TM 55-6115-491-40

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

TECHNICAL MANUAL

GS MAINTENANCE MANUAL

INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST

GENERATOR

MODEL 31220-002

HEADQUARTERS, DEPARTMENT OF THE ARMY

11 DECEMBER 1970

WARNING

PRECAUTIONARY DATA

Personnel performing instructions involving operations, procedures, and practices which are included or implied in this technical manual shall observe the following instructions. Disregard of these warnings and precautionary information can cause serious injury, death, or an aborted mission.

TEST LAMP USAGE WARNING. Use caution when working with 110-volt test lamp. Bodily contact with the probes can be painful, and under certain conditions can cause injury or death.

HIGH VOLTAGE WARNING. The output of this generator is great enough to cause severe injury or death by electrocution. Use extreme caution to prevent bodily contact with the output circuits during testing.

CHANGE
No. 3

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., *21 July 1975*

GS Maintenance Manual
Including Repair Parts and Special Tools List

GENERATOR MODEL 31220-002

TM 55-6115-491-40, 11 December 1970, is changed as follows:

1. Remove and insert pages as indicated below:

	Remove pages	Insert pages
Section IV	4-7 and 4-8	4-7 and 4-8

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To be distributed in accordance with DA Form 12-31 (qty rqr block no. 153) Direct and General Support Maintenance requirements for CH-47A aircraft.

CHANGE }
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GS Maintenance Manual
Including Repair Parts and Special Tools List

GENERATOR

MODEL 31220-002

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1. Remove and insert pages as indicated below:

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Section I	1-1 and 1-2	1-1 and 1-2
Section III	3-11 and 3-12	3-11 and 3-12

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CHANGE
No. 1

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DEPARTMENT OF THE ARMY
WASHINGTON, D.C., *16 June 1971*

GS Maintenance Manual
Including Repair Parts and Special Tools List

GENERATOR

MODEL 31220-002

TM 55-6115-491-40, 11 December 1970, is changed as follows:

1. Remove and insert pages as indicated below:

	Remove pages	Insert pages
Section IV	4-1 and 4-2	4-1 and 4-2
	4-7 and 4-8	4-7 and 4.8

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To be distributed in accordance with DA Form 12-31 (qty rqr block no. 279) requirements for Direct and General Support Maintenance Instructions for CH-47A Aircraft.

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SECTION I

INTRODUCTION

1-1. GENERAL INFORMATION.

1-2. This technical manual comprises general support maintenance instructions for Generator Model 3122C-002 (figure 1-1), manufactured by Lear Siegler, Inc., Power Equipment Division, Cleveland, Ohio, Federal Supply Code 31435. Sections I through IV contain instructions for this model. Instructions for additional models will be provided in Section V by use of difference data sheets.

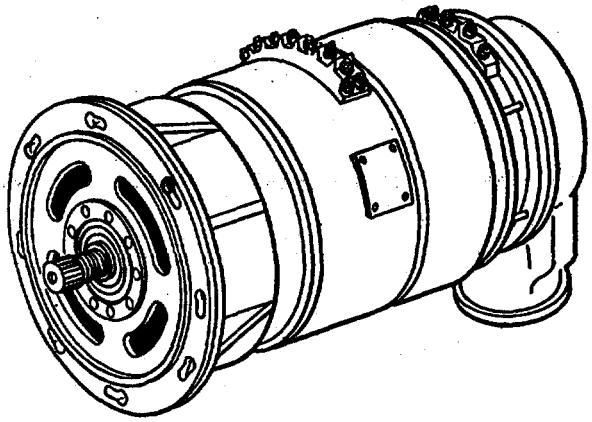

Figure 1-1. Generator Model 31220-002.

1-3. REPORTING OF IMPROVEMENTS.

1-4. The individual user is encouraged to report errors, omissions, and recommendations for improving this publication. Reports should be submitted on DA Form 2028 (Recommended Changes to DA Publications) and forwarded directly to: Commander, US Army Aviation Systems Command, ATTN: AMSAV-FC, PO Box 209, St. Louis, Missouri 63166.

1-5. PURPOSE OF EQUIPMENT.

1-6. The generator is designed to supply electrical energy for aircraft alternating current systems.

1-7. EQUIPMENT RECORDS.

1-8. The Army Maintenance Management system established in TM 38-750 applies to this equipment. The applicable forms as required by TM 38-750 shall be used.

1-9. DESCRIPTION.

1-10. This generator provides both alternating-current and direct-current outputs. The alternating-current output is rated at 120/208 volts, 375 to 425 cps, 3 phase, 20 KVA, with a power factor of 0.75 to 1.0 when driven at 7,500 to 8,500 rpm. The direct-current output is 28 volts, 90 watts at 8000 rpm.

1-11. The alternating-current portion of the generator is housed in the stator housing. It consists of an exciter section and a main output section. The exciter provides the electrical output to energize the alternator field under control of an external voltage regulator and control system. The external regulator connects to terminals Fl, A+, and A-, F2 (figure 1-2). The main generator output is available at terminals T1 through T6 on the main output terminal board.

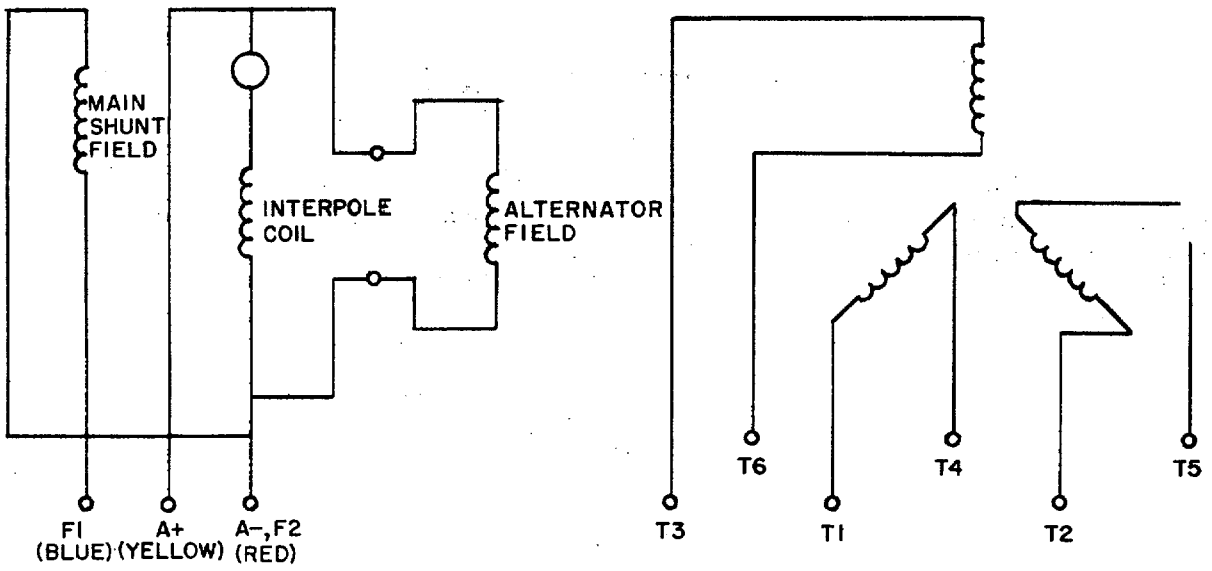

Figure 1-2. Alternate Current Generator Schematic Diagram.

1-12. The direct-current portion of the generator is housed in the radial air scoop at the anti-drive end of the generator. It consists of a permanent magnet rotor mounted on the end of the generator rotor assembly. The permanent magnet induces a current in the DC generator stator, providing an alternating-current output. The three-phase alternating current is rectified by six diodes, (figure 1-3). Direct-current output of the generator is available at terminals (+) and (-).

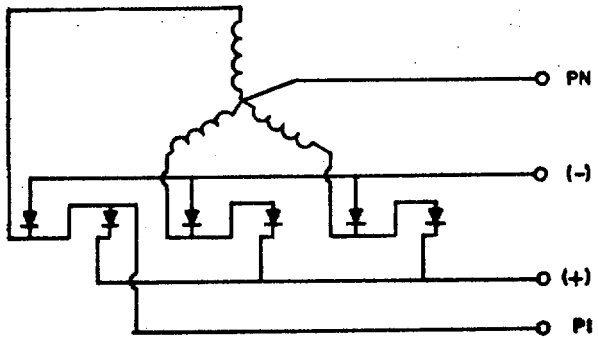

Figure 1-3. Permanent Magnet Generator Schematic Diagram.

1-13. The cover at the anti-drive end of the generator acts as an air scoop to direct an air blast through the generator to keep the operating parts within normal operating temperature limits.

1-14. LEADING PARTICULARS.

1-15. Leading particulars for Generator Model 31220-002 are given in table 1-1.

Table 1-1. Leading Particulars

AC GENERATOR RATING:	
Volts	120/ 208 AC
KVA output (0.75 power factor)	20
Phase	3
Frequency (cycles per second)	375/425
Speed (revolutions per minute)	7500/8500
Power factor	0.75 to 1.0
DC PM GENERATOR RATING:	
Output	90 Watts
Volts (nominal)	28
Speed (revolutions per minute)	7000/8500
PHASE SEQUENCE	T1, T2, T3
ROTATION (viewing drive end)	Counterclockwise
COOLING	Air
WEIGHT (less air scoop cover)	54 ± 0.5 lb

SECTION II

TEST EQUIPMENT, SPECIAL TOOLS, AND MATERIALS

2-1. GENERAL.

2-2. This section lists all test equipment, special tools and consumable materials required to perform general support maintenance for the generator.

2-3. TEST EQUIPMENT.

2-4. Test equipment required for general support maintenance of the generator is listed in table 2-1.

Table 2-1. Test Equipment Required (Sheet 1 of 3)

PART, MODEL, OR MILDES (OR EQUIVALENT)	NOMENCLATURE	TECHNICAL DESCRIPTION
	Drive motor	A prime mover having a speed range up to approximately 10,000 revolutions per minute and a minimum rating of 50 horsepower. Motor will be capable of driving the generator continuously under full load conditions.
	Speed indicator	Tachometer capable of indicating rotating speeds up to 10,000 revolutions per minute.

Table 2-1. Test Equipment Required (Sheet 2 of 3)

PART, MODEL, OR MILDES (OR EQUIVALENT)	NOMENCLATURE	TECHNICAL DESCRIPTION
	Air blower	Capable of delivering air at a total pressure (static plus velocity head) of 1.6 inches of water (measured 12 inches from the entrance of blast cap) including means to supply the cooling air at a temperature of 77'F:t27oF (250°C150C). Air pressure can be controlled by placing an adjustable clamp over a fabric hose connection.
	Manometer	Manometer calibrated in inches of water should be used for indicating air pressure.
	Thermocouple	Thermocouples and associated indicators to measure frame temperatures.
	Instruments	Direct-current ammeter with a 0-5 ampere range for measure AC generator field current and PM generator output. Alternating-current ammeters with a 0-200 ampere range for measuring line output currents. Alternating-current voltmeter having a range of 0-300 volts and a selector switch for measuring the line-to-line output voltage.

Table 2-1. Test Equipment Required (Sheet 3 of 3)

PART, MODEL, OR MILDES (OR EQUIVALENT)	NOMENCLATURE	TECHNICAL DESCRIPTION
		A frequency meter having a range of 0 to 500 cycles per second. A phase sequence indicator to measure the direction of phase rotation. Alternating-current wattmeters to measure the output power. Direct-current voltmeter having a range of 0-50 volts for measuring PM generator output.
LSI 51250-010	Voltage regulator	Electronic voltage control unit.
LSI 50185-010	Control panel	To control generator output.
	Line contactor	Capable of closing and interrupting up to 40 KVA of 120/ 208 volt alternating-current power.

Table 2-1. Test Equipment Required (Sheet 3 of 3) - Continued

PART, MODEL, OR MILDES (OR EQUIVALENT)	NOMENCLATURE	TECHNICAL DESCRIPTION
AN/USM-211	Oscilloscope	To check waveform of PM generator output.
TS352BU	Ohmmeter	Capable of reading wide range resistances of 0-120 volts.
	Variable Transformer	Capable of supplying variable ac output from 120 volt, 60 cycle ac input for PM magnet knockdown.

2-5. SPECIAL TOOLS.

2-6. Special tools required for general support maintenance of the generator are listed in table 2-2.

Table 2-2. Special Tools Required

PART, MODEL, OR MILDES (OR EQUIVALENT)	NOMENCLATURE	TECHNICAL DESCRIPTION
Model 107A (49673,)	Magnet charger	Capable of charging permanent magnet rotor.
No Number	Brush holder alignment tool	Bar stock, square, 0.280-0.004.in.

2-7. CONSUMABLE MATERIALS.

2-8. Consumable materials required during general support maintenance of the generator are listed in table 2-3.

Table 2-3. Consumable Materials Required

ITEM	MATERIAL	TYPE OR GRADE	GOVERNMENT SPECIFICATION
1	Lint-free cloth		CCC-C-440
2	Grease, aircraft, general purpose		MIL-G-7711A
3	Grease, aircraft, general purpose wide temperature range		MIL-G-81322
4	Dielectric fluid		MIL-S-21568
5	Trichloroethylene		O-T-620

SECTION III

GENERAL SUPPORT MAINTENANCE

3-1. GENERAL.

3-2. This section provides an illustrated parts breakdown, disassembly instructions, cleaning instructions, repair and replacement instructions, and reassembly instructions for the generator.

3-3. ILLUSTRATED PARTS BREAKDOWN.

3-4. The illustrated parts breakdown lists and illustrates all replaceable parts for Generator Model 31220-002 (figure 1-1), manufactured by Lear Siegler, Inc., Power Equipment Division. Since this parts breakdown covers only one model of the generator, the Usable on Code column is not used.

3-5. PARTS GROUPINGS.

The illustrated parts breakdown is divided into two groups. Figure 3-1 covers the basic generator and figure 3-2 covers the brush support assembly.

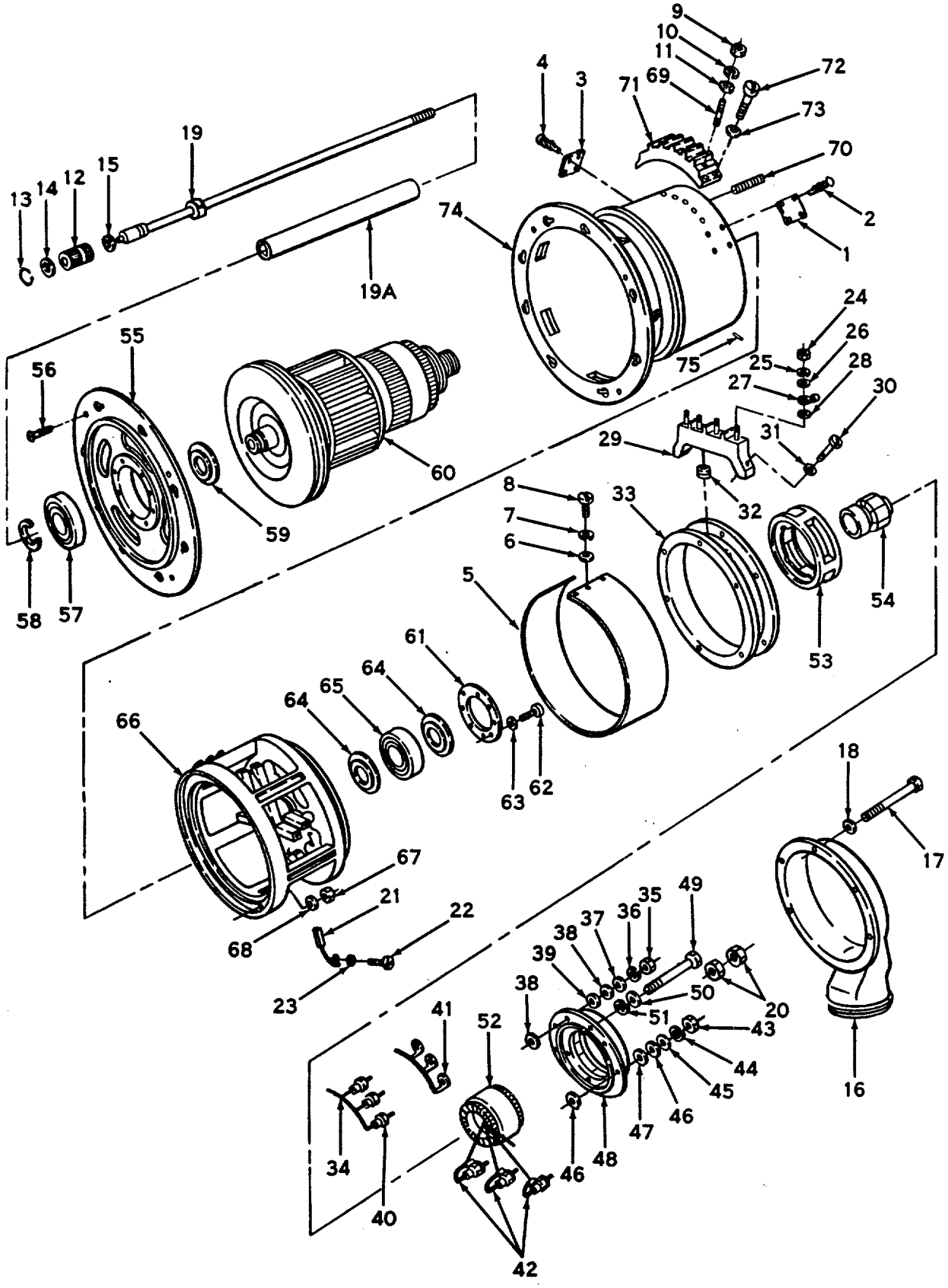

Figure 3-1. Generator Model 31220-002, exploded view.

3-6. FEDERAL SUPPLY C-ODE FOR MANUFACTURERS.

Manufacturer codes, taken from Cataloging Handbook H4-1 and H4-2, Federal Supply Code for Manufacturers, are used' in the Description column of the parts breakdown to identify manufacturers of vendor-supplied parts. Codes are not assigned to parts which carry standard Government part numbers, or to parts manufactured by Lear Siegler, Inc. Manufacturer codes used m the parts breakdown are listed in numerical sequence in table 3-1.

Table 3-1. Federal Supply Codes for Manufacturers

CODE	MANUFACTURER
06840	The Bendix Corp. Detroit, Michigan
80756	Ramsey Corp. Manchester and Weidman St. Louis, Mo.

FIGURE & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY PER ASSY	USABLE ON CODE
3-1-	31220-002	GENERATOR, Alternating and direct current	1	
-1	06-119645	• PLATE, Identification data (ATTACHING PARTS)	1	
-2	MS21318-13	• SCREW -*-	4	
-3	JH16232	• PLATE, Maintenance name (ATTACHING PARTS)	1	
-4	MS21318-13	• SCREW -*-	4	
-5	31220-1018	• COVER, Electrical contact (ATTACHING PARTS)	1	
-6	AN503-8-6	• SCREW	5	
-7	MS35338-42	• WASHER, Lock	5	
-8	AN960-8	• WASHER, Flat -*-	5	
-9	MS20341-516A	• NUT	6	
-10	MS35338-45	• WASHER, Lock	6	
-11	AN960-516L	• WASHER, Flat	6	
-12	31220-1023	• ADAPTER, Drive (ATTACHING PARTS)	1	
-13	MS16624-3027	• RING, External retaining (05-425103)	1	
3-1-14	05-370035	• WASHER	1	
-15	RST5O	• RING, Retaining (80756) (05-425811) -*-	1	
-16	MS25160-1	• COVER, Electrical generator (ATTACHING PARTS)	1	
-17	MS35265-71	• SCREW, Cap '	5	
-18	AN960-10L	• WASHER, Flat -*-	5	
-19	31220-1053	• SHAFT, Splined (ATTACHING PARTS)	1	
-19A	13-047200	• SLEEVING, Insulation	1	
-20	05-322503	• LOCKNUT, Two-piece -*-	1	
-21	31220-1027	• BRUSH (ATTACHING PARTS)	8	
-22	MS35265-27	• SCREW	8	
-23	MS35338-41	• WASHER, Lock -*-	8	
-24	MS21083B3	• NUT	4	
-25	MS35338-43	• WASHER, Lock	4	
-26	AN960-10L	• WASHER, Flat	4	
-27	05-652014	• TERMINAL, Lug	4	
3-1-28	AN960-10L	• WASHER	4	

FIGURE & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	QTY PER ASSY	USABLE ON CODE
-29	31220-1078	• BOARD, Terminal	1	
		(ATTACHING PARTS)		
-30	MS35265-65	• SCREW	2	
-31	AN960-10L	• WASHER, Flat	2	
		-*-		
-32	05-437001	• GROMMET, Rubber	1	
-33	31220-1066	• RING, Spacer	1	
-34	31220-1076	• LEAD ASSEMBLY	1	
		(ATTACHING PARTS)		
-35	MS21083B3	• NUT	3	
-36	MS35338-43	• WASHER, Lock	3	
-37	05-370162	• WASHER, Flat, 0.203 ID x 0.50.	3	
		OD x 0.054/ 0.066 inch thick		
-38	05-374059	• WASHER, Mica.	6	
-39	05-374058	• WASHER, Plastic, laminated.	3	
		-*-		
-40	05-900403	SEMICONDUCTOR DEVICE, Diode.	3	
-41	31220-1075	• LEAD ASSEMBLY	1	
-42	.05-900403	• SEMICONDUCTOR DEVICE, Diode	3	
		(ATTACHING PARTS)		
-43	MS21083B3	• NUT	3	
-44	MS35338-43	• WASHER, Lock	3	
3-1-45	05-370162	• WASHER, Flat, 0.203 ID x 0.50.	3	
		OD x 0.054/0.066 inch thick		
-46	05-374059	• WASHER, Mica.	6	
-47	05-374058	• WASHER, Plastic, laminated	3	
		-*-		
-48	31220-1064	• END BELL	1	
		(ATTACHING PARTS)		
-49	31220-1072	• BOLT, Machine, special	4	
-50	MS35338-43	• WASHER, Lock	4	
-51	AN960-10L	• WASHER, Flat	4	
		-*-		
-52	31220-1068	• STATOR, Permanent magnet	1	
		generator		
-53	31220-1065	• MOUNTING, End bell	1	
-54	31220-1062	• ROTOR, Permanent magnet	1	
-55	31220-1001	• FLANGE, Machine	1	
		(ATTACHING PARTS)		
-56	MS24693C71	• SCREW	4	
		-*-		
-57	*07-111438	• BEARING, Ball	1	
		(ATTACHING PARTS)		
-58	RS118	• RING, Retaining (80756)	1	
		(05-425806)		
		-*-		
-59	31220-1054	• DISK, Baffle	1	
-60	31220-1050	• ROTOR ASSEMBLY	1	
-61	31220-1055	• RETAINER, Bearing	1	
		(ATTACHING PARTS)		
-62	MS35275-264	• SCREW	4	
-63	MS35338-43	• WASHER, Lock	4	
		-*-		
-64	31220-1054	• DISK, Baffle	2	
-65	*07-111438	• BEARING, Ball	1	
-66	31220-303	• SUPPORT ASSEMBLY, Brush (see	1	
		figure 3-2)		
		(ATTACHING PARTS)		
-67	MS20145-3	• NUT	8	
-68	AN960-10	• WASHER, Flat	8	

*P/N 07-111438 with suffix D or F is to be matched with bearing liner coded D or F depending on bearing liner dimensions

FIGURE & INDEX NUMBER	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	QTY PER ASSY	USABLE ON CODE
		---*---		
	31220-1070	••STATOR, Generator	1	
-69	05-360062	••STUD	6	
-70	05-360011	••STUD	9	
-71	31220-1046	••BOARD, Terminal	1	
		(ATTACHING PARTS)		
-72	MS35266-67	••SCREW	4	
-73	P24532	••WASHER, Flat (06840)	4	
		---*---		
-74	No Number	••HOUSING, Stator	1	
-75	MS16562-222	•PIN, Spring	1	

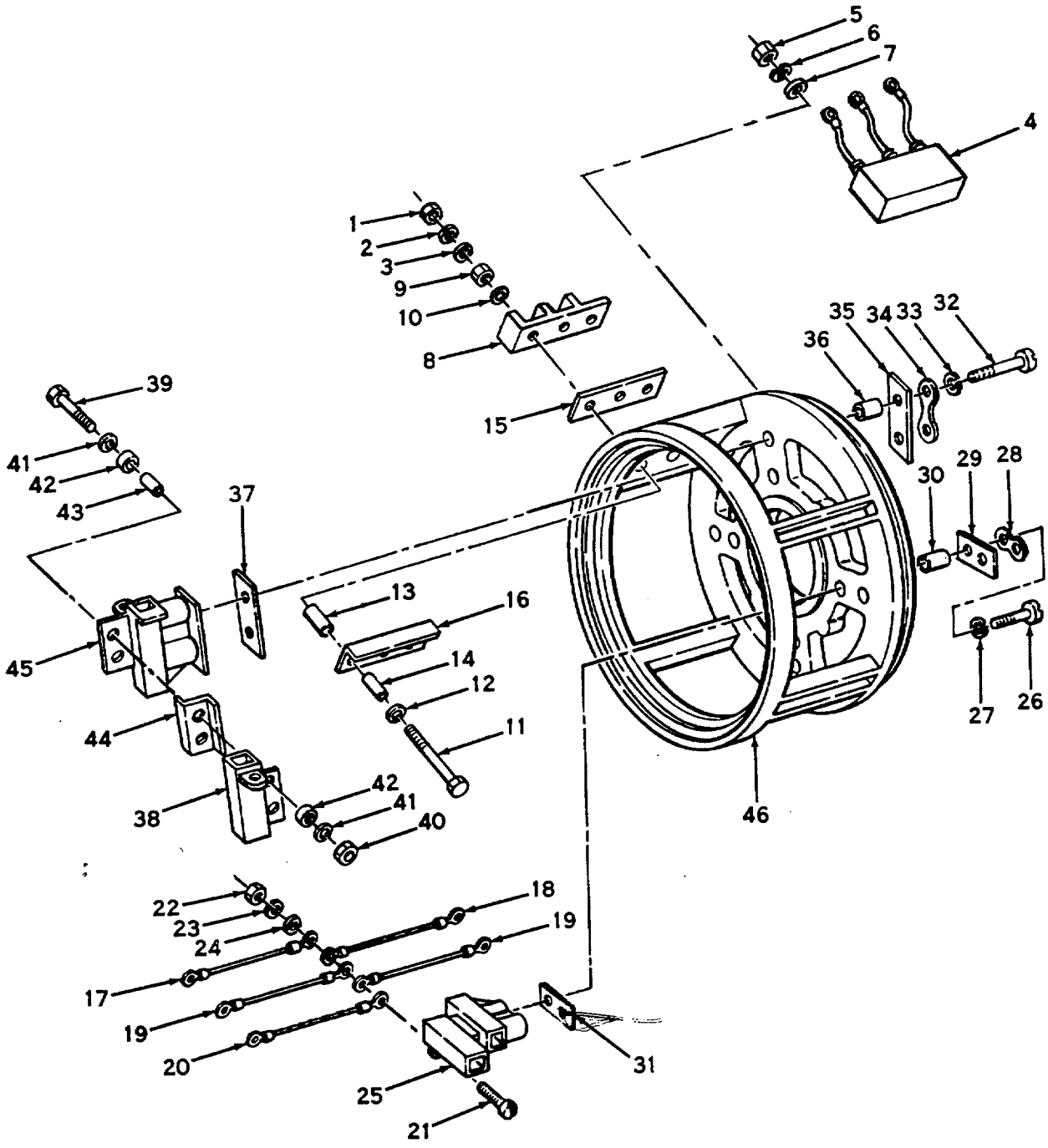

Figure 3-2. Brush Support Assembly, exploded View.

FIGURE & INDEX NUMBER	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	QTY PER ASSY	USABLE ON CODE
3-2-	31220-303	SUPPORT ASSY, Brush (see index 66, figure 3-1)	REF	
-1	AN315-3R	•NUT	3	
-2	MS35338-43	•WASHER, Lock	3	
-3	AN960-10L	•WASHER, Flat	3	
-4	31008-1258	•CAPACITOR (ATTACHING PARTS)	1	
-5	MS35649-282	•NUT	2	
-6	MS35338-42	•WASHER, Lock	2	
-7	AN960-8L	•WASHER, Flat ---+---	2	
-8	31008-1029	•TERMINAL BOARD (ATTACHING PARTS)	1	
-9	AN315-3R	•NUT	3	
-10	05-370108	•WASHER, Flat	3	
-11	31008-1044	•BOLT, Machine	3	
-12	P24532	•WASHER, Flat (06840)	3	
-13	31008-1038	•BUSHING, Insulator	3	
-14	05-435054	•SLEEVE, Terminal ---*---	3	
-15	31008-1172	•GASKET, SPACER	1	
-16	31008-1154	•INSULATOR, Standoff	1	
-17	31008-1162	•LEAD, Electrical	1	
-18	31008-1163	•LEAD, Electrical	1	
-19	31008-1164	•LEAD, Electrical	2	
-20	31008-1093	•JUMPER, Electrical wire (ATTACHING PARTS)	1	
-21	AN503-8-8	•SCREW	6	
-22	MS35649-282	•NUT	6	
-23	MS35338-42	•WASHER, Lock	6	
-24	AN960-8L	•WASHER, Flat ---*---	6	
-25	31008-1218	•HOLDER, Electrical contact brush (ATTACHING PARTS)	2	
-26	05-140060	•BOLT, Machine, bind hd steel, cad. plated No 10-32NF-2A x 0.750 inch	4	
-27	MS35338-43	•WASHER, Lock	4	
-28	31008-1256	•PLATE, Brush holder	2	
-29	31008-1082	•INSULATION, Brush holder	2	
-30	05-631098	•INSULATOR, Bushing	4	
-31	31008-1219	•INSULATION ---+---	2	
3-2-	31008-306	•BOX ASSY, Brush (ATTACHING PARTS)	2	
-32	05-140060	•BOLT, Machine, bind hd steel, cad. plated No. 10-32NF- 2A x 0.750 inch	4	
-33	MS35338-43	•WASHER, Lock	4	
-34	31008-1256	•PLATE, Brush holder	2	
-35	31008-1082	•INSULATION	2	
-36	05-631098 .	•INSULATOR, Bushing	4	
-37	31008-1219	•INSULATION, Brush holder ---+---	2	
-38	31008-1018	••HOLDER (ATTACHING PARTS)	1	
-39	05-140100	••SCREW	2	
-40	MS21045LC06	••NUT	2	
-41	AN960-6	••WASHER	4	
-42	05-631100	••RING, Insulation	4	
-43	05-631099	••SLEEVE, Insulation ---*---	2	
-44	31008-1037	••SEPARATOR, Insulation	1	
-45	31008-1217	••HOLDER	1	
-46	31220-1056	••SUPPORT, Bearing	1	

3-7. DISASSEMBLY.

Note

Do not disassemble the generator farther than is necessary to determine if the parts are serviceable for continued use.

3-8. The generator should be placed on a suitable holding fixture to protect the drive shaft during disassembly. Disassemble the generator as follows:

a. Remove identification data plate (1, figure 3-1) and maintenance name plate (3) by removing screws (2 and 4) only if replacement is necessary.

b. Remove the five screws (6), lock washers (7), and flat washers (8) that secure the electrical contact cover (5) to the generator; remove the cover.

c. Remove the nuts (9), lock washers (10), and flat washers (11) that secure the electrical leads to the studs (69) on the terminal board (71); disconnect the leads. If the terminal board (71) is damaged, remove screws (72) and flat washers (73) that secure it to the stator housing.

d. Remove the five cap screws (17) and flat washers (18) that secure the electrical generator cover (16) to the generator; remove the electrical generator cover.

e. Hold the splined end of the splined shaft (19) with a wrench. Loosen the outside nut of the two-piece locknut (20) and remove the locknut from the end of the splined shaft (19). Pull the shaft and insulation sleeving (19A) out of the front of the generator.

f. Remove the machine screws (22), and lock washers (23) that secure the eight brushes (21) to the brush support assembly (66); remove the brushes.

g. Use a pair of snap ring pliers to remove the retaining ring (13) from the end of the splined shaft (19). Pull the drive adapter (12) and washer (14) from the shaft. If damaged, remove the retaining ring (15) from the splined shaft.

h. Remove the four nuts (24), lock washers (25), and flat washers (26) and disconnect the terminals (27) of the electrical leads to the studs on the terminal board (29). Remove the assembled terminal board and ring spacer (33).

i. Remove the two screws (30) and flat washers (31) that secure the terminal board (29) to the spacer ring (33); remove the terminal board. Remove the grommet (32) if it is damaged.

j. Remove the four machine bolts (49), lock washers (50), and flat washers (51) that secure the end bell (48) to the generator; remove the end bell, stator (52), and end bell mounting (53). Pull the permanent magnet rotor (54) from the end of the shaft of the rotor assembly (60).

k. The lead assembly (34) consists of three interconnected diodes. Remove the three nuts (35), lock washers (36), flat washers (37), mica washers (38), and plastic washers (39) that secure the lead assembly diodes to the end bell (48); remove the lead assembly (34) and lead assembly (41).

Caution

Do not disconnect any of the diodes (40 or 42) from the wire assembly or from the leads of the stator (42) unless inspection indicates the need for replacement. Diodes are heat sensitive and should not be subjected to any unnecessary soldering.

l. Remove the three nuts, (43), lock washers (44), flat washers (45), mica washers (46), and plastic washers (47) that secure the three diodes to the end bell (48); disconnect the diodes from the end bell.

m. Remove the four screws (56) that secure the machine flange (55) to the stator housing. Tap on the end of the shaft of the rotor (60) with a soft hammer to remove the assembled machine flange and rotor from the stator assembly.

n. Insert two large screwdrivers into openings between flange (55) and rotor assembly (60), positioned about 110 degrees apart. With jerking movements, force both hands together in order to separate flange (55) from stator housing and slide flange free of bearing. Remove the retaining ring (58) and pull the ball bearing (57) from the rotor assembly. Remove the baffle disk (59).

o. Remove the four screws (62) and lock washers (63) that secure the bearing retainer (61) to the brush support assembly-(66). Use a soft drift positioned against the outer race of the ball bearing (65) to drive the ball bearing from the seat in the brush support assembly (66).

p. Remove the eight nuts (67}) and flat washers (68) that secure the brush support assembly (66) to the stator assembly.

q. Remove the three nuts (1, figure 3-2), lock washers (2), and flat washers (3) that connect the capacitor leads to the exciter terminal board (8); disconnect the leads.

r. Remove the three nuts (5), lock washers (6), and flat washers (7) that secure the capacitor (4) to the bearing support (46); remove the capacitor.

s. Remove the bolts (11), nuts (9), and flat washers (10 and 12) that secure the exciter terminal board (8) to the bearing support (46); remove the insulator bushing (13), terminal sleeve (14), gasket (15), and standoff insulator (16) after removing the terminal board.

t. Remove the nuts (22), lock washers (23), and flat washers (24) that secure the electrical leads (17, 18, and 19) and wire jumper (20) to the brush holders; disconnect the leads and jumper.

u. If any of the studs (69 or 70) are damaged, remove them.

v. Remove the bolt (26), lock washer (27), plate (28), insulation (29 and 31), and bushing insulator (30) that secure the brush holder to the bearing support; remove the brush holder.

w. Remove the bolt (32), lock washer (33), plate (34), insulation (35 and 37), and bushing insulator (36) that secure the brush box assembly to the bearing support; remove the brush box assembly.

x. To disassemble the brush holders (38 and 45) and the insulation separator, remove the screws (39), nuts (40), washers (41), insulation ring (42), and insulation sleeve (43).

y. Using vise pliers, remove the pin (75, figure 3-1) from the stator housing (74).

3-9. After disassembly, clean parts as indicated in paragraph 3-10.

3-10. CLEANING.

3-11. Clean all metal parts with ammonium oleate fugitive detergent. Prepare as follows:

3-12. To one gallon of water, add one teaspoon ammonium hydroxide followed by two tablespoons oleic acid. For best results, heat to 1400F (600C).

3-13. The parts to be cleaned must not remain in solution any longer than is necessary to loosen particles of dirt. Dry with a clean, lintfree cloth (item 1, table 2-3) immediately upon removal from solution. After cleaning, dry parts with clean, dehumidified compressed air. Bake rotor and stator for approximately two hours at 250° F (1210C). All ball bearings will be replaced with new bearings at time of overhaul to ensure safe operation between overhaul periods.

Caution

Do not use carbon tetrachloride or other solvents as a cleaning agent for any generator parts. The vapor from these solvents can seriously affect commutation and brush wear. The silicon varnish used on the insulation is soluble in these solvents.

3-14. After cleaning, inspect parts as indicated in table 3-2.

Table 3-2. Detail Inspection Requirements after Cleaning (Sheet 1 of 8)

FIG. NO.	INDEX NO.	NOMENCLATURE	DEFECTS	METHOD OF INSPECTION	REMARKS
3-1	5	Electrical contact cover	Cracks or distortion	Visual	Replace for major defects.
3-1	12	Drive adapter	Worn or damaged internal or external splines	Visual	Replace if wear is visible.
			Cracks	Magnetic particle per MIL-1-6868	Replace if cracked.
			Splines worn to less than 0.8850 inch when measured over 0.084 inch pins	Dimensional	Replace if worn beyond limits.
3-1	13 15	Retaining ring			Replace at each overhaul.
3-1	16	Electrical generator cover	Cracks, particularly at mounting flange	Visual	Replace if cracked.

Table 3-2. Detail Inspection Requirements after Cleaning (Sheet 2 of 8)

FIG. NO.	INDEX NO.	NOMENCLATURE	DEFECTS	METHOD OF INSPECTION	REMARKS
3-1	19	Splined shaft	Cracks, misalignment	Visual	Replace for major defects.
			Wear or damage of front spline or rear threads	Visual	Replace if wear is visible.
			Cracks	Magnetic particle per MIL-1-6868	Replace if cracked.
3-1	21	Brushes			Replace at each overhaul.
3-1	29	Terminal board	Loose or damaged terminals or cracks	Visual	Replace if damaged.
3-1	33	Spacer ring	Cracks and distortion	Visual	Replace if damaged.
3-1	40 42	Semiconductor device, diode	Cracks, signs of overheating, damaged threads	Visual	Replace if damaged.

Table 3-2. Detail Inspection Requirements after Cleaning (Sheet 3 of 8)

FIG. NO.	INDEX NO.	NOMENCLATURE	DEFECTS	METHOD OF INSPECTION	REMARKS
		Semiconductor device, diode - Continued	Improper forward or reverse flow characteristics	Electrical	Para 3-28
3-1	48	End bell	Cracks or distortion	Visual	Replace if damaged.
3-1	52	Permanent magnet generator stator	Damaged or overheated windings or damaged insulation	Visual	Replace if damaged.
			Open, grounded, or defective insulation	Electrical	7-Para 3-27
3-1	53	End bell mounting	Cracks and distortion	Visual	Replace if defective.
3-1	54	Permanent magnet rotor	Cracks, magnet loose on shaft	Visual	Replace if damaged.

Table 3-2. Detail Inspection Requirements after Cleaning (Sheet 4 of 8)

FIG. NO.	INDEX NO.	NOMENCLATURE	DEFECTS	METHOD OF INSPECTION	REMARKS
3-1	55	Machine flange ("D" or "F" coding on flange must be matched with corresponding bearing at reassembly	Cracks, loose bearing liner, distorted mounting flange, worn	Visual, SIE	Replace if damaged or bearing bore is beyond the following limits: 2.4406 to 2.4408 inches (Letter D stamped on part). 2.4405 to 2.4406 inches {Letter F stamped on part). Reidentify if required.
3-1	57 65	Ball bearing			Replace at each overhaul.
3-1	58	Retaining ring			Replace at each overhaul.
3-1	59 64	Baffle disk	Wear, scoring	Visual	Replace if worn or scored.
3-1	60	Rotor assembly	Burned commutator, slip rings, or windings, signs of melted solder	Visual	Replace if damaged.
			Cracked or distorted fan, scored bearing seats	Visual	Replace if damaged.

Table 3-2. Detail Inspection Requirements after Cleaning (Sheet 5 of 8)

FIG. NO.	INDEX NO.	NOMENCLATURE	DEFECTS	METHOD OF INSPECTION	REMARKS
		Rotor assembly -Continued	Check bearing diameter of drive and anti-drive ends. Diameter must be 1.1812 to 1.1815 on drive end and 1.1809 to 1.1812 for anti-drive end.	Air gage	Replace if not within tolerance limits.
			Commutator OD less than 2.750 inches or slip ring OD less than 2.030 inches after turning.	Dimensional	Replace
			Windings open, shorted or grounded; weak insulation	Electrical	Para 3-16
3-1	71	Terminal board	Loose or damaged terminals, cracks	Visual	Replace damaged studs; replace board if cracked.

Table 3-2. Detail Inspection Requirements after Cleaning (Sheet 6 of 8)

FIG NO	INDEX NO.	NOMENCLATURE	DEFECTS	METHOD OF INSPECTION	REMARKS
3-1	74	Stator housing	Stator mounting set screws loose	Visual	Tighten and stake.
			Structural cracks, particularly at mounting holes	Visual	Replace for major defects.
			Damaged threads	Visual	Replace if damaged.
			Damaged or overheated windings and deteriorated insulation	Visual	Replace if damaged.
			Lack of continuity, shorted or grounded; weak insulation	Electrical	Para 3-22

Table 3-2. Detail Inspection Requirements after Cleaning (Sheet 7 of 8)

FIG. NO.	INDEX NO.	NOMENCLATURE	DEFECTS	METHOD OF INSPECTION	REMARKS
3-2	4	Capacitor	Cracks, damaged terminals, signs of overheating	Visual	Replace if damaged.
			Loss of capacitance	Electrical	Para 3-23
3-2	8	Terminal board	Cracks, deterioration, overheating	Visual	Replace if damaged.
3-2	17 18 19 20	Electrical leads and jumpers	Damaged terminals, deteriorated insulation	Visual	Replace if damaged.
3-2	25 38 45	Brush holder	Any cracks or scoring or brush contact surfaces	Visual	Replace if damaged.
			Distortion	Visual	Replace if damaged.

Table 3-2. Detail Inspection Requirements after Cleaning (Sheet 8 of 8)

FIG. NO.	INDEX NO.	NOMENCLATURE	DEFECTS	METHOD OF INSPECTION	REMARKS
3-2	46	Bearing support	Any cracks, loose bearing liner	Visual	Replace if damaged.
			Cracks	Magnetic particle per MIL-1-6868	Replace if cracked.

3-15. REPAIR AND REPLACEMENT.

3-16. Rotor.

a. Test the rotor for grounds with a test lamp by placing one lead on the rotor shaft and the other lead on one commutator bar riser and then to one slip ring. If the lamp lights, the rotor is grounded and must be replaced.

Note

Use a 60-watt test lamp in series with 110 volts for test purposes. If a 110-volt source is not available. 220 volts may be used with two 110-volt lamps connected in series. Do not use a power source greater than 220 volts.

b. Test the exciter armature in a growler for short or open circuits. If any electrical faults are found, the rotor should be replaced after making sure that the fault is definitely in the coil insulation.

Note

A shorted or open exciter armature coil may have intermittently burned commutator bars, in which case the rotor must be replaced. If a whole series of consecutive bars is burned, the trouble may be due to eccentricity, oil or grease on commutator, worn or sticky brushes, or rough bearings; refinish the commutator in any of these instances. Particles of carbon dust clogging the undercut mica spaces can cause armature short circuits; therefore, be sure the spaces can cause armature short circuits; therefore, be sure the commutator has been blown clean with compressed air prior to testing.

c. To check dielectric strength of rotor insulation, apply 625 volts (RMS) for one second between each of the slip rings and ground, and between the commutator and ground. There shall be no indication of insulation breakdown.

3-17. Refinishing Commutator.

a. With bearings on the rotor shaft, install in a lathe or between V-blocks on a surface plate to measure eccentricity. Using a dial indicator, adjust gage to zero after placing gage pointer in contact with the commutator surface.

b. Rotate the rotor and check the dial indicator for total reading through one full revolution. If eccentricity exceeds 0.001 inch, refinish the commutator as described below. Bar-to-bar readings should not differ more than 0.0002 inch.

c. To recondition commutator to within tolerance limits, work must be performed on a good lathe accurately set up and adjusted. The commutator end of rotor shaft should be supported on a bearing which can be used as a master by lapping the inner race bore to obtain a slip fit on rotor shaft. Bearing should be supported in tail stock of lathe. Splined end of rotor should be driven by a suitable collet or held on a center in head stock and driven with a lathe dog.

d. Operate lathe at a speed of 500 to 600 RPM and, using a suitable tool, take lightest cut possible with a fine feed. If the first operation fails to clean up the entire commutator surface, take subsequent light cuts until the surface has been completely reconditioned.

Caution

The outside diameter of the commutator, when new, is 2.875 inches. When repeated turning has reduced this diameter to less than 2.750 inches, rotor must be replaced. During cutting operations, make certain that the previously installed commutator end bearing is covered with masking tape to prevent foreign material from entering the bearing.

e. After commutator has been turned, the mica between the copper segments must be undercut 0.030 inch wide by 0.030 inch deep. Use a sharp undercutting tool and avoid any contact with the commutator bars which would necessitate refinishing or reconditioning commutator because of scratches or gouges. Using a triangular scraping tool, remove all burrs and sharp edges from the commutator bars.

f. After undercutting the mica, sand the commutator to obtain a satin finish (25-40 microinches). Use No. 5/0 sandpaper backed up with a block holder having a radius slightly greater than the commutator and covering the full width of the surface. Then check for concentricity as described in steps a and b above.

Caution

Do not touch the commutator surface after the final finish is obtained. Fingerprints may prevent a uniform commutator film which is necessary for satisfactory operation. Repeat sanding, if necessary, to remove fingerprints.

3-18. Reconditioning Slip Rings.

3-19. Use the same procedure for reconditioning slip rings as used for finishing the exciter commutator. Set the rotor in a lathe as described in paragraph 3-17a and b. Take the lightest possible cut with a fine feed and check to see if the first cut cleans up the slip ring surface. If not, repeat the operation until the entire slip ring surface has been renewed.

Caution

The slip rings, when new, have a diameter of 2.186 inches. If the turning process reduces this diameter to less than 2.030 inches, replace the rotor.

3-20. Balancing The Rotor.

3-21. Before the rotor is reassembled in the generator, subject it to a balancing check. Balancing of the rotor is a precise operation requiring the use of suitable balancing equipment and milling machines. The rotor must be balanced to within 5 grain-inches. Correct the balance as required by milling the retaining bands on either end of the alternator field (0.040-inch maximum depth for full width of bands) and by milling the retaining bands on either side of the armature (0.25-inch diameter by 0.025-inch maximum depth). On the exciter armature, two grooves may be milled in the band closest to the commutator, and one groove may be milled on the band farthest from the commutator. The fan may contribute to the overall balance of the rotor and the rim of the outer flange may be filed as necessary. When removing stock from the fan, remove metal from outer rim only and do not extend the cut below the rim lip.

3-22. Stator Windings And Housing.

a. Test the AC generator stator windings and the exciter stator windings for ground by using the test lamp circuit described in paragraph 3-16. Place one test lead against a pole shoe in the housing and touch the other test lead to each of the stator connections. If the lamp lights, the coil being tested is grounded and the complete housing and stator assembly should be replaced.

b. Using an ohmmeter {table 2-2}, test the exciter field winding for continuity and short circuits. With one lead of the ohmmeter connected to terminal F1 and the other lead to terminal A-, resistance should be 9.6 ohms to 13.1 ohms. A resistance reading of less than 9.6 ohms indicates a short circuit, and a reading above 13.1 ohms indicates either and open circuit or a loose connection. (See figure 1-2.) Replace stator if shorted or open.

c. Check dielectric strength of stator winding insulation by applying 875 volts (RMS) phase-to-phase and phase-to-ground for one minute. There shall be no indication of insulation breakdown. Replace if breakdown is indicated.

3-23. Capacitor.

3-24. Use a capacitor tester to check capacitor (4, the capacitor. The capacitor tolerances are±10 figure 3-2). The capacitances shall be as shown in figure 3-3.Terminal designations are indicated on percent for the 6.0 μf element and±20 percent for the 0.001 and 0.022 μf elements. Replace the capacitor if capacitances are not within limits.

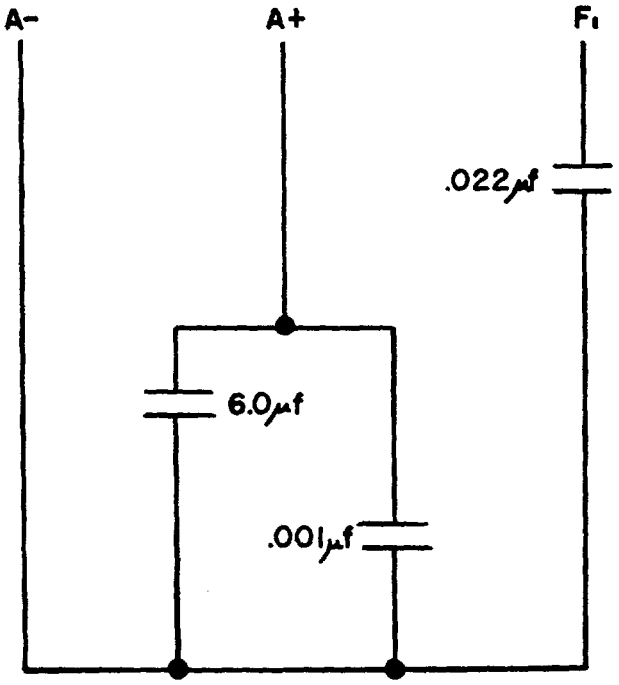

Figure 3-3. Capacitor, Schematic Diagram.

3-25. Permanent Magnet Rotor.

3-26. Magnetize a weak or new permanent magnet rotor using a magnet charger (table 2-2). Use maximum magnetizing force and magnetize so that adjacent poles have the opposite polarity. Do not use a keeper on the magnet after processing.

3-27. Permanent Magnet Stator.

a. Using test lamp described in paragraph 3-16, check continuity of the permanent magnet stator. Continuity must exist between each pair of stator leads. Replace stator if continuity fails to exist.

b. Using a test lamp, check for grounds between the stator leads and an unpainted portion of the stator frame. No continuity shall exist. Replace if grounded.

c. Check dielectric strength of stator insulation by applying 250 volts (RMS) between each winding lead and ground for one minute. There shall be no indication of insulation breakdown. Replace the stator if breakdown is indicated.

3-28. Diode Semiconductor Devices.

a. Connect the diode as shown in figure 3-4 to check reverse current flow. Be sure to observe polarity. Increase the DC input voltage until the voltmeter indicates 200 volts DC. The current at 77° F (250 C) should not exceed 0.5 milliamperes DC.

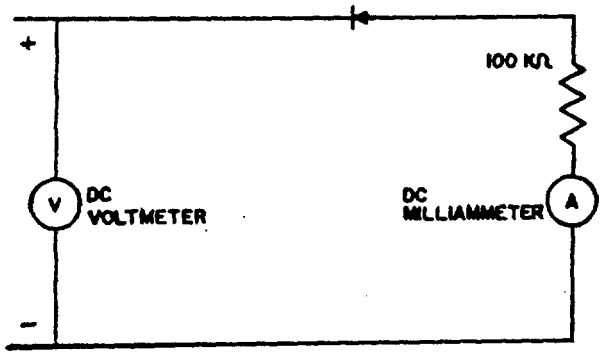

Figure 3-4. Diode Reverse Current Test.

b. Connect the diode as shown in figure 3-5 to check forward current flow. Increase the DC input voltage until the ammeter indicates 3 amps. The voltage drop across the diode should be less than 1.5 volt DC at 770F (250 C). Replace the diode if it fails to conform to these requirements.

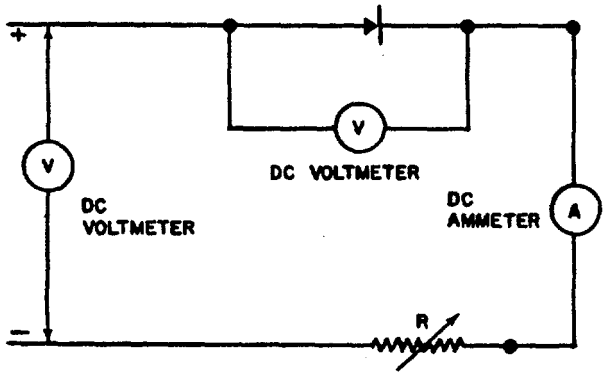

Figure 3-5. Diode Forward Current Test.

3-29. MODIFICATION CRITERIA.

3-30. Comply with the following instructions in order to control configuration of generator Part No. 31220-002.

a. If shaft Part No. 31220-1053 is installed, and if the letter "S" is already on the identification plate following the serial number, obliterate the letter "S".

b. If shaft Part No. 31220-1160 is installed, assure that the letter "S" is stamped on the identification plate following the numerical serial number.

c. If bearing Part No. 07-111424 is replaced with bearing Part No. 07-111438 and if the letter "B" is not already on the identification plate after the serial number, stamp the letter "B" onto the plate.

d. If it is necessary to install bearings Part No. 07-11424 due to the non-availability of bearing Part No. 07-111438, and if the letter "B" is already on the identification plate, either replace the identification plate or obliterate the letter "B" from the present plate.

3-31. LUBRICATION.

3-32. Lubricate the parts of the generator prior to reassembly using items 2 and 3 of table 2-3.

3-33. REASSEMBLY.

3-34. Refer to figures 3-1 and 3-2 and reassemble the generator as follows:

a. Assemble the brush boxes (items 39 through 45, figure 3-2).

b. Position the assembled brush boxes on the bearing support (46) and brush holder insulations (37) on the bearing support; secure with the bolts (32), washers (33), plates (34), insulation (35), and bushing insulator (36). Tighten the bolts to 17 to 20 inch-pounds.

c. Position the brush holders (25) and brush holder insulations on the bearing support using the aligning tool indicated in table 2-2. Secure by installing the bolts (26), washers (27), plates (28), insulations (29), and bushing insulator (30). Tighten the bolts to 17 to 20 inch-pounds.

d. Install the electrical leads (17 through 19) and the wire jumper (20) that interconnect the brush holders.

e. Position the exciter board (8), spacer gasket (15), and standoff insulator (16) on the bearing support (46); secure by installing the terminal sleeves (14), insulator bushings (13), flat washers (12), bolts (11), washers (10), and nuts (9). The terminal board must be positioned so that A- faces the anti-drive end.

f. If they were removed, install new studs (70, figure 3-1) in the stator housing. Also install any studs (69) that were removed from the terminal board (71).

g. Position the assembled brush support assembly (661 on the stator housing (74). Connect the exciter terminal board leads. Connect the DC stator leads to the brush holder. Secure with eight nuts (67) and washers (68).

Note

The brush support assembly is temporarily positioned on the stator with alignment hole temporarily aligned.

h. Position the capacitor (4) on the bearing support; secure with three nuts (5), lock washers (6), and flat washers (7). Tighten the nuts to 17 to 20 inch-pounds torque. Connect the capacitor leads to the terminal board with nuts (1) and lock washers (2).

i. Position the terminal board (71) (lettering toward anti-drive end) on the stator housing; secure with four screws (72) and washers (73).

Note

Position the six AC leads onto the studs and temporarily snug into place with six washers each (10 and 11) and nuts (9).

j. Wipe the ID of the bearing liner lightly with grease (item 2, table 2-3). Install the ball bearing (65) in the bore of the brush support assembly. Position the bearing retainer (61) on the support assembly; secure with four screws (62) and washers (63).

Note

Use new bearings each overhaul. Always match "D" or "F" coded bearings with the same soding as drive end flange.

k. Position the baffle disk (59) on the drive end of the rotor (60). Apply a light film of grease (item 2, table 2-3) to the ball bearing seat and press the ball bearing (57) onto the rotor shaft; secure with the retaining ring (58). Position the flange (55) on the ball bearing and carefully press into place. Install the baffle disk (64) on the anti-drive end of the rotor shaft and after positioning, press the rotor assembly in the generator stator.

l. Align the holes in the machine flange with those in the generator stator and install the four screws (56). Tighten securely.

m. Position the baffle disk (64) on the end of rotor shaft. Position the permanent magnet rotor (54) on the rotor shaft.

n. Install the retaining ring (15) in the groove of the splined shaft (19). Lubricate the splines of the splined shaft with grease (item 4, table 2-3). Position the adapter spline (12) on the splined shaft; secure with a washer (14) and retaining ring (13). Install plastic insulation (1 9A) over the drive shaft.

o. Insert the splined shaft (19)' through the shaft of the rotor assembly so that the splines are properly engaged. Hold the splined end of the shaft with a wrench and install the inner portion of the two-part locknut (20) on the threaded end of the splined shaft. Tighten to 180 to 200 inch-pounds torque. Install the outer portion of the two-part locknut on the inner portion and tighten to 125 to 150 inch-pounds torque.

p. Using a dial indicator, check the runout of ,the splined end of the splined shaft (19). Three splines 120 degrees apart shall not show more than 0.010-inch total indicator reading difference. Check the runout of the collar at the end of the permanent magnet rotor (54). Runout shall not exceed 0.005-inch total indicator reading.

q. Seat the brushes as follows:

(1) Cut a strip of 4/0 to 9/0 sandpaper just slightly wider than the commutator surface with a length of 1 / 16 to Vs inch less than the circumference of the commutator. With a piece of masking tape, fasten one end of the sandpaper (the rough side facing out so that it will contact the brush) in such a manner that the taped end of the sandpaper will be in the direction of rotation. The other end of the sandpaper will be wrapped around the commutator and left loose. Properly affixed, the loose end of the sandpaper will overlap the portion of the masking tape adhering to the commutator such that when the armature is rotated the brush will ride off the loose end of the sandpaper onto the taped end of the sandpaper. Install the brushes in the brush holder (wear mark pointing toward anti- drive end); secure with screws (22) and lock washers (23).

(2) For preliminary seating of slip ring brushes, install sandpaper on slip rings in same manner as for commutator.

(3) Assemble the brushes in place against the sandpaper and carefully proceed to rotate the rotor approximately 10 turns, by hand until a partial seat is obtained on the brushes.

Note

Do not reverse armature rotation when removing sandpaper.

(4) Remove the sandpaper and blow out all carbon dust with dry, clean compressed air. Proceed with brush run-in as described in paragraph 4-6.

r. Position the end bell mounting (53), permanent magnet generator stator (52), and end bell (48) on the permanent magnet end of the generator; secure with four bolts (49), lock washers (50), and flat washers (51).

Note

Diodes must be positioned so that they are aligned with the AC terminal block (71).

s. Position the diode semiconductors (42) on the flange of the end bell (48) so that they will alternate with the diode semiconductors 140) that are assembled to the lead assembly (34). (Refer to figure 3-6.1 Dip all diode-mounting mica washers (46, figure 3-2) and plastic washers (47) in dielectric fluid (item 4, table 2-3). Drain thoroughly before installation. Secure the diodes with plastic washers (47), mica washers (46), flat washers (45), lock washers (44), and nuts (43). Figure 3-6. PM Generator Wiring Diagram.

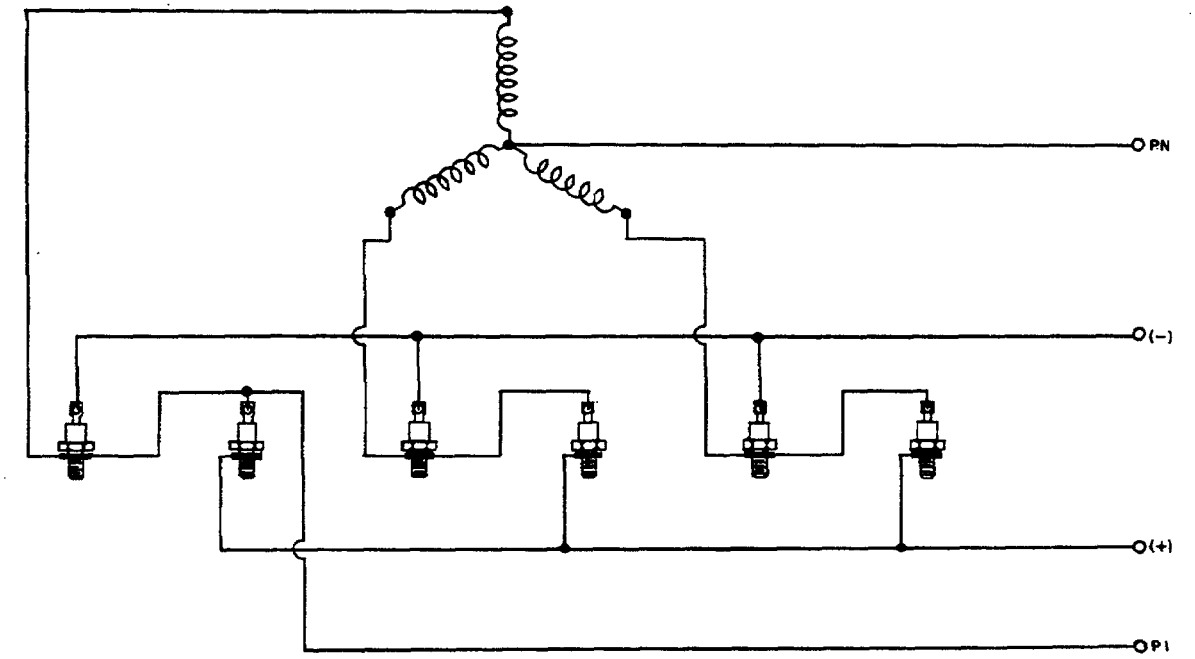

Figure 3-6. PM Generator Wiring Diagram.

t. Position the lead assembly (41) and lead assembly (34) on the end bell flange so that the diodes (40) of lead assembly (34) extend through the lug terminals of lead assembly (41). Secure the diodes to the end bell with plastic washers (39), mica washers (38), flat washers (37), lock washers (36), and nuts (35). Be sure that the nonmetallic washers are dipped in dielectric fluid (item 4, table 2-3) and are drained before assembly.

Caution

Diodes are heat sensitive. If it is necessary to solder the leads to the diodes, always use a heat dissipator between the solder joint and the diode to prevent heat damage to the diode.

u. Install the grommet (32) in the spacer ring (33). Position the terminal board (29) on the spacer ring (33) so that the (+) terminal is in alignment with terminal T4 on AC block and lettering is toward anti-drive end. Secure with two screws (30) and flat washers (31). Position the spacer ring on the bearing support.

v. Position a washer (28) on each of the studs of the terminal board and position the lug terminals (27) of the stator leads on the terminal board; secure with nuts (24), lock washers (25), and flat washers (26).

w. Position the electrical generator cover (16) on the spacer ring (33); secure the air scoop and spacer ring to the brush support assembly (66) with five screws (17) and flat washers (18).

x. Position the electrical contact cover (5) on the generator assembly; secure with five screws (6), lock washers (7), and flat washers (8).

y. If the identification data plate (1) or maintenance name plate (3) was removed, install a new plate. The plate must indicate counterclockwise rotation when viewed from the drive end.

SECTION IV

FINAL TEST PROCEDURES

4-1. TEST SETUP.

4-2. Mechanical Test Setup.

4-3. Set up the generator for testing as shown in figure 4-1. Note the following:

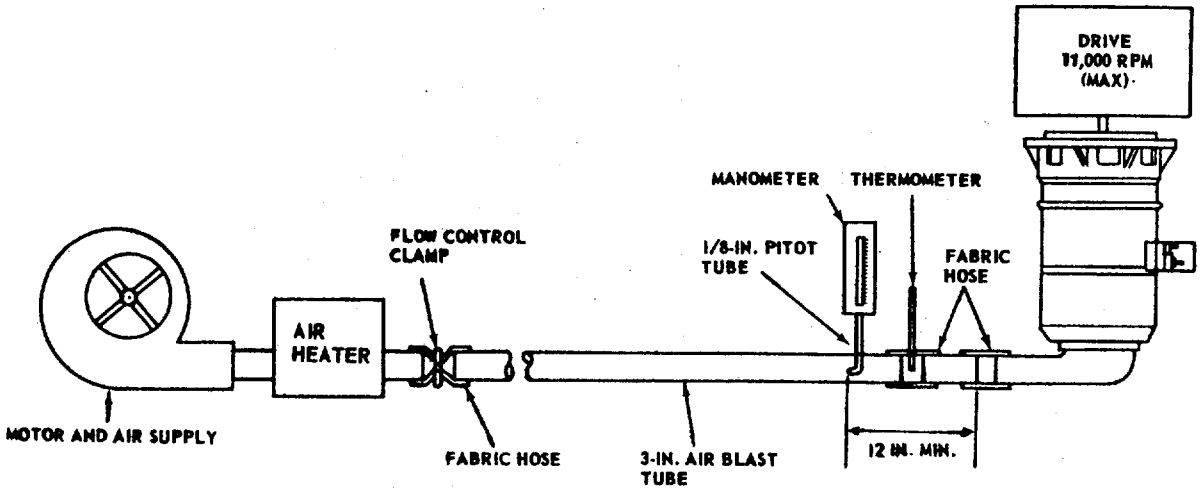

Figure 4-1. Mechanical Test Setup for Generator.

a. Air must be supplied to the generator for cooling during tests. Supply air through a thin wall tube at a pressure of 1.6 inches of water (static plus velocity head) measured 12 inches from the entrance to the radial air scoop.

b. The air inlet temperature shall be 77 °f: 27°F (25 ± 15° C).

c. The ambient temperature for the generator, regulator, and control panel shall be 77+27°F (25 ± 15° C).

d. Cooling air shall not be 90F (5° C) higher or lower than the existing ambient temperature.

4-4. Electrical Test Setup.

4-5. The electrical test setup for the generator is shown in figure 4-2. Test equipment required for generator is listed in table 2-1.

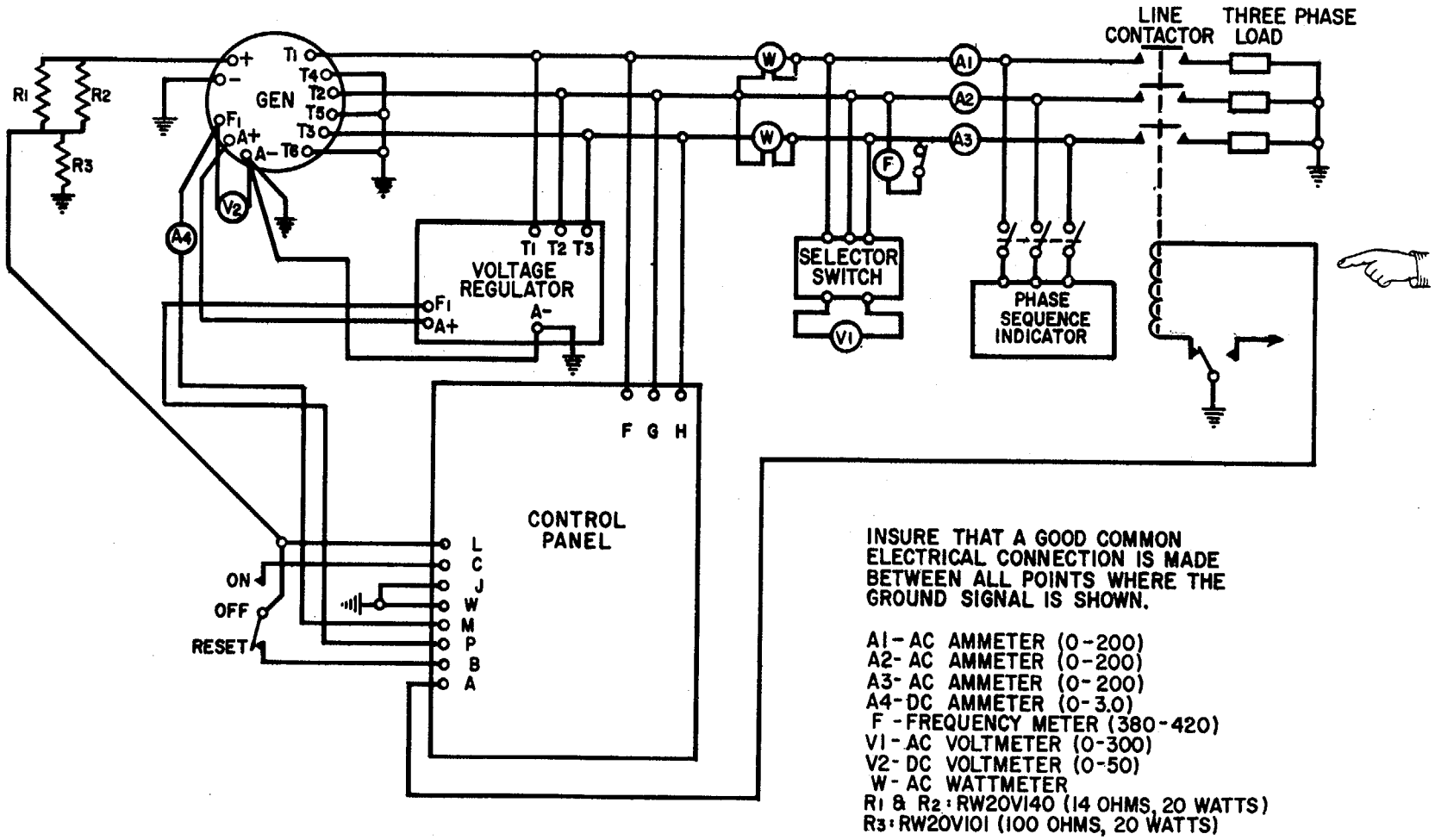

Figure 4-2. Electrical Test Setup for Generator.

4-6. BRUSH RUN-IN.

a. After new brushes have been installed and preliminary seating procedures completed (refer to paragraph 3-34), mount the generator on a suitable brush run-in stand and complete connections as indicated in figure 4-3. Insert a variable resistance (R_1) between terminals F 1 and A+; also insert a fixed resistance (R 2) of 6 ohms (400 watts) between terminals A+ and A-.

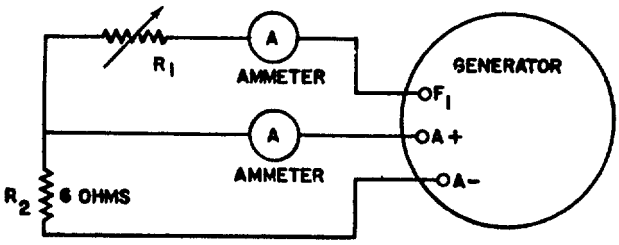

Figure 4-3. Brush Run-in Connection.

b. With the variable resistance between terminals F 1 and A+ adjusted to permit a flow of 3/4 ampere in the exciter shunt field circuit, operate generator at a speed of 6, 000 RPM. Cooling air should be provided. Continue operation until the contact surface of each brush is seated 100 percent in the direction of rotation and at least 90 percent in the axial direction.

c. Blow out all carbon dust and proceed with performance testing.

4-7. PERFORMANCE TESTS.

4-8. AC Generator Exciter Field Current Test.

a. With the generator at ambient temperature, not warmed up from operation, operate the generator at 8, 000 RPM no-load, with the cooling conditions cited in paragraph 4-3.

b. Check the exciter field current. It must be 0, 14+0.01 ampere. If it is not within this range, loosen the eight nuts (67, figure 3-1) and retightd two opposing nuts until they are just snug. Tap the brush support to rotate it slightly until the field current is in the required range. Tighten the nuts to secure the adjustment and recheck to make sure the field current adjustment has been maintained.

c. Check the output voltage across each phase. The $T_{1\text{-}T2,}$ T 2 -T3'and T3 $_{\text{-}T1}$ voltage shall be 200 1 volts. Commutation shall be black.

d. After checking to assure that output is within the required limits, the position of the brush support must be locked by drilling the stator housing and inserting a spring pin (75, figure 3-1). There are two slots machined in the lip of the bearing support that engages the stator housing. If both of these slots are aligned with or are partially aligned with a hole in the stator housing as a result of previous pinning, the brush support must be removed and a new slot will have to be machined in the lip. Refer to figure 4-4 for slot dimensions. After machining, reestablish the position of the brush support to provide the exciter field current indicated above.

e. Drill a 0.124to 0.128-inch radial hole 0.542 to 0.562 inch deep in the stator housing so that it is aligned with the slot in the lip of the brush support. Drive in the spring pin (75, figure 3-1) to lock the position of the brush support.

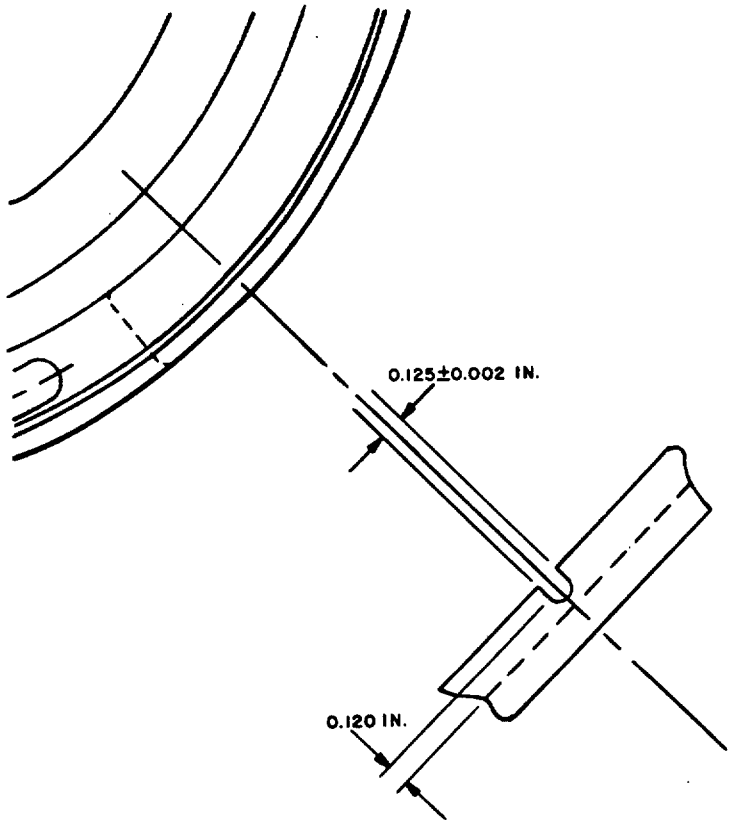

Figure 4-4. Dimensions for Brush Support Lip Slot.

4-9. PM Generator No-load AC Sensing Voltage Test.

a. Operate the generator at 8, 000 RPM no load.

b. Check the AC voltage between terminals P1 and PN. The AC output shall be 10 volts minimum.

4-10. PM Generator No-load Voltage Test.

a. Operate the generator at 8, 000 RPM at no load. Check the DC voltage output across the +and -- terminals. The no-load DC output shall be 34 volts minimum.

b. Increase the generator speed to 8, 500 RPM. The no-load DC voltage at this speed shall be 42 volts maximum.

c. Using an oscilloscope, check waveform of the PM generator output. It should be as shown in figure 4-6.

4-11. PM Generator Full-load Voltage Test.

a. Connect a resistive load of 4.0 t 0.2 ohms and a DC voltmeter and DC ammeter into a circuit with the generator + and terminals as shown in figure 4-5.

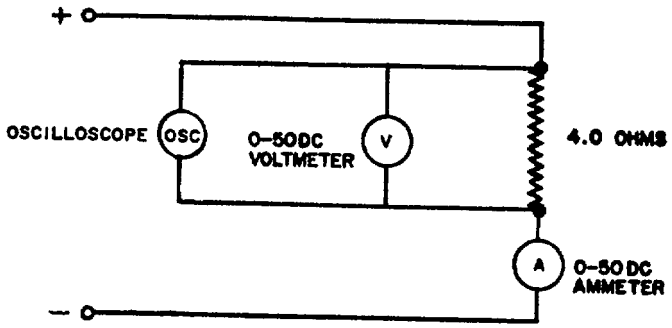

Figure 4-5. PM Generator Full-load Voltage Test.

b. Operate the generator at 7, 000 RPM for about five minutes to allow the temperature to stabilize.

c. With the generator operating at 7, 000 RPM, check the DC output voltage. It shall be 19.0 volts minimum.

d. With an oscilloscope, check the waveform of the DC output. It shall be as shown in C, figure 4-6. If a diode is defective, the waveform shall be as shown in B, figure 4-6. Locate and correct a defective diode.

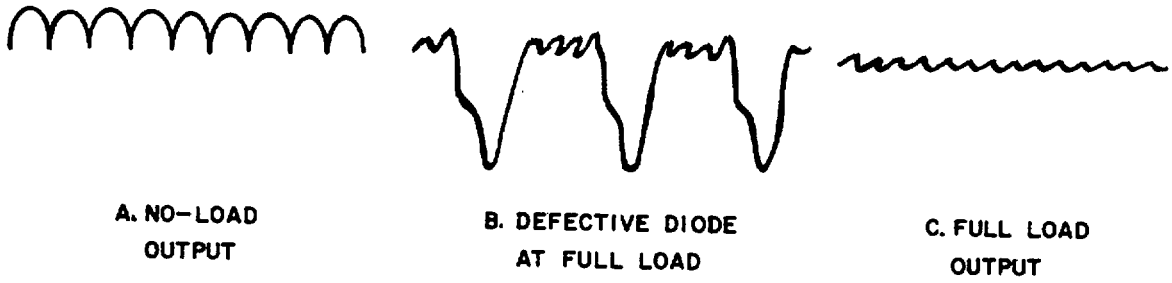

Figure 4-6. Waveforms Produced by PM Generator Output.

4-12. AC Generator Phase Rotation Test.

a. Operate the generator at 8, 000 RPM no load, driving the rotor in a counterclockwise direction, facing drive end.

b. With a phase sequence indicator connected to the generator output terminals as shown in figure 4-2, the phase rotation sequence shall be T1, T2 T3

4-13. HEATING, COMMUTATION, AND SYMMETRY OF CONSTRUCTION TEST.

a. Using a suitable clamp, attach thermocouple to generator housing. With cooling air supplied in accordance with paragraph 4-3, and with a means of determining speed within : 1 percent, operate generator at 8, 000 : 80 RPM, 208 volts, 55.5 amperes with balanced 3-phase load, and 0.75 power factor. Voltage regulator and control panel are to be connected to generator during this test as shown in figure 4-2.

b. Operate generator under these conditions until the AC stator stack temperature does not increase more than 2° F (1.1° C I in five minutes. Record line voltages and current, exciter armature voltages and field current, air inlet temperature, AC stator stack temperature and commutation. Cummutation shall be such that there is no more than pin point arcing along the edges of the brushes. AC stator stack temperature shall not exceed 3250 F (1630 C). Exciter field current shall be 0.75 ampere maximum. KVAR shall be 13.25 F0.75. KW shall be 15.0 : 0.75.

c. For symmetry of construction, determine unbalance which is defined as 100 times the

maximum deviation of the line voltage from the average of the three line voltages divided by the average of the three line voltages. Unbalance shall not exceed 1 percent. Line current shall be 55 amperes minimum, 56 amperes maximum. Line voltages shall be 208 + 3 volts.

4-14. OVERLOAD TEST.

a. Supply cooling air as described in paragraph 4-3. Provide a means of measuring speed to within ± 1 percent.

b. Operate the AC generator at 8, 000 RPM, 208 volts, 55.5 amperes, 13.25 KVA, and 15.0 KW, with the regulator connected. Operate until the AC stator stack temperature does not increase more than 20F (1.10C) in five minutes.

c. When temperature has been stabilized, increase the load to 200 percent of rated load for five seconds. Line voltage shall be 200 ± 10 volts, line amperage shall be 111 amperes maximum, KW shall be 27 minimum. KVAR shall be 23.5 minimum and 26.5 maximum.

d. Allow the generator to return to a stable temperature condition. Increase the load to 150 percent of rated load for two minutes. Make all readings during the last minute of the test. Line voltage shall be 200 =10 volts. Line amperage shall be 83+4 amperes. KW output shall be 21.5+1.0. KVAR shall be 18 minimum to 20 maximum.

4-15. PM MAGNETKNOCKDOW PROCEDURE.

a. Connect a variable power transformer and switch between terminals PNand P1 as shown in figure 4.7.

b. Operate the generator at 8, 500 rpm.

c. Apply a low-level, 60-Hertz voltage for one second. Check the (+) to (-) voltage. It shall be 42 VDC maximum or 40 VDC minimum.

d. If the (+I to (-a) voltage is excessive, repeat the knockdown procedure given in step c above using a slightly higher setting of the variable power transformer. Recheck the (+) to (-) DC voltage.

e. Repeat the procedure given in step c above if the DC voltage is not reduced to between 40 and 42 VDC.

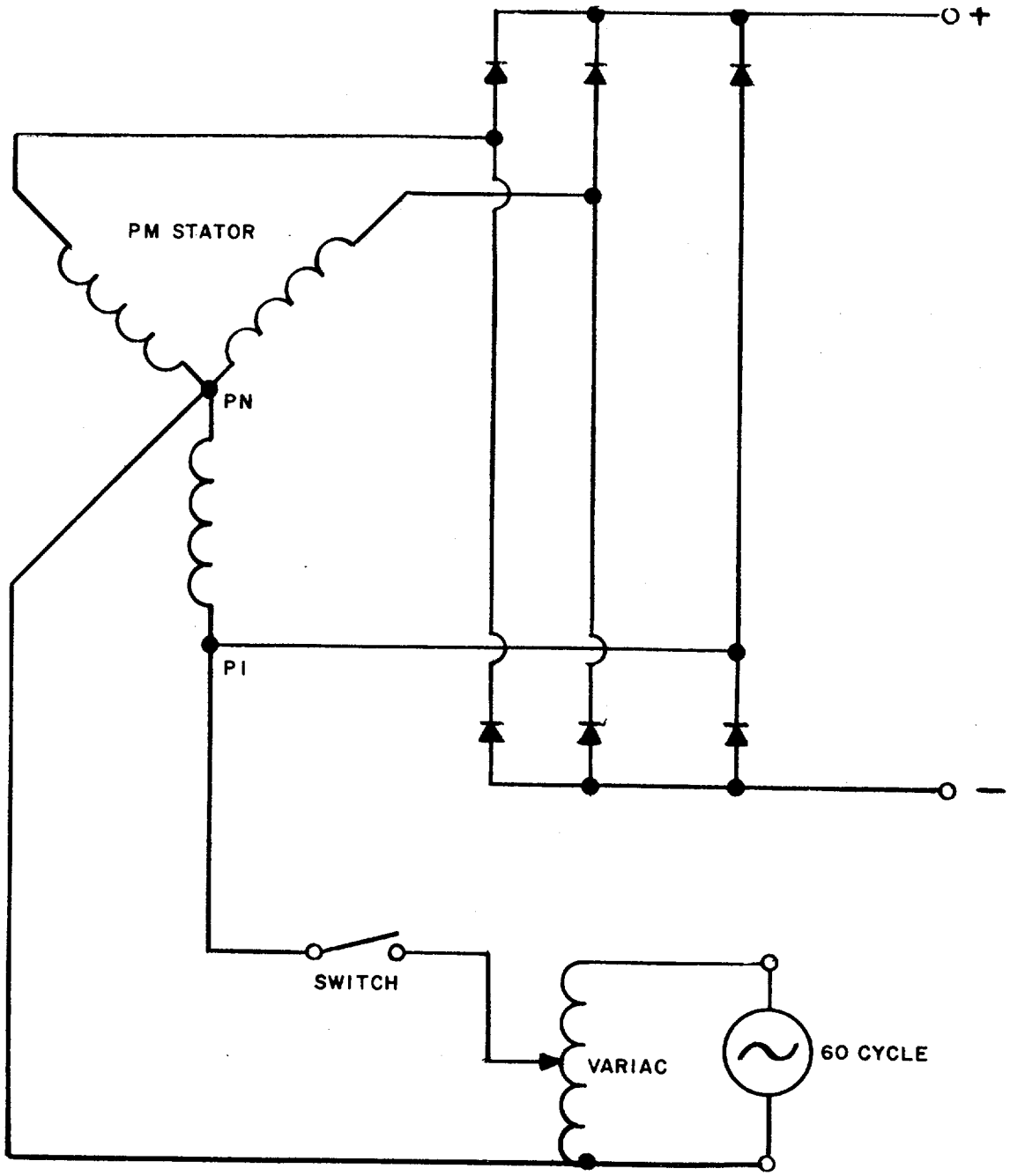

Figure 4-7. PM Generator Knockdown Circuit.

4-16. GENERATOR OVERSPEED TEST.
4-17. With the generator hot as the result of testing, operate the generator with the field circuit Iopen at a speed of 10, 000 RPM for 30 seconds. No mechanical failure shall result from this test.

4-18. DIELECTRIC STRENGTH TEST.
4-19. With the generator hot as the result of testing, apply 60-cycle AC voltages to the generator as follows to check dielectric strength:

CAUTION

Disconnect the leads of the capacitor (4, figure 3-2) from the terminal block (8) before making dielectric tests.

a. Connect the neutral terminals together and apply 700 volts (RMS) from terminal T1 to ground for one minute.

b. With no connections between output terminals, apply 700 volts (RMS) between the following sets of terminals: T1 and T2, T2 and T3, T3 and T1

c. Check the exciter circuit by applying 550 volts (RMS) from terminal F1 to ground for one minute.

d. Check the permanent magnet generator stator winding by applying 250 volts (RMS) between Terminal PMT and ground for 30 seconds.

e. There shall be no grounded circuits or shorts between circuits.

4-20. COMMUTATOR RUNOUT TEST.

4-21. Using a dial indicator, check commutator runout and bar-to-bar 'difference, by rotating the rotor assembly on its bearings. Maximum total indicated runout shall be 0.001 inch and maximum bar-to-bar difference shall be 0.0002 inch.

4-22. TROUBLESHOOTING.

4-23. If the generator fails to perform as indicated in the preceding tests, consult the troubleshooting chart, table 4-1, to help isolate the and correct the trouble.

Table 4-1. Troubleshooting (Sheet 1 of 3)

TROUBLE	PROBABLE CAUSE	REMEDY
Generator voltmeter indicates zero	Defective voltmeter	Replace the voltmeter.
	Defective selector switch	Replace the selector switch.
	Loose connections in voltmeter circuit	Tighten connections.
	Generator switch is "OFF"	Generator switch to "ON."
	Insufficient residual magnetism in exciter poles.	Operate "Reset" on control panel.
	Brushes making poor contact with commutator or slip ring	Seat and run in the brushes. Refer to paragraph 4-6.
	Short-circuited or grounded armature	Replace the rotor.
	Shorted or open exciter field winding	Replace the exciter stator.
	Broken splined shaft	Replace the shaft.
	Shorted or open field winding in AC generator	Replace the rotor.
	Shorted or open AC stator winding	Replace the complete housing and stator.

Table 4-1. Troubleshooting (Sheet 2 of 3)

TROUBLE	PROBABLE CAUSE	REMEDY
Generator fails to deliver full power to system	Line contactor open	Close the line contactor
	Shorted field winding in rotor of AC generator	Replace the rotor.
	Shorted armature in exciter rotor	Replace the rotor.
	Shorted exciter field	Replace the exciter stator.
	AC stator winding shorted	Replace the complete stator.
Excessive output voltage modulation	Poor brush contact	Seat and run in brushes. Refer to paragraph 4-6.
	Intermittent-short or open in exciter field	Replace exciter stator.
	Intermittent short in exciter armature	Replace the rotor. coils
	Intermittent short or open in field of AC generator	Replace the rotor.
	Malfunctioning voltage regulator	Replace the voltage regulator.
	Loose connections between generator and exciter field	Tighten the connections.
	Loose connection to commutator or slip ring brushes	Tighten the connection.

Table 4-1. Troubleshooting (Sheet 3 of 3)

TROUBLE	PROBABLE CAUSE	REMEDY
Excessive sparking at brushes	Exciter armature shorted	Replace rotor assembly.
	Excessive commutator bar Variation	Turn commutator on lathe.
No PM generator output	Permanent magnet rotor demagnetized	Recharge permanent magnet rotor.
	Permanent magnet stator open or shorted	Replace permanent magnet stator.
PM generator output low	One or more diodes defective	Check output with oscilloscope to ascertain diode failure. Replace defective diodes.
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SECTION V

DIFFERENCE DATA SHEETS

None required.

SECTION VI

PRESERVATION AND PACKAGING

6-1. PRESERVATION,PACKAGING, PACKING, AND MARKING REQUIREMENTS

6-2. Refer to figure 6-1 for preservation, packaging, packing, and marking data for Generator, Model 31220-002.

PRESERVATION, PACKAGING, PACKING AND MARKING REQUIREMENTS

NOMENCLATURE	STOCK NUMBER	
Generator	6115-789-1536	
	PART NUMBER	
	31220-002	

NET WEIGHT	DIMENSIONS	GROSS WEIGHT	CUBIC FEET

All specifications and standards applicable to the requirements herein shall be the issue in effect on date of invitation for bids.

PACKAGING

☒ LEVEL A ☐ LEVEL C

☒ PACKAGING SHALL BE IN ACCORDANCE WITH SPECIFICATION MIL-P-116, THE FOLLOWING DETAILED REQUIREMENTS SHALL APPLY:

UNIT PKG QTY	METHOD	PRESERVATIVE	WRAP	DUNNAGE	CONTAINER
1	IId	None	MIL-B-121 Grade A	PPP-C-1120 or MIL-P-19644	See Packing

☒ OTHER

As an alternative, generators may be mounted on a plywood plate in an inverted bend container of the MIL-D-6054 Type.

☐ PRESERVATION AND PACKAGING SHALL BE SUCH AS TO PREVENT DETERIORATION OR DAMAGE DURING HANDLING AND SHIPMENT TO THE FIRST DESTINATION

PACKING ☒ LEVEL A ☐ LEVEL C

☒ ITEMS SHALL BE PACKED IN CONTAINERS CONFORMING TO SPECIFICATION NO. MIL-D-6054.

☐ PLYWOOD USED SHALL BE STANDARD GRADE WITH EXTERIOR GLUE OF GROUP B OF NN-P-530. THIS PLYWOOD SHALL BE TREATED WITH A WATER REPELLANT CONFORMING TO TT-W-572. PLYWOOD CONTAINERS SHALL BE CONSTRUCTED WITH FILLER CLEATS ON ALL PANELS: EITHER BE BEVELED OR NOTCHED 1/4 INCH ON THE BOTTOM OF EACH END, OR SHALL BE OF SUCH LENGTH AS TO LEAVE A 1/4 INCH CHANNEL FOR DRAINAGE ON EACH END, PER PPP-B-601.

☐ ITEM SHALL BE PACKED IN A MANNER TO INSURE CARRIER ACCEPTANCE AND SAFE DELIVERY AT DESTINATION. CONTAINERS SHALL BE IN ACCORDANCE WITH UNIFORM FREIGHT CLASSIFICATION RULES OR REGULATIONS OF OTHER CARRIERS APPLICABLE TO THE MODE OF TRANSPORTATION.

☐ OTHER.

MARKING

☒ a. MARKING FOR SHIPMENTS (1968 JUN)
THE CONTRACTOR SHALL MARK ALL SHIPMENTS UNDER THIS CONTRACT IN ACCORDANCE WITH THE EDITION OF MIL-STD-129, "MARKING FOR SHIPMENT AND STORAGE," IN EFFECT AS OF THE DATE OF THIS SOLICITATION. (ASPR 7-104.68) IN ADDITION, PART NUMBER AND SERIAL NUMBER SHALL BE MARKED ON UNIT CONTAINER.

☒ b. ADDITIONAL MARKING REQUIREMENTS. EACH INTERIOR PACKAGE SHALL BE MARKED ON AT LEAST TWO (2) SIDES WITH A SILHOUETTE OF THE AIRCRAFT. (WHERE THE SIZE OF THE UNIT CONTAINER IS TOO SMALL TO PERMIT THE APPLICATION OF TWO (2) LABELS, A SINGLE LABEL SHALL BE APPLIED. IF THE PACKAGE IS TOO SMALL FOR ONE (1), NONE WILL BE REQUIRED.) WHEN THE UNIT CONTAINER IS THE SHIPPING CONTAINER AND THE ITEM IS PACKED "LEVEL A", EACH CONTAINER SHALL BE MARKED ON TWO (2) SIDES, TOP AND ONE (1) END WITH A SILHOUETTE OF THE AIRCRAFT. THE SIZE OF THE SILHOUETTE MAY VARY, BUT WILL BE LARGE ENOUGH TO FACILITATE EASY VISUAL IDENTIFICATION WITHOUT OBSCURING OTHER MARKINGS. THE CONTRACTING OFFICER WILL SUPPLY LABELS ON REQUEST. THE NOMENCLATURE OF THE MAJOR COMPONENTS SHALL BE EXTENDED TO INDICATE THE END ITEM APPLICATION AND THE POSITION OF THE PART; e.g., GEAR BOX, MAIN FOR (APPLICABLE AIRCRAFT); WING ASSEMBLY, RIGHT, FOR (APPLICABLE AIRCRAFT).

☒ c. MATERIEL CONDITION MARKING SHALL BE APPLIED IN ACCORDANCE WITH PARAGRAPH 5.5.17 OF MIL-STD-129. A MATERIEL CONDITION TAG OF THE APPLICABLE TYPE WILL BE SECURELY ATTACHED DIRECTLY TO ALL UNINSTALLED OR STORED AERONAUTICAL OR AIR DELIVERY ITEMS. WHEN SUCH ITEMS ARE PLACED OR STORED IN CARTONS, PACKAGES, CRATES OR METAL SHIPPING CONTAINERS, A DUPLICATE MATERIEL CONDITION TAG OR LABEL WILL BE SECURELY ATTACHED TO THE EXTERIOR OF THE PACKAGE OR CONTAINER IN SUCH A MANNER THAT WILL AFFORD MAXIMUM PROTECTION FROM HANDLING AND WEATHER. TAGS WILL BE COMPLETED EITHER BY TYPEWRITTEN OR PRINTED BLACK LEAD PENCIL ENTRIES. ITEMS OF A COMMON OR NONTECHNICAL NATURE (i.e., COMMON HARDWARE, BULK MATERIALS, ETC.) THE SERVICEABILITY OF WHICH IS OBVIOUS, AND THE IDENTITY AND INSPECTION REQUIREMENTS ADEQUATELY INDICATED BY COMMERCIAL TAGS, LABELS OR MARKINGS, MAY BE RECEIVED, STORED, ISSUED OR SHIPPED WITHOUT MATERIEL CONDITION TAGS.

APPROVED BY	ORGANIZATION	DATE
E. LOWMAN	AMSAV-R-MK	7 April 1970

Figure 6-1. Preservation, Packing and Marking Requirements.

APPENDIX A

REFERENCES

The Army Maintenance Management System

APPENDIX B

REPAIR PARTS AND SPECIAL TOOLS LIST

(Current as of 1 Sept 70)
Section I. INTRODUCTION

B-1. SCOPE.

This appendix lists repair parts, special tools, test and support equipment, and maintenance supplies required for the performance of general support maintenance of the Generator, Model 31220-002, manufactured by Lear Siegler Inc., Power Equipment Division, Cleveland, Ohio.

B-2. GENERAL

The Repair Parts and Special Tools List is divided into the following sections:

a. Repair Parts - Section II. A list of repair parts authorized for the performance of maintenance at the general support level in figure and item number sequence. Maintenance supplies (MSUP) are listed within the section in ascending Federal stock number sequence.

b. Special Tools, Test and Support Equipment - Section III. A list of special tools, test and support equipment authorized for the performance of maintenance at the general support level in figure and item number sequence.

c. Federal Stock Number and Reference Number Index - Section IV. This section is divided as follows:

(1) A list of Federal stock numbers in ascending numerical sequence cross-referenced to the illustration figure number and item number.

(2) A list of reference numbers in ascending alpha-numerical sequence cross referenced to the manufacturers Federal supply code, illustration figure number, and item number.

B-3. EXPLANATION OF COLUMNS.

The following provides an explanation of columns in the tabular lists in Sections II and III:

a. Source, Maintenance and Recoverability Codes (SMR), Column 1.

(1) *Source code*. Indicates the selection status and source for the listed item. Source codes are:

CODE	EXPLANATION
P	Repair Parts, Special Tools and Test Equipment supplied from the GSA/DSA, or Army supply system, and authorized for use at indicated maintenance categories.
P2	Repair Parts, Special Tools and Test Equipment which are procured and stocked for insurance purposes because the combat or military essentiality of the end item dictates that a minimum quantity be available in the supply system.
P9	Assigned to items which are NSA design controlled: unique repair parts, special tools, test, measuring and diagnostic equipment, which are stocked and supplied by the Army COMSEC Logistic System and which are not subject to the provisions of AR 380-41.
P10	Assigned to items which are NSA design controlled: special tools, test, measuring and diagnostic equipment for COMSEC support, which are accountable under the provisions of AR 380-41, and which are stocked and supplied by the Army COMSEC Logistic System.
M	Repair Parts, Special Tools and Test Equipment which are not procured or stocked, as such, in the supply system but are to be manufactured at indicated maintenance levels. A Assemblies which are not procured or stocked as such, but are made up of two or more units. Such component units carry individual stock numbers and descriptions, are procured and stocked separately, and can be assembled to form the required assembly at indicated maintenance categories.
X	Parts and assemblies that are riot procured or stocked because the failure rate is normally below that of the applicable end item of component. The failure of such part or assembly should result in retirement of the end item from the supply system.

CODE	EXPLANATION
X1	Repair Parts which are not procured or stocked. The requirement for such items will be filled by. the next higher assembly or component.
X2	Repair Parts, Special Tools, and Test Equipment which are not stocked and have no foreseen mortality. The indicated maintenance category requiring such repair parts will attempt to obtain the parts through cannibalization or salvage, the item may be requisitioned with exception data, from the end item manager, for immediate use.
G	Major assemblies that are procured with PEMA funds for initial issue only as exchange assemblies at DSU and GSU level. These assemblies will not be stocked above the DS and GS level or returned to depot supply level.

NOTE: Cannibalization or salvage may be used as a source of supply for any items source coded above except those coded X1 and aircraft support items as restricted by AR 700-42.

(2) *Maintenance code*. Indicates the lowest category of maintenance authorized to install the listed item. The maintenance level codes are:

CODE	EXPLANATION
C	Crew or operator maintenance
O	Organizational maintenance
F	Direct support maintenance
H	General support maintenance

(3) Recover ability code. Indicates whether unserviceable items should be returned for recovery or salvage. Items not coded are expendable. Recoverability codes are:

CODE	EXPLANATION
R	Applied to repair parts, (assemblies and components), special tools and test equipment which are considered economically reparable at direct and general support maintenance levels. When the item is no longer economically reparable, it is normally disposed of at the GS level. When supply considerations dictate, some of these repair parts may be listed for automatic return to supply for depot level repair as set forth in AR 710-50. When so listed, they will be replaced by supply on an exchange basis.
S	Repair Parts, Special Tools, Test Equipment and assemblies which are economically reparable at DSU and GSU activities and which normally are furnished by supply on an exchange basis. When items are determined by a GSU to be uneconomically reparable, they will be evacuated to a depot for evaluation and analysis before final disposition.
T	Higher dollar value recoverable repair parts, special tools and test equipment which are subject to special handling and are issued on an exchange basis. Such items will be repaired or overhauled at depot maintenance activities only. No repair may be accomplished at lower levels.
U	Repair Parts, Special Tools and Test Equipment specifically selected for salvage by reclamation units because of precious metal content, critical materiels, high dollar value or reusable casings or castings.

b. Federal Stock Number, Column 2. Indicates the Federal stock number assigned to the item and will be used for requisitioning purposes. Items source coded A, M, or X1 are not assigned a Federal stock number.

c. Description, Column 3. Indicates the Federal item name and any additional description of the item required. An explanation of notes and / or codes used in this column appear at the end of the figure(s) breakdown. The description column contains the following subcolumns.

(1) *Reference number and manufacturer's code*. Indicates a part number or other reference number for the listed item followed by the applicable five-digit Federal supply code for manufacturer in parentheses.

(2) *Usable on code*. Indicates an alpha coding to reflect the application of the listed item to the specific manufacturer's model designation. No entries in this column indicates the item listed applies to all models. Refer to paragraph B-4 for identification of the usable on codes (not applicable).

d. Unit of Measure (U/M), Column 4. A 2 character alphabetic abbreviation indicating the amount or quantity of the item upon which the allowances are based, e.g., FT, EA, PR, etc.

e. Quantity Incorporated in Unit, Column 5. Indicates the quantity of the item used in the assembly. A "V" appearing in this column in lieu of a quantity indicates that a definite quantity cannot be indicated.

f. Thirty-day GS Maintenance Allowance, Column 6.

(1) The allowance column is divided into three subcolumns. Indicated in each subcolumn, opposite the first appearance of each item, is the total quantity of items authorized for the number of equipments supported. Subsequent appearances of the same item will have the letters "REF" in this column. Items authorized for use as required, but not for initial stockage, are identified with an asterisk (*) in the allowance column.

(2) The quantitative allowance for GS level of maintenance will represent initial stockage for a 30-day period for the number of equipments supported.

(3) Determination of the total quantity of parts required for maintenance of more than 100 of these equipments can be accomplished by converting the equipment quantity to a decimal factor by placing a decimal point before the next to last digit of the number to indicate hundredths, and multiplying the decimal factor by the parts quantity authorized allowance for 51-100 allowance column. Example: authorized allowance for 51-100 equipments is 40; for 150 equipments, multiply 40 by 1.50, or 60 parts required.

(4) The basis of issue for authorized special tools, test and support equipment is the number of end items of equipment supported.

g. One-year Allowance per 100 Equipments/ Contingency Planning Purposes, Column 7. Indicates opposite the first appearance of each item, the total quantity required for distribution and contingency planning purposes. The range of items indicates total quantities of all authorized items required to provide for adequate support of 100 equipments for one year.

h. Depot Maintenance Allowance per 100 Equipments, Column 8. (Not applicable)

i. Illustration, Column 9. Illustrations appear in the narrative portion of this manual and / or in Section III for special tools, test and support equipment. This column is divided as follows:

(1) *Figure number, column 9a*. Indicates the figure number of the illustration in which the item is shown. Appearances of the letters "MSUP" in this column indicate maintenance supplies located in Section II: the letters "TOOL" indicate special tools located in Section III.

(2) *Item number, column 9b*. Indicates the call-out number to reference the item in the illustration.

B-4. SPECIAL INFORMATION.

a. Oversize and undersize parts, such as studs, bushings, etc., are listed following the standard size part and in the same indent. The degree of oversize or undersize is stated in the description.

b. Attaching parts are listed following the part(s) they attach and in the same indent. They are separated from the part(s) by the words "attaching parts" in the description column. When they attach an assembly which is broken down to show detail parts the attaching parts are separated from the details of the assembly by the symbol "--*--". Details of the assembly are then indented one space to the right of their next higher assembly, which appears above the attaching parts.

c. Identification of the usable on codes included in column 3 of Sections II and III are:

CODE	*USED ON*
BLANK	ALL MODELS

d. Parts which require manufacture or assembly at a category higher than that authorized for installation will indicate in the source code column the higher category

e. (Applicable to revision and / or change only). Action codes indicated in the left hand margin of the listing page denote the following:

N--Indicates an added item not included in previous publication.
C--Indicates a change in data.
F--Indicates a change in FSN only.

B-5. HOW TO LOCATE REPAIR PARTS.

a. When Federal stock number or reference number is unknown:

(1) *First*. Find the exploded view illustration of the assembly or subassembly to which the repair part belongs.

(2) *Second*. Identify the repair part on the illustration and note the illustration figure and item number of the repair part.

(3) *Third*. Using the Repair Part Listing, find the figure and item number listed in the illustration column.

b. When Federal stock number or reference number is known:

(1) *First*. Using the index of Federal stock numbers and reference numbers, find the pertinent Federal stock number or reference number. This index is in ascending FSN sequence followed by a list of reference numbers in ascending alpha-numeric sequence, cross-referenced to the illustration figure number and item number.

(2) *Second*. Using the Repair Part Listing, find the figure and item number listed in the illustration column referenced in the index of Federal stock numbers and reference numbers.

B-6. ABBREVIATIONS.

ABBREVIATION	*EXPLANATION*
EA	each
PM	permanent magnet

B-7. FEDERAL SUPPLY CODES FOR MANUFACTURERS.

Code	*Manufacturer*
06840	The Bendix Corp. Detroit, Michigan
31435	Lear Siegler, Inc. Power Equipment Division P.O. Box 6719 Cleveland, Ohio 44101
80756	Ramsey Corp. Manchester and Weidman St. Louis, Mo.
81348	Federal Specifications Promulgated by General Services Administration
81349	Military Specifications Promulgated by Standardization Division Directorate of Logistic Services, DSA
88044	Aeronautical Standards Group Department of Navy and Air Force
96906	Military Standards Promulgated by Standardization Division Directorate of Logistic Services, DSA

(1) SMR Code	(2) Federal stock number	Reference number & MFR code	(3) Description / Usable on code	(4) Unit of meas	(5) Qty inc in unit	(6) 30-day GS maint allowance (a) 1-20	(b) 21-50	(c) 51-100	(7) 1-yr alw per 100 equip entgey	(8) Depot maint alw per 100 equip	(9) Illustration (a) Fig. No.	(b) Item No.
	6115-789-1536	31220-002 (31435)	GENERATOR, ALTERNATING CURRENT	EA							3-1	
			SECTION II REPAIR PARTS: GENERATOR									
P_H_	6115-316-2564	06-119645 (31435)	PLATE, IDENTIFICATIONDATA ATTACHING PARTS	EA	1	*	*	*			3-1	1
P_H_	5305-253-5609	MS21318-13 (96906)	SCREW, DRIVE ---*---	EA	4	*	*	*			3-1	2
P_H_	6115-969-1377	JH16232 (31435)	PLATE, MAINTENANCE NAME ATTACHING PARTS	EA	1	*	*	*			3-1	3
P_H_	5305-253-5609	MS21318-13 (96906)	SCREW, DRIVE ---*---	EA	4	*	*	*			3-1	4
P_F_	6115-719-5104	31220-1018 (314.5)	COVER, ELECTRICAL CONTACT ATTACHING PARTS	EA	1	*	*	*			3-1	5
P_F_	5305-145-6Q71	AN503-8-6 (88044)	SCREW, MACHINE RPLS--PN AN500A8-6	EA	5	*	*	*			3-1	6
P_F_	5310-045-3299	MS35338-42 (96906)	WASHER, LOCK RPLS-PN AN935-8L	EA	5	*	*	*			3-1	7
P_F_	5310-515-8058	AN960-8 (88044)	WASHER, FLAT RPLS--PR 05370041 ---*---	EA	5	*	*	*			3-1	8
P_H_	5310-720-8811	MS20341-516A (96906)	NUT, PLAIN, HEXAGON RPLS--PN AN341-516	EA	6	*	*	*			3-1	9
P_H_	5310-407-9566	MS35338-45 (96906)	WASHER, LOCK RPLS--PN AN935-516L	EA	6	*	*	*			3-1	10
P_H_	5310-167-0836	AN960-516L (88044)	WASHER, FLAT	EA	6	*	*	*			3-11	11
P_O_	6115-774-5455	31220-1023 (31435)	ADAPTER, DRIVE ATTACHING PARTS	EA	1	*	*	*			3-1	12

(1) SMR Code	(2) Federal stock number	Reference number & MFR code	(3) Description / Usable on code	(4) Unit of meas	(5) Qty inc in unit	(6) 30-day GS maint allowance (a) 1-20	(b) 21-50	(c) 51-100	(7) 1-yr alw per 100 equip entgey	(8) Depot maint alw per 100 equip	(9) Illustration (a) Fig. No.	(b) Item No.
P_O_	5340-062-4074	MS16624-3027 (96906)	RING, RETAINING	EA	1	*	*	*			3-1	13
P_O_	5310-025-7729	05-370035 (31435)	WASHER, FLAT	EA	1	*	*	*			3-1	14
P_O_	5340-680-3385	RST50 (80756)	RING, RETAINING	EA	1	*	*	*			3-1	15
			---*---									
P_H_	6115-635-3135	MS25160-1 (96906)	COVER, ELECTRICAL GENERATOR	EA	1	*	*	*			3-1	16
			ATTACHING PARTS									
P_H_	5305-720-7862	MS35265-71 (96906)	SCREW, MACHINE	EA	5	*	*	*			3-1	17
			RPLS-PN AN500A10-32									
P_H_	5310-167-0834	AN960-10L (88044)	WASHER, FLAT	EA	5	*	*	*			3-1	18
P_O_	6115-969-1395	31220-1053 (31435)	SHAFT, SPLINED	EA	1	*	*	*			3-1	19
			ATTACHING PARTS									
M_O_		13-047200	SLEEVING, INSULATION		1						3-1	19A
P_O_	6115-315-0602	05-322503 (31435)	LOCKNUT-TWO-PIECE	EA	1	*	*	*			3-1	20
P_F_	5977-969-1391	31220-1027 (31435)	BRUSH, ELECTRICAL CONTACT	EA	8	*	*	*			3-1	21
			ATTACHING PARTS									
P_F_	5305-543-2394	MS35265-27 (96906)	SCREW,MACHINE	EA	8	*	*	*			3-1	22
			RPLS-PN 05-349601									
P_F_	5310-0454007	MS35338-41 (96906)	WASHER, LOCK	EA	8	*	*	*			3-1	23
			RPLS-PN AN935-6									
P_H_	5310-905-8434	MS21C83B3 (96906)	NUT, SELF-LOCKING, HEXAGON	EA	4	*	*	*			3-1	24
			RPLS-PN MS20341-10A									
P_H_	5310-045-3296	MS35338-43 (96906)	WASHER, LOCK	EA	4	*	*	*			3-1	25
			RPLS-PN AN935-10L									
P_H_	5310-167-0834	AN960-100L (88044)	WASHER, FLAT	EA	4	*	*	*			3-1	26

(1) SMR Code	(2) Federal stock number	Reference number & MFR code	(3) Description / Usable on code	(4) Unit of meas	(5) Qty inc in unit	(6) 30-day GS maint allowance (a) 1-20	(6) (b) 21-50	(6) (c) 51-100	(7) 1-yr alw per 100 equip entgey	(8) Depot maint alw per 100 equip	(9) Illustration (a) Fig. No.	(9) (b) Item No.
P_H_	6115-316-0809	05-652014 (31435)	LUG, TERMINAL	EA	4	*	*	*			3-1	27
P_H_	5310-167-0834	AN960-10L (88044)	WASHER, FLAT	EA	4	*	*	*			3-1	28
P_H_	6115-315-0449	31220-1078 (31435)	BOARD, TERMINAL	EA	1	*	*	*			3-1	29
			ATTACHING PARTS									
P_H_	5305-579.4576	MS35265-65 (96906)	SCREW, MACHINE	EA	2	*	*	*			3-1	30
			RPLS-PN AN500A10-12									
P_H_	5310-167-0834	AN960-10L (88044)	WASHER, FLAT	EA	2	*	*	*			3-1	31
			---*---									
P_H_	6115-315-3110	05-437001 (31435)	GROMMET, RUBBER	EA	1	*	*	*			3-1	32
P_H_	6115-330-5326	31220-1066 (31435)	RING, SPACER	EA	1	*	*	*			3-1	33
P_H_	6115-759-1337	31220-1076 (31435)	LEAD ASSEMBLY	EA	1	*	*	*			3-1	34
			ATTACHING PARTS									
P_H_	5310-905-8434	MS21083B3 (96906)	NUT, SELF-LOCKING, HEXAGON	EA	3	*	*	*			3-1	35
			RPLS-PN MS20341-10A									
P_H_	5310-045-3296	MS35338-43 (96906)	WASHER, LOCK	EA	3	*	*	*			3-1	36
			RPLS--PN AN935-10L									
P_H_	6115-316-0410	05-370162 (314351	WASHER, FLAT	EA	6	*	*	*			3-1	37
P_H_	5970-807-1992	05-374059 (31435)	INSULATOR, WASHER	EA	6	*	*	*			3-1	38
P_H_	5330-807-0698	05-374058 (31435)	WASHER, NONMETALLIC	EA	3	*	*	*			3-1	39
P_H_	5961-856-0084	05-900403 (31435)	SEMICONDUCTOR DEVICE, DIODE	EA	3	*	*	*			3-1	40
P_H_	6115-759-1303	31220-1075 (31435)	LEAD ASSEMBLY	EA	1	*	*	*			3-1	41
P_H_	5961-856-0084	05-900403 (31435)	SEMICONDUCTOR DEVICE, DIODE.	EA	3	*	*	*			3-1	42
			ATTACHING PART									
P_H_	5310-905-8434	MS21083B3 (96906)	NUT, SELF-LOCKING, HEXAGON	EA	3	*	*	*			3-1	43
			RPLS-PN MS20341-10A									

(1) SMR Code	(2) Federal stock number	Reference number & MFR code	(3) Description / Usable on code	(4) Unit of meas	(5) Qty inc in unit	(6) 30-day GS maint allowance (a) 1-20	(6) (b) 21-50	(6) (c) 51-100	(7) 1-yr alw per 100 equip entgey	(8) Depot maint alw per 100 equip	(9) Illustration (a) Fig. No.	(9) (b) Item No.
P_H_	5310-045-3296	MS35338-43 (96906)	WASHER, LOCK RPLS-PN AN935-10L	EA	3	*	*	*			3-1	44
P_H_	6115-316-0410	05-370162 (31435)	WASHER, FLAT	EA	3	*	*	*			3-1	45
P_H_	5970-807-1992	05-374059 (31435)	INSULATOR, WASHER	EA	6	*	*	*			3-1	46
P_H_	5330-807-0698	05-374058 (31435)	WASHER, NONMETALLIC ---*---	EA	3	*	*	*			3-1	47
P_H_	6115-330-2793	31220-1064 (31435)	END BELL ATTACHING PARTS	EA	I	*	*	*			3-1	48
P_H_	6115-330-5348	31220-1072 (31435)	BOLT-SPECIAL	EA	4	*	*	*			3-1	49
P_H_	5310-045-3296	MS35338-43 (96906)	WASHER, LOCK RPLS-PN AN935-10L	EA	4	*	*				3-1	50
P_H_	5310-167-0834	AN960-1OL (88044)	WASHER, FLAT ---*---	EA	4	*	*	*			3-1	51
P_H_	6115-330-5342	31220-1068 (31435)	STATOR	EA	1	*	*	*			3-1	52
P_H_	6115-330-5321	31220-1065 (31435)	MOUNTING, END BELL	EA	1	*	*	*			3-1	53
P_H_	6115-472-7324	31220-1062 (31435)	ROTOR	EA	1	*	*	*			3-1	54
P_H_	6115-771-9542	31220-1001 (31435)	FLANGE, GENERATOR ATTACHING PARTS	EA	1	*	*	*			3-1	55
P_H_	5305-900-0560	MS24693C71 (96906)	SCREW, MACHINE	EA	4	*	*	*			3-1	56
P_H_	3110-115-0756	07-111438F (31435)	BEARING, BALL, ANNULAR	EA	1	*	*	*			3-1	57
P_H_	3110-937-0276	07-111438D (31435)	BEARING, BALL, ANNULAR ATTACHING PARTS	EA	1	*	*	*			3-1	57
P_H_	5340-200-8514	RS118 (80756)	RING, RETAINING ---*---	EA	1	*	*	*			3-1	58
P_H_	6115-969-1401	31220-1054 (31435)	DISK, BAFFLE	EA	1	*	*	*			3-1	59
P_H_	6115-969-1393	31220-1050 (31435)	ROTOR ASSEMBLY	EA	1	*	*	*			3-1	60

(1) SMR Code	(2) Federal stock number	Reference number & MFR code	(3) Description / Usable on code	(4) Unit of meas	(5) Qty inc in unit	(6) 30-day GS maint allowance (a) 1-20	(6) (b) 21-50	(6) (c) 51-100	(7) 1-yr alw per 100 equip entgey	(8) Depot maint alw per 100 equip	(9) Illustration (a) Fig. No.	(9) (b) Item No.
P_H_	6115-330-1345	31220-1055 (31435)	RETAINER, BEARING	EA	1	*	*	*			3-1	61
			ATTACHING PARTS									
P_H_	5305-939-9189	MS35275-264 (96906)	SCREW, MACHINE	EA	4	*	*	*			3-1	62
P_H_	5310-045-3296	MS35338-43 (96906)	WASHER, LOCK	EA	4	*	*	*			3-1	63
			RPLS-PN AN935-10L									
			---*---									
P_H_	6115-969-1401	31220-1054 (31435)	DISK, BAFFLE	EA	2	*	*	*			3-1	64
P_H_	3110-115-0756	07-111438F (31435)	BEARING, BALL, ANNULAR	EA	1	*	*	*			3-1	65
P_H_	3110-937-0276	07-111438D (31435)	BEARING, BALL, ANNULAR	EA	1	*	REF	REF			3-1	65
P_H_	6115-316-8793	31220-303 (31435)	SUPPORT ASSEMBLY	EA	1	*	*	*			3-1	66
			ATTACHING PARTS									
P_H_	5310-061-7326	MS21045-3 (96906)	NUT, SELF-LOCKING, HEXAGON	EA	8	*	*	*			3-1	67
P_H_	5310-167-0818	AN960-10 (88044)	WASHER, FLAT	EA	8	*	*	*			3-1	68
			---*---									
P_H_	6115-316-5226	31220-1070 (31435)	STATOR	EA	1	*	*	*			3-1	
P_H_	5307-953-0253	05-360062 (31435)	STUD	EA	6	*	*	*			3-1	69
P_H_	5307-576-1151	05-360011 (31435)	STUD, PLAIN	EA	8	*	*	*			3-1	70
P_H_	6115-831-4415	31220-1046 (31435)	BOARD, TERMINAL	EA	1	*	*	*			3-1	71
			ATTACHING PARTS									
P_H_	5305-156-2721	MS35266-67 (96906)	SCREW, MACHING	EA	4	*	*	*			3-1	72
			RPLS-PN AN501A10-16									
P_H_	5310-530-4114	P24532 (06840)	WASHER, FLAT	EA	4	*	*	*			3-1	73
			RPLS--PN 05-370001									
			---*---									
P_H_	5315-058-9747	MS16562-222 (96906)	PIN, SPRING	EA	1	*	*	*			3-1	75
			RPLS--PN MS171527									
P_H_	6115-316-8793	31220-303 (31435)	SUPPORT ASSEMBLY	EA	1	*	*	*			3-2	

(1) SMR Code	(2) Federal stock number	Reference number & MFR code	(3) Description / Usable on code	(4) Unit of meas	(5) Qty inc in unit	(6) 30-day GS maint allowance (a) 1-20	(6) (b) 21-50	(6) (c) 51-100	(7) 1-yr alw per 100 equip entgey	(8) Depot maint alw per 100 equip	(9) Illustration (a) Fig. No.	(9) (b) Item No.
P_H_	5310-167-1343	AN315-3R (88044)	NUT, PLAIN, HEXAGON	EA	3	*	*	*			3-2	1
P_H_	5310-045-3296	MS35338-43 (96906)	WASHER, LOCK RPLS-PN AN935-10L	EA	3	*	*	*			3-2	2
P_H_	5310-167-0834	AN960-10L (88044)	WASHER, FLAT ATTACHING PARTS	EA	3	*	*	*			3-2	3
P_H_	5310-934-9757	MS35649-282 (96906)	NUT, PLAIN, HEXAGON RPLS-PN AN340-8	EA	2	*	*	*			3-2	5
P_H_	5310-045-3299	MS35338-42 (96906)	WASHER, LOCK RPLS--PN AN935-8L	EA	2	*	*	*			3-2	6
P_H_	5310-167-0833	AN960-8L (88044)	WASHER, FLAT ---*---	EA	2	*	*	*			3-2	7
P_H_	6115-811-2271	31008-1029 (31435)	TERMINALBOARD ATTACHING PARTS	EA	1	*	*	*			3-2	8
P_H_	5310-167-1343	AN315-3R (88044)	NUT, PLAIN, HEXAGON	EA	3	*	*	*			3-2	9
P_H_	5310-864-1607	05-370108 (31435)	WASHER	EA	3	*	*	*			3-2	10
P_H_	5306-800-6207	31008-1044 (31435)	BOLT, MACHINE	EA	3	*	*	*			3-2	11
P_H_	5310-530-4114	P24532 (06840)	WASHER, FLAT RPLS-PN 05-370001	EA	3	*	*	*			3-2	12
P_H_	6115-969-1383	31008-1038 (31435)	BUSHING	EA	3	*	*	*			3-2	13
P_H_	6115-969-1379	05-435054 (31435)	SLEEVE ---*---	EA	3	*	*	*			3-2	14
P_H_	6115-729-6666	31008-1172 (31435)	GASKET	EA	1	*	*	*			3-2	15
P_H_	5970-719-5106	31008-1154 (31435)	INSULATOR, STANDOFF	EA	1	*	*	*			3-2	16
P_H_	6115-969-2399	31008-1162 (31435)	LEAD	EA	1	*	*	*			3-2	17
P_H_	6115-969-2380	31008-1163 (31435)	LEAD	EA	1	*	*	*			3-2	18

(1) SMR Code	(2) Federal stock number	Reference number & MFR code		(3) Description / Usable on code	(4) Unit of meas	(5) Qty inc in unit	(6) 30-day GS maint allowance (a) 1-20	(b) 21-50	(c) 51-100	(7) 1-yr alw per 100 equip entgey	(8) Depot maint alw per 100 equip	(9) Illustration (a) Fig. No.	(b) Item No.
P_H_	6115-959-8769	31008-1164	(31435)	LEAD	EA	2	*	*	*			3-2	19
P_H_	6115-316-3438	31008-1093	(31435)	JUMPER	EA	1	*	*	*			3-2	20
				ATTACHING PARTS									
P_H_	5305-145-7011	AN503-8-8	(88044)	SCREW, MACHINE	EA	6	*	*	*			3-2	21
				RPLS-PN 05-349694									
P_H_	5310-934-9757	MS35649-282	(96906)	NUT, PLAIN, HEXAGON	EA	6	*	*	*			3-2	22
				RPLS-PN AN340-8									
P_H_	5310-045-3299	MS35338-42	(96906)	WASHER, LOCK	EA	6	*	*	*			3-2	23
				RPLS-PN AN935-8L									
P_H_	5310-167-0833	AN960-8L	(88044)	WASHER, FLAT	EA	6	*	*	*			3-2	24
P_H_	5977-589-4464	31008-1218	(31435)	HOLDER, BRUSH	EA	2	*	*	*			3-2	25
				ATTACHING PARTS									
P_H_	5305-637-9428	05-140060	(31435)	SCREW, CAP, HEXAGON HEAD	EA	4	*	*	*			3-2	26
P_H_	5310-045-3296	MS35338-43	(96906)	WASHER, LOCK	EA	4	*	*	*			3-2	27
				RPLS-PN AN935-10L									
P_H_	6115-330-1342	31008-1256	(31435)	PLATE	EA	2	*	*	*			3-2	28
P_H_	6115-316-2919	31008-1082	(31435)	INSULATION	EA	2	*	*	*			3-2	29
P_H_	5970-797-4186	05-631098	(31435)	INSULATOR, BUSHING	EA	4	*	*	*			3-2	30
P_H_	6115-475-2590	31008-1219	(31435)	INSULATION	EA	2	2	4	86			3-2	3
				---*---									
P_H_	6115-475-2591	31008-306	(31435)	BOXASSEMBLY	EA	2	*	*	*			3-2	
				ATTACHING PARTS									
P_H_	5305-637-9428	05-140060	(31435)	SCREW, CAP, HEXAGON HEAD	EA	4	*	*	*			3-2	32
P_H_	5310-045-3296	MS35338-43	(96906)	WASHER, LOCK	EA	4	*	*	*			3-2	33
				RPLS-PN AN935-10L									
P_H_	6115-330-1342	31008-1256	(31435)	PLATE	EA	2	*	*	*			3-2	34
P_H_	6115-316-2919	31008-1082	(31435)	INSULATION	EA	2	*	*	*			3-2	35

(1) SMR Code	(2) Federal stock number	Reference number & MFR code	(3) Description / Usable on code	(4) Unit of meas	(5) Qty inc in unit	(6) 30-day GS maint allowance (a) 1-20	(6) (b) 21-50	(6) (c) 51-100	(7) 1-yr alw per 100 equip entgey	(8) Depot maint alw per 100 equip	(9) Illustration (a) Fig. No.	(9) (b) Item No.
P_H_	5970-7974186	05-631098 (31435)	INSULATOR, BUSHING	EA	4	*	*	*			3-2	36
P_H_	6115-475-2590	31008-1219 (31425)	INSULATION	EA	2	REF	REF	REF			3-2	37
			---*---									
P_H_	5977-719-5556	31008-1018 (31435)	HOLDER, ELECTRICAL CONTACT ATTACHING PARTS	EA	1	*	*	*			3-2	38
P_H_	5305-953-2424	05-140100 (31435)	SCREW, MACHINE	EA	2	*	*	*			3-2	39
P_H_	5310-982-5003	MS21045LC06 (96906)	NUT, SELF-LOCKING, HEXAGON RPLS-PN AN363C632	EA	2	*	*	*			3-2	40
P_H_	5310-167-0816	AN960-6 (88044)	WASHER, FLAT	EA	4	*	*	*			3-2	41
P_H_	4935-959-8956	05-631100 (31435)	RING, INSULATION	EA	4	*	*	*			3-2	42
P_H_	6115-315-2602	05-631099 (31435)	SLEEVE	EA	2	*	*	*			3-2	43
			---*---									
P_H_	6115-771-9543	31008-1037 (31435)	SEPARATOR, INSULATION	EA	1	*	*	*			3-2	44
P_H_	5977-5894462	31008-1217 (31435)	HOLDER, ELECTRICAL	EA	1	*	*	*			3-2	45
P_H_	6115-330-1347	31220-1056 (31435)	SUPPORT MAINTENANCE SUPPLIES	EA	1	*	*	*			3-2	46
P_O_	5970-285-0490	(81349)	SLEEVING, INSULATION-SIZE 1 MIL-I-18057	IN	V	*	*	*			MSUP	
P_O_	6810-664-0387	(81348)	TRICHLOROETHANE, TECHNICAL FED O-T-620, 1 GAL CAN	GL	V	*	*	*			MSUP	
P_F_	8305-753-2967	(81348)	CLOTH, NONWOVEN-FED CCC-C-96	YD	V	*	*	*			MSUP	
P_F_	9150-190-0893	(81349)	GREASE, AIRCRAFT-MIL-G-7711 5 LB CAN	LB	V	*	*	*			MSUP	
P_O_	9150-664-0047	(81349)	DAMPING FLUID-MIL-S-21568 1 LB CAN	LB	V	*	*	*			MSUF	
P_O_	9150-944-8953	(81349)	GREASE, AIRCRAFT-MI L-G-81322 1 LB CAN	LB	V	*	*	*			MSUP	

SECTION III

SPECIAL TOOLS, TEST AND SUPPORT EQUIPMENT

(Not Applicable)

SECTION IV

STOCK NUMBER AND REFERENCE NUMBER INDEX

STOCK NUMBER INDEX

STOCK NUMBER	FIG.	ITEM	STOCK NUMBER	FIG.	ITEM
3110-115-0756	3-1	57	5310-167-1343	3-2	9
3110-115-0756	3-1	65	5310-407-9566	3-1	10
3110-937-0276	3-1	57	5310-530-4114	3-1	73
3110-937-0276	3-1	65	5310-530-4114	3-2	12
4935-959-8956	3-2	42	5310-720-8811	3-1	9
5305-145-6971	3-1	6	5310-864-1607	3-2	10
5305-145-7011	3-2	21	5310-905-8434	3-1	24
5305-156-2721	3-1	72	5310-905-8434	3-1	35
5305-253-5609	3-1	2	5310-905-8434	3-1	43
5305-253-5609	3-1	4	5310-934-9757	3-2	5
5305-543-2394	3-1	22	5310-934-9757	3-2	22
5305-579-4576	3-1	30	5310-982-5003	3-2	40
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5307-576-1151	3-1	70	5961-856-0084	3-1	42
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5310-025-7729	3-1	14	5970-719-5106	3-2	16
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5310-045-3296	3-1	36	5970-797-4186	3-2	36
5310-045-3296	3-1	44	5970-807-1992	3-1	38
5310-045-3296	3-1	50	5970-807-1992	3-1	46
5310-045-3296	3-1	63	5977-589-4462	3-2	45
5310-045-3296	3-2	2	5977-589-4464	3-2	25
5310-045-3296	3-2	27	5977-719-5556	3-2	38
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5310-045-3299	3-2	6	6115-315-0602	3-1	20
5310-045-3299	3-2	23	6115-315-2602	3-2	43
5310-045-4007	3-1	23	6115-315-3110	3-1	32
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5310-167-0833	3-2	7	6115-316-2564	3-1	1
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5310-167-0834	3-1	31	6115-316-8793	3-1	66
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5310-167-0834	3-2	3	6115-330-1342	3-2	28
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6115-330-1347	3-2	46	6115-811-2271	3-2	8
6115-330-2793	3-1	48	6115-831-4415	3-1	71
6115-330-5321	3-1	53	6115-831-4417	3-2	4
6115-330-5326	3-1	33	6115-959-8769	3-2	19
6115-330-5342	3-1	52	6115-969-1377	3-1	3
6115-330-5348	3-1	49	6115-969-1379	3-2	14
6115-472-7324	3-1	54	6115-969-1383	3-2	13
6115-475-2590	3-2	31	6115-969-1393	3-1	60
6115-475-2590	3-2	37	6115-969-1395	3-1	19
6115-475-2591	3-2		6115-969-1401	3-1	59
6115-635-3135	3-1	16	6115-969-1401	3-1	64
6115-719-5104	3-1	5	6115-969-2380	3-2	18
6115-729-6666	3-2	15	6115-969-2399	3-2	17
6115-759-1303	3-1	41	6810-664-0387	MSUP	
6115-759-1337	3-1	34	8305-753-2967	MSUP	
6115-771-9542	3-1	55	9150-190-0893	MSUP	
6115-771-9543	3-2	44	9150-664-0047	MSUP	
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AN960-10L	88044	3-1	26
AN960-O1L	88044	3-1	28
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AN960-O1L	88044	3-1	51
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AN960-516L	88044	3-1	11
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GREASE	81349	MSUP	
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MS35265-27	96906	3-1	22
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31008-1217	31435	3-2	45
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31008-1219	31435	3-2	31
31008-1219	31435	3-2	37
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