# TM 55-2925-236-40

# DEPARTMENT OF THE ARMY TECHNICAL MANUAL

# **GS MAINTENANCE MANUAL**

# STARTER GENERATOR

# **PART** NO. 30E20-61-A

(BENDIX)

HEADQUARTERS, DEPARTMENT OF THE ARMY

MAY 1969

# WARNING PRECAUTIONARY DATA

Personnel performing instructions involving operations, procedures, and practices which are included 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.

PRECAUTIONARY DATA DEFINITION

PRECAUTIONARY DATA PRESENTATION.

CLEANING SOLVENT

Use solvent in a well-ventilated area. Avoid inhaling solvent fumes. Do not allow solvent to contact skin as burns may occur.

#### HEADQUARTERS DEPARTMENT OF THE ARMY WASHINGTON, D. C., 19 December 1988

GS Maintenance Manual Including Repair Parts and Special Tools Lists

#### **STARTER GENERATOR**

#### PART NO. 30E20-61-A

#### NSN 2925-00-927-9483

#### (BENDIX)

#### TM 55-2925 -236-40,2 May 1969, is changed as follows:

Cover and page i. Title is changed as shown above.

*Page 1-1, para. b. 7th and 8th lines.* ATTN: AMSAV-R-M, P. O. Box 209, St. Louis, Missouri 63166 i changed to read ATTN: AMSAV-MMD, 4300 Goodfellow Blvd., St. Louis, Mo. 63120-1798.

Page 1-1, para. 1-3, 2nd and 4th lines. TM 38-750 is changed to read DA PAM 738-751.

*Page 1-2, para. 1-7.* Add after the first sentence: For general technical information on preparation] for storage and shipment refer to TM 55-1500-204-25/1 and TM 743-200-1.

Page 2, Change 2, Figure 3-2, Index No's 11, 18, and 25. Add alternate part number MS2503-150 (96906).

Page 2-2, C	<b><i>hange 3.</i></b> The following item is added to Table 2-3:		
Item No.	Nomenclature	Number	Specification
20	Epoxy Lead Putty	Devon L.	(FMC 16059)

**Page 3-1c.** (1) Delete the last sentence - "Do not attempt to remove terminals (4, 11, 18, or 25) unless damaged."

**Page 3-1.** Add note following paragraph 3-16. (8): NOTE. Replace capacitor lead terminals with alter nate part number for indexes 11, 18, 25 (Figure 3-2). These leads will be reconnected to brush holders (28) Figure 3-2 with screws (5), Figure 3-1.

Page 3-3, Figure 3-1, Index No. 19. Part Number 59NTE2834-054 is changed to read F52NTE2834-054.

**Page 3-11, para. 3-12a.** (1) The note is superseded as follows: NOTE. Terminals of capacitors 6, 13 20, and 27 will be secured to electrical contact holders (28) when the brushes are installed, para. b. (18).

Page 3-12, para. 3- 12b. (14) is rescinded.

CHANGE `

No. 5

*Page 3-12, para. 3-12b. (14)* is *added after para. 3-12b. (13).* (14) Use setting gage (1106353-1) to measure and check the compressed length of compression spring (21). This assembled length should be 1.100 inches. Insert the gage size plug into the fan housing end of the fan (18) and install washer (20) and self-locking nut (19). Insure washer (20) and self-locking nut (19) are seated flat on the shoulder of the gage size plug. Seat the setting gage on the washer and adjust gage indicator to read zero. Remove the setting gage, self-locking nut, washer, and gage size plug. Install front plate (23) on drive shaft assembly (22) and insert the shaft through armature assembly (39). Install fan (18) on drive shaft assembly (22). Install compression spring (21), washer (20), self-locking nut (19) and the setting gage. Using spline wrench (QB80059-3) to keep the shaft from turning, retighten self-locking nut (19) with the 7/16 inch (12 point thin wall) socket wrench until the setting gage again indicates zero, plus or minus 0.005 inch. Remove the setting gage. NOTE: Insure indicator makes at least one full revolution prior to zeroing to insure contact is made between plunger and washer.

Page 3-12 para. 3-12b. (18) is rescinded.

**Page 3-12 para. 2-12b.** (18) is added after para 3-12b. (17). (18) Align the terminals of capacitors (6, 13, 20, and 27, Figure 3-2) over the threaded holes for brush cap screws (5, Figure 3-1). Install split-type brushes ((4, Figure 3-1) in brush holders, and secure, along with capacitor terminals, using eight screws (5), eight lockwashers (6), and eight plainwashers (7). Tighten the screws to a torque of 35 to 50 pound-inches.

Page 4-3, para. 4-5b. Is rescinded.

*Page 4-3, para. 4-5b.* Is added after para. 4-5a. b. Disconnect all capacitor terminals using insulation breakdown test set 13700-IC, apply 250 present volts, 60 CPS for one minute between each terminal post and the frame (ground).

Page 4-3, para. 4-5c, 1st line. Is changed to read 1.5.

Page 6, change 1. NSN 5310-804-0075 is rescinded.

Page 6, change 1. Part Number EB054 is changed to read F52NTE2834-054.

Page A-1. TM 38-750 is rescinded.

*Page A-1.* Add before MS 33540 (ASG) DA PAM 738-751 Functional Users Manual for the Army Maintenance Management Systems Aviation (TAMMS-A).

Page A-1. TM 55-405-10 is rescinded.

Page A-1. Add after QQ-S-571, TM 743-200-1 Storage and Materials Handling.

Page A-1. Add after TM 743-200-1, TM 55-1500-204-25/1, General Aircraft Maintenance Manual.

By Order of the Secretary of the Army:

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

**Official:** 

#### R. L. DILWORTH Brigadier General, United States Army The Adjutant General

DISTRIBUTION :

To be distributed in accordance with DA Form 12-31, AVUM and AVIM Maintenance requirements for AH-1G Helicopter, Attack and UH-1C, UH-1H and UH-1M Helicopter, Utility.

PIN: 0139685005

HEADQUARTERS DEPARTMENT OF THE ARMY WASHINGTON, DC., 3 October 1975

GS Maintenance Manual Including Repair Parts and Special Tools Lists

STARTER GENERATOR PART NO. 30E20-61-A

#### (BENDIX)

TM 55-2925-236-40, 2 May 1969, is changed as follows:

Page 2-2, Table 2-3, Item No. 12. Number Specification "MIL-G-3545" is changed to read "MIL-G-81322A."

Page 3-8. Paragraph 3-6f is superseded as follows:

f. Check the armature assembly for static and dynamic balance, using balancing machine, model 40B. If out of balance by more than 0.020 oz. in., rebalance by inserting leaded epoxy material inside and under winding openings as required. Armature having Balance Ring will be rebalanced by applying Solder (item 17, table 2-3) to inside of balancing ring. Solder must not extend beyond lip of ring.

By Order of the Secretary of the Army:

Official:

PAUL T. SMITH

Major General, United States Army The Adjutant General FRED C. WEYAND General, United States Army Chief of Staff

DISTRIBUTION:

To be distributed in accordance with DA Form 12-31 Direct and General Support Maintenance Requirements for AH-1G, UH-1C/M and UH-1D/H aircraft.

★ U. S. GOVERNMENT PRINTING OFFICE: 1975--665689/64

CHANGE

No. 4

CHANGEHEADQUARTERSDEPARTMENT OF THE ARMYNo. 3WASHINGTON, D. C., 11 March 1974

GS Maintenance Manual Including Repair Parts and Special Tools Lists

STARTER GENERATOR PART NO. 30E20-61-A

#### (BENDIX)

TM 55-2925-236-40, 2 May 1969, is changed as follows:

Page 2-2. The following items are added to table 2-3.

Nomenclature	Number Specification
Solder	Type QQS571SN5WRAP3 (FCM 81348)
Adhesive	FSN 8040-145-0019
Adhesive paper	FSN 5350-224-7207
	Nomenclature Solder Adhesive Adhesive paper

Page 3-8. Paragraph 3-4a is superseded as follows:

a. General.

(1) Replace or repair all parts that are worn and damaged.

(2) Replace split-type brushes (4, figure 3-1) and ball bearings (36 and 44) at each overhaul.

(3) Replace all wiring having burned or cracked insulation, or broken or corroded terminals.

(4) Terminal board (item 49, figure 3-1) with damage not exceeding 1 crack per mounting hole and with no chunking out of parent material may be repaired as follows: Clean terminal board with trichlorethylene (item 1, table 2-3). Fill mounting flange crack with adhesive (item 18, table 2-3). Wipe away excess material. Before adhesive cures blend area with 240 grit abrasive paper (item 19, table 2-3). Allow terminal board dust to imbed in uncured adhesive.

Page 3-8. Paragraph 3-6f is superseded as follows:

f. Check the armature assembly for static and dynamic balance, using balancing machine, model 40B. If out of balance by more than 0.020 inch-ounce, rebalance by applying solder (item 17, table 2-3) to inside of balancing rings. Solder must not extend beyond lip of rings.

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By Order of the Secretary of the Army:

#### CREIGHTON W. ABRAMS

General, United States Army Chief of Staff

#### Official:

VERNE L. BOWERS

Major General, United States Army The Adjutant General

#### DISTRIBUTION:

To be distributed in accordance with DA Form 12-31 (qty rqr blocks no. 35, 354, and 39, cumulative for all blocks) Direct and General Support Maintenance Requirements for UH-1C, UH-1D and 1H, and AH-1G Aircraft.

HEADQUARTERS DEPARTMENT OF THE ARMY WASHINGTON, D. C., 18 December 1970

GS Maintenance Manual Including Repair Parts and Special Tools Lists

#### STARTER GENERATOR PART NO. 30E20-61-A (BENDIX)

#### TM 55-2925-236-40, 2 May 1969, is changed as follows:

Page 2-1, table 2-1. In line 2, the first three columns are changed from "1650A 24655 Capacitance Bridge" to: "ZM3/U 80058 Capacitance Analyzer."

Pages 3-5 and 3-6. Figure 3-2 and "LEGEND FOR FIGURE 3-2" are superseded.



Figure 3-2. End Bell Assembly, Exploded View.

No. 2

CHANGE ]

TM 55-2925-236-40 C 2

## LEGEND FOR FIGURE 3-2

Index No.	Part Number	Description (	Qty Per Assy	
3-2-	1543956	END BELL ASSEMBLY (See item 30, fig. 3-1 for nha)	Ref	
	1545592-1	. CAPACITOR ASSEMBLY (ATTACHING PARTS)	2	T
-1	819106-110	. SCREW, fil h, cad. pl stl, No. 6-32 x 5/16 in. lg	2	
-2	MS35338-41	. WASHER, Lock	2	
-3	890487	. WASHER, Flat, sst, for No. 6 screw	2	
-4	1329221	TERMINAL	1	
-5	1532827-3	CLAMP, Loop	1	
-0	109D406C2075TO	CAPACITOR, Fixed, 40 uf + 20 pct - 15 pct, 75 V dc (06001) (83298, part No. 1102113-2)	2	
	1545592-6	. CAPACITOR ASSEMBLY (ATTACHING PARTS)	2	
-7	MS2 1044N06	. NUT, Self-locking	1	
-8	33338	. WASHER, Flat, cad. pl stl, for No. 6 screw	1	
-9	AN960-6L	. WAS HER	1	
- 10	MS35265-31	. SCREW	1	
-11	34110	. TERMINAL, Solderless (00779) (83298, part No. 1102238-4)	1	
-12	1532827-19	. CLAMP. Loop	1	
-13	121P10401R5S2	CAPACITOR, Fixed, 0.10 uf ± 20 pct, 150 V dc (56289) (83298, part No. 1111769-5)	ī	
	1545592-3	(APACITOR ASSEMBLY (ATTACHING PARTS)	1	
- 14	MS2 10 14NO6	NUT Self-locking	1	1
- 15	33338	WASHER Flat, cad pl stl for No. 6 screw	1	
- 16	AN960-CL	WASHER	1	
-17	MS35265-31	. SCREW	1	
-18	34110	TERMINAL solderless (00779) (83298 part No. 1102238-4)	1	
- 10	1532827-20	CLAMP Loop	1	
-20	69F 196G3	. CAPACITOR, Fixed, 4.7 uf ± 10 pct, 100 V dc (06001) (83298, part No. 1545591-1)	<b>b.</b> 1	
	1545592-4	CAPACITOR ASSEMBLY	1	
		(ATTACHING PARTS)		
-21	MS2 1044NO6	. NUT, Self-locking	I	
-22	33338	. WASHER, Flat, cad. pl stl, for No. 6 screw	1	
-23	AN960-6L	. WASHER	1	
-24	MS35265-31	. SCREW	1	
-25	34110	TERMINAL, Solderless (00779) (83298, part No. 1102238-4)	1	
-26	1532827-19	CLAMP, Loop	1	
-27	121P4740R5S1	. CAPACITOR, Fixed, 0.47 uf ±20 pct, 50 V dc (56289) (83298, part No 15455 90)	. 1	
-28	1542776	. HOLDER, Electrical contact (ATTACHING PARTS)	4	
-29	1543503	. SCREW. Cap. hex hd. $5/16-18 \times 1-1/8$ in. 1g	í	4
-30	MS35338-45	WASHER, Lock	4	
-31	867491	WASHER, Flat. cad. pl stl. for 5/16 in. screw	4	
-32	1543622	WASHER. Insulating	16	
-33	1328928	. TUBE. Insulating	4	
-34	1543976	. BELL, End	1	

Page 4-3, paragraph 4-6c(2). In line 1, the words "blower and" are deleted. Page 4-4. Figure 4-2 is changed as follows:



Figure 4-2. Stall Torque Curve.

#### TM 55-2925-236-40 C 2

Page 4-5, paragraph 4-6e(4). In line 2, "6000 rpm" is changed to read "8000 rpm."

By Order of the Secretary of the Army:

W. C. WESTMORELAND, General, United States Army, Chief of Staff.

Official:

KENNETH G. WICKHAM, Major General, United States Army, The Adjutant General.

#### DISTRIBUTION:

To be distributed in accordance with DA Form 12-31 (qty rqr block nos. 35, 354, and 39, cumulative for all blocks) requirements for Direct and General Support Maintenance Instructions for UH-1C, UH-1D and 1H, and AH-1G Aircraft.

CHANGE

HEADQUARTERS DEPARTMENT OF THE ARMY WASHINGTON, D. C., 29 December 1969

GS Maintenance Manual Including Repair Parts and Special Tools Lists

#### STARTER GENERATOR

#### PART NO. 30E20-61-A

(BENDIX)

TM 55-2925-236-40, 2 May 1969, is changed as follows:

Cover and page i. Title is changed as shown above.

Page i. Change "page A-1" for "REFERENCES" to read "page A-1/B-1." Add "Appendix B, REPAIR PARTS AND SPECIAL TOOLS LISTS, page A-1/B-1" to Table of Contents.

Page A-1. Change page no. to read "A-1/B-1." Appendix B is added as follows:

#### APPENDIX B

REPAIR PARTS AND SPECIAL TOOLS LISTS (Current as of 28 July 1969)

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 starter-generator, engine.

B-2. General

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

Repair Parts - Section II. A list of repair parts authorized for *a*. 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 (FSN) 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.

No. 1.

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

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

(2) A list of reference numbers (R/Ns) in ascending alpha-numerical sequence, cross-referenced to the manufacturer's Federal supply code, illustration figure, 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 used are:

CODE EXPLANATION

- P Applies to repair parts which are stocked in or supplied from GSA/DSA, or Army supply system and authorized for use at indicated maintenance categories.
- X1 Applies to repair parts which are not procured or stocked. The requirement for such items will be filled by use of the next higher assembly or component.
- X2 Applies to repair parts which are not stocked. The indicated maintenance category requiring such repair parts will attempt to obtain same through cannibalization. When such repair parts are not obtainable through cannibialzation, requirements will be requisitioned, with accompanying justification, through normal supply channels.

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

CODE	EXPLANATION
0	Organizational maintenance
F	Direct support maintenance
Н	General support maintenance

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

b. Federal Stock Number - Column 2. Indicates the FSN assigned to the item and will be used for requisitioning purposes. Items source coded X1 are not assigned an FSN.

c. Description - Column 3. Indicates the Federal item name and any additional description of the item required. The description column contains the following subcolumns.

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

(2) Usable on code. Not applicable.

d. Unit of Issue (U/I) - Column 4. A two-character alphabetic abbreviation indicating the standard or minimum basic quantity in which the item is issued (e.g., EA, FT, PR).

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 demical 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.

g. One-year Allowance per 100 Equipments/Contingency Planning Purposes -Column 7. Indicates opposite the first appearance of each item, the total TM 55-2925-236-40 C 1

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. 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 callout number used to reference the item in the illustration.

B-4. Special Information

a. 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.

B-5. How to Locate Repair Parts

a. When FSN or R/N 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 Parts 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 FSNs and R/Ns, find the pertinent FSN or R/N. This index is in ascending FSN sequence, followed by a list of R/Ns in ascending alpha-numerical sequence, cross-referenced to the illustration figure and item number.

(2) Second. Using the Repair Parts Listing, find the figure and item number listed in the illustration column referenced in the index of FSNs and R/Ns.

B-6. Federal Supply Codes for Manufacturers

CODE	MANUFACTURER
24446	General Electric Co 1 River Road Schenectady NY 12305
72962	Elastic Nut Corp of America 2330 Vauxhall Road Union NJ 07083
81348	Federal Specifications Promulgated by General Services Administration
81349	Military Specifications Promulgated by Standardization Div Directorate of Logistic Services DSA
83298	Bendix Corp the Electric Power Division W/S Route 35 Eatontown NJ 07724
88044	Aeronautical Standards Group Dept of Navy and Air Force
96214	Texas Instruments Inc Apparatus Division 6000 Lemmon Ave Dallas Tx 75209
96906	Military Standards Promulgated by Standardization Div Directorate of Logistic Services DSA

SOUR	(I) CE,MAIN RECOV CODE	(2) FEDERAL		DES	SCRIPTION	MODELS	(4) UNIT OF ISSUE	(5) QTY INC IN	3	(6) O-DAY MAINT A	í GS LW	(7) 1-YR ALWPER 100	(8) DEPOT MAINT ALWPER	( ILLUST	9) RATION	TM 55-
SOURCE	RECOV	NUMBER	REFERENCE NUMBE	R & MFR CODE	F	USABLE ON			(¤) 1 - 20	(b) 21 -50	(c) 51 - 100	CNTGCY	EQUIP	(a) FIG NO	(b) ITEM NO	2925-2 C 1
		2925-927-9483	30E20-61A	(83298)	STARTER-GENERATOR, ENGINE		EA							1-1		36-40
					SECTION III REPAIR PARTS STARTER-GENERATOR											
P P P P	F F H	9999-247-0215 5305-912-4832 5310-439-4711 5977-681-1431	1544776 M335276-268 833656 1110489	(83298) (96906) (83298) (83298)	COVER, ACCESS SCREW, MACHINE NUT, PIAIN, SQUARE BRUSH, ELECTRICAL, CONTACT		EA EA EA EA	1 1 1 8	* *	* *	* * *			3-1 3-1 3-1 3-1	1 2 3 4	
P P P	H H H	5306-523-8866 5310-582-5965 5310-141-1795	890065-2 MS35338-44 AN960-416	(83298) (96906) (88044)	BOLT, INTERNAL WRENCHING WASHER, LOCK.		EA HD HD	8 8 8	* * *	* * *	* *			3-1 3-1 3-1	5 6 7	
P P P P P	0 0 0 H H	5310-926-1852 5310-167-0821 5310-807-1467 5310-167-0834 5910-443-4010 2925-228-8854	MS21083N6 AN960-616 MS21042-3 AN960-101 1545592-5 1543975	(96906) (88044) (96906) (88044) (83298) (83298)	NUT, SELF-LOCKING, HEXAGON WASHER, FLAT NUT, EXTENDED WASHER, HEXAGON WASHER, FLAT CAPACITOR ASSEMBLY HOUSING, GENERATOR ATTACHING PARTYS		HD HD HD HD HD EA EA	3 3 2 2 1 1	* * * *	* * *	* * * * *			3-1 3-1 3-1 3-1 3-1 3-1 3-1	8 9 10 11	
P	H	5305-959-2689	MS35191-279	(96906)	SCREW, MACHINE		EA	6	*	*	*			3-1	17	
P	H	6150-455-9645	1543970	(83298)	FAN, ELECTRICAL		EA	1	*	*	*			3-1	18	
P	H	5310-004-0015	1549110-1	(72962) (83298)	NUT, SELF-LOCKING, HEXAGON		ea Ea	1 1	*	*	*			3-1 3-1	19 20	
P P P P P P P Y R P P P	H H H H H H H H H H H H H H H H H H H	5340-420-5954 2925-228-8852 2925-731-4906 5305-940-9488 5310-680-4241 5310-531-9514 5340-804-2026 5305-943-5918 5310-045-3299 5305-983-6654 5310-045-3296 5310-435-0511	1543736 1543441 1111791 MS35275-226 819001-016 AN960c6 MS16624-1098 MS35275-249 MS35338-42 1543956 MS16998-31 MS35338-43 1546968-1 MS171b2b	(83298) (83298) (96906) (83298) (88044) (96906) (96906) (96906) (83298) (96906) (83298) (96906) (83298)	SPRING, HELICAL, COMPRESSION. SHAFT ASSEMBLY, DRIVE. PLATE, RETAINING, SHAFT. SCREW, MACHINE. WASHER, JOCK. WASHER, FLAT. RING, RETAINING. SCREW, MACHINE. WASHER, IOCK. END BELL ASSEMBLY. ATTACHING PARTS SCREW, CAP, SOCKET HEAD. WASHER, JOCK. WASHER, SPECIAL.		EA EA EA EA EA EA HD EA	1113331441 666	***	* * * * * * * * *	* * * * * * * * *			3-1 3-1 3-1 3-1 3-1 3-1 3-1 3-1 3-1 3-1 3-1 3-1 3-1 3-1 3-1	21 22 23 24 25 26 27 28 29 30 31 32 33	
P	H	5315-823-8740 6115-512-6759	MS171434 844923	(96906) (83298)	PIN, SPRING DEFLECTOR, DIRT AND LIQUID		HD EA	1 2	*	*	*			3-1 3-1	34 35	

SØ A	(1) URCE,MAI ND RECO CODE	(2) NT V FEDERAL		DES	SCRIPTION	MODELS	(4) UNIT OF ISSUE	(5) QTY INC IN	30	(6) DAY MAINT A	GS LW	(7) 1-YR ALWPER 100	(8) DEPOT MAINT ALWPER	۱ ۱LLŲST	?) RATION	
SOLIDE	CODE D MAINT O LEVEL O	C) STOCK NUMBER	REFERENCE NUMBER	& MFR CODE		USABLE ON		UNIT	(a) 1 - 20	( <b>b</b> ) 21 -50	(c) 51 - 100	EQUIP CNTGCY	100 EQUIP	(a) FIG NO	(b) ITEM NO	
E	P H H H	3110-516-5151 6115-326-5049 5340-804-2026	890659-5 1329018 MS16624-1098	(83298) (83298) (96906)	BEARING, BALL, ANNULAR PLATE, RETAINING, BEARING RING, RETAINING		EA EA EA	1 1 1	* * * *	* * *	* *			3-1 3-1 3-1	36 37 38	
Ē		6115-698-0569	1322942	(83298)	PLATE, RETAINING, BEARING ATTACHING PARTS		EA EA	1	*	×	*			3-1 3-1	39 40	
J	PH	5305-638-3499	1322944	(83298)	SCREW, MACHINE.		EA	4	*	¥	*			3-1	41	
H H H H H	р Н Р Н Р Н Р Н Р Н	2925-585-9604 6115-512-6759 3110-516-5151 6115-326-5049 9905-798-1292	1325794-3 844923 890659-5 1329018 1543979	(83298) (83298) (83298) (83298) (83298)	BUSHING, SLEEVE. DEFLECTOR, DIRT AND LIQUID. BEARING, BALL, ANNULAR. PLATE, RETAINING, BEARING. PLATE, IDENTIFICATION.		EA EA EA EA	4 2 1 1 1	* * * *	* * * *	* * *			3-1 3-1 3-1 3-1 3-1	42 43 44 45 46	
1	РН	5305-053-1111	MS24621-7	(96906 <b>)</b>	SCREW, TAPPING, THREAD.		HD	4	*	¥	*			3-1	47	
1	(2 H H	5940-435-4830	1543960 1544525	(83298) (83298)	STATOR, GENERATOR		EA EA	1 1	*	*	*			3-1 3-1	49	
]	Р Н Н	5310 <b>-</b> 590-7931	819110-120 890489	(83298) (83298)	.SCREW, FILLISTER HEAD		EA EA	2 2	* *	* *	*			3-1 3-1	50 51	
7	рн (2 н	5970-421-1837	1543966 1543960	(83298) (83298)	.INSULATOR, PLATE		EA EA	3 1	*	*	*			3-1 3-1	52 53	
					END BELL ASSEMBLY										1	
1		5910-421-0286	1543956 1545592-1	(83298) (83298)	END BELL ASSEMBLY		EA	1 2	¥	*	*			3-2 3-2	1	
]	PH PH PH	5310-045-4007 5310-515-8243	819106-110 MS35338-41 30723	(83298) (96906) (96214)	SCREW, FILLISTER HEAD WASHER, LOCK WASHER, FLAT		EA HD EA	2 2 2	* * *	* * *	* *			3-2 3-2 3-2	1 2 3	
1	H S	5910-420-8367	1545592-6	(83298)	CAPACITOR ASSEMBLY		EA	1	*	*	*			3 <b>-</b> 2	I	
]	Р Н Р Н Р Н Р Н	5310-081-8087 5310-950-1310 5310-167-0832 5305-582-5808	MS21044n06 MS27183-4 An960-61 MS35265-31	(96906) (96906) (88044) (96906)	.NUT, SELF-LOCKING, HEXAGON WASHER, FLAT WASHER, FLAT SCREW, MACHINE		EA HD HD EA	1 1 1 1	* * *	* * *	* * *			3-2 3-2 3-2 3-2 3-2	7 8 9 10	
I	P H	5910-420-8365	1545592-3	(83298)	CAPACITOR ASSEMBLY		EA	ı	*	*	*			3 <b>-</b> 2	1	
]	PH PH PH PH	5310-081-8087 5310-950-1310 5310-167-0832 5305-582-5808	MS21044N06 MS27183-4 AN960-61 MS35265-31	(96906) (96906) (88044) (96906)	NUT ,SELF-LOCKING, HEXAGON		EA HD HD EA	1 1 1 1	¥ ¥ ¥	* * *	* * *			3-2 3-2 3-2 3-2	14 15 16 17	

œ	SOURC AND CO	(1) E,MAIN1 RECOV DDE	(2) FEDERAL		DES	DESCRIPTION		(4) UNIT OF ISSUE	(5) QTY INC	30	(6) D-DAY MAINT AI	GS LW	(7) 1-YR ALWPER 100	(8) DEPOT MAINT ALWPER	(9) T ILLUSTRATIO		TM 55-
	SOURCE .	MAINT LEVEL (9) RECOV ()	STOCK NUMBER	REFERENCE NUMBER	R & MFR CODE		USABLE ON		UNIT	(a) 1 - 20	(b) 21 -50	(c) 51 - 100	EQUIP CNTGCY	100 EQUIP	(a) FIG NO	(b) ITEM NO	2925-2 C 1
	P	H	5910-420-8366	1545592-4	(83298)	.CAPACITOR ASSEMBLY		EA	1	*	*	*			3-2	-	36-
	P P P P	H H H	5310-081-8087 5310-950-1310 5310-167-0832 5305-582-5808	MS21044N06 MS27183-4 AN960-6L MS35265-31	(96906) (96906) (88044) (96906)	ATTACHING PARTS .NUT,SELF-LOCKING,HEXAGON .WASHER,FLAT		EA HD HD EA	1 1 1 1	* * *	* * *	* * *			3-2 3-2 3-2 3-2	21 22 23 24	40
	P	н	5977-369-9720	1542776	(83298)	.HOLDER, ELECTRICAL		EA	4	*	*	¥			3-2	28	
	P P P P P	ннн	5305-435-3321 5310-407-9566 5310-205-8985 5970-435-5674 5970-846-1664	1543503 MS35338-45 867491 1543622 1328928	(83298) (96906) (83298) (83298) (83298)	ATTACHING PARTS SCREW, SPECIAL. WASHER, LOCK. WASHER, FLAT. INSULATOR, WASHER. INSULATION, SLEEVING, BLECTRICAL		KA HD EA EA EA	4 4 16 4	* * * *	* * *	* * * *			3-2 3-2 3-2 3-2 3-2 3-2	29 30 31 32 33	
	<b>x</b> 2	н		1543976	(83298)	.END BELL GENERATOR		EA	1						3-2	34	
						MAINTENANCE SUPPLIES									,		
	P	F	3439-224-3567		(81348)	SOLDER, TIN ALLOY FED QQ-S-571,		EA	v	*	*	*			MSUP		
	P	Ħ	5970-161-7421	1201	(24446)	INSULATING VARNISH, ELECTRICAL COLORED RED, OIL, MOISTURE & SALT WATER RESISTANT 1 PT CAN		PT	v	*	*	*			MSUP		
	P	H	6810-184-4800		(81348)	TRICHLORETHYLENE, TECHNICAL		DR	v	*	*	*			MSUP		
	P	F	6810-201-0907		(81348)	ALCOHOL, DENATURED-COLORLESS,		CN	v	¥	*	*			MSUP		
	P	o	6850-264-9038		(81348)	DRY CLEANING SOLVENT FED P-D-680,		PL	v	*	*	*			MSUP		
	P	0	8010-141-6081		(81348)	SHELLAC, DRY-FED TT-S-271, TYPE 1,		CN	v	¥	*	*			MSUP		
	P	ο	8030-081-2338		(81349)	FORM A, GRADE A, L LB SEALING COMPOUND-LIQUID FORM, FOR SEALING & RETAINING METAL PARTS, MIL-S-22473, GRADE A, 50 CC.		EA	v	*	*	*			MSUP		
	P	ο	8305-267-3015		(81348)	PLASTIC BOTTLE CLOTH, CHEESECLOTH, COTTON-WHITE, UNSERVINK, 36 IN. W, FED CCC-C-440,		YD	v	*	*	*			MSUP		
	P	F	9150-223-4003		(81349)	TIFE 2, CLASS 2 GREASE, AIRCRAFT-PETROLEUM OIL & GELLING AGENT, CORROSION, OXIDATION & WATER RESISTANT,		LB	v	*	*	*			MSUP		
	P	þ	9150 <b>-263-349</b> 0		(81349)	MIL-G-3545,1 LB CAN LUBRICATION OIL, GENERAL PURPOSE CORROSION & OXIDATION RESISTANT, MIL-L-7870,1 QT CAN		QT	v	*	*	*			MSUP		
																	]

	(1) CE,M CREC CODE (b) INIV	(2) FEDERAL STOCK NUMBER	REFERENCE NUM	DES Ber & MFR CODE	SCRIPTION	MODELS USABLE ON	(4) UNIT OF ISSUE	(5) QTY INC IN UNIT	30 (a) 1 - 20	(6) H-DAY MAINT A (b) 21 -50	GS _W (c) 51 - 100	(7) 1-YR ALWPER 100 EQUIP CNTGCY	(8) DEPOT MAINT ALWPER 100 EQUIP	(S ILLUSTI (a) FIG NO	P) RATION (b) ITEM NO	
				۰.	SECTION III SPECIAL TOOLS, TEST AND SUPPORT EQUIPMENT											
P P P P P P P P P	H H H H H H H H H H H H H H H H H H H	4920-435-7838 4920-453-9516 4920-456-6008 5120-075-6015 5120-178-1275 5120-339-0606 5120-369-9472 5120-511-0253 5120-511-0254	1106187 1106354-1 1106149 QB80059-3 1106353-1 QB80277-1 1106269-1 1106005-1 1106006-1	(83298) (83298) (83298) (83298) (83298) (83298) (83298) (83298)	STAND, MAINTENANCE. INTERFACE, MAINTENANCE. STAND, ROTOR MAINTENANCE. WRENCH. TOOL, INDICATOR. HOOK, BRUSH SPRING. PULLER, REFAINER BEARING. FILOT, BRUSH BOX. ALIGNER, BRUSH BOX.		EA EA EA EA EA EA		* * * * * * * *	* * * * * * * *	* * * * * * *			TOOL TOOL TOOL TOOL TOOL TOOL TOOL		
				,												c •

TM 55-2925-236-40 C 1

SECTION IV FEDERAL STOCK NUMBER AND REFERENCE NUMBER INDEX

STOCK	FIGURE	ITEM	STOCK	FIGURE	ITEM
NUMBER	NUMBER	NUMBER	NUMBER	NUMBER	NUMBER
2925-228-8852 2925-228-8854 2925-385-9604 2925-927-9483 3110-516-5151 3110-516-5151 3110-516-5151 3439-224-3567 4920-453-7838 4920-453-6008 5120-075-6015 5120-178-1275 5120-339-0606 5120-369-9472 5120-511-0253 5120-511-0253 5120-511-0254 5305-582-5808 5305-582-5808 5305-582-5808 5305-943-5918 5305-943-5918 5305-943-5918 5305-943-5918 5305-943-5918 5305-943-5918 5305-943-5918 5305-943-5918 5310-045-3299 5310-045-3299 5310-045-3299 5310-045-3299 5310-045-3299 5310-045-3299 5310-045-3295 5310-045-3295 5310-045-3295 5310-045-3295 5310-141-1795 5310-141-1795 5310-167-0832 5310-167-0832 5310-167-0832 5310-167-0832 5310-167-0832 5310-167-0832 5310-167-0832 5310-167-0832	3-1 3-1 3-1 3-1 3-1 3-1 3-1 3-1 TOOL TOOL TOOL TOOL TOOL TOOL TOOL TOO	22 39 142 23 36 44 47 29 17 12 41 24 87 11 53 29 27 42 17 99 16 22 13 33 33	5310-439-4711 5310-515-8243 5310-582-5965 5310-582-5965 5310-680-4241 5310-804-0075 5310-950-1310 5310-950-1310 5310-950-1310 5310-950-1310 5310-950-1310 5310-950-1310 5310-950-1310 5340-804-2026 5340-804-2026 5910-420-8365 5910-420-8367 5910-420-836 6810-184-4800 6810-201-0907 6850-264-9038 8010-141-6081 8030-081-2338 8030-264-9038 8010-141-6081 8030-081-2338 8030-264-903 9150-263-3490 9905-778-1292 9999-247-0215	3-1 3-2 3-1 3-1 3-1 3-1 3-2 3-2 3-2 3-2 3-2 3-1 3-1 3-1 3-2 3-2 3-2 3-2 3-2 3-2 3-1 3-1 3-1 3-1 3-1 3-1 3-1 3-1 3-1 3-1	3 3 26 6 51 25 19 10 8 8 15 22 34 12 7 8 49 5 22 33 8 47 5 5 3 8 49 5 22 32 8 4 7 5 32 8 4 7 5 32 8 4 7 5 32 8 4 1 2 5 2 5 19 10 8 8 15 22 34 12 7 8 8 15 22 34 12 7 8 8 15 22 34 12 7 8 8 15 22 34 12 7 8 8 15 22 34 12 7 8 8 15 22 34 12 7 8 8 15 22 34 12 7 8 8 15 22 34 12 7 8 8 15 22 34 12 7 8 8 15 22 34 12 7 8 8 15 22 34 12 7 8 8 15 22 34 12 7 8 8 15 22 34 12 7 8 8 15 22 34 12 7 8 8 15 22 3 8 8 15 22 3 8 8 15 22 3 8 8 15 22 3 8 8 15 22 3 8 8 15 22 3 8 8 15 22 3 8 8 15 22 3 8 8 15 23 3 8 8 15 23 3 8 8 15 23 3 8 8 15 3 2 8 14 12 3 8 18 15 3 2 8 18 10 10 10 10 10 10 10 10 10 10 10 10 10

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						U 1	
REFERENCE	MEG	FIG		REFERENCE	MEG	FIG	ІТЕМ
NUMBER	CODE	NUIAABER		NUMBER	CODE		
NOMBER	CODE	NUMBER	NOMBER	NOMBER		NOMBER	NOMBER
AN960-10L	88044	3-1	11	1201	24446	MSUP	
AN960-416	88044	3-1	7	1322942	19315	3-1	40
AN960-61	88044	3-2	9	1322944	83298	3-1	41
AN960-61	88044	3-2	16	1325794-3	83298	3-1	42
AN960-61	88044	3-2	23	1328928	83298	3-2	33
AN960-616	88044	3-1	9	1329018	83298	3-1	37
AN960C6	88044	3-1	26	1329018	83298	3-1	45
<b>EB</b> 054	72962	3-1	19	1542776	83298	3-2	28
MS16624-1098	96906	3-1	27	1543441	83298	3-1	22
<b>MB16624-1</b> 098	96906	3-1	38	1543503	83298	3-2	29
MS16998-31	96906	3-1	31	1543622	83298	3-2	32
MS171434	96906	3-1	34	1543736	83298	3-1	21
MS21042-3	96906	3-1	10	1543956	83298	3-1	30
MS21044N06	96906	3-2	7	1543956	83298	3-2	
MS21044N06	96906	3-2	14	1543957-1	83298	3-1	39
MS21044N06	96906	3-2	21	1543960	83298	3-1	
MS21083N6	969 <b>0</b> 6	3-1	8	1543960	83298	3-1	53
MS24621-7	96906	3-1	47	1543966	83298	3-1	52
MS27183-4	96906	3-2	8	1543970	83298	3-1	18
MS2 (103-4	96906	3-2	15	1543975	83298	3-1	16
MS2(103-4	90900	3-2	22	1543976	83298	3-2	34
M935045-21	90900	3-1	11	1543919 1566505	83298	3-1	46
M825265-21	96906	3-2	10	1744727	03298	3-1	49
MB35265-31	90900	3-2	2	15,5500.1	03290	3-1	1
MS25075-006	90900	2-1	24	1545502-2	03290	3-2	
MB35275-220	90900	2-1	24	1545592-3	03290	3-2	
MB35276-268	90900	2-1	20	1545502-5	03290	3-2	
MB35238_k1	90900	2-2	2	1545502-6	03290	3-1	
MB35338-12	96906	3-1	20	1546068-1	82208	3-2	22
MS35338-43	96906	3-1	30	1549110-1	83208	1-C	22
MS35338-44	96906	3-1	6	30E20-61A	83208	1-1	20
MS35338-45	96906	3-2	30	30723	96214	3-2	3
QB80059-3	83298	TOOL		819001-016	83208	3_1	25
QB80277-1	83298	TOOL		819106-110	83298	3-2	- <u>í</u>
1106005-1	83298	TOOL		819110-120	83298	3-1	50
1106006-1	83298	TOOL		833656	83298	3-1	<b>1</b>
1106149	83298	MSUP		844923	83298	3-1	35
1106187	83298	TOOL		844923	83298	3-1	44
1106269-1	83298	TOOL		867491	19315	3-2	31
1106353-1	83298	TOOL		890065-2	19315	3-1	5
1106354-1	83298	TOOL		890489	83298	3-1	51
1110489	83298	3-1	4	890659-5	19315	3-1	36
1111791	83298	3-1	23	890659-5	19315	3-1	<u> </u>
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By Order of the Secretary of the Army:

Official:

KENNETH G. WICKHAM, Major General, United States Army, The Adjutant General. W. C. WESTMOR ELAND, General, United States Army, Chief of Staff.

Distribution:

To be distributed in accordance with DA Form 12-31 requirements for Direct and General Support Maintenance Instructions for UH-1C, UH-1D, and AH-1G Aircraft.

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TECHNICAL MANUAL No. 55-2925-236-40

HEADQUARTERS DEPARTMENT OF THE ARMY WASHINGTON, D. C., 2 May 1969

# **GS** Maintenance Manual

STARTER GENERATOR

PART NO.30E20-61-A

# (BENDIX)

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# SECTION I

# INTRODUCTION

#### 1-1. General information

*a.* This technical manual comprises overhaul instructions for starter generator, part no. 30E20–61–A (figure 1–1). This equipment is manufactured by The Bendix Corporation, Electric Power Division (83298), Eatontown, New Jersey 07724. Sections I through IV of this technical manual contain instructions only for the basic type.

*b.* Report of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to DA Publications) and forwarded direct to Commanding General, US. Army Aviation Systems Command, ATTN: AMSAV-R–M, P. O. Box 209, St. Louis, Missouri 63166.

#### 1-2. Purpose of Equipment

The starter generator is used to start the engine, and generate the electrical power required for 28-volt aircraft electrical systems.

#### 1-3. Equipment Records

The Army equipment record system and procedures established in TM 38–750 apply to this equipment. The applicable forms as required by TM 38–750 shall be used.



Figure 1-1. Three-quarter View, Starter Generator Part No, 30E20-61-A.

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### 1-4. Description

The starter generator is a brush-type rotating machine capable of delivering 30 volts dc at a rated current of 300 amperes, when driven at a speed within its rated speed range. The unit is self-cooled by means of an integral fan rotating with the output shaft. A terminal board is mounted' on the housing to facilitate external connections. Slotted mounting holes are provided for ease of installation on the engine.

## 1-5. Leading Particulars

Refer to table 1-1 for leading particulars of the starter generator.

#### Table 1-1. Leading Particulars

Item	Characteristic
Rated Voltage	30 V
Rated current	300 amp
Rated speed	4000-8600 rpm
Minimum Speed for Regulation	4400 rpm
Maximum Speed for Regulation	10,000 <sup>°</sup> rpm
Cooling Air	40°C (max)
Weight	47 lb (approx)
Diameter (Housing)	6-1/2 in.
Length (Housing)	10-7/8 in.
Outside Spline	16 teeth
Mounting Bolt Circle Diameter	5.000 in.
No. of Mounting Slots	6
Rotation (Viewing Drive. End)	Counterclockwise

#### 1-6. Painting Requirements

Repainting or touching up surfaces if required shall 'be done in accordance with table 1-2.

Item Name	Fig. No.	Index No.	Paint Type and Specification	Method of Application	No.of Coats	Notes
Fan Housing	3-1	16	MIL-P-8585, Primer	Brush	1	Paint Flange and Rear
_			MIL-E-5557, Type I, Color Black, Enamel	Brush	2	Face Only
End Bell	.3-2	84	MIL-P-8585, Primer	Brush	1	No Paint or Prime in
			MIL-E-5557, Type I, Color Black, Enamel	Brush	2	Area Covered by Brush Access Cover or in Bearing Mounting Surface

Table 1-2. Painting Requirement

1-7. Preservation, Packaging, Packing and Marking Requirements

Preservation, packaging, packing and marking shall be in accordance with figure 1-2.

	PRESERV	ATION, PACKAG	ING, PAC	(ING AI	ND MARKING	REQUIR	EMENTS	
NOMENCLATURE				STOCK N	UMBER			
Starter Gen.			<u>2925-063-078× .</u>					
				PART NU 2010 9	MBER			
NET WEIGHT		MENSIONS		GROSS W	J=+-1 A E IGHT			FT
							0001010	_ '
All s	pecilications and standar	ds applicable to the r	equirements h	erein sha	11 be the issue in	effect on	date of inv	itation for bids.
P ACK AG ING	X LEVEL A	LEVE	LС					
	THE FOLLOWING	L BE IN ACCORDAN DETAILED REQUIRE	CE WITH SPI	L APPL	TION MIL-P-116, Y:			
	UNIT PKG QTY	METHOD	PRESERVA	TIVE	WRAP	DUN	NAGE	CONTAINER
	1.	IId			MI1-8-12)	MII	<b>-</b> 7769	for Horking
		I	I	1.(	Fr A or	1 (	r.	
				ŀ	blyethylera	MI	-25514	
PACKING	X LEVEL A	LEVE	L c					
					MT;	-105	54	
LA ITEMS PLYW	OOD USED SHALL BE 5	CONTAINERS CONF	TH EXTERIC	SPECIFIC	OF U.S. PRODUC	T STAND	ARD PSI-	56. THIS PLYWOOD
SHAL	L HAVE THE GRADE ST	AMP OF AN APPROV	ED TESTING	AGENC	Y. FURTHER, P	LYWOOD	SHALL BE	SURFACE TREATED
THE 1	OP INVERTED SO AS T	O PROVIDE A FLUSH	H TOP SURF	ACE FOR	WATER RUNOF			SN3TROCTED WITH
	SHALL BE PACKED IN	A MANNER TO INSU	RE CARRIEF	ACCEP	TANCE AND SAF	EDELIVE	ERY AT DE	ESTINATION. CON-
	RS SHALL BE IN ACCO	RDANCE WITH UNIF	ORM FREIGH	T CLASS	IFICATION RULE	S OR RE	GULATION	IS OF OTHER
	IERS APPLICABLE TO	THE MODE OF TRAN	SPORTATIO	N.				
Cant	ERS APPLICABLE TO	THE MODE OF TRAN	SPORTATIO	Ν.				
CBAR	IERS APPLICABLE TO	THE MODE OF TRAN	SPORTATIO	N.				
MARKING	IERS APPLICABLE TO	THE MODE OF TRAN	5 PORTATIO	N.				
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Figure 1–2. Preservation, Packaging, Packing and Marking Requirements.

# SECTION II TEST EQUIPMENT, SPECIAL TOOLS, AND MATERIALS

#### 2-1. Test Equipment

Refer to table 2–1 for a list of test equipment required to perform the procedures described in this manual.

<b>Part, Model</b> or Mil <b>Des</b>	FML	Nomenclature	Technical Description
Model 40B	06365	Balancing Machine	Used to Balance Armature Assembly.
1650A	24655	Capacitance Bridge	Used to Check Capacitor Values.
13700-10	19315	Insulation Breakdown Test Set	Used to Perform Insulation Breakdown Tests.
7085-5	99664	Electrical Test Stand	Used to Provide Load Conditions for Performance Testing.
7199-1	99664	Aircraft Generator Test Stand	Used for Performance Testing of Starter Generator.
Type B-1	99664	Starter Torque Tester	Used to Test Starter Generator Torque.

Table 2-1. Test Equipment Required

Note. Equivalent teat equipment may be used.

#### 2-2. Special Tools

Refer to table 2–2 for a list of special tools required to perform the procedures described in this manual.

Table 2-2.	Special	Tools	s Required
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Part, Model or Mil Des	Nomenclature
QB80059-3	Spline Wrench
QB80277-1	Brush Spring Hook
1106005-1	Brush Box Aligner Pilot
1106006-1	Brush Box Aligner
1106023-1	Bearing Puller
1106140-3	Spring Scale
1106149	Rotor Stand
1106187	Generator Overhaul Stand

Table 2-2.	Special	Tools	Required	-	Continued
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Part, Model or Mil Des	Nomenclature
1106269	Bearing Retainer Puller
1106353-1	Setting Gage
1106354-1	Interface

*Note.* All tools listed above are manufactured by The Bendix Corporation, Electric Power Division, Eatontown, New Jersey. Equivalent tools may be used.

#### 2-3. Consumable Materials

Refer to table 2-3 for a list of all consumable materials required to perform the procedures described in this manual.

<i>Table 2-3.</i>	Consumable	Materials

Item No.	Nomenclature	Specification Number	Title
1	Trichlorethylene	MIL-T-7003	Trichlorethylene, Stabilized Degreasing
2	Solvent	P-D-680	Dry Cleaning Solvent
3	Lint-free Cloth	CCC-C-440	Cloth, Cotton, Cheesecloth, Bleached and Unbleached
4	Lubricating Oil	MIL-L-7870	Lubricating Oil, General Purpose, Low Temperature
5	Corrosion Preventive	MIL-C-4339	Corrosion Preventive, Soluble Oil
6	Shellac	TT-S-271	Shellac, Dry
7	Dentured Alcohol	MIL-A-6091	Alcohol, Ethyl, Specially Denatured, Aircraft
8	Soft Solder	MIL-S-6872	Soldering Process, General Specification for
9	Epoxy Resin (red)	Type CR-1056B (FMC 72688)	

Item No.	Nomenclature	Number Specification	Title
10	Epoxy Reactor (tan)	Type CC–1056A (FMC 72688)	
11	Spline Lubricant.	Pioneer No. 31 (FMC 83298)	
12	High Temperature Lubricating	MIL-G-3545	Lubricating Grease, High Temperature
	Grease (Alternate for item 11)		
13	Red Glyptal Lacquer	Part No. 1201 (FMC 04314)	
14	Sealant, Grade C	MIL-S-22473	Sealing, Lock and Retaining Compounds, Single Component
15	Sealant, Grade A	MIL-S-22473	Sealing, Locking and Retaining Compounds, Single Component
16	LockWire	MS20995C32-6	- surponent

#### Table 2-3. Consumable Materia1s-Continued

# SECTION III GENERAL SUPPORT MAINTENANCE

#### 3-1. Disassembly

#### a. General.

(1) Disassemble the starter generator to the extent necessary for repair by following the illustrated parts breakdowns and the exploded views (figures 3-1 and 3-2), as described in paragraphs b and c.

(2) The index numbers are assigned in the order of disassembly, except that attaching parts are listed immediately following the parts they attach.

#### b. Starter Generator.

(1) Secure the starter generator to interface (1106354-1) and mount both on generator overhaul stand (1106187).

(2) Loosen screw (2, figure 3-1) enough so that brush access cover assembly (1) can be slipped off from the fan end of the housing and stator (53).

*Note.* The last two threads of screws (2) have been distorted to captivate nut (3).

(3) Remove eight screws (5), eight lock washers (6), and eight washers (7). Using brush spring hook (QB80277-1, lift up the brush springs, and remove eight split-type brushes (4). Discard the brushes.

(4) Remove three self-locking nuts (8) and three washers (9), and disconnect capacitor terminals from the B + and E- studs.

(5) Remove two self-locking nuts (10) and two washers (11), and disconnect the stator terminals from the A+ and D terminal studs.

(6) If visual inspection indicates damage, remove capacitors (15) with terminals (12 through 14).

(7) Remove six screws (17) and fan housing (16). Hold the spline of drive shaft assembly (22) with spline wrench (QB80059-3), and using a 7/16-inch (12-point thin wall) socket wrench, remove self-locking nut (19), washer (20), fan (18), and compression spring (21), Remove drive shaft assembly (22), and front plate (23). (8) Remove three screws (24), three lock washers (25), and three washers (26) to free capacitor leads,

(9) Using retaining ring pliers, remove lock rings (27 and 38). Remove outer dirt slingers (35 and 43). Remove four screws (28) and four lock washers (29) to free bearing retainer (37).

(10) Remove four screws (41) to free bearing retainer (45), Remove outer race bearing retainer (40).

(11) Remove six screws (31), six lock washers (32), and six special washers (33), Press armature assembly (39), with attached end bell assembly (30), out of housing and stator (53).

# *Note.* Use bearing retainer puller (1106269) only if there is bearing or other internal failure.

(12) Using bearing retainer puller (1106269), press armature assembly (39), with ball bearings (36 and 44) attached, out of end bell assembly (30). Refer to paragraph c below for disassembly instructions of the end bell assembly.

(13) Using bearing puller (1106023-1), pull ball bearings (36 and 44) off the shaft of armature assembly (39). Discard the ball bearings at each overhaul.

(14) Remove inner dirt slingers (35 and 43) and bearing retainers (37 and 45). Remove four bushings (42) from housing and stator (53).

(15) Remove four screws (47) and identification plate (46).

(16) Remove two screws (50), two washers (51), terminal board (49), and terminal board insulators (52) if they are damaged.

c. End Bell Assembly.

(1) Remove capacitors (6, 13, 20, and 27, figure 3–2) if physical damage is indicated, by removing two screws (1), two lock washers (2), and two washers (3), self -locking nuts (7, 14, and 21), washens (8, 15, and 22), washers (9, 16, and 23), and screws (10, 17, and 24). Do not attempt to remove terminals (4, 11, 18, or 25) unless damaged.



Figure s-1. Starter Generator, Exploded View.



dex o,	Part Number Description		Qty Per Assy	Index No.	Part
1_	30E20-61-A	GENERATOR, Starter	1	3-1-	
^	1544776	COVER ASSEMBLY, Brush access	1	-48	15461
-1	MS25976_968	SCREW	1		15439
- <u>-</u> 2	2002Kg	NIT Source and al stI No 10-32	1	_19	15442
-0 4	1110/80	BRUSH Solit-type	8		10110
<u> </u>	1110405	(A m/t) A CITINC D A D m C)		50	01011
_	ADDURE D	(ATTAUHING PARIS)	8	-50	81911
-5	890065-2	. SUREW, Cap, sen, cao. pl orz, $1/4-20 \times 1/2$ m, ig	8	-91	89040
-6	MS35338-44	WASHER, LOCK	8	•	
-7	AN960-416	. WASHER	•	-52	15439
				-53	No N
-8	MS20364-624A	.NUT, Self-locking	3		
-9	AN960-616	, WASHER	3		
-10	MS20364 - 1032A	. NUT, Self-locking	2		
-11	AN960-10L	. WASHER	2		
	15455 <b>925</b>	, CAPACITOR ASSEMBLY	1		
-12	34112	TERMINAL, Solderless (00779) (83298, part No. 1102238-7)	1		
-13	34115	TERMINAL, Solderless (00779) (83298, part No. 1102238-15)	1		
-14	34126	TERMINAL, Solderloss (00779) (83298, part No. 1102238-16)	1		
-15	96P47302S2	. CAPACITOR, FIXED, 0.047 uf ±20 pct, 200 V dc (56289) (83298, part No.			
10		1103587-45)	2		
-16	1543975	HOUSING, Fan	1		
10	1010010				
	MC05101 070	(ATTAUMING FARIS)	6		
-17	MI2021A1-71A	. SURE W *			
-18	1543970	. FAN	1		
		(ATTACHING PARTS)			
-19	59NTE2834-054	.NUT, Self-locking (72962) (83298, part No. 1549109-1)	1		
-20	1549110 - 1	. WASHER, Flat, cad. pl stl, for 5/16 in. screw	1		
		*- <b></b>			
21	1543736	SPRING, Compression	1		
_22	1548441	SHAFT ASSEMBLY, Drive	1		
-22	1111791	PLATE Front	1		
-20	810006 008	SCREW Filh est No $6-32 \times 1/4$ in la	3		
-24	910001 016	WASHER Look set for No 6 serow	3		
-20	810002 002	WASHED Plat ast for No. 6 seren	3		
-40	019092-000 MS12224 1009	DINC Look	1		
-21	MIS10024-1098		1		
-20	M 005 000 40				
-29	MIS35338-42	WASHER, LOCK	4		
-30	1543996	. END BELL ASSEMBLY (See fig. 3-2)	1		
	- F + 40 <b>F</b> 0 - 4	(ATTAUHING PARTS)	c		
-31	1544079-1	. SURFIW, Cap, sch, cad. pl sti, No. 10-32 x 1 m. 1g	0		
-32	MS35337 - 43	WASHER, Lock	6		
-33	1546968 - 1	. WASHER, Special	6		
-34	MS171434	. PIN, Roll	1		
-35	844923	. SLINGER, Dirt	2		
-36	890659-5	. BEARING, Ball	1		
-37	1329018	RETAINER, Bearing	1		
-38	MS16624 - 1098	. RING, Lock	1		
-39	1543957 - 1	ARMATURE ASSEMBLY	1		
-40	1322942	RETAINER, Bearing, outer race	1		
		(ATTACHING PARTS)			
41	1999044	SCREW Flot hd and pl at No. 8. $32 \times 15/16$ in la	4		
-41	1044744	$x^{2}$	т		
10					
-42	1325794-3	, BUSHING	4		
-43	844923	. SLINGER, Dirt	Z		
-14	890659 - 5	. BEARING, Ball	1		
-45	1329018	. RETAINER, Bearing	1		
-46	1543979	. PLATE, Identification	1		
		(ATTACHING PARTS)			
-47	22996 - 16	. SCREW, Self-tapping, rd hd, stl, No. 4 x 3/16 in, lg	4		
		*			

Part Number	Description	Qty Per Assy
1546139	. PLATE, Identification	1
1543960	. STATOR, Generator	1
1544525	BOARD, Terminal	1
819110-120 890489	(ATTACHING PARTS) SCREW, Fil h, ead. pl stl, No. 10-32 x 5/16 in. lg WASHER, Flat, sst, for No. 10 screw $^{*}$	2 2
1543966 No Number	INSULATOR, Terminal board HOUSING AND STATOR (order 1543960)	<b>3</b> 1



Figure 3-2. End Bell Assembly, Exploded View.

LEGENDFOR	FIGURE 3-2
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Index No.	Part Number	Description	Qty Per Assy
32	1543956	END BELL ASSEMBLY (See item 30, fig. 3–1 for nha)	Ref
	1545592-1	• CAPACITOR ASSEMBLY (ATTACHING PARTS)	2
-1	819106-110	. SCREW, fil h, cad. pl stl, No. $6-32 \ge 5/16$ in. lg	2
-2	MS35338-41	. WASHER, Lock	2
3	890487	WASHER, Flat, sst, for No. 6 screw	2
-4	1329221	TERMINAL	1
-5	1532827-3	CLAMP, Loop	1
6	1102113-2	CAPACITOR, Fixed, 40 uf +20 pct -15 pct, 75 V dc	1
	1545592-6	CAPACITOR ASSEMBLY (ATTACHING PARTS)	1
-7	MS21044NO6	. NUT, Self-locking	1
8	3333 <b>8</b>	. WASHER, Flat, cad. pl stl, for No. 6 screw	1
-9	AN9606L	.WASHER	1

#### TM 55-2925-236-40

Index No.	Part Number	Description	Qty Per Assy
3-2-			
10	MS35265-31	.SCREW	1
-11	34110	TERMINAL, Solderless (00779) (83298, part No. 1102238–4)	1
-12	1532827-19	CLAMP, Loop	1
	15455923	CAPACITOR, Fixed, 0.10 uf, 150 V dc (56289) (83298, part No. 1111769-5)	1
-13	$121\mathrm{P10401R5S2}$	. CAPACITOR ÁSSEMBLY (ATTACHING PARTS)	1
-14	MS21044NO6	. NUT, Self-locking	1
-15	33338	. WASHER, Flat, cad. pl stl, for No. 6 screw	1
-16	AN960-CL	. WASHER	1
-17	MS35265-31	. SCREW	1
		*	
-18	34110	TERMINAL, solderless (00779) (83298, part No. 1102238-4)	1
-19	1532827 - 20	CLAMP, Loop	1
-20	69F196G3	CAPACITOR, Fixed, 4.7 uf $\pm$ 10 pct, 100 V dc (06001) (83298, part No.	1
		1545591-1)	1
	1545592-4	. CAPACITOR ASSEMBLY (ATTACHING PARTS)	1
-21	MS21044NO6	. NUT, Self-locking	1
-22	33338	. WASHER, Flat, cad. pl stl, for No. 6 screw	1
-23	AN9606L	.WASHER	1
-24	MS35265-31	. SCREW	1
-25	34110	TERMINAL, Solderless (00779) (83298, part No. 1102238-4)	1
-26	1532827-19	CLAMP, Loop	1
-27	121 P4740R5S1	CAPACITOR, Fixed, 0.47 uf ±20 pct, 50 V dc (56289) (83298, part No. 1545590)	
-28	1542776	. HOLDER, Electrical contact (ATTACHING PARTS)	4
-29	1543503	SCREW, Cap. hex hd, 5/16-18 x 1-1/8 in. lg	4
-30	MS35338-45	. WASHER, Lock	4
-31	867491	. WASHER, Flat, cad, pl stl, for 5/16 in. screw	4
32	1543622	. WASHER, Insulating	16
-33	1328928	- TUBE, Insulating	4
-34	1543976	. BELL, End	1

(2) Remove four screws (29), four lock. washers (30), four washers (31), sixteen insulating washers (32), and four insulating tubes (33), from end bell (34). Do not remove four electrical contact holders (28) unless damage is visible. *Caution:* Do not attempt to remove the cast-in bearing liner from end bell (34).

#### 3-2. Inspection Requirements

*a.* Refer to table 3–1 for detail inspection requirements for components of the starter generator.

Fig. No.	Index No.	Nomenclature	Inspection Category	Method of Inspection	Remarks
3–1	15	Capacitor	Cracks, Leaks, Damaged Insulation	Visual	Refer to Parts List
3 <b>2</b>	6, 13, 20, 27		Electrical Rating	*1650A	for Ratings
3–1	21	Compression Spring	Cracks, Distortion Load at Compressed Length of 1.100 in. to be 180 to 200 lb	Visual	-
3–1	22	Drive Shaft Assembly	Cracks	Magnetic Particle (Specification MIL-I-6868)	Para 3-2b
3–1	89	Armature Assembly	Commutator Undercut to 0.030 in. Wide by 1/32 in. Deep	,	

Table 3-1	. Detail	Inspection	<i>Requirements</i>
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Fig No.	Index No.	Nomenclature	Inspection Category	Method of Inspection	Remarks
			Commutator Contact Surface	Visual	Para 3-2c
			Cracks, Damaged Insula- tion, Damaged Conduc- tors	Visual	
			Insulation Breakdown – 300 volts, 60 cps for 1 sec Between Commutator Bars and Shaft (Ground)	*13700-1C	Para 3-5e
			Static and Dynamic Balance within 0.020 oz in.	*Model 40B	
			Bearing Surfaces		Table 3-2
3-1	53	Housing and Stator	Cracks, Damaged Insula- tion	Visual	
			Bearing Bore Worn		Para <i>3-2d</i>
			Insulation Breakdown - 300 volts, 60 cps for 1 sec Between Terminals and Housing (Ground)	*13700-1C	
3-2	28	Electrical Contact Holder	Cracks, Distorted Springs Spring Pressure to be 46 to 52 oz when Spring is Just Lifted Beyond Brush Position	Visual *1106140-3	
3-2	33	Insulating Tube	Cracks	Visual	
3-2	34	End Bell	Cracks, Damaged Threads Bearing Bore Worn	Visual	Para 3-2d

Table 3-1. Dental Inspection Requirements - Continued

● See tables 2–1 and 2-2.

b. Check the drive shaft assembly (22, figure 3–1) splines for wear. The "top land" dimension of new spline teeth are 0.029 inch minimum for the 16-tooth spline, and 0.039 inch minimum for the 12-tooth spline. Replace the drive shaft when the "top land" dimension of a spline reaches zero.

*Note.* The spline is safe down to a "top land" dimension of zero, but if service records indicate "top land" dimension may reach zero during the next service period, the drive shaft should be replaced.

*Caution:* Spline wear rate will increase rapidly after reaching the zero "top land" dimension condition.

*c.* Inspect the commutator of armature assembly (39). The brush contact surface should be even, high burnished, and dark brown or almost black in color. If the contact surface is rough, pitted, burned, or covered by a hardened film of carbon or oil which cleaning does not remove, resurface the commutator as described in paragraph 3–6.

*d.* Refer to table 3–2 for fits and clearances of component parts. If the inside diameter of housing and stator (53) or end bell (34, figure 3-2) bearing bore is worn beyond 2.0475 inches, as measured with an air gage, air probe, and 2.0475-inch setting ring, metallize the worn surface as described in paragraph 3-7.

Table 3	-2 Fits	and (	Clearances
---------	---------	-------	------------

Part No.	Nomenclature	Service Dimensionss (Inches)	Mating Part No.	Nomenclature	Service Dimensions (Inches)	Service Tolerance (Inches)	
1543957-1	Armature Assembly	0.9843 OD	890659-5	Ball Bearing	0.9843 ID	0.0000 L/L	
1543976 1543960	End Bell Generator Stator	2.0475 ID 2.4075 ID	890659-5 890659-5	Ball Bearing Ball Bearing	2.0470 OD 2.0470 OD	0.0005 L 0.0005 L	

### 3-3. Cleaning

a. *General.* Clean all parts of the starter generator with trichlorethylene (item 1, table 2-3)

or dry cleaning solvent (item 2, table 23). Do not dip parts into the solvent. Use a stiff, non-wire brush to scrub the parts thoroughly. *Warning:* Use solvent only in a well-ventilated area. Avoid inhaling solvent fumes. Do not allow solvent to contact the skin as burns may occur.

**Note.** Refer to paragraph b for specific cleaning procedures for armature assembly (39, figure 3-1) and housing and stator (53).

(1) Ultrasonic cleaning equipment may be used, if available. Consult the manufacturer of this equipment for proper cleaning solutions and methods to be used.

(2) Dry parts with a clean, lint-free cloth (item 3, table 2-3).

**b.** Armature Assembly and Housing Stator. Using a cleaning solvent specified in paragraph 3-3 with a stiff, non-wire brush, scrub armature assembly (39, figure 3–1) and housing and stator (53) thoroughly to remove any carbon and copper particles imbedded between commutator bars and stator bars.

(1) After cleaning, bake the armature assembly and the housing and stator in an oven at 250° F (121° C) for two hours or at 200° F (93° C) for three hours.

(2) After baking, apply a light film of lubricating oil (item 4, table 2–3) or corrosion preventive (item 5, table 2-3) to all ferrous metal surfaces to prevent rusting.

*Caution:* Do not apply oil to the commutator.

## 3-4. Repair or Replacement

*Note.* Paragraphs 3-5 through 3-7 list and describe procedures for reparable parts only.

## a. General.

(1) Replace all parts that are worn and damaged,

(2) Replace split-type brushes (4, figure 3-1) and ball bearings (36 and 44) at each overhaul.

(3) Replace all wiring having burned or cracked insulation, or broken or corroded terminals.

## 3-5. Armature Assembly

Replace armature assembly (39, figure 3-1) If any of the following conditions exist:

a. If the shaft diameter is less than 0.9843 in.

**b.** If the commutator has badly burned bars, because such a condition is usually the result of open-circuited armature coils.

c. If commutator bars are loose or out of alignment.

**d.** If resurfacing the commutator (paragraph 3–6) would reduce the outside diameter below the allowable minimum of 2.800 inches. This diameter is indicated by a step cut into the edge of the commutator.

*e*. If the insulation breakdown test (table 3–1) between commutator bars and ground shows indication of insulation breakdown.

*Caution:* When performing this test, keep test probes outside brush path to avoid damaging contact surface.

## *3-6.* Resurfacing the Commutator

a. To remove oil or carbon film, mount armature assembly (39, figure 3-1) in a lathe and take a single light cut across the face of the commutator at a speed of approximately 600 surface feet per minute. If the contact surface is scored or pitted, take a series of light cuts at approximately 200 surface feet per minute. A diamondtipped cutting tool (figure 3-3) is recommended, The point of the cutting tool must be held on the centerline of the armature shaft (see figure 3-4). If a Carboloy-tipped cutting tool (figure 3-5) is used, the point of the cutting tool must be held 0.031 in, below the centerline of the armature shaft. The minimum diameter to which the commutator may be turned down is 2.800 inches. This limit is indicated by a step cut into the commutator. If necessary to remove metal beyond this point, replace the armature assembly.

**b.** After the commutator has been turned down, measure the depth of undercutting between commutator bars. If the depth is less than 1/32 in., undercut to this depth and to a width of .030 in,

c. After undercutting, take a final light cut of not more than 0.001 in. across the face of the commutator to remove burrs, If a diamond-tipped cutting tool is not available, make the final cut with a freshly honed Carboloy-tipped tool. Cutting speed should be approximately 600 surface feet per minute with dither type tool. Do not use polishing abrasives. After the final cut, remove burrs between commutator bars with a strip of fiber.

**d.** Check that the commutator is concentric with the bearing surfaces of the armature shaft within 0.005 in.. full indicator reading.

*e*. After resurfacing, clean the commutator to remove all traces of oil, grease, and metal chips, as specified in paragraph 3-36.

f. Check the armature assembly for static and dynamic balance, using balancing machine, model



Figure 3-3. Fabrication of Diamond-tipped Cutting Tool



Figure 3-4. Mounting of Commutator Cutting Tool.

40B. If out of balance by more than 0.020 oz in., rebalance by inserting leaded epoxy material inside and under winding openings as required.

#### 3-7. Metalizing Bearing Bores

If the bearing bore of end bell (34, figure 3-2) or housing and stator (53, figure 3-1) is worn beyond 2.0475 in., metallize the bore as described in steps *a* through *i*.

*a.* Degrease the face of the bore and adjacent areas from which contaminants might be introduced, using a solvent specified in paragraph 3-32.

*b.* Mask the area adjacent to the face of the bearing bore with shellac (item 6, table 2-3) to prevent adherence of the sprayed metal to these surfaces. Any shellac on the face of the bore will be removed by boring (step c).

*c.* Using a feed which will provide a suitable base for metallizing, roughbore the bearing surface to correct any taper or out-of-round condition. Remove at least 0.006 in., but do not exceed the original dimension by more than 0.015 in. on the radius.

*d.* Insert the housing in a lathe, and rotate it at a speed of approximately 60 rpm.

*Caution:* The area to be metallized must be absolutely clean.

*e.* To prevent condensation of moisture, make several rapid passes over the work with the flame only, immediately before applying the molybdenum (spraybond or molybond) coating. Should the bore be so impregnated with grease as to prevent metallizing, replace the end bell or housing and stator.

*f.* Make several passes over the bearing bore, to deposit a thin coat of molybdenum.

g. Complete the metallizing with molybdenum or 0.80 percent carbon steel wire to a thickness of 0.006 in. on top of the finished diameter (finished diameter minus 0.012 in.)

*h*. Rough-bore the surface to 0.010 in. under the finished diameter. Finish the surface by grinding to an inside diameter of 2.0472, plus 0.0003, minus 0.0000 in. The concentricity between the inside diameter of the bearing bore and both the outermost (4.122 in.) diameter of the housing and stator, and the largest inside diameter (6.125 in.) of the end bell must be within 0.002 in., full indicator reading.

*i.* Remove masking shellac and grinding residue with denatured alcohol (item 7, table 2-3).

#### 3-8. Soldering

*a.* In all soldering operations (capacitor leads to terminals), use a resin core solder composed of 63 percent tin and 37 percent lead (item 8, table



Figure 3-5. Fabrication of Carboloy-tipped Cutting Tool.

2-3). This solder has a melting temperature of 357° F (181° C).

*Caution:* Do not use an acid core solder or an acid flux. Do not burn insulation when soldering.

*b.* All soldering must be done in accordance with Federal Specification QQ–S–571.

c. After soldering, clean all joints with denatured alcohol (item 7, table 2-3) to remove all traces of resin and other foreign matter.

#### 3-9. Sleeving Replacement

All sleeting used on the starter generator is teflon natural color sleeving, and with the exception of the one length specified in step a, all sleeving has an inside diameter between 0.032 and 0.039 in. The wall thickness on all sleeving is 0.030 in. Lengths are given in steps a through f.

*a.* The length of sleeving joining capacitors (15, figure 3-1) to terminal post E- has an inside diameter between 0.051 and 0.061 in. and is 1-1/2 in. long.

*b.* The sleeving on the lead of capacitor (15) to terminal post B + is 2-1/16 in. long.

c. The two lengths of sleeving on capacitor (6, figure 3–2) are 2 in. long.

d. The sleeving on capacitor (13) is 1-5/32 in. long.

e. The sleeving on capacitor (20) is 1-15/32 in. long.

f. The sleeving on capacitor (27) is 1-1/4 in. long.

*Note.* All capacitors are firm components. There is no alternate or equivalent part number for capacitors.

#### 3-10. Capacitor Mounting

If any capacitors have been removed or replaced, they must be cemented in their mounting positions. The material to be used consists of two parts of red epoxy resin (item 9, table 2-3) to one part of tan epoxy reactor (item 10, table 2–3) by weight. Follow the procedure of steps a through f.

*a.* Make sure areas to be cemented are free from grease, oil, or any contaminant that might prevent adhesion.

*b.* Stir the epoxy mixture until uniform in color.

Note. The pot life of the mixture is 3 hours.

*c.* Secure the end bell capacitors in place with mounting hardware (see figure 3-2).

*d.* Position the terminal board capacitors as shown in figure 3–6.

*e.* Apply the epoxy mixture with a paddle or spatula to form a fillet. On the end bell capacitors, cement the capacitors and loop clamps to the housing. Wipe away all excess material before curing.

f. Allow the mixture to cure for 24 hours at room temperature or for 3 hours at  $150^{\circ}$  F (66° C).

#### 3-11. Lubrication

The only lubrication required for the starter generator is after assembly, coat the drive shaft spline with a light film of spline lubricant (item 11, table 2-3). If this lubricant is not available, use high-temperature lubricating grease (item 12, table 2-3).

*Note.* Use of sealing compounds is specified throughout the reassembly paragraphs.

#### 3-12. Reassembly

Reassembly is basically the reverse of disassembly. Follow the exploded views (figures 3-1 and 3-2), the schematic diagram (figure 3-7) and the detailed instructions (paragraphs a and b) for reassembly information.

a. End Bell Assembly.

(1) If capacitors (6, 13, 20, and 27, figure 3-2) were removed or replaced, secure them to end bell (34) and cement as described in paragraph 3-10.

Note. Terminals of capacitors (6) will be secured to electrical contact holders (28) when split-type brushes are installed (paragraph b). Terminals of capacitors (13, 20, and 27) will be secured to threaded holes in heads of screws (29) at final assembly (paragraph b).

(2) Using brush box aligner (1106006-1) and brush box aligner pilor (1106005-1), secure electrical contact holders (28) to end bell (34) with four screws (29), four lock washers (30),



Figure 3-6. Capacitor Mounting Position.



Figure 3–7. Starter Generator, Schematic Diagram.

four washers (31), sixteen insulating washers (32), and four insulating tubes (33).

(3) Coat the area between the insulating washers and the electrical contact holder bosses with red glyptal lacquer (item 13, table 2-3), and tighten screws (29) to a torque of 75 to 80 pound-inches.

b. Starter Generator.

(1) Mount three terminal board insulators (52, figure 3-1) in position on housing and stator (53). Apply sealing compound (item 14, table 2-3) to threads of two screws (50). Secure terminal board (49) to the housing and stator with two screws (50) and two washers (51), making sure to install the terminal of capacitor (15) under one screw as shown in figure 3-6.

(2) If capacitors (15, figure 3-1) were removed or replaced, secure them to terminal board (49) as described in paragraph 3-10.

(3) Install identification plate (46) on housing and secure with four screws (47).

(4) Mount bearing retainer (45) and one dirt slinger (43) on the drive end of armature assembly (39).

(5) Mount bearing retainer (37) and one dirt slinger (35) on the commutator end of armature assembly (39).

(6) Stand armature assembly (39) on rotor stand (1106149). Heat ball bearings (36 and 44) to 250° F (121° C) and install on armature assembly (39), making sure that the dirt slingers are properly positioned.

(7) Insert armature assembly (39) into housing and stator (53), seating ball bearing (44) in the bore of the housing.

(8) Mount end bell assembly (30) on ball bearing (36), and secure to housing and stator (53) with six screws (31), six lock washers (31), and six special washers (33). Tighten screws to a torque of 35 to 40 pound-inches.

(9) Secure the housing to interface (1106354-1) and mount on generator overhaul stand (1106187).

(10) Install the remaining dirt slingers (35 and 43) and lock rings (17 and 38).

(11) Align bearing retainer (45) with the holes in housing and stator (53). Apply sealing compound (item 15, table 2-3) to the threads of four screws (41). Install bushings (42) and outer race bearing retainer (40), and secure with four screws (41).

(12) Align bearing retainer (37) with the four holes in end bell assembly (30). Apply sealing compound (item 15, table 2-3) to the threads of four screws (28), and install the screws with four lock washers (29).

(13) Align the terminals of end bell capacitors (13, 20, and 27, figure 3-2) over the threaded holes in four screws (29), and secure with three screws (24, figure 3-1), three lock washers (25), and three washers (26).

(14) Use setting gage (1106353-1) to measure and check the compressed length of compression spring (21). This assembled length should be 1.100 inches. Insert the gage size plug into the fan end of armature assembly (39), and install washer (20) and self-locking nut (19). Seat the setting gage on the washer, and tighten the self-locking nut, using a 7/16-inch (12-point thin wall) socket wrench until the gage indicator is at zero, plus or minus 0.005 inch. Remove the setting gage, self-locking nut, washer, and gage size plug. Install front plate (23) on drive shaft assembly (22) and insert the shaft through armature assembly (39). Install fan (18) through the armature assembly. Install compression spring (21), washer (20), self-locking nut (19) and the setting gage. Using spline wrench (QB80059–3) to keep the shaft from turning, retighten selflocking nut (19) with the 7/16-inch (12-point thin wall) socket wrench until the setting gage again indicates zero, plus or minus 0.005 inch. Remove the setting gage.

(15) Apply sealing compound (item 14, table 2–3) to the threads of six screws (17). Secure fan housing (16) to end bell assembly (30) with six screws (17).

(16) Fasten generator stator terminals to terminal posts D and A+ with two self-locking nuts (10) and two washers (11).

(17) Fasten generator stator terminals and capacitor terminals to terminal posts  $E_{-}$ ,  $B_{+}$ , and  $C_{+}$  with three self-locking nuts (8) and three washers (9) (see figure 3-6 and 3-7).

(18) Install split-type brushes (4, figure 31) in brush holders, and secure, along with two end bell capacitor terminals, with eight screws
(5), eight lock washers (6), and eight washers
(7). Tighten the screws to a torque of 35 to 40 pound-inches.

(19), Slide brush access cover assembly (1) over fan housing (16), and tighten screw (2) and square nut (3).

(20) After the starter generator has been tested satisfactorily, safety wire the drilled head screw (2) to brush access cover assembly (1) with lock wire (item 16, table 2-3) in accordance with Military Standard MS33540 (ASG).

(21) After the final test procedure has established optimum position of brushes, lock the end bell assembly in position. Using the notch in the end bell for location, drill a 0.062, plus 0.003, minus 0.000 in. diameter hole through the housing, and press in roll pin (34) flush to the housing.

# SECTION IV FINAL TEST PROCEDURES

# 4-1. General

If the starter generator fails to meet any of the test requirements and visual inspection does not disclose the cause of the trouble, refer to the troubleshooting table 4-1, disassemble, and repeat inspection procedures as outlined in Section III. After reassembling, repeat the test procedure from the beginning.

Table 4-1. Troubleshooting

Item	Trouble	Probable Cause	Remedy
1	Short Brush Life or Excessive Sparking	Worn, Improperly Seated, or Loose Fitting Brushes	Replace, Service, and/or Readjust Brushes as Necessary.
		Low Brush Spring Tension	Readjust and/or Replace Spring.
		Dirty Commutator	Service Commutator.
		Scored, Pitted, or out-of-round Commutator	Resurface Commutator.
		Short, Ground, or Open Armature	Replace Armature,
		Ball Bearings Worn	Replace Ball Bearings.
_	~	Shorted Compensating Winding	Replace Yoke Assembly.
2	Generator Noisy	Faulty Condensers	Replace Condensers.
		Discharged Battery	Replace Battery.
		Excessive Sparking at Generator Brushes	See Item 1.
3	Output Voltage Low or no Reading	Shorted or Open Rotor or Exciter and/or Shorted or Open Diodes	Test; if Faulty, Replace Rotor and/or Diodes.
		control Panel Faulty	Replace Control Panel.
		Shorted and/or Open Output Windings	Test; Replace Housing if Necessary.
		Drive Inoperative	Check Drive.
4	Output Voltage Indicates High	Control Panel Faulty	Replace Control Panel.
	-	Wrong or Faulty Connection Between Generator and Control Panel	Make Proper Connections and/or Tighten Connections.
5	Output Voltage Erratic or	Faulty Control Panel	Replace Control Panel.
	Fluctuates	High Resistance, Internal or External Connection in the dc Connection of Generator	Clean and/or Tighten Connections.
		Intermittently Shorted, Grounded, or Open ac Rotor and/or Stator	Test; Replace Rotor and/or Housing if Necessary.
6	Output Phase Sequence Incorrect With Generator Rotation Correct	External Wiring Not Properly Connected	Check External Wiring. Make Proper Connections. (Refer to External Wiring Diagram)
7	System Meters Indicates	External Wiring Not Properly	Check External Wiring, Make Proper
	Zero, Low, or Fluctuating	Connected	Connections and Tighten.
	Reading (Output Voltage satisfactory)	Improper Adjustment of Voltage Regulator	Check Adjustments. Make Proper Adjustments.
8	System Meters Read Off	Generator Field Magnetized in	Flash Field in Proper Direction.
	Scale in Wrong Direction,	Wrong Direction	1
	with Generator Connected	External Wiring Not Properly	Refer to Wiring Diagram. Check All
	to Load	Connected	Wiring Connections. All Connections Should be Clean and Tight.
9	Equipment Operating Un-	Faulty Control Panel	Replace Control Panel.
	satisfactorily Although No Load Voltage is at Proper Value	Improper Frequency	Check Drive.
10	Generator Overheats	Excessive Load	Check and Reduce Load, if Necessary.

### a. Test Conditions.

(1) *Temperature.* Since the starter generator is self-cooled, no cooling air is required. Check that the ambient temperature is  $77 \pm 27^{\circ}$  F (25  $\pm 15^{\circ}$ C).

(2) *Direction of rotation.* Drive the starter generator in a counterclockwise direction, as viewed from the drive end, during all tests.

(3) *Plastic windows.* It is recommended that a transparent plastic window strap be used during the brush seating procedure, so that the commutator end brushes will be visible. A spare brush access cover can be modified in the shop by cutting out squares, and riveting transparent non-flammable plastic window panes in place on the cover.

*Caution:* Do not operate the starter generator without the brush access cover in place, as overheating may occur.

(4) *Mounting.* The starter generator should be mounted on aircraft generator test stand (7199-1), or an equivalent test stand, capable of driving the generator continuously over the rated speed. The longitudinal axis of the generator should be horizontal.

(5) *Excitation.* The starter generator should be self-excited and controlled by a suitable variable resistance with the shunt field.

# $\it Note.$ The shunt field current should not be considered as part of the starter generator load current.

(6) *Load location.* The load for the starter generator should be located so that it will not affect the ambient temperature.

(7) *Warm-up.* The starter generator should be operated at a continuous operating speed delivering the rated load at the rated voltage, to obtain a constant temperature.

(8) *Voltage measurements.* The voltages should be measured between terminals E and B.

(9) *Shunt field voltage.* The voltage drop across the shunt field should be measured between terminals A and E. (See figure 3-7.)

*b. Test Equipment.* When performing stall torque test, use starter torque tester, type B-1.

#### 4-2. Flashing fhe Field

To be sure that the d-c magnetic circuit retains enough residual magnetism to allow the starter generator voltage to build up properly, flash the field as described in steps *a* through d.

a. Connect the positive terminal of a 12-volt battery through a singlepole, single throw knife switch to terminal A+ on terminal board (49, figure 3-1). *b.* Connect 'the negative terminal of the battery to terminal E- on the terminal board.

*c.* Apply battery current to the field for 5 seconds by closing the knife switch.

d. Repeat the operation several times to be sure that the field is properly flashed.

**Caution:** Use a knife switch when flashing the field. Opening the circuit at the starter generator or battery terminals can result in severe damage to the terminals or explosion of the battery.

#### 4-3 Brush Seating

a. Remove the brush access cover and replace it with the plastic window strap. (Refer to paragraph 4-1a(3).) The brush "run-in" can now be observed.

*b.* Operate the starter generator at the rated speed until the face of each brush contacts the commutator 100 percent in the direction of rotation and for at least 75 percent of brush dimension parallel to the shaft. (See figure 4-1.) There must be no evidence of excessive grooving or other surface damage to the face of the brush.

c. There must be no sparking except for fine pinpoint sparking at the generator brushes. Brushes should be removed from their brush holders for periodic inspection.

Note. If the brushes are removed from the brush holders, be sure to return each brush to the brush holder from which it was removed.

#### 4-4. Stall Torque Test

a. Mount the starter generator on starter torque tester, type B–1.

*b.* Connect the spline coupling of the torque coupling arm to the spline of drive shaft assembly (22, figure 3–1) and place one of the notched ends of the torque coupling arm in the shackle suspended from the scale.



Figure 4-1. Typical Brush Seating.

*c.* Connect the starter generator to the varidrive and start the vari-drive.

d. Set the main switch to ON.

*e.* Set the VOLTAGE INPUT GENERATOR AND SUPPLY switch to SUPPLY. The voltage indicated is the field voltage applied to the starter generator.

*f.* Turn the LINE AMPERE ADJUSTMENT control to obtain a current reading between 500 and 800 amperes. The stall torque as indicated by the stall torque test stand scale, at any point within this 500- to 800-ampere range, must comply with the values indicated by figure 4-2.

*g.* If the specified stall torque cannot be obtained within the current range indicated in step *f*, turn end bell assembly (30, figure 3-1) until the correct torque is obtained.

*h.* Set the VOLTAGE INPUT GENERATOR AND SUPPLY switch to VOLTAGE INPUT GENERATOR and read and record the starter generator voltage. The voltage reading should be in accordance with values given in figure 4-2.

*i.* If for any reason the position of end bell assembly (30, figure 3-1) was shifted, allow the starter generator to run for 1/2 hour and repeat the test.

#### 4-5. Dielectric Strength

a. Perform this test before any of the final tests.

*b.* Using insulation breakdown test set 13700-1C, apply 250 volts, 60 cps for one minute between each terminal post and the frame (ground).

c. A current. flow of more than 15 milliamperes indicates insulation breakdown.

### 4-6. Final Tests

*a. General.* Mount the starter generator on the test stand, as described in paragraph 4-1a(4).

b. Maximum Speed for Regulation.

*Note. The* starter generator must not be given an operational warm-up prior to this test.

(1) Turn on the test stand controls and increase the drive motor speed to 10,000 rpm.

(2) Adjust the regulator until the output voltage is 30 volts.

(3) Record the field voltage (Ef) and field current (If ).

(4) Calculate the external resistance in the field circuit by dividing the field voltage by the field current.

(5) The external resistance in the shunt field must not exceed 35 ohms.

c. Heating, Commutation, Minimum Speed an Equalizing Voltage.

(1) For heating, commutation, minimum speed, and equalizing voltage tests, the following is considered as a continuous operating condition: While the starter generator is cold, the resistance and temperature of the shunt field must be determined for use in calculating the averag field temperature rise used during continuous operation at full load. The starter generator is considered to have reached its continuous operating condition when the rate of rise of the shunt field temperature does not increase more than  $2^{\circ}F$  (1° *C*) during a five-minute period.

(2) Start the blower and drive motor. In crease the drive motor speed to operate the start er generator at 8000 rpm. Close suitable switches of the load bank to apply 300 amperes d-c load When the starter generator reaches its continuous operating condition as described in step a proceed as follows:

*(a)* Check the readings of the instruments. During the heat run, readings must be limited to those shown in table 4–2.

Table 4-2. Heating Test Readings

Shunt Field	8 amperes (max)
Load Ammeter	300 amperes
Line Voltage	30 volts

*(b)* Measure the equalizing voltage across terminals D and E on terminal board (49, figure 3-1). The voltage must be between 1.9 and 2.1 volts.

(3) After completing the previous test, de crease the speed of the motor until the minimum rated speed of 4000 rpm is measured on the ta chometer. Adjust the voltage regulator until a 26-volt reading is obtained. The starter generator must deliver rated current of 300 amperes, as read on the ammeter.

*Note.* At no time during the above heat runs should the required resistance external to the shunt field be less than 1.25 ohms. Refer to paragraph *4-6b* to calculate the external shunt field resistance.

(4) Readjust the regulator until a 30-volt reading is obtained.

*d. Commutation.* Immediately following the previous heat runs, with the starter generator hot, observe the commutation of the starter generator over the speed range 4400 to 8000 rpm for no load (all load switches off), half load (suitable load switches turned onto give 150 amperes), and rated load (suitable switches turned on to give 300 amperes). Table 4-3 lists the vari-



Figure4-2. Stall Torque Curve.

ous conditions. There should be no sparking except for the fine pinpoint sparking at the generator brushes.

*Note.* For any speed within the speed range, the field current must increase with increases in load.

Table 4-3. Commutation Test Readings

Speed (rpm)	Line Voltage	Load (amperes)	
4400	30	0	
4400	30	150	
4400	30	300	
6000	30	0	
6000	30	150	
6000	30	300	
8 ( MO	30	0	
8000	30	150	
8000	30	300	

#### e. Overspeed.

(1) Perform this test while the starter generator is hot as a result of testing.

(2) Open all load switches and the field switch. Operate the generator at no load.

(3) Increase the speed of the driving motor to 11,000 rpm. The generator must operate al this speed for five minutes without mechanical failure, the throwing of varnish, or impairment of electrical performance.

(4) At the end of the five-minute overspeed run, reduce the speed to 6000 rpm. Apply rated load of 300 amperes.

(5) Operate the starter generator for one minute and check the electrical performance. The results should compare with those observed in paragraph 4-6c.

#### f. Polarity Check.

(1) Operate the starter generator at rated speed and load conditions. Connect the voltmeter leads to starter generator terminals B+ and E-observing proper polarity.

(2) If the voltmeter connections must be reversed to obtain a reading, the polarity of the starter generator is reversed. In this case, flash the field in the proper direction as described in paragraph 4-2.

# APPENDIX A REFERENCES

MS33540 (ASG) QQ-S-571 TM 33-750 TM 55-405-10 Safety Wiring, General Practices for Solder, Soft Army Equipment Record System Ground Handling and Service Equipment

By Order of the Secretary of the Army:

W. C. WESTMORELAND, General, United States Army, Chief of Staff.

KENNETH G. WICKHAM, Major General, United States Army, The Adjutant General.

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