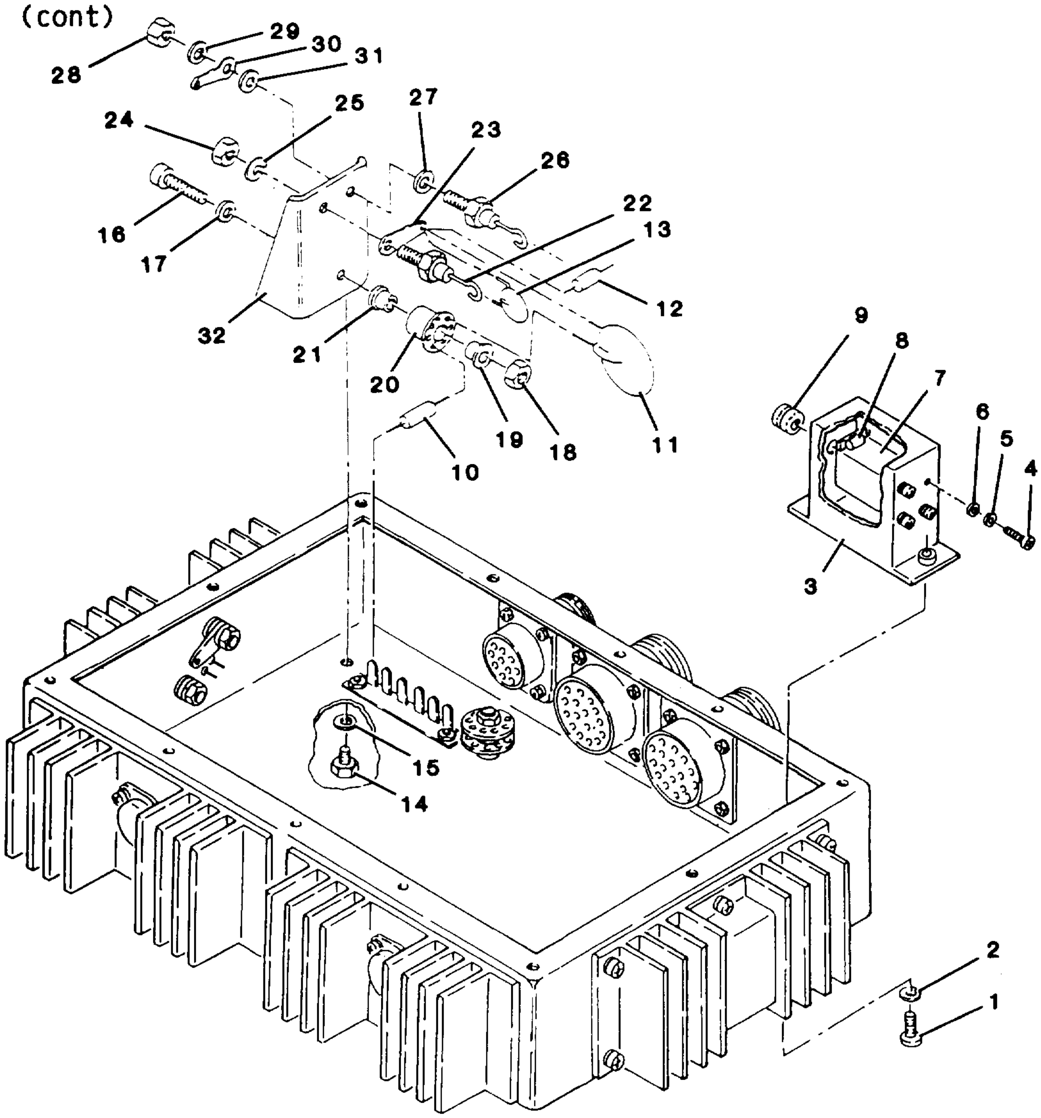
(e) Install shouldered washer (21), multiple ground terminal (20), and shouldered washer (19) on threaded end of screw (16). Secure with nut (18). Torque to 8.5-11.5 inch pounds (1.0-1.3 Nm).

(f) Install mounting bracket (32) in EECM and secure with washers (15) and screws (14). Torque to 10-12 inch pounds (1.1-1.4 Nm).

(g) Install diode CR6 (13).

(h) Install capacitor C1 (12).

10-2. ENGINE ELECTRONIC CONTROL MODULE (EECM). (cont)



LEGEND

1.	SCREW	12.	CAPACITOR C1	23.	TERMINAL LUG
2.	HASHER	13.	DIODE CR6	24.	NUT
3.	CONTACTOR COVER	14.	SCREW	25.	LOCKHASHER
4.	SCREW	15.	WASHER	26.	DIODE CR5
5.	LOCKWASHER	16.	SCREW	27.	SHOULDERED WASHER
6.	WASHER	17.	WASHER	28.	NUT
7.	CONTACTOR	18.	NUT	29.	WASHER
8.	DIODE CR2	19.	SHOULDERED WASHER	30.	TERMINAL LUG
9.	GROMMET	20.	MULT-GND TERMINAL	31.	INSULATED WASHER
10.	DIODE CR3	21.	SHOULDERED WASHER	32.	MOUNTING BRACKET
11.	RESISTOR VR1	22.	TRANSISTOR Q4		

Figure 10-7. Contactor/Diode Replacement

10-2. ENGINE ELECTRONIC CONTROL MODULE (EECM). (cont)

h. Diode Replacement. (cont)

(i) Install resistor VR1 (11).

(j) Install diode CR3 (10).

(k) Connect wiring to completed assembly. Remove tags.

(1) Position bottom cover (3, figure 10-2) on EECM and secure with washers (2) and screws (1). Torque to 10-12 inch pounds (1.1-1.4 Nm).

i. Wiring Repair and Replacement. If it becomes necessary to repair or replace internal EECM wiring, refer to EECM schematic (F0-1) and the EECM wire list (F0-2). Measure appropriate wire to meet requirements. Install using standard electrical wiring practices and procedures.

10-3. CONTROL PANEL ASSEMBLY. Maintenance of the control panel at this level consists of removal and replacement of the control panel only. Refer to paragraph 2-8 for control panel removal and replacement procedures.

CHAPTER 11

MAINTENANCE OF LOAD CONNECTION

11-1. GENERAL. The only load connection component requiring maintenance at this level is the power cable. The power cable serves as the electrical connection between the generator set and the aircraft.

11-2. POWER CABLE.

a. Removal. Remove power cable in accordance with paragraph 4-81a, TM5-6115-612-12.

b. Replacing Terminal Lugs.

(1) Remove shrink sleeve from damaged lug.

(2) Cut damaged lug from cable.

(3) Strip insulation to bare 3/4 inch (1.9 cm).

(4) Insert bare wire into lug and crimp securely in place.

(5) Install new shrink sleeve.

Replacing Plug Connector. If the power cable plug connector becomes damaged and requires replacement, use repair kit P/N 84-14137. Complete instructions and all necessary parts for splicing on a new plug connector are contained in the kit.

d. Installation. Install power cable in accordance with paragraph 4-81b, TM5-6115-6l2-l2.

CHAPTER 12

MAINTENANCE OF RUNNING GEAR

12-1. PURPOSE AND FUNCTION OF RUNNING GEAR. The running gear provides the means for moving the generator set manually or with a tow vehicle. The brake control, consisting of a handbrake and adjustable linkage, will prevent movement of the generator set when the handbrake lever is placed in the set position. A torsion axle and the associated wheels, tires, and tubes are the components that allow easy movement of the generator set. The lunette eye is the connecting point for a towing vehicle. A swivel caster provides support for the front of the generator set and can be rotated up from the down position when the set is being towed.

12-2. TORSION AXLE ASSEMBLY.

a. Removal.

(1) Set handbrake.

(2) Loosen lug nuts on both wheels.

WARNING

To prevent Injury, ensure that battery is disconnected before performing maintenance.

(3) Disconnect battery cable plug connector from battery.

(4) Remove power cable from cable support.

WARNING

Use lifting device with lifting capacity of 2000 pounds (907.2 kg) when lifting generator set.

(5) Attach lifting device to tiedown rings. Raise generator set and place on blocks. Blocks should be placed at each corner of generator set. Disconnect lifting device.

(6) Remove wheels in accordance with paragraph 4-92, TM 5-6115-612-12.

(7) Remove brake and hub assemblies in accordance with paragraph 4-94b, TM 5-6115-612-12. Make sure all brake lines are disconnected and secured.

WARNING

To prevent injury, ensure that torsion axle is supported before removing attaching parts.

(8) Place blocks or other suitable support under torsion axle.

(9) On underside of generator set, remove self-locking nuts (1, figure 12-1), capscrews (2), and washers (3) that secure torsion axle (4) to frame.

b. Installation.

(1) Support torsion axle (4) in place on underside of generator set.

(2) Apply threadlocking compound, type II, grade N (MIL-S-46163) to threads of capscrews (2).

12-2. TORSION AXLE ASSEMBLY. (cont)

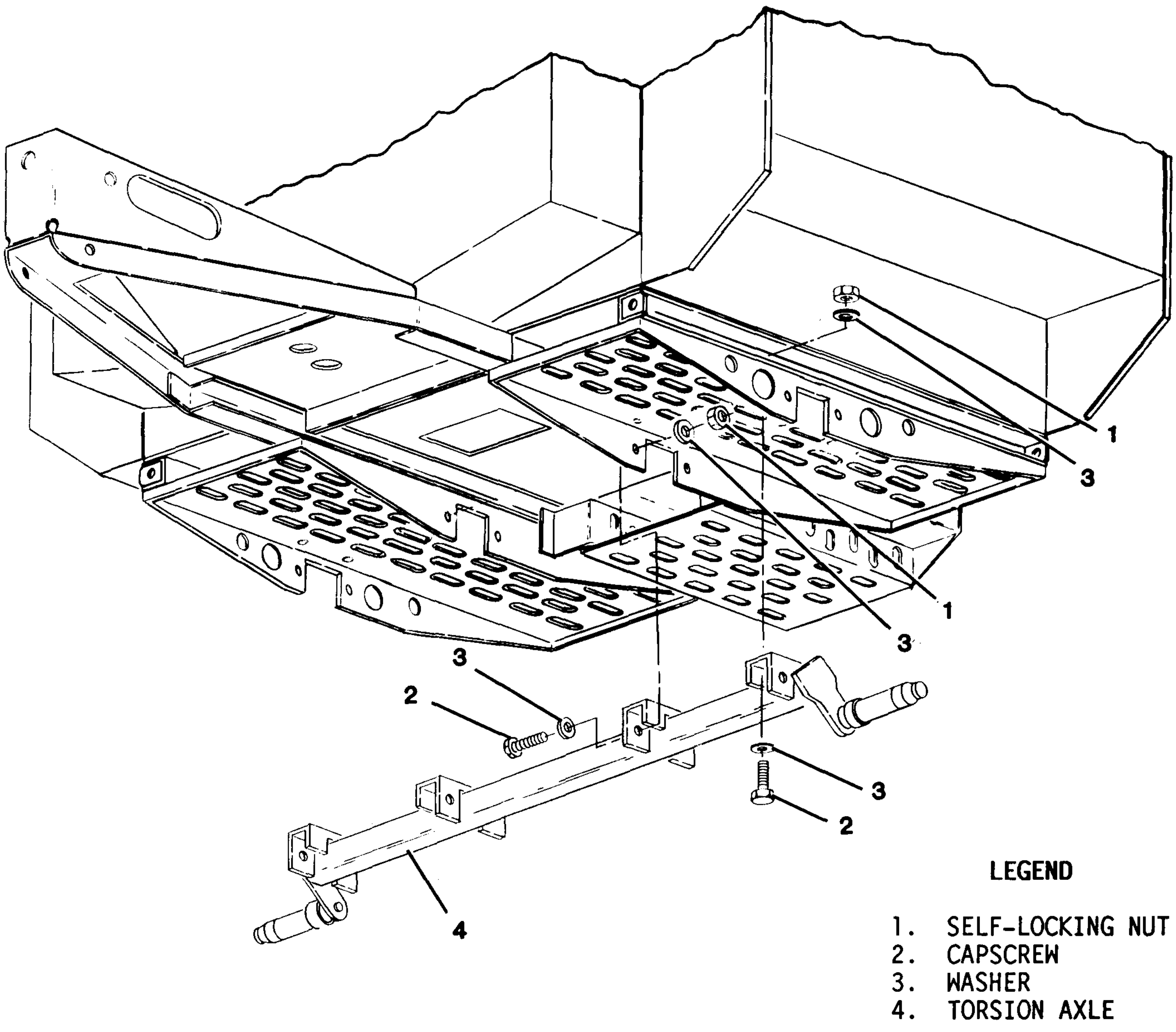


Figure 12-1. Torsion Axle Replacement

12-2. TORSION AXLE ASSEMBLY. (cont)

b. Installation (cont)

(3) On underside of generator set, install capscrews (2), washers (3) and self-locking nuts (1).

(4) Torque capscrews to 75-84 foot pounds (101.7-113.0 Nm).

(5) Remove supports from torsion axle.

(6) Install brake and hub assemblies in accordance with paragraph 4-94d, TM 5-6115-612-12. Make sure all brake lines are connected.

(7) Install wheels in accordance with paragraph 4-92, TM 5-6115-612-12.

(8) Attach lifting device to tiedown rings. Lift generator set and remove blocks. Lower generator set.

(9) Connect battery cable plug connector to battery.

(10) Stow power cable on cable support.

(11) Tighten lug nuts on wheels to 580 inch pounds (65.53 Nm).

(12) Release handbrake.

12-3. SHIVEL CASTER ASSEMBLY.

a. Removal.

WARNING

To prevent injury, ensure that handbrake is set and both wheels are chocked to prevent accidental movement of generator set during maintenance.

(1) Set handbrake and chock both wheels.

(2) Loosen nut (1, figure 12-2).

WARNING

To prevent injury, do not attempt to lift front of generator set with less than two persons.

(3) Raise generator set and block under fuel tank.

(4) Remove nut (1), bolt (2), and wheel (3).

(5) Remove nuts (4), capscrews (5), and washers (6) to separate swivel caster assembly from generator set.

(6) Remove set screw (7) from collar (9). Slide fork (8) out of swivel head (13). Remove collar (9) from swivel head.

(7) Remove hinge pin (10), handle (11), and spring (12) from frame bracket (14).

(8) Remove grease fitting (15) from swivel head (13).

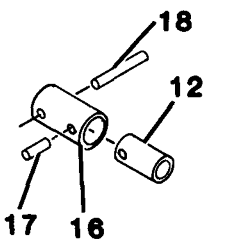
b. Repair. Repair the caster assembly by replacing worn and damaged parts.

c. Installation.

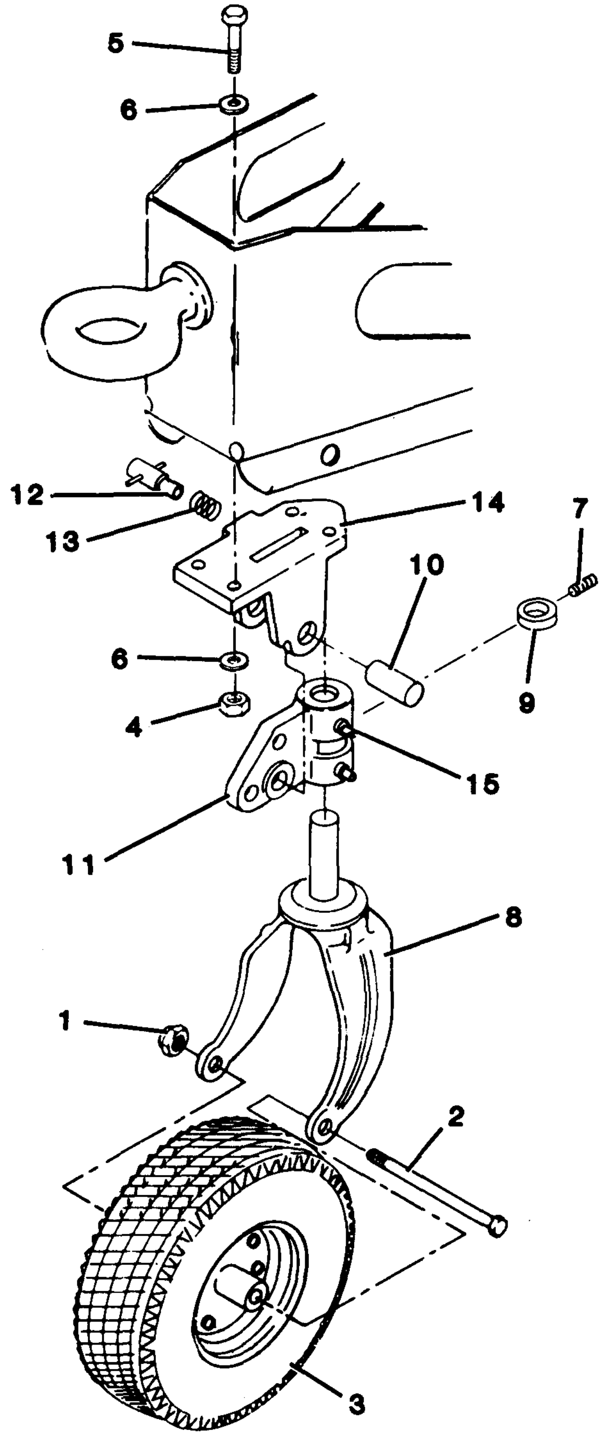
(1) Install grease fitting (15) in swivel head (13).

(2) Anne swivel head mounting hole with mounting hole in frame bracket (14). Secure with hinge pin (10).

12-3. SWIVEL CASTER ASSEMBLY. (cont)



DETAIL ASSEMBLY



LEGEND

1. NUT
2. BOLT
3. WHEEL
4. NUT
5. CAPSCREW
6. WASHER
7. SETSCREW
8. FORK
9. SHAFT COLLAR
10. HINGE PIN
11. SWIVEL HEAD
12. HANDLE
13. SPRING
14. FRAME BRACKET
15. GREASE FITTING
16. HANDLE EXTENSION
17. SPRING PIN
18. SPRING PIN

Figure 12-2. Swivel Caster Repair

12-3. SWIVEL CASTER ASSEMBLY. (cont)

c. Installation. (cont)

(3) Refer to Detail Assembly shown in Figure 12-2. Ensure that handle extension (16) has been installed on handle (12). If not, remove spring pin (18) from handle (12). Slide handle extension (16) into place on handle (12) and secure with spring pin (17). Reinstall spring pin (18) in hole provided in handle extension (16).

(4) Place collar (9) in swivel head. Slide fork (8) into swivel head.

(5) Secure collar to shaft of fork with setscrew (7).

(6) Attach assembled swivel caster to generator set with capscrews (5), washers (6), and nuts (4). Torque to 450-500 inch pounds (50.8-56.5 Nm).

(7) PositIon wheel (3) in fork and install bolt (2) and nut (1).

(8) Raise generator set and remove blocks.

(9) Torque nut (1).

(10) Remove chocks and release handbrake.

CHAPTER 13

GENERATOR SET TEST AND INSPECTION AFTER REPAIR AND OVERHAUL

Section I. GENERAL REQUIREMENTS

13-1. GENERAL. The activity performing repair and 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.

NOTE

In addition to following standard shop procedures and safety precautions, personnel performing maintenance on the generator set shall become familiar with specific warnings and cautions appearing in this manual and in TM 5-6115-612-12.

Section II. INSPECTION

13-2. GENERAL. A thorough inspection shall be conducted each time the generator set is overhauled or rebuilt to ensure that workmanship and materials are satisfactory. For specific inspection and Installation procedures, refer to the appropriate chapter and paragraph in TM 5-6115-612-12 or TM 5-6115-612-34.

13-3. FRAME AND HOUSING INSPECTION. Inspect the frame and housing as follows:

Inspect exterior for proper finish.

b. Inspect tiedown rings for proper Installation.

Inspect access covers and access doors for proper operation. Ensure that all latches and fasteners are properly installed.

d. Inspect battery and battery holddown for proper installation. Ensure that all cables and cable connections are secure.

e. Inspect welded joints for cracks.

13-4. ENGINE INSPECTION.

a. Inspect engine mount for proper attachment to frame.

b. Inspect fuel system components for proper electrical connections. Ensure that loop clamps are installed to prevent chafing of wires.

c. Inspect fuel system components for proper installation of fuel lines. Ensure that loop clamps are installed to prevent chafing of fuel lines.

d. Inspect spark igniter, exhaust gas temperature thermocouple, monopole speed sensor, ignition coil , and starter for proper installation.

Inspect oil lines, fittings, drain valves, and plugs for proper Installation. Ensure that loop clamps are Installed to prevent chafing of oil lines.

f. Inspect oil cooler for proper installation.

13-4. ENGINE INSPECTION. (cont)

g. Inspect engine exhaust for proper installation.

h. Ensure that lockwire is properly installed where required.

i. Inspect air filter, air baffle, and muffler for proper installation.

13-5. GENERATOR INSPECTION.

a. Inspect generator for proper installation. Ensure that lockwire is properly installed where required.

b. Inspect electrical connectors for proper installation. Ensure that loop clamps are installed to prevent chafing.

c. Inspect exterior surfaces for proper refinishing.

13-6. ELECTRICAL ACCESSORIES INSPECTION .

a. Inspect all instruments, switches, gages, and control units for proper installation.

b. Ensure that loop clamps are installed to prevent chafing.

Section III. OPERATIONAL TESTS

13-7. GENERAL. After overhaul/ rebuild, each engine assembly must meet the minimum requirements set forth in paragraph 13-8. Complete test data shall be recorded during each run and performance evaluated at all phases of operation. At completion of testing, a copy of the test log data shall be attached to the engine assembly. Engine testing shall be carried out with engine mounted in a separate test cell. Upon test completion and acceptance, engine assembly shall he preserved in accordance with MIL-E-5595C.

13-8. ENGINE OPERATIONAL TEST. Perform operational test as follows:

Install engine to be tested in test cell. Minimum test cell instrumentation and equipment shall be as follows:

NOTE

The accuracy of all instruments used in testing shall be in accordance with MIL-HDBK-705.

(1) Generator, l0kW (part number l528-l2K) and appropriate load bank.

(2) Speed signal for data must be supplied by engine mounted speed sensor.

(3) An engine control, speed sequencing, voltage control, and safety circuit system equal to that shown on schematic FO-2, TM 5-6115-612-12.

(4) An engine and control system electrical harness.

(5) Magnetic oil sump drain plug.

(6) Fuel filter, 10-micron, located as close to engine fuel inlet as practical.

(7) Vibration pickup and adapters.

(8) Exhaust temperature test probe.

(9) Air inlet thermocouple test probe.

(10) Oil temperature test probe.

13-8. ENGINE OPERATIONAL TEST. (cont)

(11) An overspeed shutdown device activated at 110 percent (nominal) engine speed.

(12) A high exhaust temperature shutdown device activated at 1225 + 25°F (662.8 ± -3.9°C).

b. The following engine components shall be tested with, and remain as part of, the engine assembly:

(1) Starter.

(2) Low oil pressure switch.

(3) Fuel manifold with fuel injection nozzles.

(4) High tension lead.

(5) Ignition coil.

(6) Spark igniter.

(7) Exhaust gas temperature thermocouple.

c. Install 10-micron filter as close to engine fuel inlet as practical and connect fuel supply. Fuel shall be in accordance with MIL-T-5624, Grade JP-4. Fuel supply pressure, measured at the high pressure pump inlet, shall be 0 to 7 psig (0-48.26 kPa).

d. Install test probes and vibration pickups in accordance with figure 13-1.

e. Measure rotor and gearbox vibration with vibration pickup and vibration meter. Install one vibration pickup on lifting lug. Rotor vibration must not exceed 0.3 mil.

f. Using lubricating oil MIL-L-23699, bring lube oil level to full mark on dipstick. Record lube oil temperature.

g. During test, keep a record of all data in accordance with table 13-1.

h. Figures 13-2 through 13-5 show acceptable limits of transient response, exhaust gas temperature, oil sump temperature, and fuel flow limits.

i. Normal operating conditions are shown in table 13-2. Test cell operating limits are shown in table 13-3. The engine shall be shut down immediately and corrective action taken if any of those conditions or limits are exceeded, or if any of the following conditions are noted.

(1) Oil leaks or fuel leaks in excess of 10 drops /minute.

(2) Engine vibration amplitudes exceed 0.3 mil at any rotor frequency from O -1500 Hz.

(3) Oil pressure falls below 17 psi (117 kPa) or exceeds 35 psi (241 kPa).

(4) Oil temperature exceeds 250°F (121.1 °C).

(5) Fuel flow or turbine exhaust temperature exceeds normal limits.

(6) Acceleration time from initiation of cranking to rated speed is longer than 30 seconds.

13-8. ENGINE OPERATIONAL TEST. (cont)

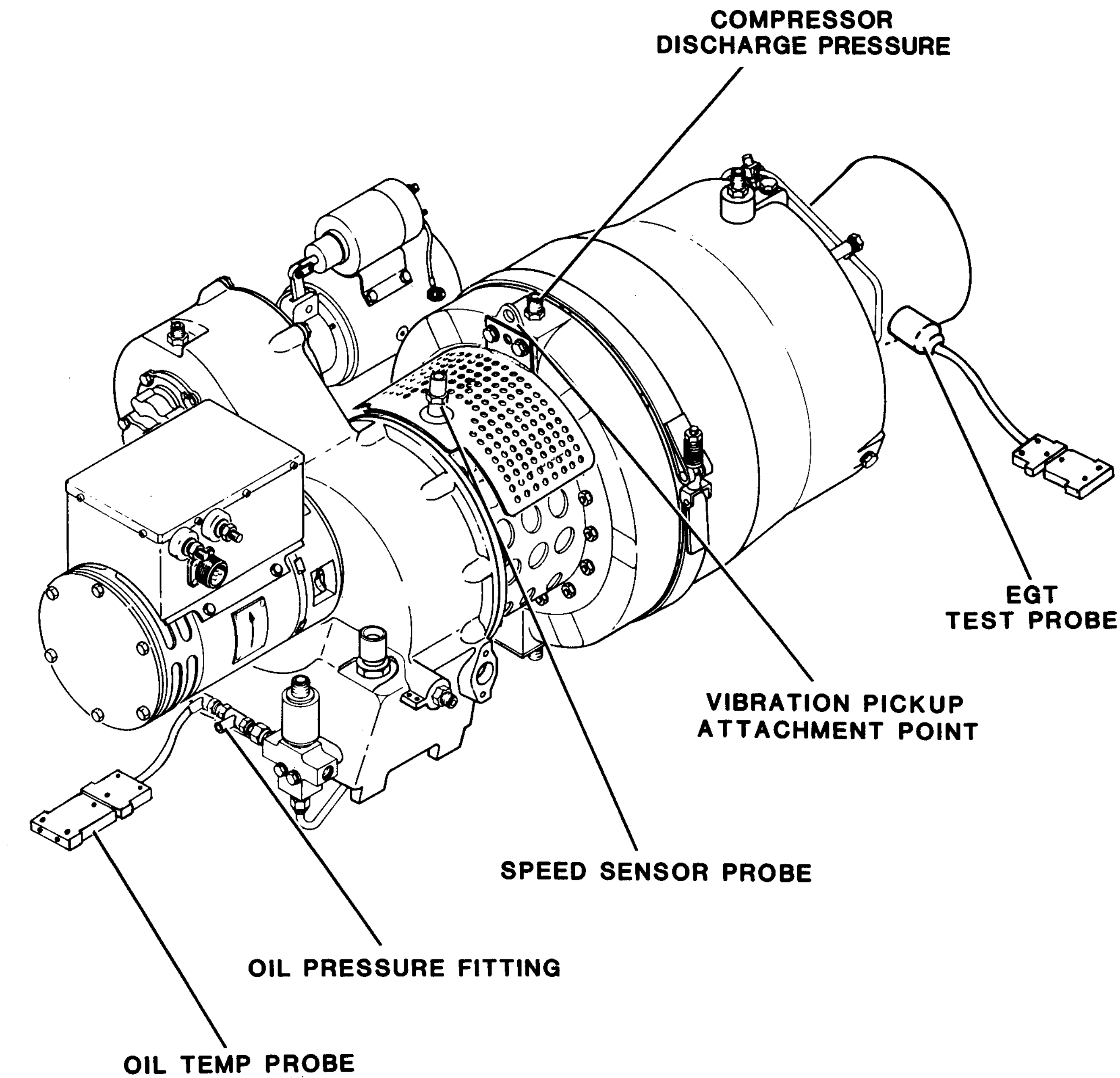


Figure 13-1. Test Equipment Installation

13-8. ENGINE OPERATIONAL TEST. (cont)

Table 13-1. Engine-Generator Operational Tests (Uninstalled)

Step	Point of test	Control setting and operation of equipment	Performance standards	Adjustment or corrective action
1 Energize fuel solenoid, ignition exciter and starter.	100 percent start	Two successive starts shall be made, and engine shut down during each start at approximately 100 percent normal rotational speed.	Check for unusual noise, vibration, and fuel or oil leaks. Oil pressure shall indicate on gage.	Correct causes of unusual noise, vibration, leaks, or lack of oil pressure.
2 Start and run engine at 100 percent rotational speed at no load.	Start/ acceleration reliability	Record all data. Shut down and repeat start.	After first successful start, engine shall start and accelerate to 100 percent rotational speed within 15-30 seconds at each successive start. All data shall be in accordance with table 13-2.	Correct failures to start as necessary. Correct causes of abnormal data.
3 Run engine at 100 percent rotational speed at no load.	Observation run	Observe engine operation for a minimum of 15 minutes. Observe and record all data.	All data shall be in accordance with table 13-2. There shall be no oil or fuel leakage.	Correct causes of abnormal data and fuel or oil leaks as required.
4 Run engine at 100 percent rotational speed. Increase load to 5kW.	Observation run	Same as step 3, except observation to be for a minimum of 5 minutes. Allow EGT to stabilize. Record.	Same as step 3. Check for unusual noise or vibration.	Same as step 3.
5 Run engine at 100 percent rotational speed. Increase load to 10KW.	Observation run	Same as step 4.	Same as step 3.	Same as step 3.

13-8. ENGINE OPERATIONAL TEST. (cont)

Table 13-1. Engine-Generator Operational Tests (Uninstalled) - Continued

Step	Point of test	Control setting and operation of equipment	Performance standards	Adjustment or corrective action
6 Run engine at 100 percent rotational speed at no load.	Stabilization run	Allow temperature to stabilize for a minimum of 5 minutes.	None	None
7 Run engine at 100 percent rotational speed at 10KW load. Cycle to 0, and back to 10KW.	Transient response	Load shall be cycled for 4 consecutive cycles at 30 second intervals. Data shall be taken by direct writing/ recording oscillograph.	During changing load conditions, voltage dips and rises shall not exceed the limits shown in figure 13-2. In addition, the voltage must return to within 3% of rated voltage within 1 second after a load change.	Adjust or repair EECM system as required.
8 Repeat step #6.	Stabilization run	Same as step 6.	None	None
9 Shut down engine.	Run-down		Observe run-down for unusual noise or vibration. Check for fuel and oil leaks. Compute oil consumption if level is low.	Correct causes of unusual noise or vibration. Correct oil or fuel leaks. Check lube oil level prior to final runs.
10 Start and run engine at 100 percent rotational speed for 5 minutes. Increase load to 5KW and run 5 minutes. Increase load to 10KW and run 5 minutes.	Performance run.	Record all data at end of each 5 minute interval. At end of 10 KW run, plot EGT power and fuel consumption in accordance with figure 13-2.	All data shall be in accordance with table 13-3. EGT, power, and fuel consumption shall be in accordance with figures 13-3, 13-4, and 13-5.	Repairs shall be made as necessary to conform to table 13-3.

Table 13-1. Engine-Generator Operational Tests (Uninstalled) - Continued

Step	Point of test	Control setting and operation of equipment	Performance standards	Adjustment or corrective action
11 Run engine at 100 percent rotational speed at rated load for 30 minutes.	Run-in	Record all data at start of run and just before end of run.	All data shall be in accordance with table 13-3	No corrective action should be required.
12 Run engine at 100 percent rotational speed at no load for 5 minutes.	Stabilization run	Shut down engine at end of run.	None	None
13 Compute oil consumption.	Oil consumption	None	Oil consumption shall not exceed 100mL/hr	No corrective action should be required.

13-8. ENGINE OPERATIONAL TEST. (cont)

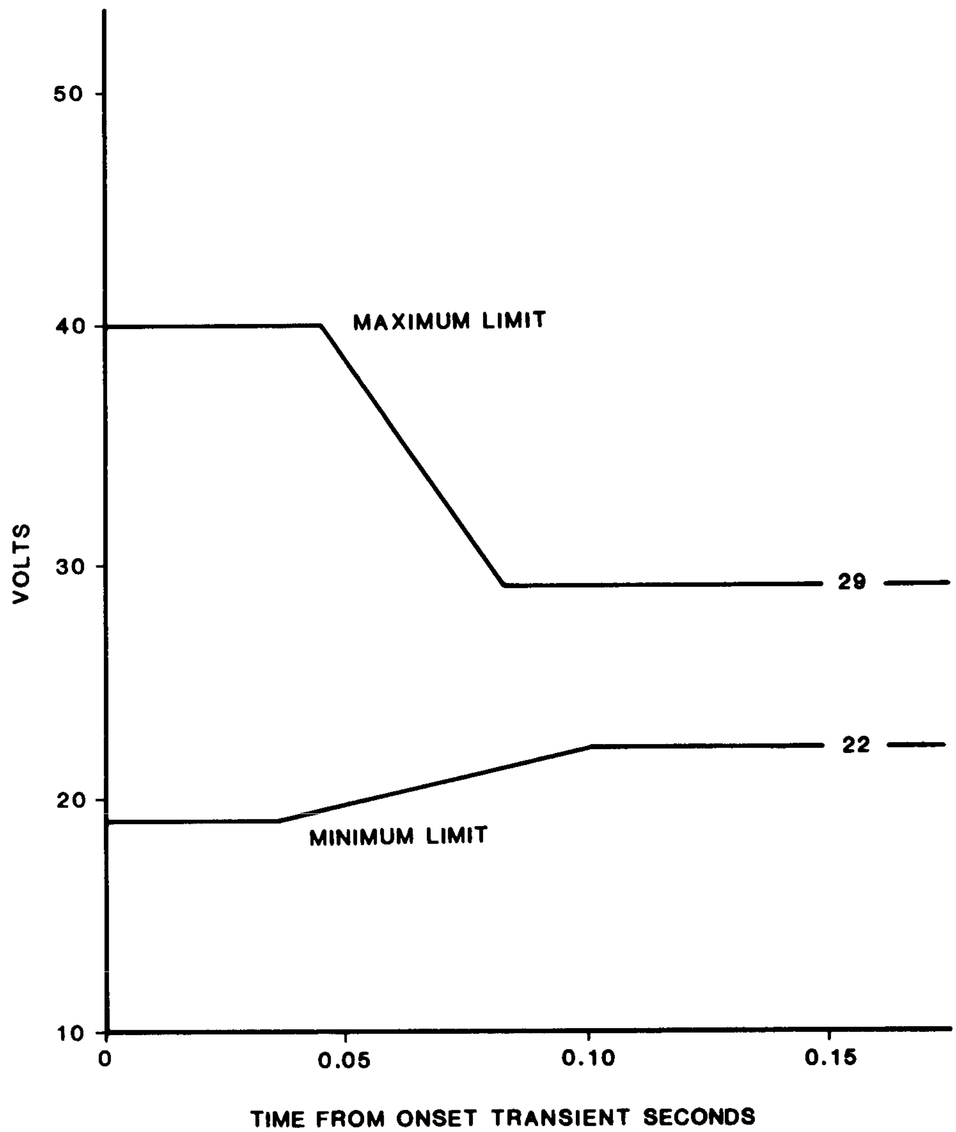


Figure 13-2. Envelope of Voltage Transient for 28 Volts (Nominal) DC System

13-8. ENGINE OPERATIONAL TEST. (cont)

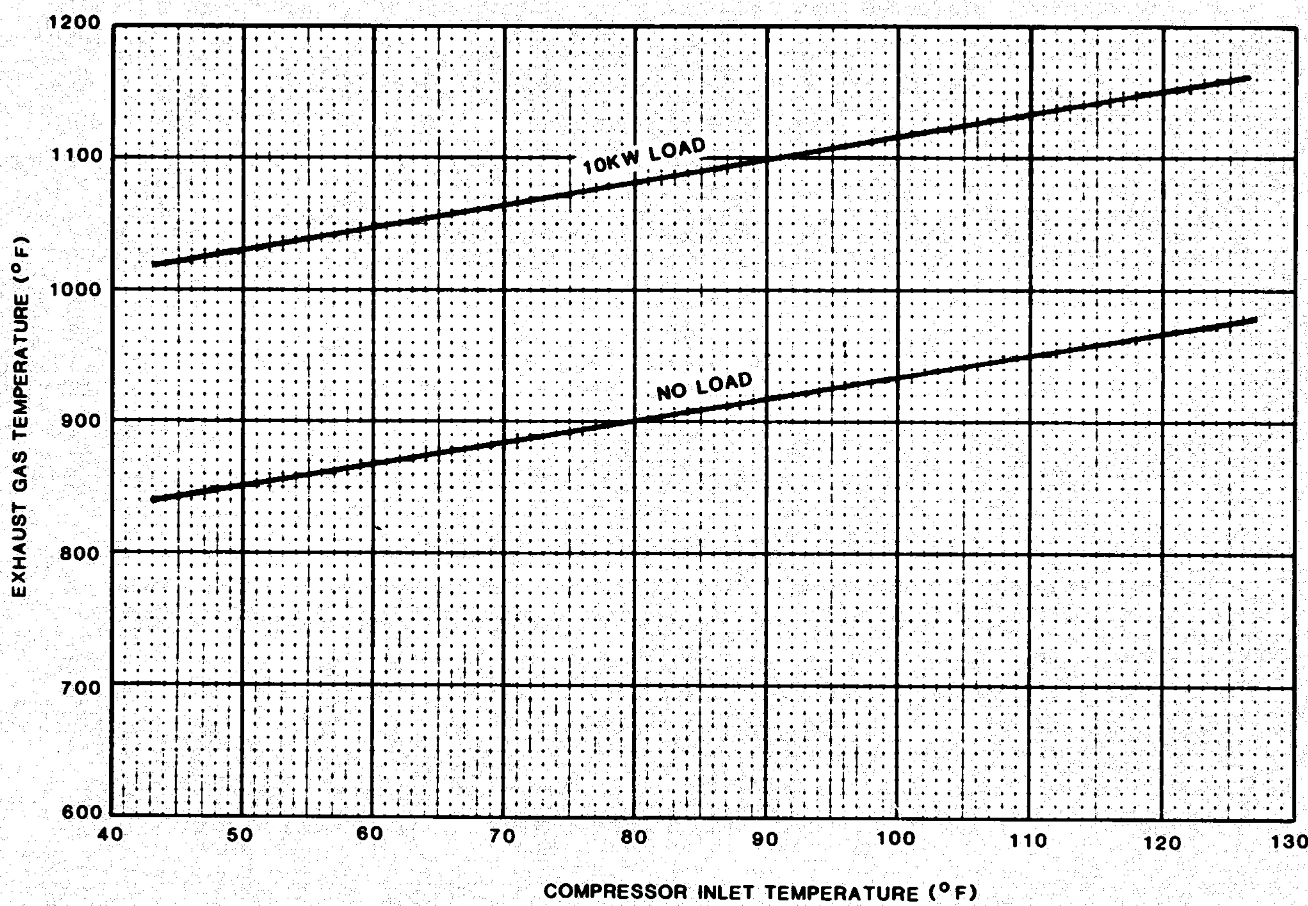


Figure 13-3. Exhaust Gas Temperature Limits

13-8. ENGINE OPERATIONAL TEST. (cont)

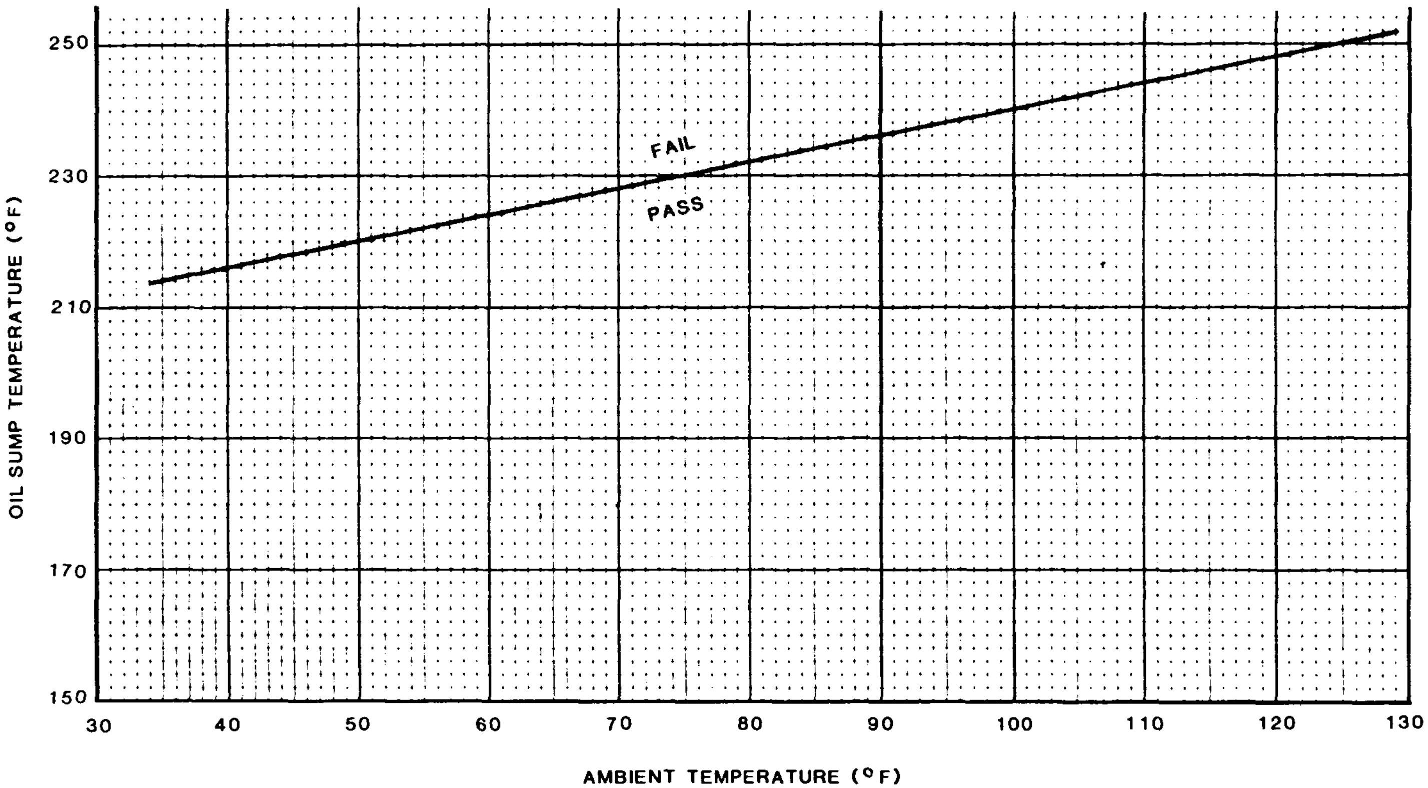


Figure 13-4. Oil Sump Temperature Limits

13-8. ENGINE OPERATIONAL TEST. (cont)

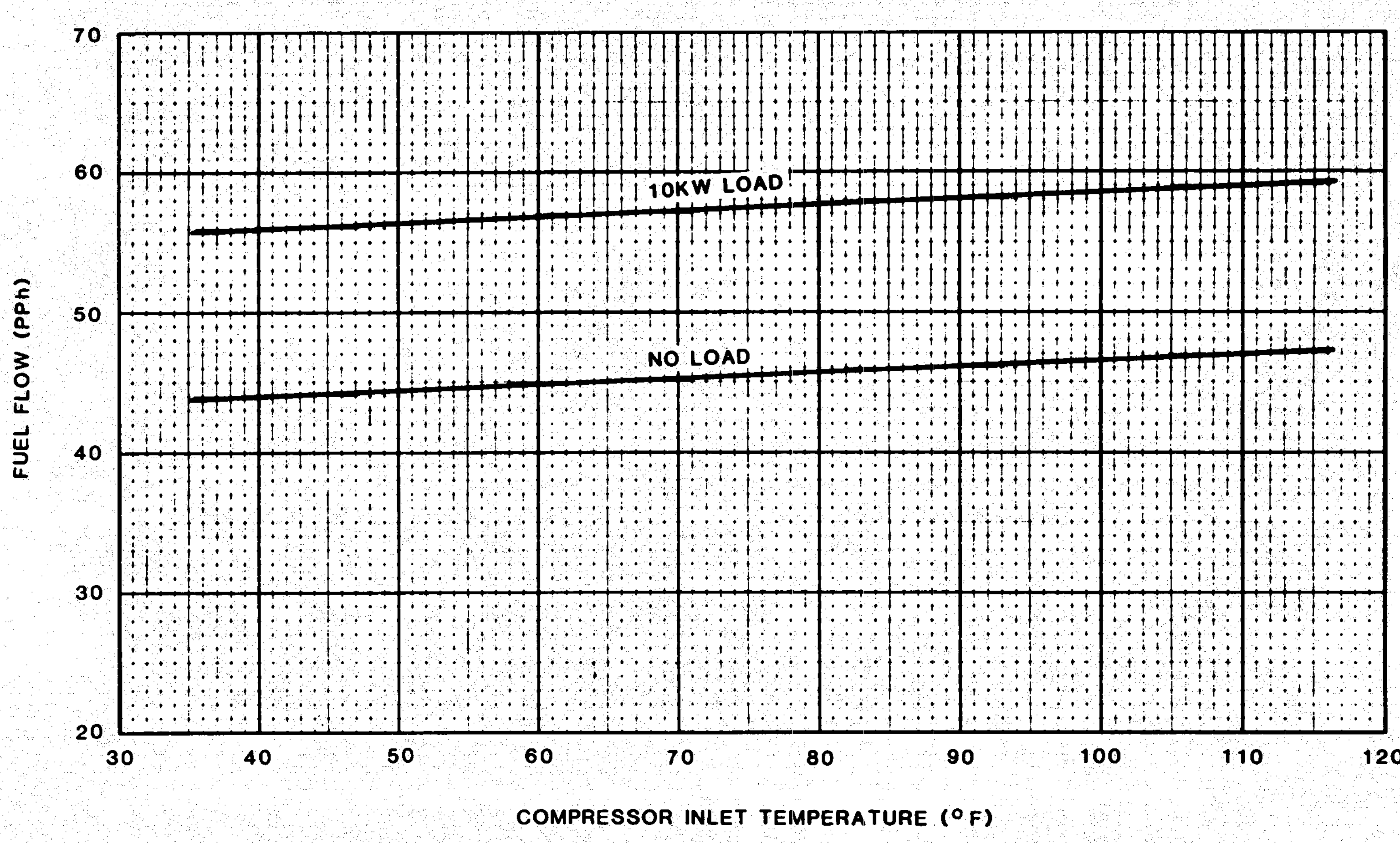


Figure 13-5. Fuel Flow Limits

13-8. ENGINE OPERATIONAL TEST. (cont)

Table 13-2. Normal Operating Conditions

Item	Limits
Gearbox output speed	12,000 rpm
Rotor speed	50,300 rpm
Magnetic Pickup frequency	3353 Hz
Rated output load (flat rated 8000 ft (2438 m) at 125°F (52°C) ambient temperature)	10 kW
Maximum fuel consumption (at sea level, 59°F (15°C) with 10kW load and zero duct losses)	52 PPH (23.6 kg/h) (8 gal/30.3 1)
Maximum oil consumption	0.34 oz/hr (10 cc/hr)
Exhaust gas temperature (at sea level 59°F (15°C) with 10kW load and zero duct losses)	885°F (474°C)
Oil pressure	30-35 psi (207 to 241 kPa)
Maximum oil temperature	250°F (121.1°C)
Normal acceleration time	20-30 seconds
Maximum vibration amplitude (eng)	0.3 mil at rotor frequency
Normal rundown time	

Table 13-3. Test Cell Operating Limits

Item	Limits
Maximum exhaust gas temperature (EGT)	1225 + 25°F (662.8 + -3.9°C)
Maximum fuel flow	52 pph (23.6 kg/hr)-(8 gal/30.3 1)
Maximum oil pressure	35 psi (241 kPa)
Maximum oil temperature	250°F(121.1°C)
Maximum gearbox sump pressure	3 psig (20.7 kPa)
Maximum vibration amplitude	0.3 mils
Starter cutout speed	30,000 ±2000 rpm
Overspeed rpm	55,300 rpm
Maximum EGT spread	-10°F to 30°F (-23.3°C to -1.l°C)
Normal rated rpm	50,300 rpm

13-8. ENGINE OPERATIONAL TEST. (cont)

(7) During start, the turbine exhaust temperature exceeds 1225°F (662.8°C).

(8) Speed exceeds 110 percent.

(9) After the first successful start, starting is delayed or erratic.

(10) Unusual/abnormal noises.

j. Perform tests (1) through (9) in table 13-1.

k. Compute oil consumption following steps 9 and 13, table 13-1, as follows:

(1) Stabilize oil temperature to that recorded in step f, above.

(2) Using a graduate calibrated in cubic centimeters, measure that amount of oil required to bring oil level to FULL mark on dipstick. Divide quantity of oil used by elapsed time of run in hours (cc/elapsed time hours).

13-9. GENERATOR SET OPERATIONAL TEST. After receiving a successfully tested engine, install engine in generator set and test in accordance with table 13-4. See figure 13-6 for the control panel layout.

13-9. GENERATOR SET OPERATIONAL TEST. (cont)

Table 13-4. Engine-Generator Operational Tests (Installed)

Step	Point of test	Control setting and operation of equipment	Performance standards	Adjustment or corrective action
1	Panel lights	Set PANEL LIGHTS switch to ON.	Two panel lights turn on.	If no panel light turns on, check that battery is not discharged. If one light turns on, but one does not, replace light.
2	Panel lights	Set PANEL LIGHTS switch to OFF.	Two panel lights turn off.	If light does not turn off, replace PANEL LIGHTS switch.
3	Deleted.	Deleted.	Deleted.	If light does not come on, replace lamp or lamp socket.
4	LOW OIL PRESSURE indicator light	Press to test LOW OIL PRESSURE indicator light.	Light turns on while pressed, turns off when released.	Same as step 3.
5	OVERTEMP indicator light (Engine).	Press to test engine OVERTEMP indicator light.	Light turns on while pressed, turns off when released.	Same as step 3.
6	OVERSPEED indicator light	Press to test OVERSPEED indicator light.	Light turns on while pressed, turns off when released.	Same as step 3.
7	OVERLOAD indicator light	Press to test OVER-LOAD indicator light.	Light turns on while pressed, turns off when released.	Same as step 3.

13-9. GENERATOR SET OPERATIONAL TEST. (cont)

Table 13-4. Engine-Generator Operational Tests (Installed) - Continued

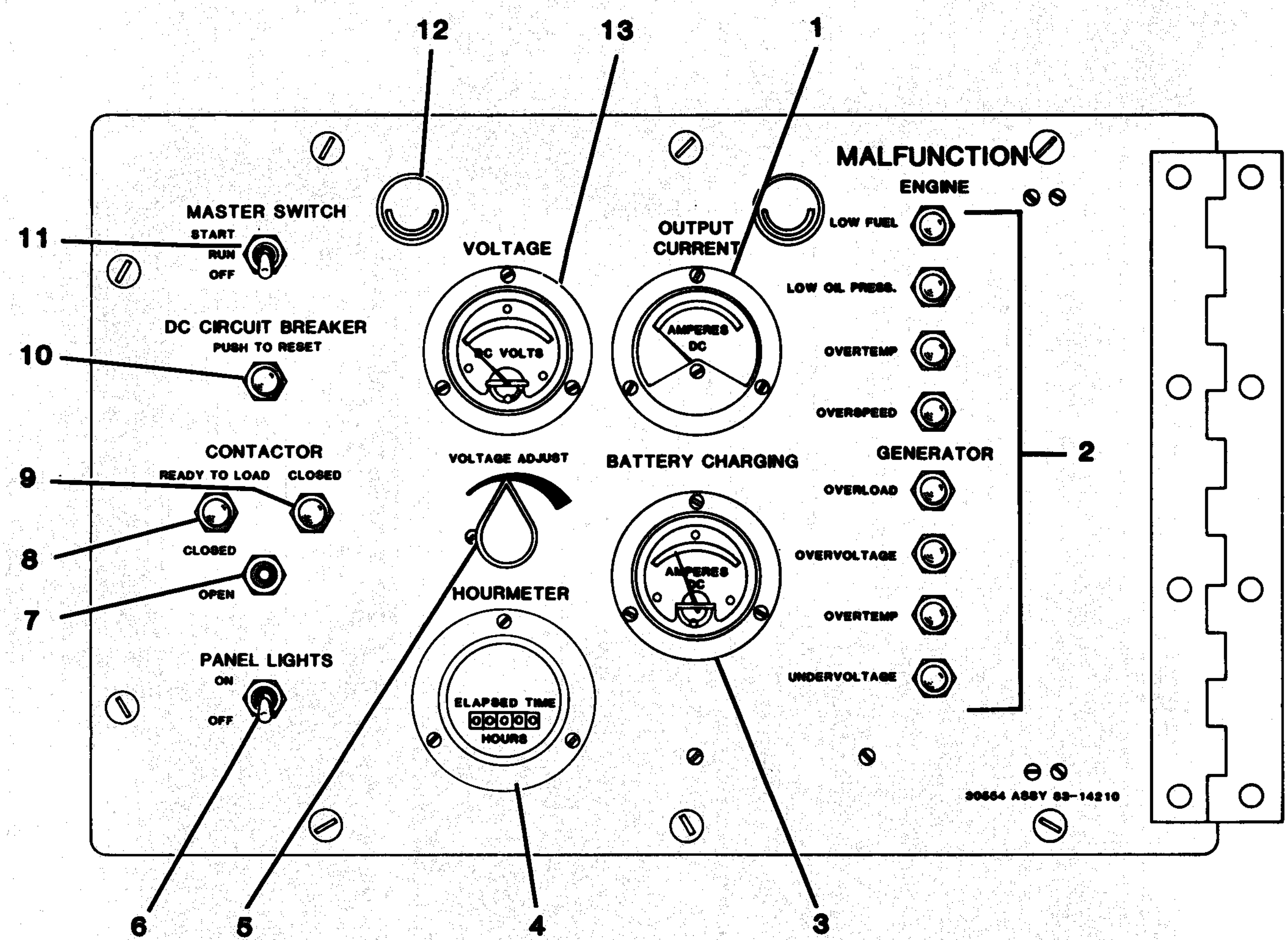
Step	Point of test	Control setting and operation of equipment	Performance standards	Adjustment or corrective action
8	OVERVOLTAGE indicator light	Press to test OVER-VOLTAGE indicator light.	Light turns on while pressed, turns off when released.	Same as step 3.
9	OVERTEMP indicator light (Generator)	Press to test generator OVERTEMP indicator light.	Light turns on while pressed, turns off when released.	Same as step 3.
10	UNDERVOLTAGE indicator light.	Press to test UNDER-VOLTAGE indicator light.	Light turns on while pressed, turns off when released.	Same as step 3.
11 Deleted.	Deleted.	Deleted.	Deleted.	Deleted.
12	EECM	Set MASTER SWITCH to START then release it to the RUN position.	Gas turbine engine should start.	If gas turbine engine does not start, refer to troubleshooting, table 2-4.

13-9. GENERATOR SET OPERATIONAL TEST. (cont)

Table 13-4. Engine-Generator Operational Tests (Installed) - Continued

Step	Point of test	Control setting and operation of equipment	Performance standards	Adjustment or corrective action
13	GECM and generator	Generator set operating as in step 12.		
		a. Connect output to a suitable load bank.		
		b. Increase demand at load bank to 5kW at 150 amps, 28 Vdc.	OUTPUT current and VOLTAGE indicators at control panel should read the same with a 10% adjustment.	An unequal voltage reading indicates that connections have not been properly made to generator, or that generator is defective. See FO-3 in TM 5-6115-612-12 and check wiring connections to generator and output contactor.
		c. Set demand at 10kW, 360 amps.	Same as b above.	Same as above.
		d. Set demand at 10kW, 1000 amps.	Same as b above.	Same as above.

13-9. GENERATOR SET OPERATIONAL TEST. (cont)



LEGEND

1. OUTPUT CURRENT AMMETER
2. MALFUNCTION INDICATOR LIGHTS
3. BATTERY CHARGING AMMETER
4. HOURMETER
5. VOLTAGE ADJUSTMENT KNOB
6. PANEL LIGHTS SWITCH
7. CONTACTOR SWITCH
8. READY TO LOAD LIGHT
9. CONTACTOR CLOSED LIGHT
10. DC CIRCUIT BREAKER
11. MASTER SWITCH
12. PANEL LIGHTS
13. DC VOLTAGE VOLTMETER

Figure 13-6. Control Panel

CHAPTER 14

REPAIR COATING INSTRUCTIONS

Section I. INTRODUCTION

D-1. **Scope**. This appendix lists repair coating instructions required to recoat metal parts contained In the TT-10 Gasoline Driven Turbine Engine

Section II. COATING INSTRUCTIONS

D-2. Flame Spray Coating Low-Alloy Steel. This appendix lists repair coating instructions required to recoat metal parts contained in the TT-10 Gasoline Driven Turbine Engine

a Scope

(1) Type This specification covers the procedure for flame spray deposition of a low-alloy steel

(2) Application This specification covers the procedure for flame spray deposition of a low-alloy steel

b. Applicable Documents The latest Issue of Aerospace Materials Specifications (AMS) shall apply

(1) Material Specifications

- Steel wire (item 13, appx B)
- Nickel alloy wire (item11 appx B)
- Solvent, petroleum (item 5, appx B)

(2) Engineering Process Specifications

- Vapor degreasing In accordance with ASTM STP 310 A using solvent (item 4, appx B)
- Aluminum oxide grit (item 3, appx B)

c. Requirements.

(**1)** **Equipment**. Approved metalized equipment designed to provide automatic gas pressure and wire feed control

(2) Coating Materials Bond coating (item 140 appx B)

(3) Coating Alloy. (Item 13, appx B).

d. Coating Procedure.

WARNING

Toxic solvent is used for general cleaning Illness or skin damage may be caused by prolonged breathing of solvent fumes or excessive skin contact with the liquid. Ensure there Is adequate ventilation and avoid open flame or sparks when using flammable solvent

(1) Cleaning. Parts shall be thoroughly cleaned free from grease oil, dirt, or other foreign materials by vapor degreasing using solvent (item 4, appx B) or by washing In petroleum solvent (Item 4, appx B)

(2) Masking Parts shall be masked as required to protect areas not designated to be coated Masks may be steel, brass, or other suitable materials properly protected against adherence of the sprayed coating.

(3) Surface Conditioning Grit blast the masked parts sufficiently to remove all metallic luster Excessive blasting shall be avoided.

(a) Care must be taken to prevent contamination of the prepared surfaces by contact or other means If necessary to handle the prepared part clean lint-free gloves (item 6, appx B) must be used Parts shall be spray coated as soon as possible but In no case longer than two hours after surfaces have been prepared for coating.

(b) Wipe grit-blasted surfaces with clean lint-free rag (item 7, appx B) dampened with acetone (item 1, appx B) or other suitable solvent just prior to spraying

(4) Spray coating

(a) Place part In fixture designed to permit uniform coverage of areas designated to be coated

(b) Preheat the cleaned and masked parts to 175-200° F (79-93° C)

(c) Apply nickel alloy bond coat (item 140, appx B) onto designated areas to a thickness of 0 004-0 006 in (0 10-0 15 mm)

1 As soon as spraying operations are started, Introduce a stream of air onto the part being coated to maintain a part temperature not higher than 2500 F (1210 C)

2 Maintain cooling air blast throughout all coating operations

(d) Apply low-alloy steel coating (item 13, appx B) onto the designated areas to a total thickness sufficient to meet drawing requirements after finish machining

(e) The spray coating must Impinge on the surface to be coated at an angle of 75 to 105 degrees (1 31 to 1 83 radians)

(f) Remove masking In a manner that will avoid damage to the sprayed coating

e Quality

(1) The sprayed coating shall be adherent to the basis material and shall have a uniform surface free from blisters, chips, or other objectionable Imperfections not readily removable by finishing operations

(2) Coating shall be free from grit particles and contamination at the Interlace between the coating and substrate

f Rejections Parts on which the sprayed coating does not conform to the requirements of this specifications, or to authorized modification shall be subject to rejection

g Approved Equipment Any model Metco type E gun

D-3 **Plasma Spray Coating-Nickel Aluminum Composite.**

a Scope

(1) Type This specification covers the procedure for plasma spray deposition of a nickel-aluminum composite coating (Item 140, appx B)

(2) Application Primarily to provide a nickel-aluminum composite coating as an undercoat for other spray coatings and as a salvage coating for build-up of undersize parts

b Applicable Documents The latest issue of Aerospace Material Specifications (AMS) shall apply

(1) Engineering Process Specifications

- Vapor degreasing (Item 4, appx B)
- Grit blasting (Item 3, appx B)
- Acid cleaning (Item 2, appx B)

(2) Engineering Material Specifications

- Nickel-aluminum composite powder (Item 8, appx B)
- Solvent, petroleum (item 5, appx B)

c. Requirements

(1) Equipment An approved metalizing gun to provide automatic gas pressure and powder feed control

(2) Coating Materials Nickel-aluminum composite powder (item 8, appx B)

d Procedure

(1) Cleaning

WARNING

Toxic solvent is used for general cleaning Illness or skin damage may be caused by prolonged breathing of solvent fumes or excessive skin contact with the liquid Ensure there is adequate ventilation and avoid open flame or sparks when using flammable solvent

(a) Titanium Base Parts Parts shall be cleaned by washing In petroleum solvent (item 4, appx B) or by wiping with a clean, lint-free rag (Item 7 appx B) dampened with keytone (Item 9, appx B)

NOTE

No cleaner or solvent shall be used that will introduce excessive chlorides or halides onto the surface of titanium pans

(b) Aluminum Base Parts or Steel Parts Parts shall be thoroughly cleaned free from dirt, grease, oil or otherforeign materials by vapor degreasing or by washing in petroleum solvent (item 4, appx B)

(2) Masking Parts shall be masked as required to protect areas not designated to be coated Masks may be steel, brass, or other suitable materials properly protected against adherence by the sprayed coating.

(3) Surface Conditioning Grit blast the masked parts sufficiently to remove all metallic luster Excessive blasting shall be avoided When section thickness or geometry of the part will result In excessive distortion due to grit blasting, condition surfaces as follows

(a) Titanium base parts Surfaces shall be etched to roughen the surfaces and provide adequate adhesion of the sprayed coating

(b) Aluminum base alloy or steel parts Surfaces shall be prepared by immersion in suitable solutions to roughen the surfaces and provide adequate adhesion of the sprayed coating

(c) Care must be taken to prevent contamination of the prepared surfaces by contact or other means If necessary to handle the prepared part, clean lint-free gloves (item 6, appx B) must be used Parts shall be spray coated as soon as possible but In no case longer than 2 hours after surfaces have been prepared for coating

(d) Wipe grit blasted surfaces with clean, lint-free rag (item 7, appx B) dampened with acetone (item 1, appx B) or other suitable solvent just prior to spraying

(4) Spray Coating.

(a) Place part in fixture designed to permit uniform coverage of areas designated to be coated

Proper ventilation is required to remove over-spray and non-adherent particles

(b) Preheat cleaned and masked part to 175-200o F (79-93° C)

(c) Spray the nickel-aluminum composite coating (item 8, appx B) onto designated surfaces to a thickness sufficient to meet bond coat re- quirements or on salvage areas, to meet specified thickness requirements after finish machining.

(d) The spray composite must impinge on the surface to be coated at an angle of 75-105 degrees (1.31-1.83 radians).

(e) Remove masking in a manner that will avoid damage to the sprayed coating

e Quality The sprayed coating shall be adherent to the base material and shall have a uniform surface free from blisters, chips, or other objectionable imperfections not readily removable by finishing operations

(1) Coatings shall be tree from cracks excessive and massive oxides, and excessive porosity

(2) Coatings shall be essentially tree from grit particles and contamination at the Interface between the coating and substrate

f Rejections. Parts on which the sprayed coating does not conform to the requirements of this specification, or to authorized modifications, shall be subject to rejection

g Approval Sources The following equipment is approved for use under requirements of this specification

(1) Plasma spray (item 10, appx B)

(2) Avco plasma unit

D-4 Flame Spray Coating-Nickel Aluminum Composite.

a Scope

(1) Type This specification covers the procedure for flame spray deposition of a nickel-aluminum composite coating (item 8, appx B)

(2) Application Primarily to detail the procedure for the application of a flame-sprayed nickel-aluminum coating as an undercoat for other sprayed coatings and as a material for salvaging parts by metalizing

b Applicable Documents The latest Issue of Aerospace Material Specifications (AMS) shall apply

(1) Engineering Process Specifications

- Vapor degreasing (Item 4, appx B)
- Grit blasting (Item 3, appx B)
- Acid cleaning (item 2, appx B)

(2) Engineering Materials Specifications

- Nickel-aluminum composite powder (item 8, appx B)
- Solvent, petroleum (Item 5, appx B)

c Requirements

(1) Equipment An approved metalizing gun designed to provide automatic gas pressure and powder feed control

(2) Coating Materials Coating materials shall be an approved nickel-aluminum composite powder (item 8, appx B)

d Procedure

(1) Cleaning

WARNING

Toxic solvent Is used for general cleaning Illness or skin damage may be caused by prolonged breathing of solvent fumes or excessive skin contact with the liquid Ensure there is adequate ventilation and avoid open flame or sparks when using flammable solvent

(a) Titanium Base Parts shall be cleaned by washing in petroleum solvent (item 4, appx B) or by wiping with a clean, lint-free rag (item 7, appx B) dampened with keytone (Item 9, appx B)

NOTE

No cleaner or solvent shall be used that will introduce excessive chlorides or halides onto the surface of titanium pans

(b) Aluminum Base Parts or Steel Parts Parts shall be thoroughly cleaned free from dirt, grease, oil or otherforeign materials by vapor degreasing or by washing In petroleum solvent (item 4, appx B)

(2) Masking Parts shall be masked as required to protect areas not designated to be coated Masks may be steel, brass, or other suitable materials properly protected against adherence by the sprayed coating

(3) Surface Conditioning Grit blast the masked parts sufficiently to remove all metallic luster Excessive blasting shall be avoided

(a) Titanium base parts Surfaces shall be etched to roughen the surfaces and provide adequate adhesion of the sprayed coating

(b) Aluminum base alloy or steel parts Surfaces shall be prepared by immersion In suitable solutions to roughen the surfaces and provide adequate adhesion of the sprayed coating

(c) Care must be taken to prevent contamination of the prepared surfaces by contact or other means If necessary to handle the prepared part clean lint-free gloves (item 6, appx B) must be used Parts shall be spray coated as soon as possible but In no case longer than 2 hours after surfaces have been prepared for coating.

(d) Wipe grit blasted surfaces with clean lint-free rag (item 7, appx B) dampened with acetone (item 1, appx B) or other suitable solvent just prior to spraying.

(4) Spray Coating

(a) Place part in fixture designed to permit uniform coverage of areas designated to be coated Proper ventilation is required to remove over-spray and non-adherent particles

(b) Preheat cleaned and masked part to 175-200° F (79-93° C)

(c) Spray the nickel-aluminum composite coating (item 8, appx B) onto designated surfaces to a thickness sufficient to meet bond coat re- quirements or on salvage areas, to meet specified thickness requirements after finish machining

(d) The spray composite must Impinge on the surface to be coated at an angle of 75-105 degrees (1 31-1 83 radians).

(e) Remove masking In a manner that will avoid damage to the sprayed coating e Quality The sprayed coating shall be adherent to the base material and shall have a uniform surface free from blisters, chips, or other objectionable imperfections not readily removable by finishing operations

(1) Coatings shall be tree from cracks, excessive and massive oxides, and excessive porosity

(2) Coatings shall be essentially tree from grit particles and contamination at the Interface between the coating and substrate

f Rejections Parts on which the sprayed coating does not conform to the requirements of this specification, or to authorized modifications, shall be subject to rejection.

g Approval Sources Metco type

D-5 Plasma Spray Coating - Molybdenum.

a Scope

(1) Type This specification covers the procedure for plasma spray deposition of a molybdenum coating

(2) Application. Primarily to provide a molybdenum coating for dampening steel gears

b Applicable Documents The latest Issue of Material Specifications shall apply

(1) Engineering Process Specifications

- Vapor degreasing (item 4, appx B)
- Grit blasting (item 3, appx B)

(2) Engineering Material Specifications

- Molybdenum powder (item 78, appx B)
- Solvent, petroleum (Item 5, appx B)

(3) ASTM publications ASTM C-633, Adhesion or Cohesive Strength of Flame - Sprayed Coatings, Test for

c Requirements.

(1) Equipment An approved metalizing gun designed to provide automatic gas pressure and powder feed control.

(2) Coating Materials Coating materials shall be an approved nickel-aluminum composite powder (item 8, appx B)

d Procedure

(1) Cleaning

WARNING

Toxic solvent is used for general cleaning.
Illness or skin damage may be caused by prolonged breathing of solvent fumes or excessive skin contact with the liquid Ensure there is adequate ventilation and avoid open flame or sparks when using flammable solvent

(a) Steel Parts Parts shall be thoroughly cleaned free from dirt, grease, oil or other foreign materials by vapor degreasing (item 4, appx B) or by washing In petroleum solvent (item 4, appx B) or other suitable solvent

(2) Masking Parts shall be masked as required to protect areas not designated to be coated Masks may be steel, brass, or other suitable materials properly protected against adherence by the sprayed coating.

(3) Surface Conditioning Grit blast the masked parts sufficiently to remove all metallic luster Excessive blasting shall be avoided Grit blasted surfaces shall be compare to Quality Assurance standards and approved as satisfactory prior to applying the molybdenum coating

(a) Care must be taken to prevent contamination of the prepared surfaces by contact or other means If necessary to handle the prepared part clean lint-free gloves (item 6, appx B) must be used Parts shall be spray coated as soon as possible but in no case longer than 2 hours after surfaces have been prepared for coating

(b) Wipe grit blasted surfaces with clean lint-free rag (item 7, appx B) dampened with acetone (item 1, appx B) or other suitable solvent just prior to spraying

(4) Spray Coating.

(a) Place part in fixture designed to permit uniform coverage of areas designated to be coated Proper ventilation is required to remove over-spray and non-adherent particles

(b) Preheat cleaned and masked part to 175-200° F (79-93° C) using plasma, flame, or oven Check temperature with infrared thermometer gun or equivalent (c) Spray the molybdenum powder coating (Item 78, appx B) onto designated surfaces to a thickness required by engineering drawing

(d) The molybdenum spray must impinge on the surface to be coated at an angle of 75-105 degrees (1 31-1 83 radians)

(e) Remove masking In a manner as will avoid damage to the sprayed coating

(f) The part number, serial number, coating thickness, date sprayed and any discrepancies noted during the coating process must be recorded when the parts being processed are serialized parts.

(g) Coated areas shall be rotary wire brushed to remove any loose particles on the surface and edges of coating

e Molybdenum Removal. If required, the sprayed molybdenum coat may be removed by masking areas not coated and removing plasma sprayed molybdenum by grit blasting using 120 grit aluminum oxide at 60 to 80 lb (414 to 552 kPa) air pressure or other methods approved by Materials Research and Engineering.

f Quality Perform In-process inspection as follows

(1) Parts and coupons shall be inspected for adequate surface preparation and cleanliness just prior to coating.

(2) The sprayed coating shall be adherent to the base material and shall have a uniform surface free from blisters, chips, or other objectionable imperfections.

(3) Metallographic examination The lest specimen shall be metallographically examined at 100 diameters for the following

(a) Freedom of cracks

(b) Freedom from separations within the coating or between the coating and the base metal

(4) Coating thickness. The coating thickness shall be measured for conformance to drawing requirements

(5) Hardness Surface hardness shall be not lower than 81 0 HR30T Surface on which hardness is determined should have 0.003-0 005 In (0 076-0 127 mm) removed by machining or polishing to provide a smooth surface.

(6) Minimum bond strength shall be 2500 psi (172 kPa)A bond test specimen will be checked on Initial production startup and on request thereafter

g Approval To assure adequate performance characteristics, parts sprayed In accordance with this specification shall be approved by Quality Assurance unless such approval Is waived.

h Rejection Parts on which the sprayed coating does not conform to the requirements of this specification, or to authorized modifications, shall be subject to rejection

i Approved Equipment The following equip- ment Is approved for use under requirements of this specification

D-6 Flame Spray Coating - Aluminum Alloy (4043).

a Scope

(1) Type This specification covers the procedure for flame spray deposition of an aluminum alloy

(2) Application Primarily to provide abradable coating to reduce clearance between compressor rotor blade tips and sealed compressor case wall

b Applicable Documents The latest Issue of Aerospace Material Specifications (AMS) shall apply

(1) Engineering Material Specifications

- Nickel-aluminum composite (item 11, appx B)
- Steel wire, corrosion resistant (item 12, appx B)

(2) Engineering Process Specifications

- Vapor degreasing (item 4, appx B)
- Grit blasting (Item 3, appx B)
- Solvent, petroleum (item 5, appx B)
- Aluminum alloy wire (Item 14, appx B)

c Requirements.

(1) Equipment. An approved metalizing gun designed to provide automatic gas pressure and wirer feed control.

(2) Coating materials.

(a) Bond coat Shall be an approved martensitic chromium corrosion resistant steel or a nickel aluminum composite wire (item 11, appx B)

(b) Coating alloy Shall be an approved aluminum alloy wire (item 14, appx B)

(c) Resin sealer coat (Item 105, appx B)

d Procedure

WARNING

Toxic solvent Is used for general cleaning Illness or skin damage may be caused by prolonged breathing of solvent fumes or excessive skin contact with the liquid Ensure there is adequate ventilation and avoid open flame or sparks when using flammable solvent

(1) Cleaning Parts shall be thoroughly cleaned free from grease, oil, dirt, or other foreign materials by vapor degreasing or by washing In petroleum solvent (item 5, appx B) or other suitable solvent

(2) Masking Parts shall be masked as required to protect areas not designated to be coated Masks may be steel, brass, or other suitable materials properly protected against adherence of the sprayed coating

(3) Surface conditioning Grit blast the masked parts sufficiently to remove all metallic luster, excessive blasting snail be avoided

(a) Care must be taken to prevent contamination of the prepared surfaces by contact or other means. If necessary to handle the prepared part, clean, lint-free gloves (Item 6, appx B) must be used Parts shall be spray coated as soon as possible, but In no case longer than 2 hours after surfaces have been prepared for coating If this time is exceeded, repeat step (3)

(b) Wipe grit blasted surfaces with clean, lint-free rag (item 7, appx B) dampened with acetone (item 1, appx B) or other suitable solvent just prior to spraying

(4) Spray coating.

(a) Place part in fixture designed to permit uniform coverage of areas designated to be coated

(b) Preheat the cleaned and masked parts to 175-200° F (79-93° C)

(c) Apply the bond coat onto designated areas to a thickness of 0 002-0 007 in (0.05-0 18 mm)

(d) As soon as spraying operations are started, introduce a stream of air onto the part being coated to maintain a part temperature 120-250° F (40-121° C) Maintain cooling air blast throughout all coating operations.

(e) Spray the aluminum alloy (item 14 appx B) coating onto the designated areas to a total thickness sufficient to meet drawing requirements after finish machining.

(f) The spray coating must impinge on the surface to be coated at an angle of 75-105 degrees (1.31-1.83 radians)

(g) Remove masking in a manner that will avoid damage to the sprayed coating

(h) Impregnate the aluminum alloy coating completely with an approved silicone resin coating (item 15, appx B) Completely impregnation is accomplished when, 30 minutes after application, resin is still present on the coated surfaces Bake the silicone resin coated part by heating to 140-160° F (60-73° C) holding at heat for 25 to 30 minutes, heating to 440-460° F (226-238° C), holding at heat for 55 to 65 minutes, heating to 575-625° F (301-331 o C) and holding at heat for 165 to 195 min- utes, and cooling In air to room temperature

e QualityThe sprayed coating shall be adherent to the basis material and shall have a uniform surface free from blisters, chips, or other objectionable imperfections not readily removable by finishing operations.

(1) Examination shall show the coatings to be free from cracks and massive oxides, and contamination at the interface between the coating and substrate.

(2) Quadrant cases Hairline cracking of the coating at the permanent (non-disassembled) split line is acceptable provided there is no evidence of bond separation

f Approval To ensure adequate performance characteristics, parts sprayed in accordance with this specification shall be approved by Quality Assurance, unless such approval Is waived

g Rejections Parts on which the sprayed coating does not conform to the requirements of this specification, or to authorized modifications, shall be subject to rejection.

h. Approved Equipment and Materials The following equipment and materials are approved for use under requirements of this specification

(1) Equipment Metco gun

(2) Wire coating alloys

(a) SF aluminum (item 20, appx B)

(b) AVCO silicon aluminum (item 16, appx B)

(3) Silicone resin alloys

(a) Silicone Resin (Item 18, appx B)

(b) Silicone Resin (item 17, appx B)

(c) Silicone Resin (Item 19, appx B)

D7. Flame Spray Coating - Aluminum Bronze, Silicone Resin Impregnated.

a Scope

(1) Type This specification covers the procedure for flame spray deposition of an aluminum bronze coating and the impregnation of the sprayed coating with a silicone resin

(2) Application Primarily to provide abrasion, wear, and corrosion resistant surfaces on aluminum and magnesium alloy parts

b. Applicable Documents The latest issue of Aerospace Material Specifications (AMS) shall apply.

(1) Engineering Material Specifications

- Aluminum bronze wire (item 20, appx B)
- Nickel-aluminum composite (item 11, appx B)

(2) Engineering Process Specifications

- Vapor degreasing (Item 4, appx B)
- Grit blasting (item 3, appx B)
- Solvent, petroleum (item 5, appx B)

c Requirements

(1) Equipment An approved metalzing equipment designed to provide automatic gas pres- sure and wirer feed control

(2) Coating materials

(a) Bond coat (item 11, appx B)

(b) Coating alloy (item 20, appx B)

(c) Resin sealer coat (item 15, appx B)

d Procedure

WARNING

Toxic solvent is used for general cleaning Illness or skin damage may be caused by prolonged breathing of solvent fumes or excessive skin contact with the liquid Ensure there is adequate ventilation and avoid open flame or sparks when using flammable solvent

(1) Cleaning. Parts shall be thoroughly cleaned free from grease, oil, dirt, or other foreign materials by vapor degreasing or by washing in petroleum solvent (Item 5, appx B) or other suitable solvent

(2) Masking Parts shall be masked as required to protect areas not designated to be coated Masks may be steel, brass, or other suitable materials properly protected against adherence of the sprayed coating

(3) Surface conditioning. Grit blast the masked parts sufficiently to remove all metallic luster, excessive blasting snail be avoided

(a) Care must be taken to prevent contamination of the prepared surfaces by contact or other means If necessary to handle the prepared parts clean, lint-free gloves (item 6, appx B) must be used Parts shall be spray coated as soon as possible, but In no case longer than 2 hours after surfaces have been prepared for coating If this time is exceeded, repeat step (3).

(b) Wipe grit blasted surfaces with clean lint-free rag (Item 7, appx B) dampened with acetone (Item 1, appx B) or other suitable solvent just prior to spraying

(4) Spray coating

(a) Place part in fixture designed to permit uniform coverage of areas designated to be coated

(b) Preheat the cleaned and masked parts to 175-2000 F (79-930 C)

(c) Apply the nickel alloy bond coat onto designated areas to a thickness of 0 002-0 007 in (0 05-0.18 mm)

(d) As soon as spraying operations are started, introduce a stream of air onto the part being coated to maintain a part temperature not to exceed 2500 F (121 C)Maintain cooling air blast throughout all coating operations

(e) Apply the aluminum bronze coating onto the designated areas to a total thickness of 0.025-0 035 Inch (0 64-0 89 mm) or to a total thickness required to meet drawing requirements after finish machining.

(f) The spray coating must impinge on the surface to be coated at an angle of 75-105 degrees (1.31-1 83 radians)

(g) Remove masking In a manner that will avoid damage to the sprayed coating.

(h) Impregnate the aluminum alloy coating completely with an approved silicone resin coating

Completely impregnation is accomplished when, 30 minutes after application, resin is still present on the coated surfaces Air dry the silicone resin coated parts for 55 to 65 minutes and then bake the coated parts at 140-1600 F (60-730 C). holding at heat for 55 to 65 minutes followed by heating to 450-5000 F (232-2600 C), holding at the selected temperature within 15° F (80 C) for 55 to 65 minutes, and cooling In air.

e Quality The sprayed coating shall be adherent to the basis material and shall have a uniform surface free from blisters, chips, or other objectionable imperfections not readily removable by finishing operations

(1) Examination shall show the coatings to be free from cracks and massive oxides, and excessive porosity

(2) Coating shall be free from grit particles and contamination at the Interface between the coating and substrate

f Rejections. Parts on which the sprayed coating does not conform to the requirements of this specification, or to authorized modifications, shall be subject to rejection

g Approved Equipment and Materials The following equipment and materials are approved for use under requirements of this specification

(1) Equipment Any model Metco gun

(2) Coating Alloys

(a) SF aluminum (item 20, appx B)

(b) AVCO silicon aluminum (item 16 appx B)

(3) Silicone resin alloys.

(a) Silicone Resin (item 18, appx B)

(b) Silicone Resin (item 17, appx B)

(c) Silicone Resin (item 19, appx B)

APPENDIX A

REFERENCES

A-1 . SCOPE . This appendix contains a list of reference manuals that may be used in conjunction with this technical manual for the operation and maintenance of the 10kW generator set.

A-2. GENERAL. The reference manuals listed below are coded to indicate the service to which they pertain. The codes are (A) Army, (F) Air Force, (N) Navy, and (MC) Marine Corps. Reference manuals with no code are applicable to all services.

1. FIRE PROTECTION

TB 5-4200-200-10 (A)	Hand Portable Fire Extinguishers Approved for Army Use
TB MED 251	Noise and Conservation of Hearing

2. LUBRICATION

C91OO-IL	Fuels, Lubricants, Oils and Waxes
C6BO0-IL	Chemicals and Chemical Products
LO 5-6115-612-12	Lubrication Order

3. PAINTING

TM9-213 (A)	Painting Instructions for Field Use

4. RADIO SUPPRESSION

MIL-STD-461	Radio Interference Suppression
TM 11-483 (A)	Radio Interference Suppression

5. MAINTENANCE

AMCR 700-11 (A)	Equipment Data Plates and Data Marking
AR 750-43 (A)	Test, Measurement, and Diagnostic Equipment (including Prognostic Equipment and Calibration Test/Measurement Equipment) with Supplement 1
DAPAM 738-750 (A)	The Army Maintenance Management System (TAMMS)
DARCOM-R 702-7 (A)	Logistics Product Assurance
DESCOM-R 702-1 (A)	Depot Quality System

A-2. GENERAL INFORMATION. (cont)

5. MAINTENANCE (cont)

FM 20-31	Grounding Techniques
MIL-C-5541	Chemical Conversion Coatings on Aluminum and Aluminum Alloys
MIL-HDBK-705	Generator Sets, Electrical, Measurements and Instrumentations
MIL-I-45208A	Inspection System Requirements
MIL-I-45607B	Inspection Equipment, Acquisition, Maintenance and Disposition Of
MIL-P-514	Plate, Identification, Instruction and Marking, Blank
MIL-STD-109	Quality Assurance Terms and Definitions
MIL-STD-248	Welding and Brazing Procedure and Performance Qualification
MIL-STD-410	Nondestructive Testing Personnel Qualification and Certification (Eddy Current, Liquid Penetrant, Magnetic Particle, Radiographic and Ultrasonic)
MIL-STD-481A	Configuration Control-Engineering Changes, Deviations and Waivers (Short Form)
MIL-STD-705	Generator Sets, Engine Driven, Methods of Test and Instructions
MIL-STD-794	Part and Equipment, Procedures for Packaging and Packing Of
MIL-STD-1595	Aerospace Welder Performance Qualification (Supplement to ASME Boiler, Section IX, 1974)
MIL-W-8604	Welding of Aluminum Alloys, Process for
TB 55-1500-307-24	Aircraft Components Requiring Maintenance Management and Historical Data

A-2. GENERAL INFORMATION. (cont)

5. MAINTENANCE (cont)

TM 9-6140-200-14 (A) 24 Sept 1981	Maintenance of Storage Batteries, Lead Acid Type
TM 55-1500-323-25 (A) 14 Aug 1968	Installation Practices for Aircraft Electric and Electronic Wiring
TM 9-2610-200-20 (A) 28 Feb 1977	Organizational Care, Maintenance and Repair of Pneumatic Tires and Inner Tubes
TM 5-6115-612-24P	Organizational, Intermediate (Field) (Direct Support and General Support) and Depot Maintenance Repair Parts and Special Tools List
TM 5-6115-612-12	Operator and Organizational Maintenance Manual

6. SHIPMENT AND STORAGE

MIL-STD-129	Marking for Shipment and Storage
MIL-STD-1188	Commercial Packaging of Supplies and Equipment
PPP-8-601	Boxes, Wood, Cleated Plywood
PPP-8-636	Box, Shipping, Fiberboard
TM 38-230-1 (A) TM 38-230-2 (A)	Preservation, Packaging and Packing of Military Supplies and Equipment
TM 740-90-1 (A) 12 Mar 1971	Administrative Storage of Equipment

7. DESTRUCTION TO PREVENT ENEMY USE

TM 750-244-3 (A) 14 Dec 1971	Procedures for Destruction of Equipment to Prevent Enemy Use

8. FIRST AID

FM 21-11	First Aid for Soldiers

APPENDIX B

EXPENDABLE SUPPLIES AND MATERIALS LIST

SECTION I. INTRODUCTION

B-1. SCOPE.

This appendix lists expendable supplies and materials that you will need to operate and maintain the Gas Turbine Engine Driven Generator Set (TT-10). These items are authorized to you by CTA 50-970, Expend- able Items (except Medical, Class V, Repair Parts, and Heraldic Items)

B2. EXPLANATIONQE COLUMNS

a. Column (1) - Item number This number is assigned to the entry in the listing and is referenced in the narrative Instructions to identify the item (e g. "Use cleaning compound, item 5, Appendix E")

b Column (2) - National stock number. This is the national stock number assigned to the item which you can use to requisition it

c. Column (3) - Description Indicates the Federal name and, if required, a description to identify the item The last line for each item indicates the part number followed by the Federal Supply Code of Manufacturer (FSCM) in parenthesis, if applicable.

d. Column (4) - Unit of Measure (U/M). Indicates the physical measurement or count of an item, such as gallon, dozen, gross, etc If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

SECTION II. EXPENDABLE SUPPLIES AND MATERIALS LIST

(1) ITEM NUMBER	(2) NSN	(3) DESCRIPTION	(4) (U/M)
1	6810-00-184-4796	Acetone (Fed Spec O-A-51 F)	gl
2		Acid, titanium and titanium alloy, cleaning	gl
3		Grit, aluminum oxide, 12-36 mesh	
4	6850-00-941-5054	Solvent, tetrachloroethylene (perchloroethlene) technical grade, Fed Spec O-T-236	
5		(vapor degreasing) Solvent, Petroleum	
6	8415-01-110-8994	Gloves, lint-free	
7	7920-00-205-1711	Rag, wiping, cotton and cotton synthetic	
8		Powder, nickel-aluminum composite	
9	6810-00-281-2763	Keytone, methylethyl (or equivalent)	
10		Spray, type 3M plasma	
11	343901-141-1462	Wire, welding, nickel-aluminum composite 78 Ni-22A1 (Metco 405) (or equivalent)	
12		Wire, welding, steel, corrosion resistant, 13 Cr (type 420) (or equivalent)	sp
13		Wire, welding, low-alloy s 1.5 Cr4.4 Ni-2.0 Mo (0.10 max) (or equivalent)	
14		Wire, welding, aluminum bronze 86 Cu-95A1-1-O FE (or equivalent)	sp
15	8030-01-207-8453	Sealer, silicone resin1 -2351 (or equivalent)	
16		Wire, welding, AVCO silicon aluminum (or equivalent)	sp
17	8040-()-023-7720	Sealer, silicone resin R-671 (or equivalent)	
18		Sealer, silicone resin SR-6426 (or equivalent)	
19		Sermetal 611	
20		Wire, welding, aluminum SF (or equivalent)	sp

*U.S. GOVERNMENT PRINTING OFFICE: 1997-554-024/60107

INDEX

INDEX (Continued)

INDEX (Continued)

INDEX (Continued)

Subject	Paragraph, Figure, Table Number

O

P

R

S

T

INDEX (Continued)

Subject	Paragraph, Figure, Table Number
Troubleshooting	2-3, T2-4, 8-4, F8-8
Turbine Assembly, Maintenance of	8-3, F8-5, F8-6
Turbine Assembly, Overhaul of	8-4, F8-6, F8-8, F8-9, F8-10, F8-11, F8-12, F8-13, F8-14, F8-15, F8-16, T1-1 T2-3, T8-1, T8-2, T8-3
Turbine Wheel	8-4, F8-8
Turnlock Fastener Replacement	2-4, F2-1
V	
Valve, Solenoid (See Solenoid Valve)	
W	
Wiring (Controls and Instruments)	FO-9
Wiring (EECM)	FO-1, FO-2, FO-3, FO-4, FO-5
Wiring (EECM to Engine)	FO-7
Wiring (GECM)	FO-10, FO-11, FO-12
Wiring (GECM to EECM)	FO-8
Wiring (Generator to GECM)	FO-6

ARMY TM 5-6115-612-34
MARINE CORPS TM 6115-24/8
AIR FORCE TO 35C2-3-471-2
NAVY AG-320B0-MME-000

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

CARL E. VUONO
General, United States Army
Chief of Staff

Official:

R.L.DILWORTH
Brigadier General, United States Army
The Adjutant General

J.P.JONES,JR.
Rear Admiral, CEC, US Navy
Commander
Naval Facilities Engineering Command

LARRY O. WELSH, *General USAF*
Chief of Staff

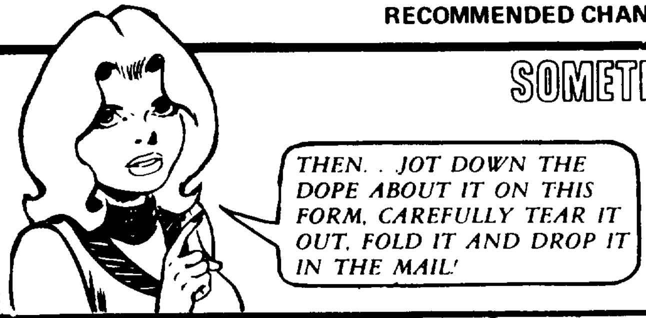
Offical:

ALFRED G. HANSEN
General, USAF, Commander, Air Force
Logistics Command

H. E. REESE
Executive Director
Marine Corps Research, Development and
Acquisition Command

Distribution:
To be distributed in accordance with DA Form 12-25A, Direct and General Support Maintenance requirements for Generator Set, Gas Driven, 2 Wheel Mounted, 28V, DO, 7.5KW (JHGV7.5A).

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS



SOMETHING WRONG WITH THIS PUBLICATION?

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)
PFC JOHN DOE
CO A, 3d ENGINEER BN
FT. LEONARDWOOD, MO 63108

DATE SENT

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 5-6115-612-34	25 JUL 88	Generator Set, Aviation, Gas Turbine Engine Driven

BE EXACT. PIN-POINT WHERE IT IS

PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO	IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
6	2-1 a			In line 6 of paragraph 2-1a the manual states the engine has 6 Cylinders. The engine on my set only has 4 Cylinders. Change the manual to show 4 Cylinders.
81		4-3		Callout 16 on figure 4-3 is pointing at a bolt. In key to figure 4-3, item 16 is called a shim. Please correct one or the other.
125	line 20			I ordered a gasket, item 19 on figure B-16 by NSN 2910-00-762-3001. I got a gasket but it doesn't fit. Supply says I got what I ordered, so the NSN is wrong. Please give me a good NSN

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER
JOHN DOE, PFC (268) 317-7111

SIGN HERE: John Doe
JOHN DOE

DA FORM 1 JUL 79 2028-2

PREVIOUS EDITIONS ARE OBSOLETE.

DRSTS-M Overprint 1, 1 Nov 80

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS

TEAR ALONG PERFORATED LINE

REVERSE OF DA FORM 2028-2 Reverse of DRSTS-M Overprint 2,
1 Nov 80

TEAR ALONG PERFORATED LINE

FILL IN YOUR UNIT'S ADDRESS

FOLD BACK

DEPARTMENT OF THE ARMY

____

____

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE $300

POSTAGE AND FEES PAID
DEPARTMENT OF THE ARMY
DOD 314

U.S.MAIL

COMMANDER
U S ARMY TROOP SUPPORT COMMAND
ATTN: AMSTR-MCTS
4300 GOODFELLOW BOULEVARD
ST. LOUIS, MO 63120-1798

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

SOMETHING WRONG WITH THIS PUBLICATION?

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

DATE SENT

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 5-6115-612-34	25 JUL 88	Generator Set, Aviation, Gas Turbine Engine Driven

BE EXACT. . .PIN-POINT WHERE IT IS				IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
PAGE NO.	PARA-GRAPH	FIGURE NO.	TABLE NO.	

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER	SIGN HERE:

TEAR ALONG PERFORATED LINE

DA FORM 1 JUL 79 2028-2

PREVIOUS EDITIONS ARE OBSOLETE.

DRSTS-M Overprint 2, 1 Nov 80.

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

REVERSE OF DA FORM 2028-2 Reverse of DRSTS-M Overprint 2,
1 Nov 80

TEAR ALONG PERFORATED LINE

FILL IN YOUR
UNIT'S ADDRESS

FOLD BACK

DEPARTMENT OF THE ARMY

____

____

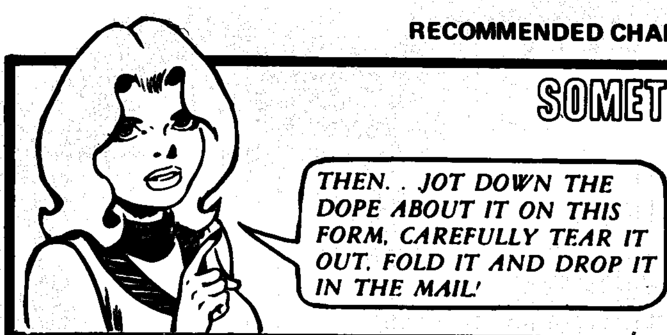
OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE $300

POSTAGE AND FEES PAID
DEPARTMENT OF THE ARMY
DOD 314

U.S.MAIL

COMMANDER
U S ARMY TROOP SUPPORT COMMAND
ATTN: AMSTR-MCTS
4300 GOODFELLOW BOULEVARD
ST. LOUIS, MO 63120-1798

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS



SOMETHING WRONG WITH THIS PUBLICATION?

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

DATE SENT

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 5-6115-612-34	25 JUL 88	Generator Set, Aviation, Gas Turbine Engine Driven

BE EXACT. . PIN-POINT WHERE IT IS				IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO	

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER	SIGN HERE:

TEAR ALONG PERFORATED LINE

DA FORM 1 JUL 79 2028-2 PREVIOUS EDITIONS ARE OBSOLETE.

DRSTS-M Overprint 2, 1 Nov 80.

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

REVERSE OF DA FORM 2028-2 Reverse of DRSTS-M Overprint 2,
1 Nov 80

TEAR ALONG PERFORATED LINE

FILL IN YOUR UNIT'S ADDRESS

FOLD BACK

DEPARTMENT OF THE ARMY

____

____

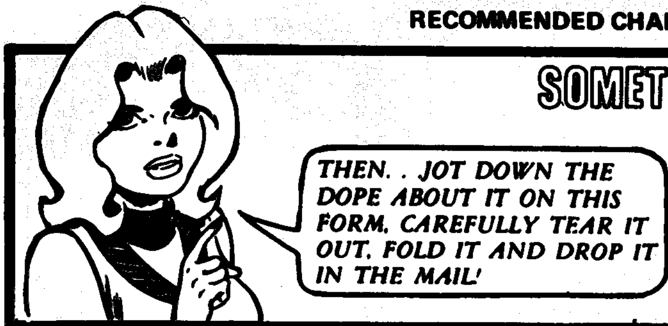
OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE $300

POSTAGE AND FEES PAID
DEPARTMENT OF THE ARMY
DOD 314

COMMANDER
U S ARMY TROOP SUPPORT COMMAND
ATTN: AMSTR-MCTS
4300 GOODFELLOW BOULEVARD
ST. LOUIS, MO 63120-1798

"TEAR ALONG PERFORATED LINE"

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS



SOMETHING WRONG WITH THIS PUBLICATION?

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

DATE SENT

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 5-6115-612-34	25 JUL 88	Generator Set, Aviation, Gas Turbine Engine Driven

BE EXACT. . PIN-POINT WHERE IT IS

PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO	IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER	SIGN HERE:

DA FORM 1 JUL 79 2028-2

PREVIOUS EDITIONS ARE OBSOLETE.

DRSTS-M Overprint 2, 1 Nov 80.

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

REVERSE OF DA FORM 2028-2 Reverse of DRSTS-M Overprint 2,
1 Nov 80

TEAR ALONG PERFORATED LINE

FILL IN YOUR
UNIT'S ADDRESS

FOLD BACK

DEPARTMENT OF THE ARMY

____

____

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE $300

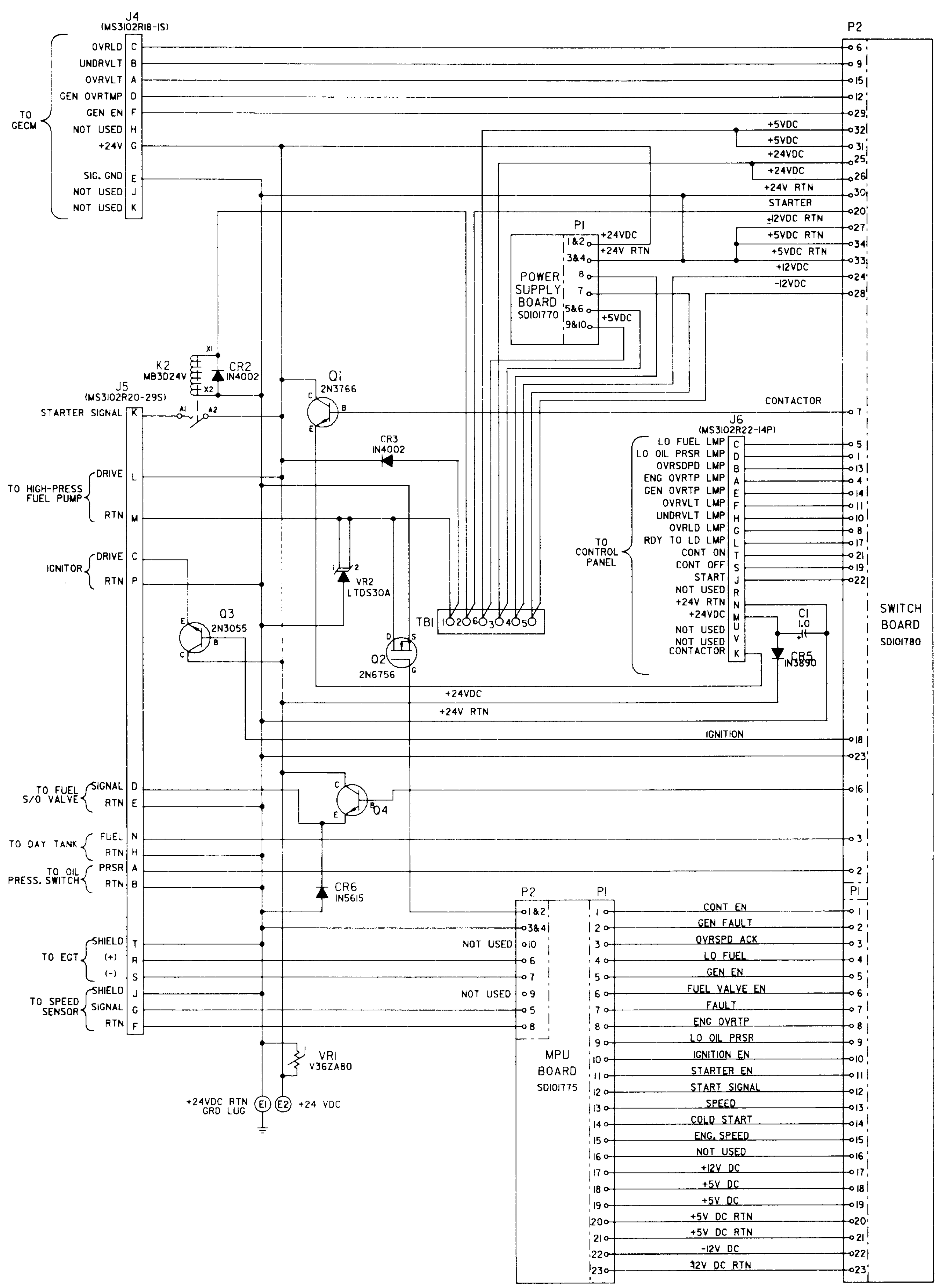
POSTAGE AND FEES PAID
DEPARTMENT OF THE ARMY
DOD 314

U.S. MAIL

COMMANDER
U S ARMY TROOP SUPPORT COMMAND
ATTN: AMSTR-MCTS
4300 GOODFELLOW BOULEVARD
ST. LOUIS, MO 63120-1798

REF DES	DESCRIPTION
C1	Capacitor, 1.0 µF
CR2, CR3	Diode, Rectifier 1N4002
CR5	Diode, Fast Recovery 1N3890
CR6	Diode, 1N5615
J4,J5,J6	Connector Receptacle
K2	Contactor, DC (60 amp)
P1,P2	Multi-pin Connector
Q1	Transistor 2N3766
Q2	Transistor FET 100V 2N6756
Q3	Transistor 2N3055
Q4	Transistor 101761-1
TB1	Terminal Board
VR1	Resistor, Variable V36ZA80
VR2	Supressor, Transient Voltage

HIGHEST REFERENCE DESIGNATION							
C1	CR6	J6	K2	P2	Q4	TB1	VR2
REFERENCE DISIGNATIONS NOT USED							
	CR1, CR4	J1,J2, J3	K2				



FO-1. Engine Electronic Control Module (EECM) Schematic

WIRE NO.	WIRE COLOR	WIRE SIZE	FROM	TO
1	GRN	22	J4-E	E1(GND)
2	RED	22	J4-G	E2(+24V)
3	GRN	24	J5-B	E1(GND)
4	WHT	22	J5-C	Q3-E
5	GRN	24	J5-E	E1(GND)
6	GRN	24	J5-H	E1-(GND)
7	GRN	22	J5-J	E1-(GND)
8	WHT/BLU	18	J5-K	K2-A1
9	RED	20	J5-L	E2(+24V)
10	WHT/GRN	20	J5-M	TB1-1
11	GRN	22	J5-P	E1(GND)
12	GRN	22	J5-T	E1(GND)
13	WHT/GRN	18	TB1-1	VR2 (K)
14	WHT/BRN	24	J6-K	Q1-E
15	WHT/ORG	18	J6-M	CR5 (A)
16	GRN	18	J6-N	E1 (GND)
17	101769-2	28	P2-20SWB	TB1-2
18	YEL	24	TB1-2	K2-X1
19	GRN	24	K2-X2	E1(GND)
20	101769-2	28	P2-34SWB	E1(GND)
21	RED	22	K2-A2	E2(+24V)
22	101764-5	22	VR2(1)	VR2(2)
23	RED	22	Q1-C	E2(+24V)
24	RED	22	E2(+24V)	CR5 (K)
25	WHT/GRN	20	VR2(K)	Q2-D
26	GRN	22	VR2(A)	E1(GND)
27	GRN	20	E1(GND)	Q2-S
28	RED	22	Q3-C	E2(+24V)
29	101769-2	28	Q3-B	P2-18SWB
30	GRN	24	E1(GND)	TB2-1
31	101727-1	24	P1-1MPU	P1-1SWB
32	101727-1	24	P1-2MPU	P1-2SWB
33	101727-1	24	P1-3MPU	P1-3SWB
34	101727-1	24	P1-4MPU	P1-4SWB
35	101727-1	24	P1-5MPU	P1-5SWB
36	101727-1	24	P1-6MPU	P1-6SWB
37	101727-1	24	P1-7MPU	P1-7SWB
38	101727-1	24	P1-8MPU	P1-8SWB
39	101727-1	24	P1-9MPU	P1-9SWB
40	101727-1	24	P1-10MPU	P1-10SWB
41	101727-1	24	P1-11MPU	P1-11SWB
42	101727-1	24	P1-12MPU	P1-12SWB
43	101727-1	24	P1-13MPU	P1-13SWB
44	101727-1	24	P1-14MPU	P1-14SWB
45	101727-1	24	P1-15MPU	P1-15SWB
46	101727-1	24	P1-16MPU	P1-16SWB
47	101727-1	24	P1-17MPU	P1-17SWB
48	101727-1	24	P1-18MPU	P1-18SWB
49	101727-1	24	P1-19MPU	P1-19SWB
50	101727-1	24	P1-20MPU	P1-20SWB
51	101727-1	24	P1-21MPU	P1-21SWB
52	101727-1	24	P1-22MPU	P1-22SWB
53	101727-1	24	P1-23MPU	P1-23SWB
54	101769-2	28	J4-A	P2-15SWB
55	101769-2	28	J4-B	P2-9SWB
56	101769-2	28	J4-C	P2-6SWB
57	101769-2	28	J4-D	P2-12SWB
58	101769-2	28	J4-F	P2-29SWB
59	101769-2	28	J5-A	P2-2SWB
60	101769-2	28	Q4(B)	P2-16SWB
61	101769-1	28	J5-F	P2-8MPU
62	101769-1	28	J5-G	P2-5MPU
63	101769-2	28	J5-N	P2-3SWB
64	101769-1	28	J5-S	P2-7MPU
65	101769-1	28	J5-R	P2-6MPU
66	101769-2	28	J6-A	P2-4SWB
67	101769-2	28	J6-B	P2-13SWB
68	101769-2	28	J6-C	P2-5SWB
69	101769-2	28	J6-D	P2-1SWB
70	101769-2	28	J6-E	P2-14SWB
71	101769-2	28	J6-F	P2-11SWB
72	101769-2	28	J6-G	P2-8SWB
73	101769-2	28	J6-H	P2-10SWB
74	101769-2	28	J6-J	P2-22SWB
75	101769-2	28	J6-L	P2-17SWB
76	101769-2	28	J6-S	P2-19SWB
77	101769-2	28	J6-T	P2-21SWB
78	101769-2	28	P2-25SWB	TB1-3
79	101769-1	28	TB1-3	P1-5PSB
80	101769-2	28	P2-31SWB	TB1-6
81	101769-1	28	TB1-6	P1-9PSB
82	101769-2	28	P2-23SWB	E1(GND)
83	101769-1	28	P2-7SWB	Q1-B
84	101769-1	28	E1(GND)	P2-3MPU
85	101769-1	28	Q2-G	P2-1MPU
86	101769-1	28	E2(+24V)	P1-1PSB
87	101769-1	28	E1(GND)	P1-3PSB
88	101769-2	28	P2-33SWB	E1(GND)
89	101769-2	28	P2-30SWB	E1(GND)
90	101769-2	28	P2-27SWB	E1(GND)
91	101769-2	28	P2-24SWB	TB1-4
92	101769-2	28	P2-28SWB	TB1-5
93	101769-1	28	P1-8PSB	TB1-4
94	101769-1	28	P1-7PSB	TB1-5
95	101769-1	28	TB1-3	P1-6PSB
96	101769-1	28	TB1-6	P1-10PSB
97	101769-1	28	E1(GND)	P2-4MPU
98	101769-1	28	Q2-G	P2-2MPU
99	101769-1	28	E2(+24V)	P1-2PSB
100	101769-1	28	E1(GND)	P1-4PSB
101	101769-2	28	P2-26SWB	TB1-3
102	101769-2	28	P2-32SWB	TB1-6
103	BLU	22	Q4(E)	J5-D
104	RED	22	Q4(C)	E2(+24V)

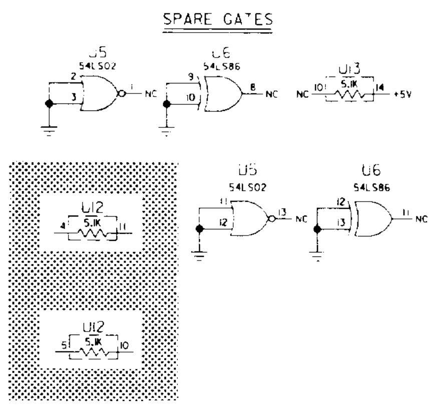
FO-2. Engine Electronic Control Module (EECM) Wire List

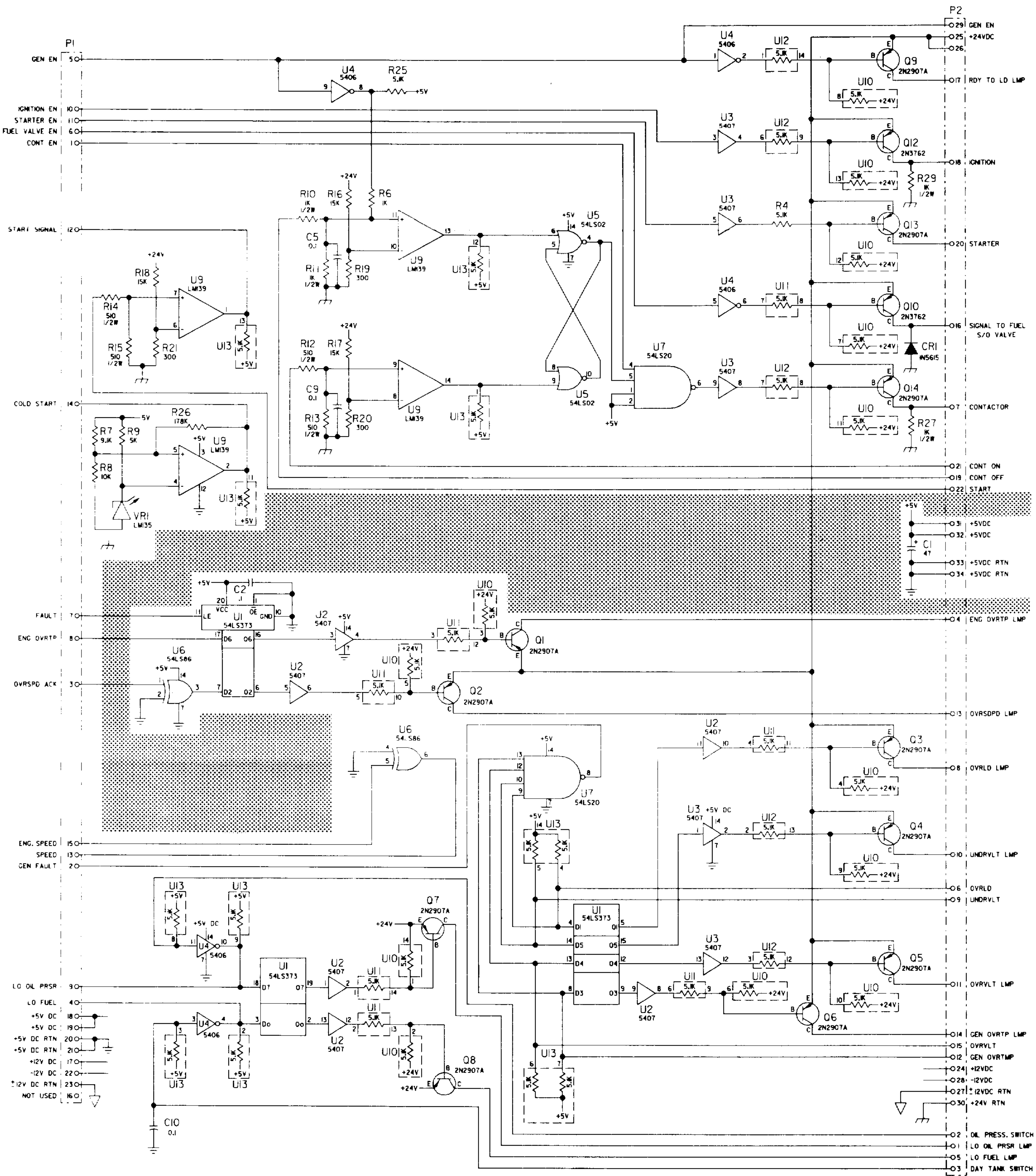
REF DES	DESCRIPTION
C1	Capacitor, 47µF, 10V, 20%
C2,C5,C9,C10	Capacitor, 0.1µF, 50V, 10%
CR1	Diode 1N5615
Q1-Q9,Q13,Q14	Transistor 2N2907A
Q10,Q12	Transistor 2N3762A
R6	Resistor, 1KΩ, 1/8W, 1%
R4,R25	Resistor, 5.1KΩ, 1/8W, 5%
R16,R17,R18	Resistor, 15KΩ, 1/8W, 5%
R7	Resistor, 9.2KΩ, 1/8W, 5%
R8	Resistor, 10KΩ, 1/8W, 5%
R9	Resistor, 30KΩ, 1/8W, 5%
R10,R11,R27,R29	Resistor, 1KΩ, 1/2W, 5%

REF DES	DESCRIPTION
R12-R15	Resistor, 500Ω, 1/2W, 5%
R19	Resistor, 300Ω, 1/8W, 5%
R26	Resistor, 178KΩ, 1/4W, 1%
U1	IC, Transparent Latch
U2,U3	IC, Hex Buffer
U4	IC, Hex Inverter
U5	IC, Quad NOR Gate
U6	IC, Quad Exclusive OR
U7	IC, Dual 4-Input NAND
U9	IC, Quad Comparator
U10,U13	Resistor Network 5.1K (B)
U11,U12	Resistor Network 5.1K (A)
U124	IC, Dual Op-Amp
VR1	Zener Diode, 12V

HIGHEST REFERENCE DESIGNATION					
C10	CR1	Q14	R29	U14	VR1
REFERENCE DISIGNATIONS NOT USED					
C3,C4,C6 C7,C8		Q11	R1,R2,R3 R5,22,R23 R24,R28	U8	

SPARE GATES

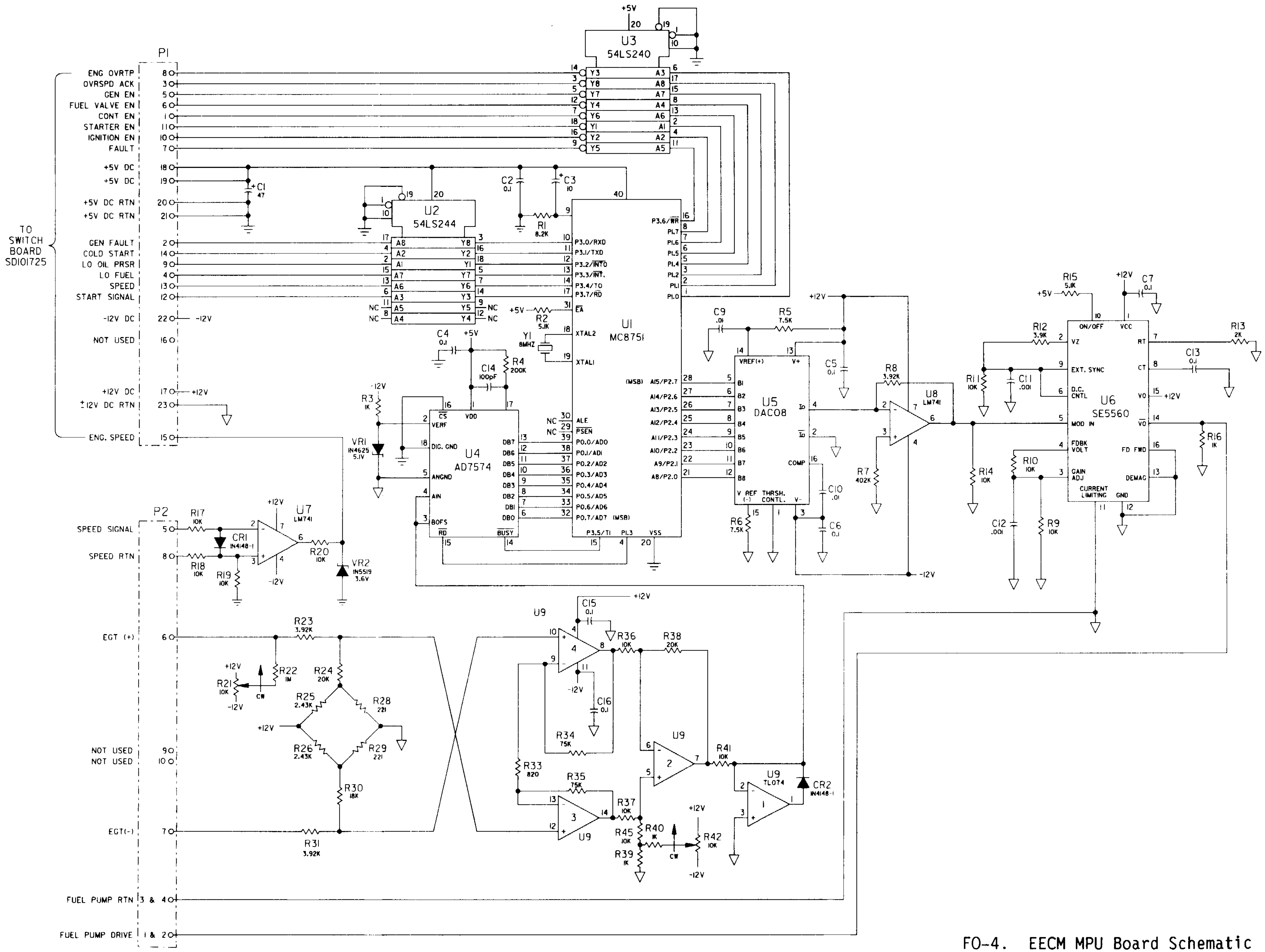




FO-3. EECM Switch Circuit Card Schematic

REF DES	DESCRIPTION
C1	Capacitor, 47μF, 10V
C2,C4,C5,C6, C7,C13,C15,C16	Capacitor, 0.1μF, 50V
C3	Capacitor, 10μF, 25V
C9,C10	Capacitor, 0.01μF, 100V
C11,C12	Capacitor, 0.001μF, 200V
C14	Capacitor, 100μF, 200V
CR1,CR2	Diode 1N41148-1
R1	Resistor, 8.2KΩ, 1/8W, 5%
R2,R15	Resistor, 5.1KΩ, 1/8W, 5%
R3,R16	Resistor, 1KΩ, 1/8W, 1%
R4	Resistor, 200KΩ, 1/8W, 1%
R5,R6	Resistor, 7.5KΩ, 1/8W, 1%
R7	Resistor, 402KΩ, 1/8W, 1%
R8,R23,R31	Resistor, 3.92KΩ, 1/8W, 1%
R9,R10,R11,R17 R18,R19,R20,R41,R45	Resistor, 10KΩ, 1/8W, 5%
R12	Resistor, 3.9KΩ, 1/8W, 5%
R13	Resistor, 2KΩ, 1/8W, 1%
R14,R36,R37	Resistor, 10KΩ, 1/8W, 1%
R21,R42	Resistor, 10KΩ Pot
R22	Resistor 1MΩ, 1/8W, 5%
R24,R38	Resistor, 20KΩ, 1/8W, 1%
R25,R26	Resistor, 2.43KΩ, 1/8W, 1%
R28,R29	Resistor, 221Ω, 1/8W, 1%
R30	Resistor, 18KΩ, 1/8W, 1%
R33	Resistor, 820Ω, 1/8W, 1%
R34,R35	Resistor, 75KΩ, 1/8W, 1%
R39,R40	Resistor, 1KΩ, 1/8W, 5%
U1	IC, Microcomputer
U2	IC, Octal Buffer
U3	IC, Octal Inverter
U4	IC, A/D Converter
U5	IC, D/A Converter
U6	IC, Switch Mode Control
U7,U8	IC, Op-Amp
U9	IC, Quad Op-Amp
VR1	Zener Diode 5.1V
VR2	Zener Diode 3.6V
Y1	Crystal, 8MHz

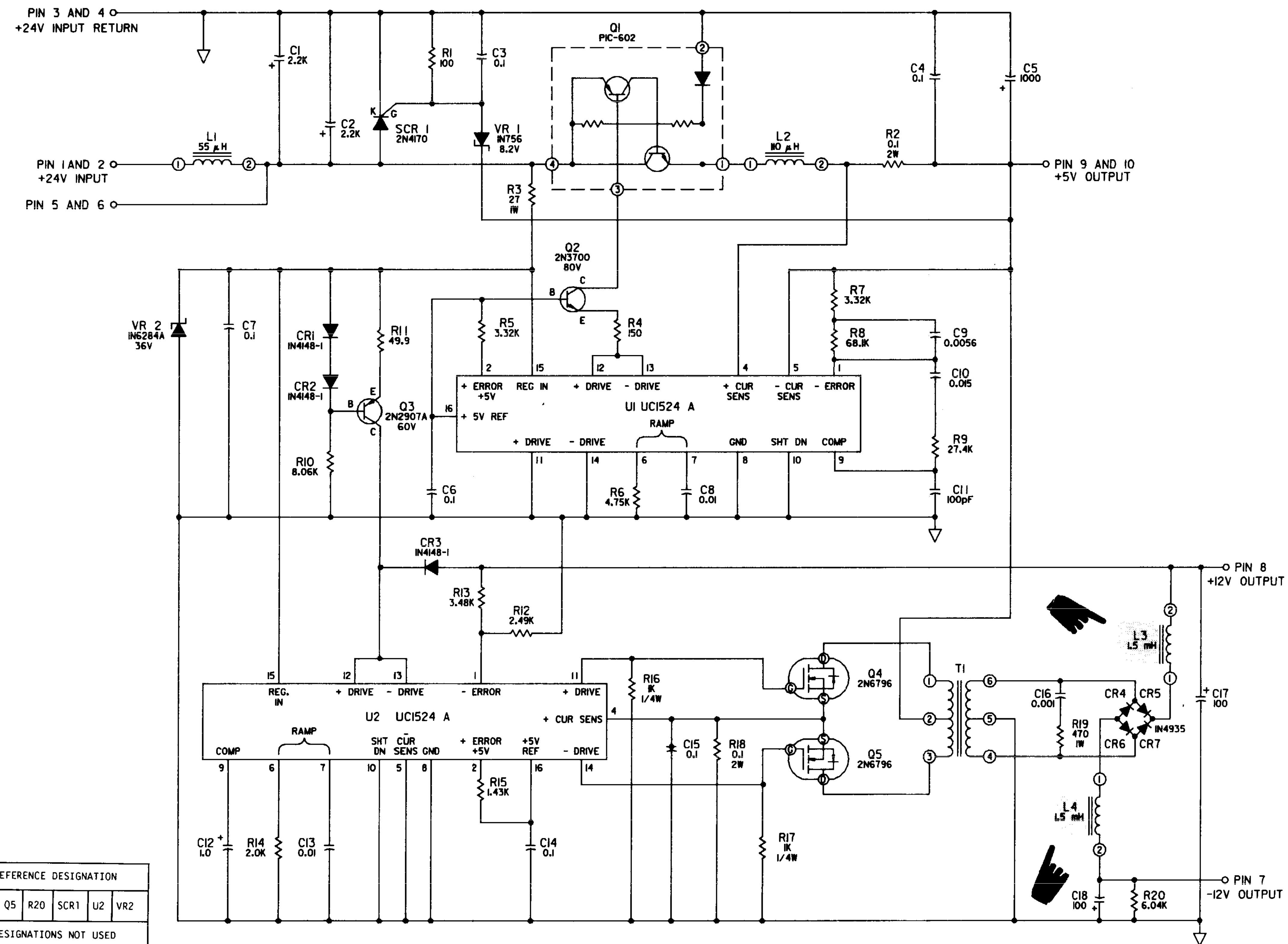
HIGHEST REFERENCE DESIGNATION					
C16	CR2	R45	U9	VR2	Y1
REFERENCE DISIGNATIONS NOT USED					
C8		R27,R32 R43,R44			



FO-4. EECM MPU Board Schematic

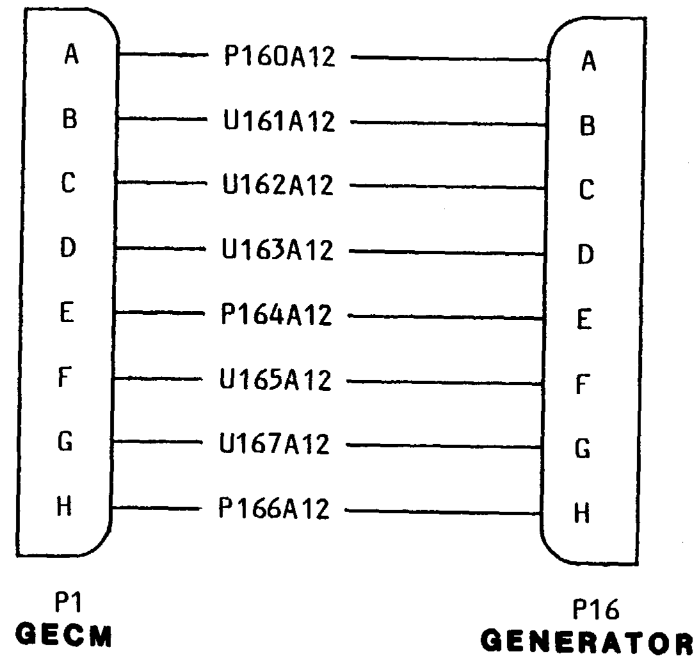
REF DES	DESCRIPTION
C1, C2	Capacitor, 2200 µF, 100V ± 20%
C3,C4 C6,C7 C14,C15	Capacitor, 0.1 µF, 50V
C5	Capacitor, 100 µF, 10V ± 20%
C8,C13	Capacitor, 0.01 µF, 100V
C9	Capacitor, 0.0056 µF, 50V
C10	Capacitor, 0.015 µF, 50V
C11	Capacitor, 100 pF, 200V
C12	Capacitor, 1 µF, 50V
C16	Capacitor, 0.001 µF, 200V
C17,C18	Capacitor, 100 µF, 25V ± 20%
CR1, CR2 CR3	Diode, 1N4148-1
CR4,CR5 CR6, CR7	Diode, Fast Recovery 1N4935
L1	Coil, 55 µH
L2	Coil, 110 µH
L3,L4	Coil, 1.5 mH
Q1	Regulator, Switching
Q2	Transistor, NPN 80V
Q3	Transistor, PNP 60V
Q4,Q5	Transistor, FET
R1	Resistor, 100 Ohm, 1/8W, 5%
R2	Resistor, 0.1 Ohm, 2W, 1%
R3	Resistor, 27 Ohm, 1W, 5%
R4	Resistor, 150 Ohm, 1/8W, 1%
R5,R7	Resistor, 3.32K Ohm, 1/8W, 1%
R6	Resistor, 4.75K Ohm, 1/8W, 1%
R8	Resistor, 68.1K Ohm, 1/8W, 1%
R9	Resistor, 27.4K Ohm, 1/8W, 1%
R10	Resistor, 8.06K Ohm, 1/8W, 1%
R11	Resistor, 19.9 Ohm, 1/8W, 1%
R12	Resistor, 2.49K Ohm, 1/8W, 1%
R13	Resistor, 3.48K Ohm, 1/8W, 1%
R14	Resistor, 1.43K Ohm, 1/8W, 1%
R15	Resistor, 1.43K Ohm, 1/8W, 1%
R16,R17	Resistor, 1K Ohm, 1/8W, 1%
R18	Resistor, 0.1 Ohm, 2W, 1%
R19	Resistor, 470 Ohm, 1W, 5%
R20	Resistor, 6.04K Ohm , 1/8, 1%
SCR1	Semiconductor Controlled Rectifier
U1, U2	Pulse Width Modulator
VR1	Zener Diode, 6.2V
VR2	Overvoltage Suppressor

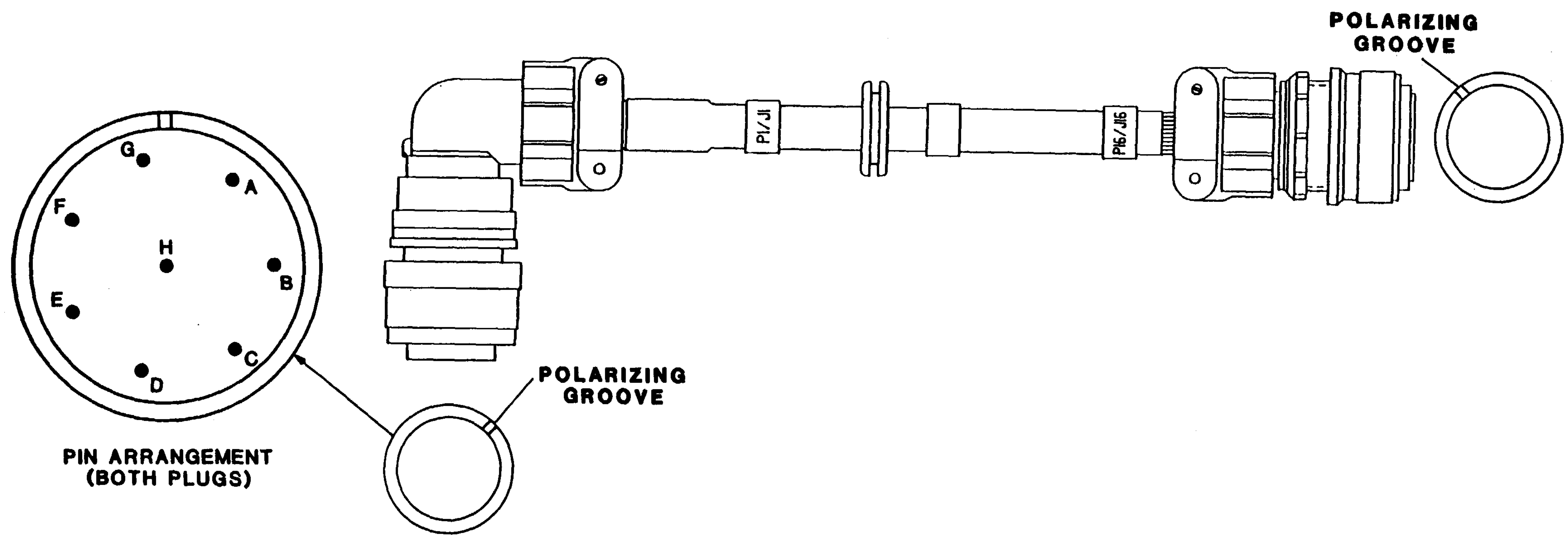
HIGHEST REFERENCE DESIGNATION							
C18	CR7	L4	Q5	R20	SCR1	U2	VR2
REFERENCE DESIGNATIONS NOT USED							



FO-5. EECM Power Supply Board Schematic

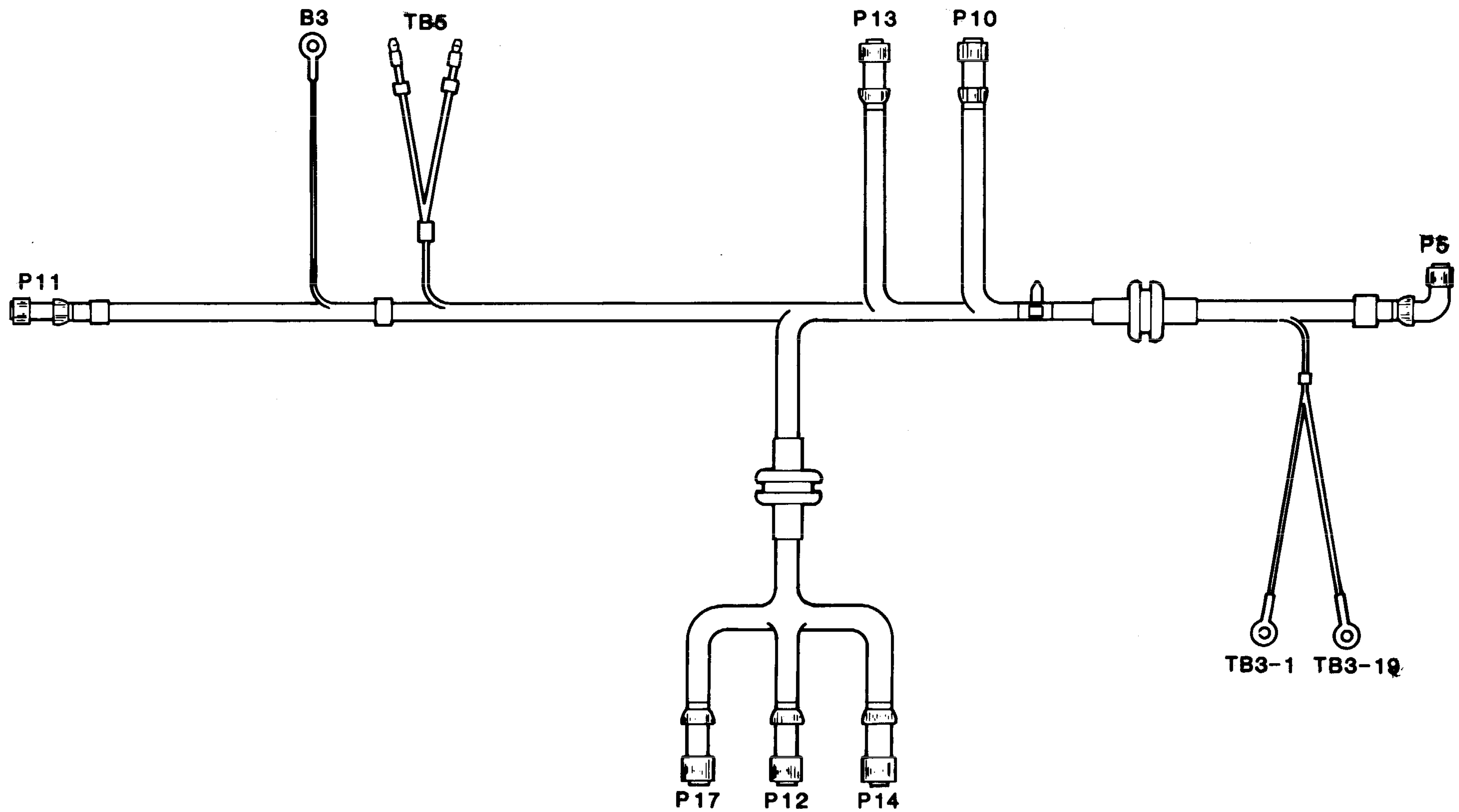
WIRE REF. NO.	FROM	TO
P160A12	P1-A	P16-A
U161A12	P1-B	P16-B
U162A12	P1-C	P16-C
U163A12	P1-D	P16-D
P164A12	P1-E	P16-E
U165A12	P1-F	P16-F
U167A12	P1-G	P16-G
P166A12	P1-H	P16-H





FO-6. Generator to Generator Electronic Control Module (GECM) Wiring Harness

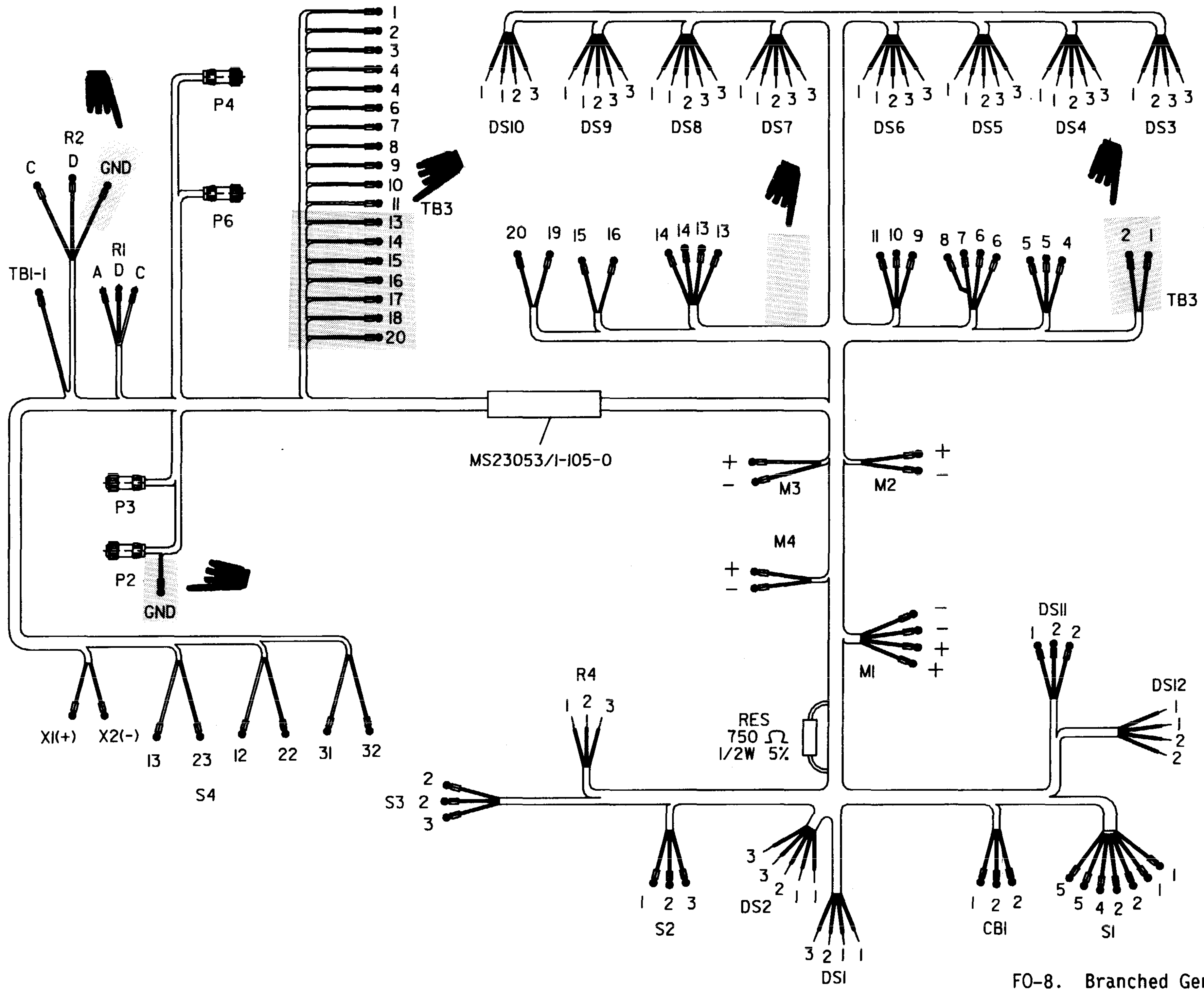
WIRE REF NO.	FROM	TO	WIRE SIZE	WIRE COLOR
Q147A18	P5-A	P10-A	18	WHT
U148A18	P5-B	P10-B	18	WHT
U149A18	P5-C	P11-B	18	WHT
Q155A18	P5-D	P12-A	18	WHT
U156A18	P5-E	P12-B	18	WHT
U150A18	P5-F	P13-A	18	BLU
U117A16	TB3-19	P17-A	16	WHT
V102AF16	TB3-1	P17-B	16	WHT
U153A	P5-J	BRAIDED CU SHIELD		SHIELD
K154A18	P5-K	B3(SOL)	18	WHT
Q158A18	P5-L	P14-A	18	WHT
Q159A18	P5-M	P14-B	18	WHT
U145A CHROM	P5-R	TB5-WHT	18	WHT
U146A ALML	P5-S	TB5-GRN	18	GRN
U144A	P5-T	BRAIDED CU SHIELD	18	WHT
U148B18	P5-P	P11-A	18	WHT
U156B18	P5-H	P5-N	18	WHT
U151A18	P5-G	P13-B	18	RED



FO-7 . Branched Engine Electronic Control Module (EECM) to Engine Wiring Harness

Wire Ref No.	Termination From	Termination Part No (If Applicable)	Termination To	Termination Part No (If Applicable)	Wire Size	Wire Color
V102N18N	TB3-1	MS25036-102	P6-N	MS3108R22-14S	18	WHT
V102Q18N	TB3-2	MS25036-102	DS2-1	S-T	18	WHT
P103F14	TB3-4	MS25036-107	CB1-1	MS25036-153	14	WHT
P105F18	TB3-6	MS25036-102	S1-5	MS25036-102	18	WHT
P105A14	TB3-9	MS25036-107	CB1-2	MS25036-153	14	WHT
P105C18	TB3-5	MS25036-102	DS3-3	S-T	18	WHT
P105D15	TB3-6	MS25036-102	DS2-3	S-T	18	WHT
U113B18	TB3-7	MS25036-102	M1(+)	MS25036-150	18	RED
U114B18	TB3-8	MS25036-102	M1(-)	MS25036-150	18	BLU
U116B18	TB3-9	MS25036-102	DS2-2	S-T	18	WHT
U115B18	TB3-11	MS25036-102	P6-K	MS3108R22-14S	18	WHT
U110B18	TB3-13	MS25036-102	M2(+)	MS25036-150	18	RED
U110C18	TB3-13	MS25036-102	P2-K	MS3108R20-29S	18	RED
U109B18	TB3-14	MS25036-102	M2(-)	MS25036-150	18	BLU
U109C18	TB3-14	MS25036-102	P2-J	MS3108R20-29S	18	BLU
U112B18	TB3-15	MS25036-102	M3(-)	MS25036-150	18	WHT
U111B18	TB3-16	MS25036-102	M3(+)	MS25036-150	18	WHT
U117B18	TB3-19	MS25036-102	S1-1	MS25036-102	18	WHT
U113C18	M1(+)	MS25036-150	P2-F	MS3108R20-29S	18	RED
U114C18	M1(-)	MS25036-150	P2-E	MS3108R20-29S	18	BLU
U125A18	R4-3	S-T	P2-P	MS3108R20-29S	18	WHT
U124A18	R4-2	S-T	P2-R	MS3108R20-29S	18	WHT
U123A18	R4-1	S-T	P2-N	MS3108R20-29S	18	WHT
P105H18	S1-2	MS25036-102	P6-R	MS3108R22-14S	18	WHT
U117C18	S1-1	MS25036-102	P6-M	MS3108R22-14S	18	WHT
U120A18	S1-4	MS25036-102	P6-J	MS3108R22-14S	18	WHT
W136A18	DS10-2	S-T	P6-H	MS3108R22-14S	18	WHT
W133A18	DS9-2	S-T	P6-E	MS3108R22-14S	18	WHT
W134A18	DS8-2	S-T	P6-F	MS3108R22-14S	18	WHT
W135A18	DS7-2	S-T	P6-G	MS3108R22-14S	18	WHT
W130A18	DS6-2	S-T	P6-B	MS3108R22-14S	18	WHT
W129A18	DS5-2	S-T	P6-A	MS3108R22-14S	18	WHT
W132A18	DS4-2	S-T	P6-D	MS3108R22-14S	18	WHT
W131A18	DS3-2	S-T	P6-C	MS3108R22-14S	18	WHT
U122A18	DS1-2	S-T	P6-L	MS3108R22-14S	18	WHT
U127A18	S2-1	MS25036-102	P6-2	MS3108R22-14S	18	WHT
P105J18	DS3-3	S-T	DS4-3	S-T	18	WHT
P105K18	DS4-3	S-T	DS5-3	S-T	18	WHT
P105L18	DS5-3	S-T	DS6-3	S-T	18	WHT
P105M18	DS6-3	S-T	DS7-3	S-T	18	WHT
P105N18	DS7-3	S-T	DS8-3	S-T	18	WHT
P105P18	DS8-3	S-T	DS9-3	S-T	18	WHT
P105Q18	DS9-3	S-T	DS10-3	S-T	18	WHT
V102M14	TB3-1	MS25036-107	P3-C	MS3108R16-9S	14	WHT
V102J18	TB3-2	MS25036-102	TB1-1	MS25036-105	18	WHT
P103E14	TB3-4	MS25036-107	R1-A	MS25036-154	14	WHT
P103D14	TB3-4	MS25036-106	P3-A	MS3108R16-9S	14	WHT
U113A18	TB3-7	MS25036-102	S4-22	MS25036-103	18	RED
U114A18	TB3-8	MS25036-102	S4-12	MS25036-103	18	BLU
U116A18	TB3-9	MS25036-102	S4-31	MS25036-103	18	WHT
P105T18	TB3-6	MS25036-102	S4-32	MS25036-103	18	WHT
U115A18	TB3-11	MS25036-102	S4-(+)X1	MS25036-103	18	WHT
V102AD18N	TB3-12	MS25036-102	S4-(-)X2	MS25036-103	18	WHT
U110A18	TB3-3	MS25036-102	R2-C	MS25036-149	18	RED
U109A18	TB3-14	MS25036-102	R2-D	MS25036-149	18	BLU
U112A18	TB3-15	MS25036-102	R1-D	MS25036-149	18	WHT
U111A18	TB3-16	MS25036-102	R1-C	MS25036-149	18	WHT
U119A18	TB3-17	MS25036-102	P3-B	MS3108R16-9S	18	WHT
U118A18	TB3-18	MS25036-102	P3-D	MS3108R16-9S	18	WHT
U137A18	P2-A	MS3108R20-29S	P4-A	MS3108R18-1P	18	WHT
U138A18	92-B	MS3108R20-29S	P4-B	MS3108R18-1P	18	WHT
U139A18	P2-C	MS3108R20-29S	P4-C	MS3108R18-1P	18	WHT
U140A18	P2-D	MS3108R20-29S	P4-D	MS3108R18-1P	18	WHT
U141A18	P2-M	MS3108R20-29S	P4-E	MS3108R18-1P	18	WHT
U142A18	P2-L	MS3108R20-29S	P4-F	MS3108R18-1P	18	WHT
P143A18	P2-G	MS3108R20-29S	P4-G	MS3108R18-1P	18	WHT
U168-A18	P2-H	MS3108R20-29S	P4-H	MS3108R18-1P	18	WHT
U126A18	S2-3	MS25036-102	P6-T	MS3108R22-14S	18	WHT
P105B14	CB1-2	MS25036-153	S3-2	MS25036-107	14	WHT
P105R18	S3-2	MS25036-102	S2-2	MS25036-102	18	WHT
V102T18N	DS11-2	MS25036-102	DS12-2	MS25036-102	18	WHT
V102S18N	DS11-2	MS25036-102	DS1-1	S-T	18	WHT
V102R18	DS1-1	S-T	DS2-1	S-T	18	WHT
U128B18	DS11-1	MS25036-102	DS12-1	MS25036-102	18	WHT
U128A18	DS12-1	MS25036-102	S3-3	MS25036-102	18	WHT
P105S18	DS2-3	S-T	DS1-3	S-T	18	WHT
P105G18	S1-2	MS25036-102	S1-5	MS25036-102	18	WHT
V102U18N	DS12-2	MS25036-102	DS10-1	S-T	18	WHT
V10DV18N	DS10-1	S-T	DS9-1	S-T	18	WHT
V102W18N	DS9-1	S-T	DS8-1	S-T	18	WHT
V102X18N	DS8-1	S-T	DS7-1	S-T	18	WHT
V102Y18N	DS7-1	S-T	DS6-1	S-T	18	WHT
V102Z18N	DS6-1	S-T	DS5-1	S-T	18	WHT
V102AA18N	DS5-1	S-T	DS4-1	S-T	18	WHT
V102AB18N	DS4-1	S-T	DS3-1	S-T	18	WHT
P107D18	S4-23	MS25036-103	TB3-10	MS25036-102	18	WHT
P106C18	S4-13	MS25036-103	TB3-20	MS25036-102	18	WHT
P107E18	TB3-10	MS25036-102	M4(+)	MS25036-149	18	WHT
P106D18	TB3-20	MS25036-102	M4(-)	MS25036-149	18	WHT
V102C18N	SHIELD	-	GROUND	-	18	WHT

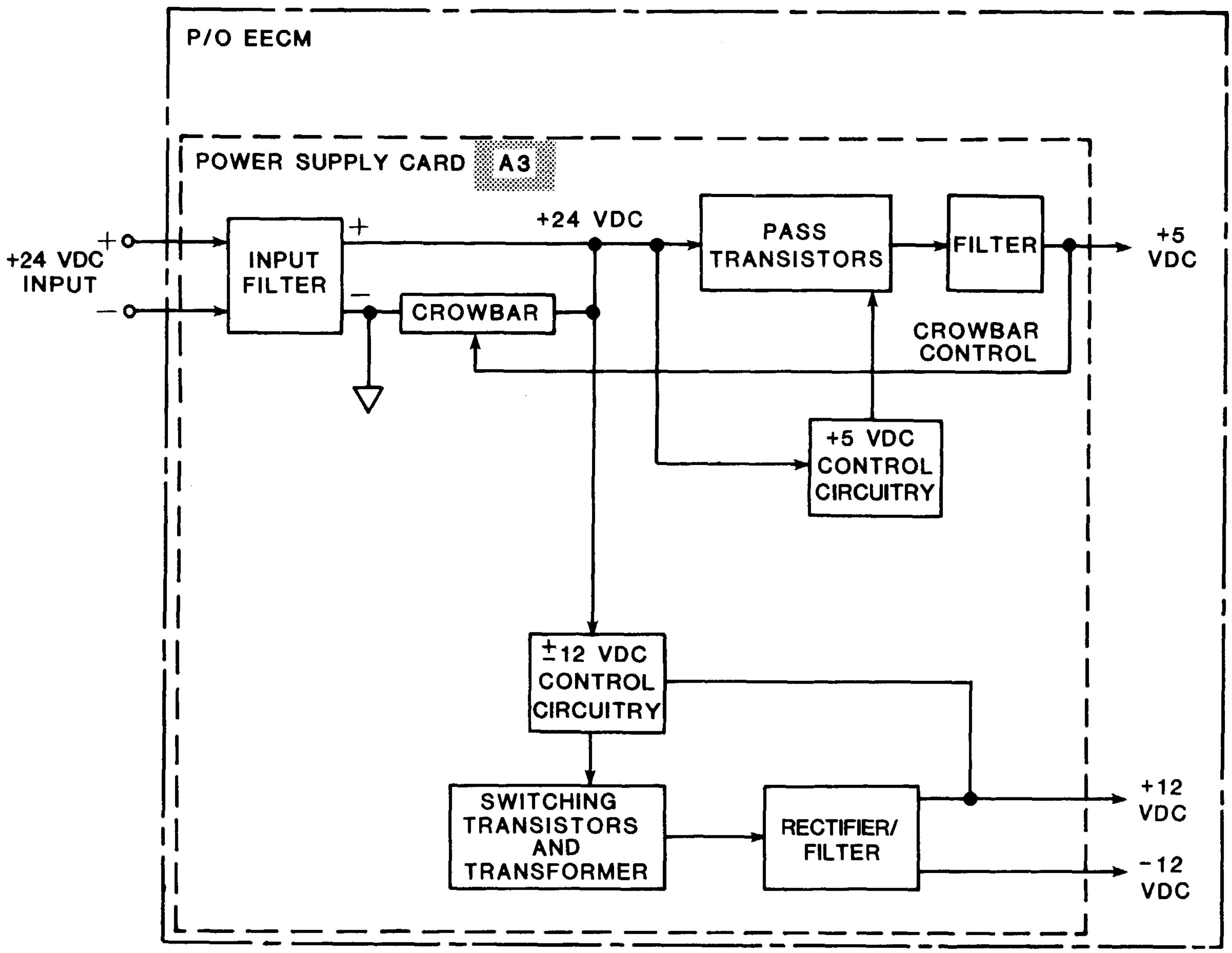
S-T = STRIP AND TIN



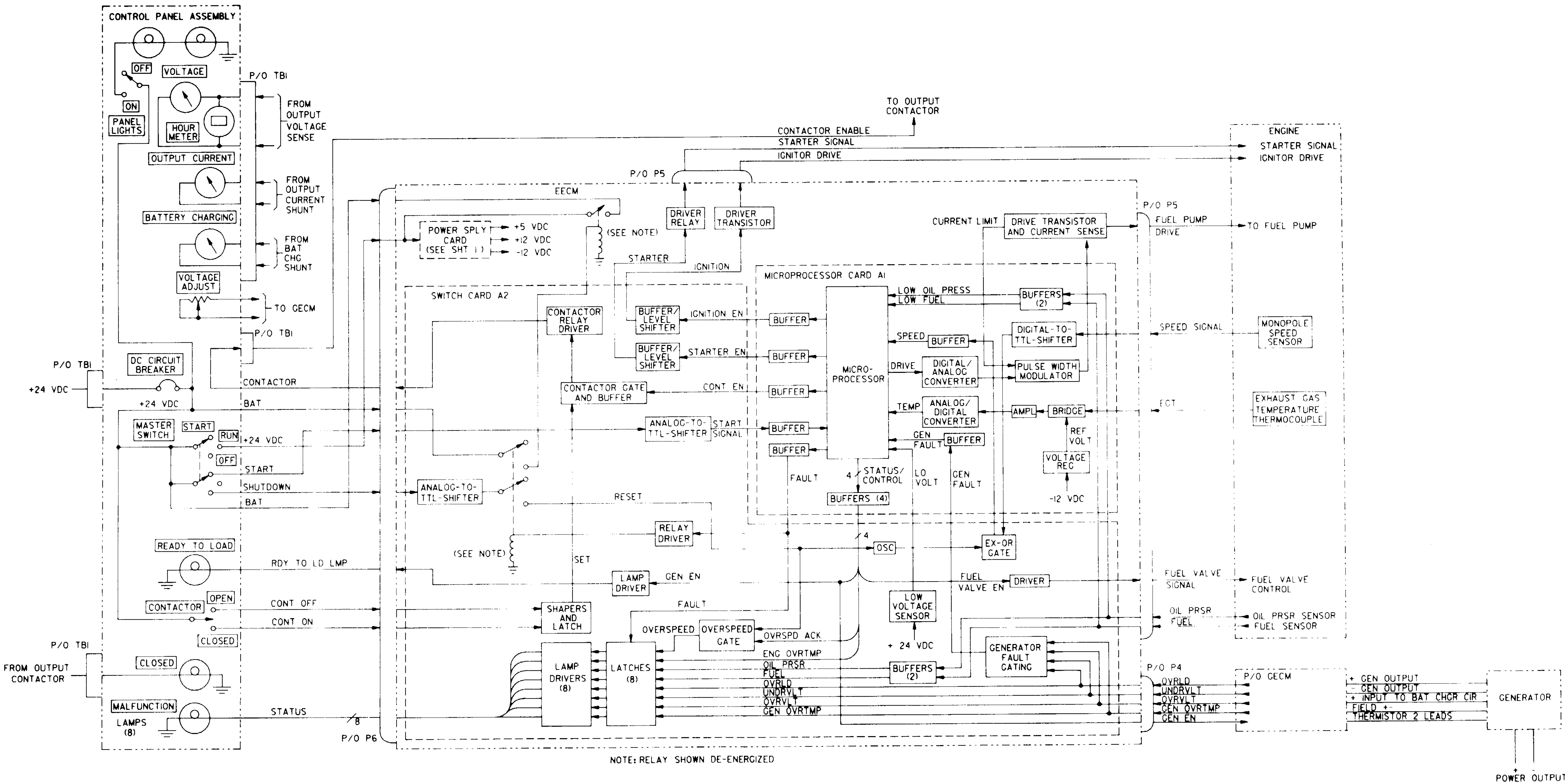
FO-8. Branched Generator Electronic Control Module (GECM) to Control Panel and Engine Electronic Control Module (EECM) Wiring Harness

☆ U.S. GOVERNMENT PRINTING OFFICE: 1991 554-123/20183

PIN: 060188-002



FO-9. Engine and Generator Controls and Instruments Detailed Block Diagram (Sheet 1 of 2)



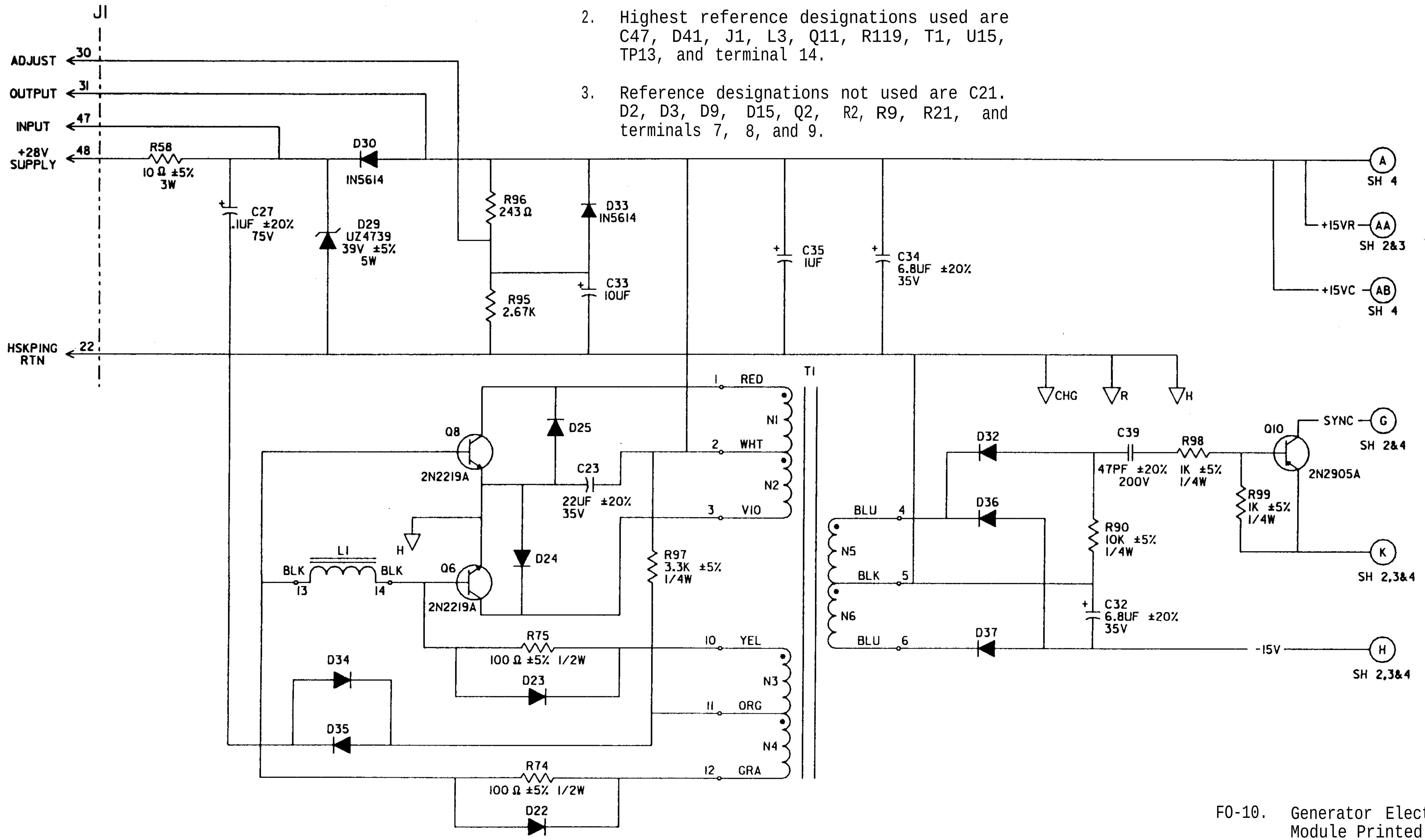
FO-9. Engine and Generator Controls and Instruments Detailed Block Diagram (Sheet 2 of 2)

NOTES

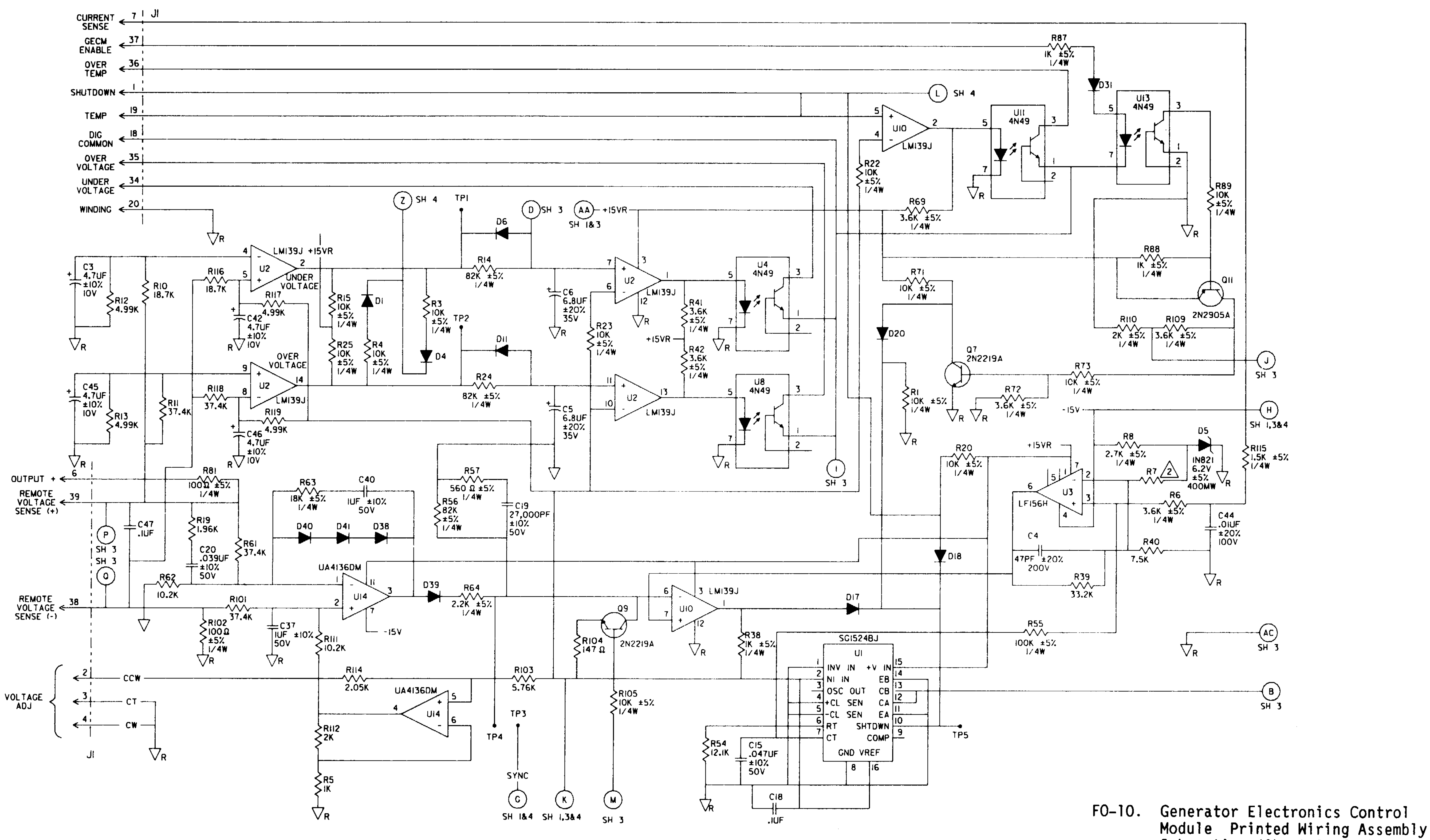
1. Unless otherwise specified, resistors are 1% 1/10W, diodes are IN4148-1, and capacitors are 20% 50V.

2. Highest reference designations used are C47, D41, J1, L3, Q11, R119, T1, U15, TP13, and terminal 14.

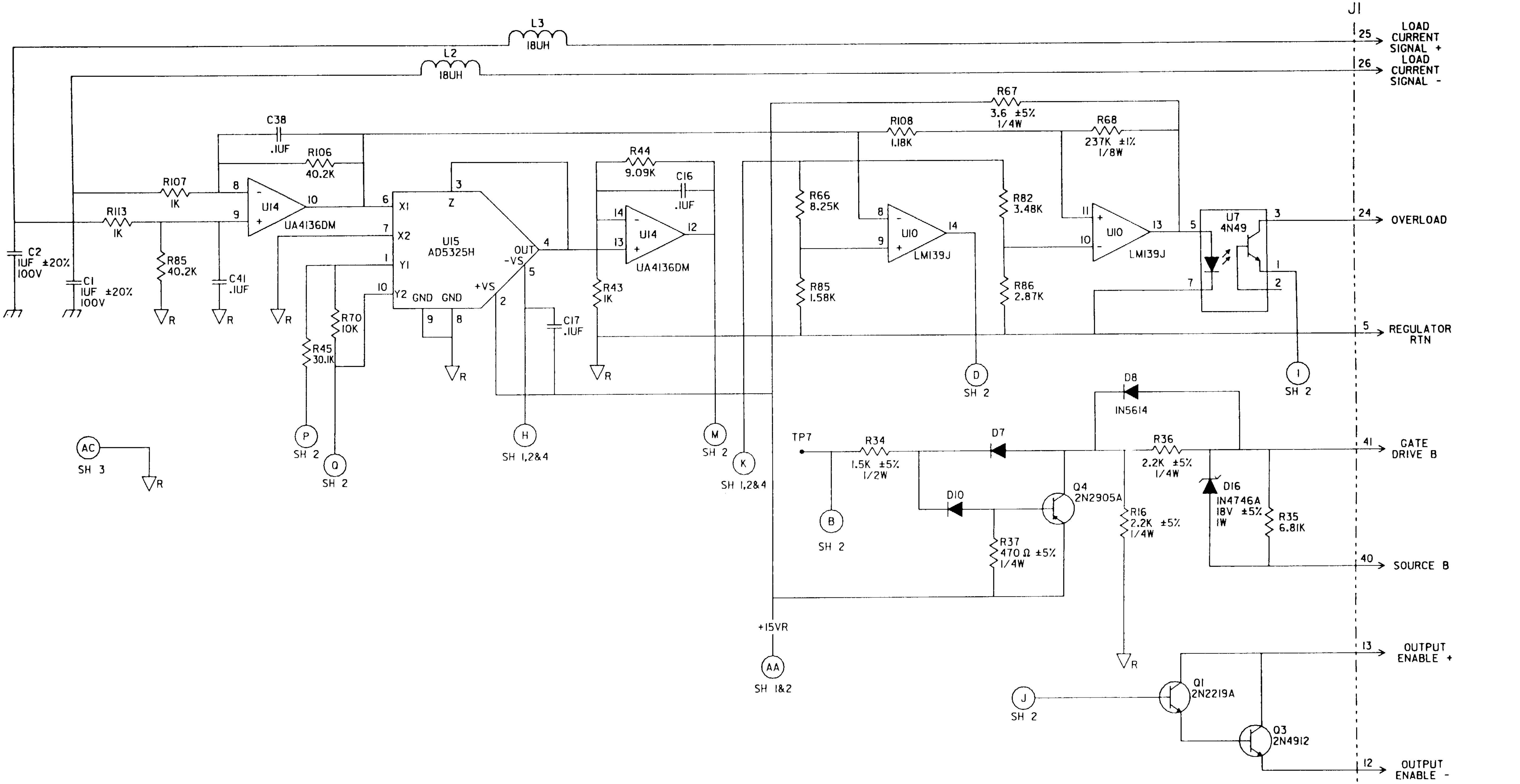
3. Reference designations not used are C21. D2, D3, D9, D15, Q2, R2, R9, R21, and terminals 7, 8, and 9.



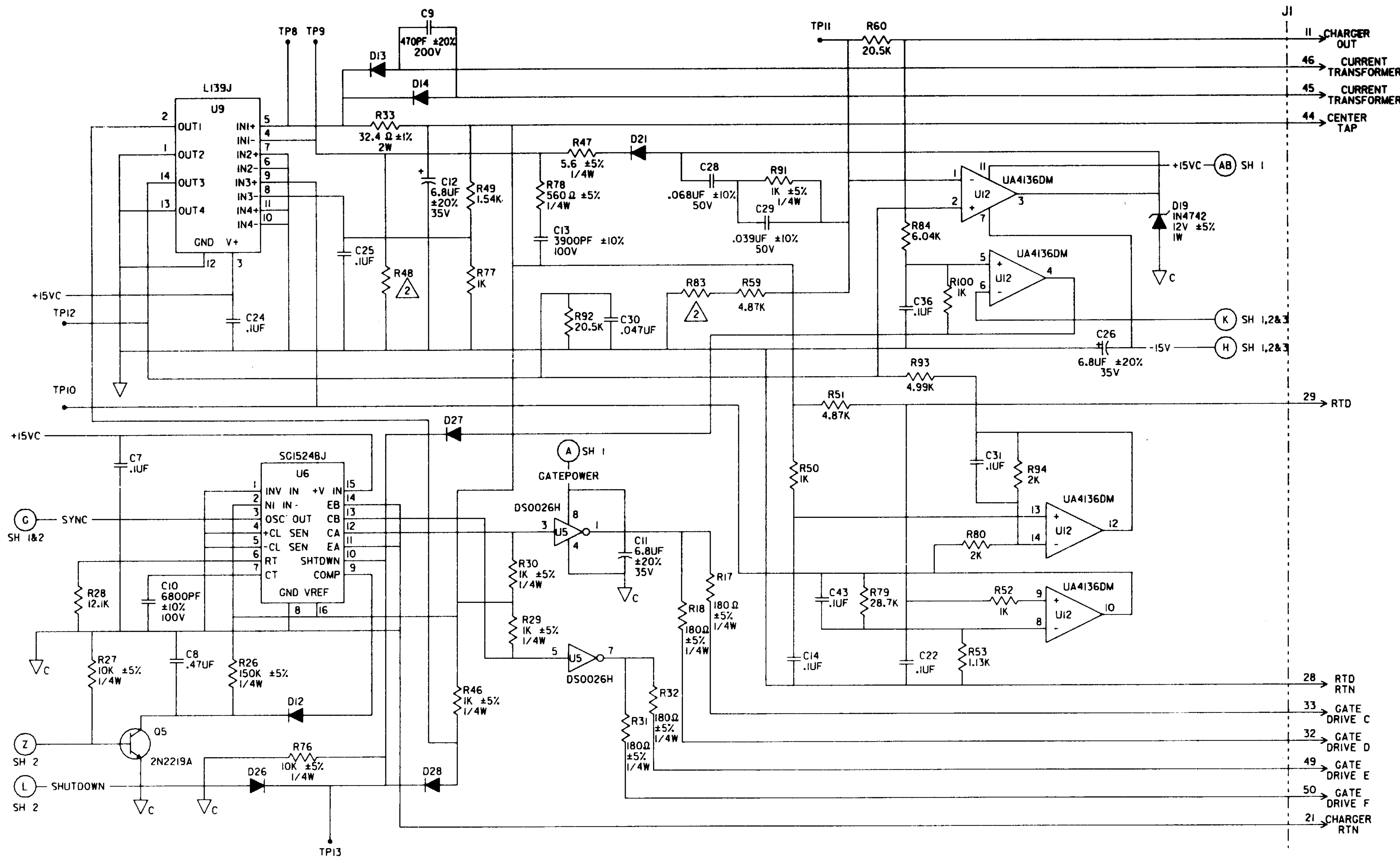
FO-10. Generator Electronics Control Module Printed Wiring Assembly Schematic (Sheet 1 of 4)



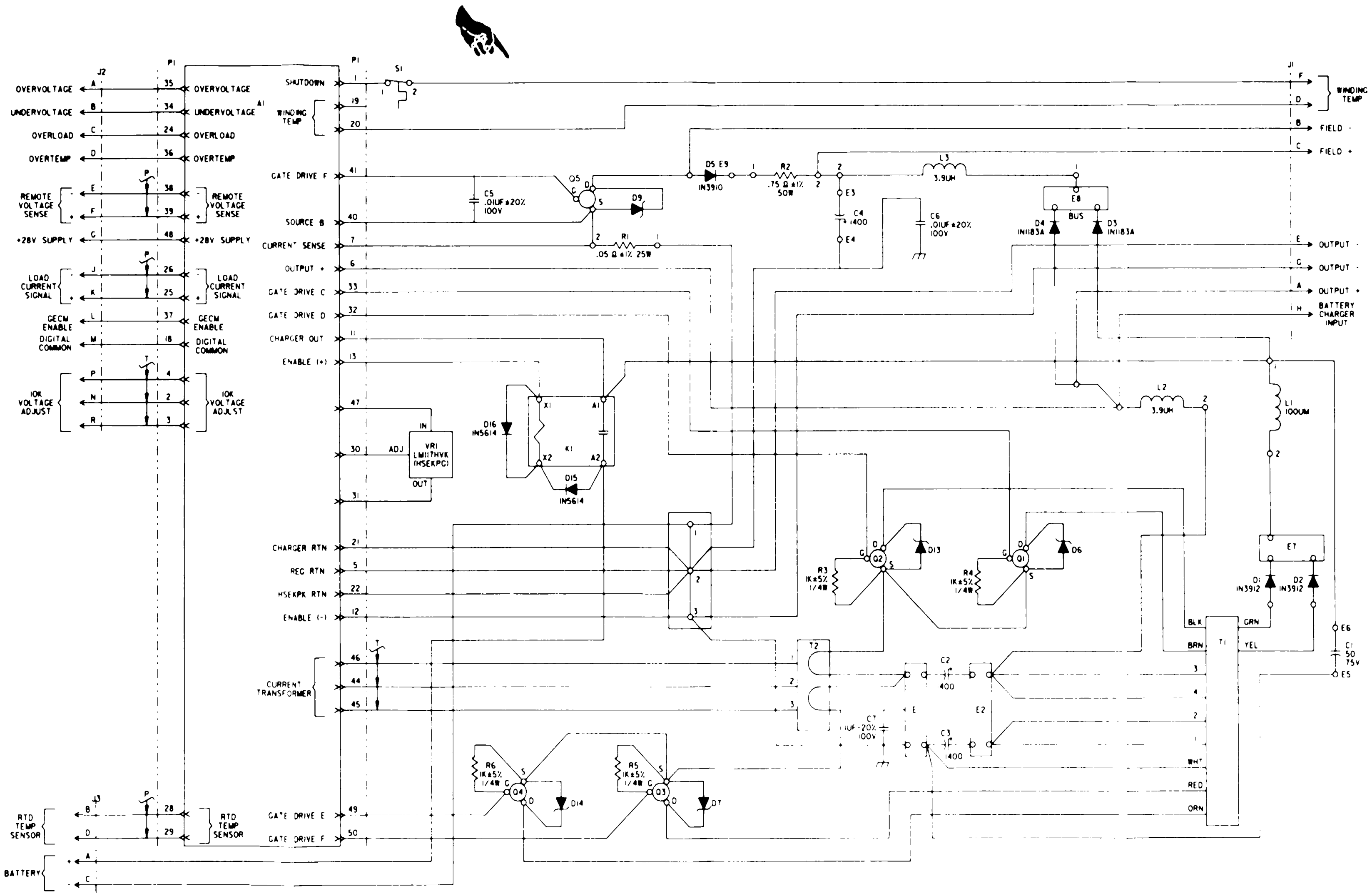
FO-10. Generator Electronics Control Module Printed Wiring Assembly Schematic (Sheet 2 of 4)



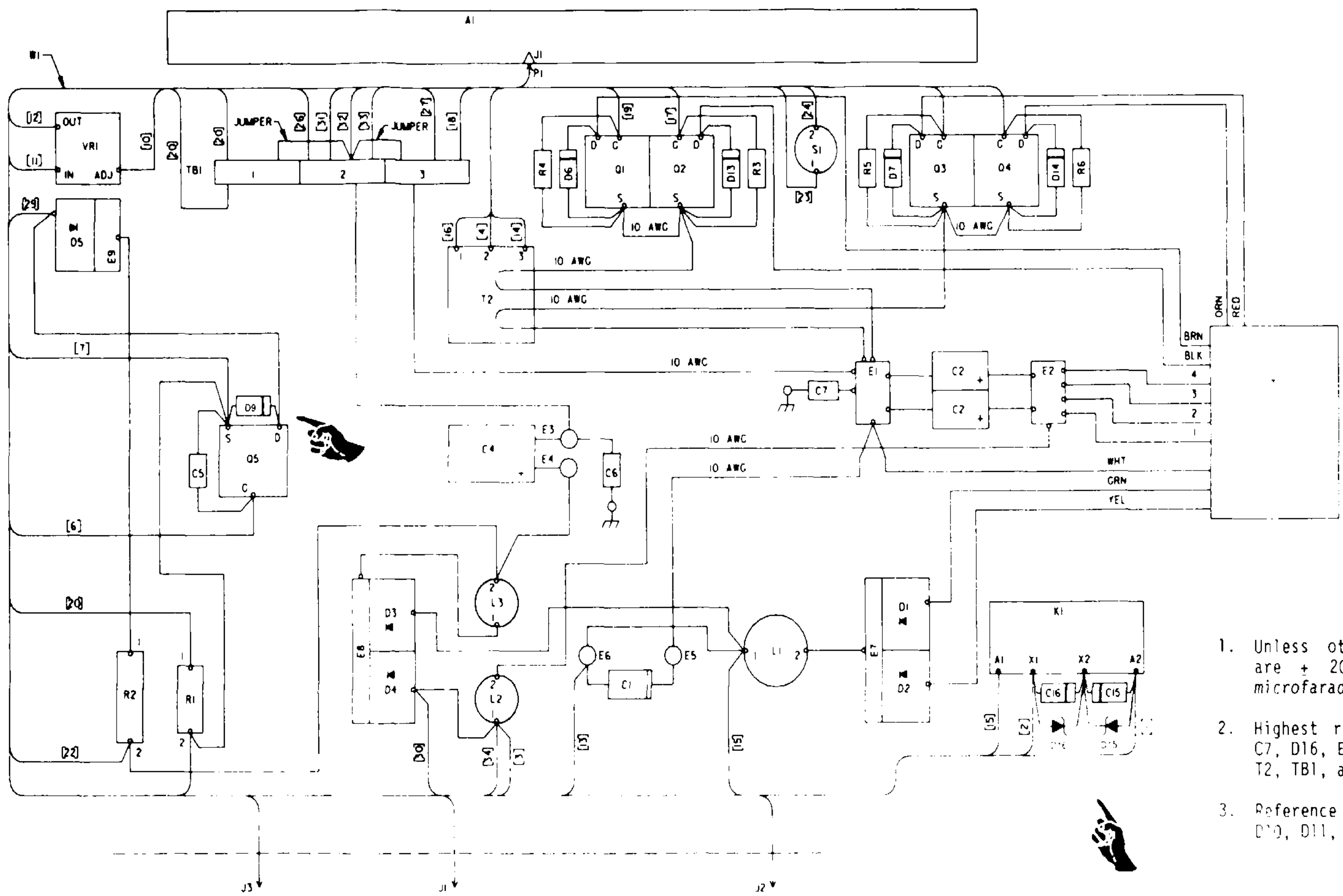
FO-10. Generator Electronics Control Module Printed Wiring Assembly Schematic (Sheet 3 of 4)



F0-10. Generator Electronics Control Module Printed Wiring Assembly Schematic (Sheet 4 of 4)



FO-11. Generator Electronic Control Module Assembly Wiring Diagram



NOTES

1. Unless otherwise specified, capacitors are ± 20%, 63V. Capacitance is in microfarads.
2. Highest reference designations used are C7, D16, E9, J3, K1, L3, P1, Q5, R6, S1, T2, TB1, and VR1.
3. Reference designations not used are D8, D10, D11, and D12.

FO-12. Generator Electronic Control Module Assembly Schematic

The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigram = .035 ounce
1 dekagram = 10 grams = .35 ounce
1 hectogram = 10 dekagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 33.81 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	*To*	*Multiply by*	*To change*	*To*	*Multiply by*
inches	centimeters	2.540	ounce-inches	newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29,573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	newton-meters	1.356	metric tons	short tons	1.102
pound-inches	newton-meters	.11296			

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

PIN: 060188-000