ROYAL CANADIAN AIR FORCE

HANDBOOK WITH PART LIST

GENERATOR DC ENGINE DRIVEN TYPE M-3

(ECLIPSE-PIONEER)

(This EO replaces EO 40-10BA-2 dated 22 Oct 51)

ISSUED ON AUTHORITY OF THE CHIEF OF THE AIR STAFF.

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LIST OF RCAF REVISIONS

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INTRODUCTION

This Handbook contains the Installation, Operation, Service, Maintenance, Overhaul and Testing Instructions, and a Part List for the following d-c generators manufactured by the Eclipse-Pioneer Division of the Bendix Aviation Corporation, Teterboro, New Jersey:

AF Type	Navy Stock No.	Eclipse-Pioneer Type	Nomenclature
M-3		1381-1-A	D-C Generator
	R86-EC-30E01-1-A	30E01-1-A	D-C Generator

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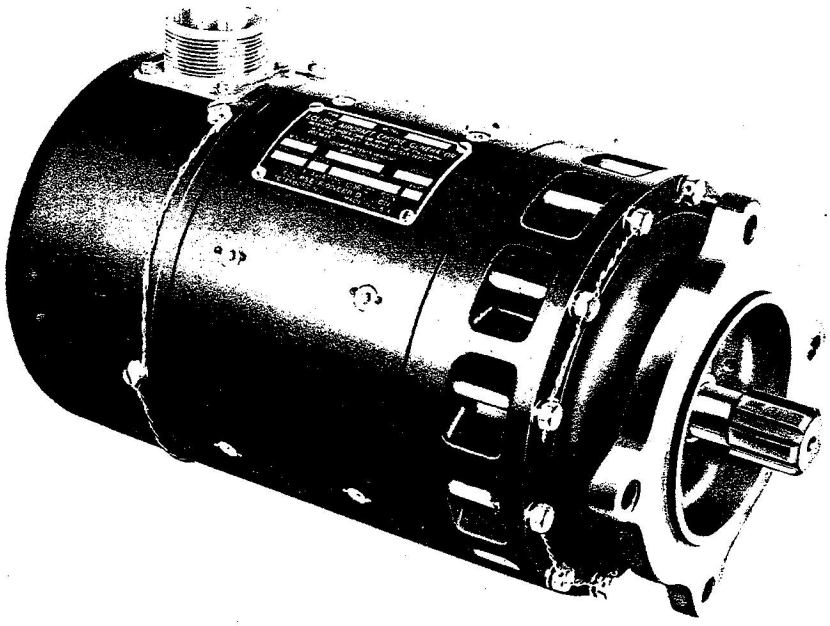
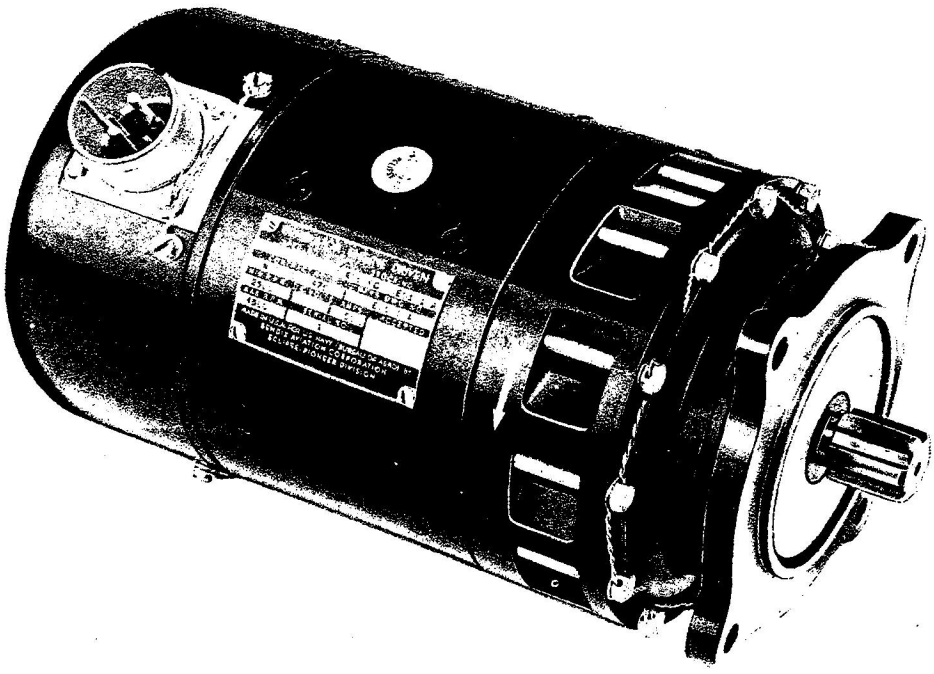


AF Type M-3 D-C Generator



D-C Generator, Eclipse-Pioneer Type 30E01-1-A

PART 1

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DESCRIPTION

GENERAL

Purpose

1 The generator is used as an engine-driven source of d-c electrical energy for 24-volt systems.

General Characteristics and Performance Data

2 Refer to Table 1 for general characteristics and performance data.

DETAILED, TYPE M-3
see Figure 1-1

3 The generator consists primarily of four basic components: the front head (20), yoke (9) and armature (7) assemblies, and the back head (13). The front head assembly and the back head are attached to opposite ends of the yoke assembly, forming the housing of the generator. The armature assembly is supported in ball bearings pressed into the front and back heads, and rotates within the generator housing.

TABLE 1 SPECIFICATIONS

Output	*Volts	28.5
	Amperes	50
Speed Range	Rpm	2,500 to 4,500
Rotation		Counterclockwise (viewing generator drive end)
Cooling		Integral fan
Drive Coupling		6-tooth straight spline (male)
Mounting Flange	Shape	Square
	Number of Holes	4
	Diameter of Holes	$1\frac{1}{32}$ inch
	Pilot Diameter	3.249 inches
	Bolt Circle Diameter	5 inches
Shielding		AN-3102-22-12P Receptacle
Wiring		Insulated

*Do not confuse the rated voltage of the generator with the setting of the voltage regulator, which is specified by the procuring agency.

Front Head Assembly (20)

4 The commutator end of the armature shaft (22) is supported by a completely sealed ball bearing (14) that is pressed into the front head liner (15) and held in place by means of a bearing retainer (3). A removable cover (1), attached to the front head provides access to the brush rigging, brushes (5) and commutator (6). Perforations in the cover admit cooling air. The brush rigging consists of four brush boxes (16) and four brush springs (19). Each brush box is individually insulated, and bolted to the inside face of the front head. An AN receptacle (4) is mounted in the front head for completing the external electrical connections.

Yoke Assembly

5 The yoke assembly (9) consists of the yoke, shunt field coil assembly, and six pole shoe assemblies (8). Six field coils (10) connected in series form the shunt field coil assembly. The coils are assembled on the pole shoes, which are attached to the inside of the yoke by means of pole shoe screws (21).

Back Head (13)

6 The drive end of the armature shaft (22) is supported by a completely sealed ball bearing (24) that is pressed into the back head liner (23). Openings in the back head permit expulsion of exhaust air. The drive end of the head forms a standard SAE mounting flange.

Armature Assembly

7 The armature assembly (7) consists of the tubular armature shaft (22), the commutator (6), and the armature core and coils. A cooling fan (11) is mounted on the drive end of the shaft. The armature is driven through a flexible pencil drive shaft (26) which is splined to the inside diameter of the tubular armature shaft at the commutator end only, the drive end being free. A lock ring (2) at the commutator end holds the pencil drive shaft in place. An integral spline at the drive end is used for coupling the generator to the engine drive member.

DETAILED, TYPE 30E01-1-A, see Figure 1-2

8 Construction of the type 30E01-1-A generator is similar to that of the type M-3 generator except for the following: The drive shaft assembly (12) consists of a pencil drive shaft and a vibration damper back plate. A self-locking nut (21) at the commutator end holds the drive shaft in place. A vibration damper is incorporated in the back head section. The damper components consist of a lining (11) assembled between the front plate (13) and the back plate mounted on the drive shaft assembly (12). The damper loading spring (22) is located at the commutator end of the drive shaft between the spring retainer (23) and the front bearing nut (20). The self-locking nut (21) that holds the commutator end of the drive shaft in place also secures the spring retainer.

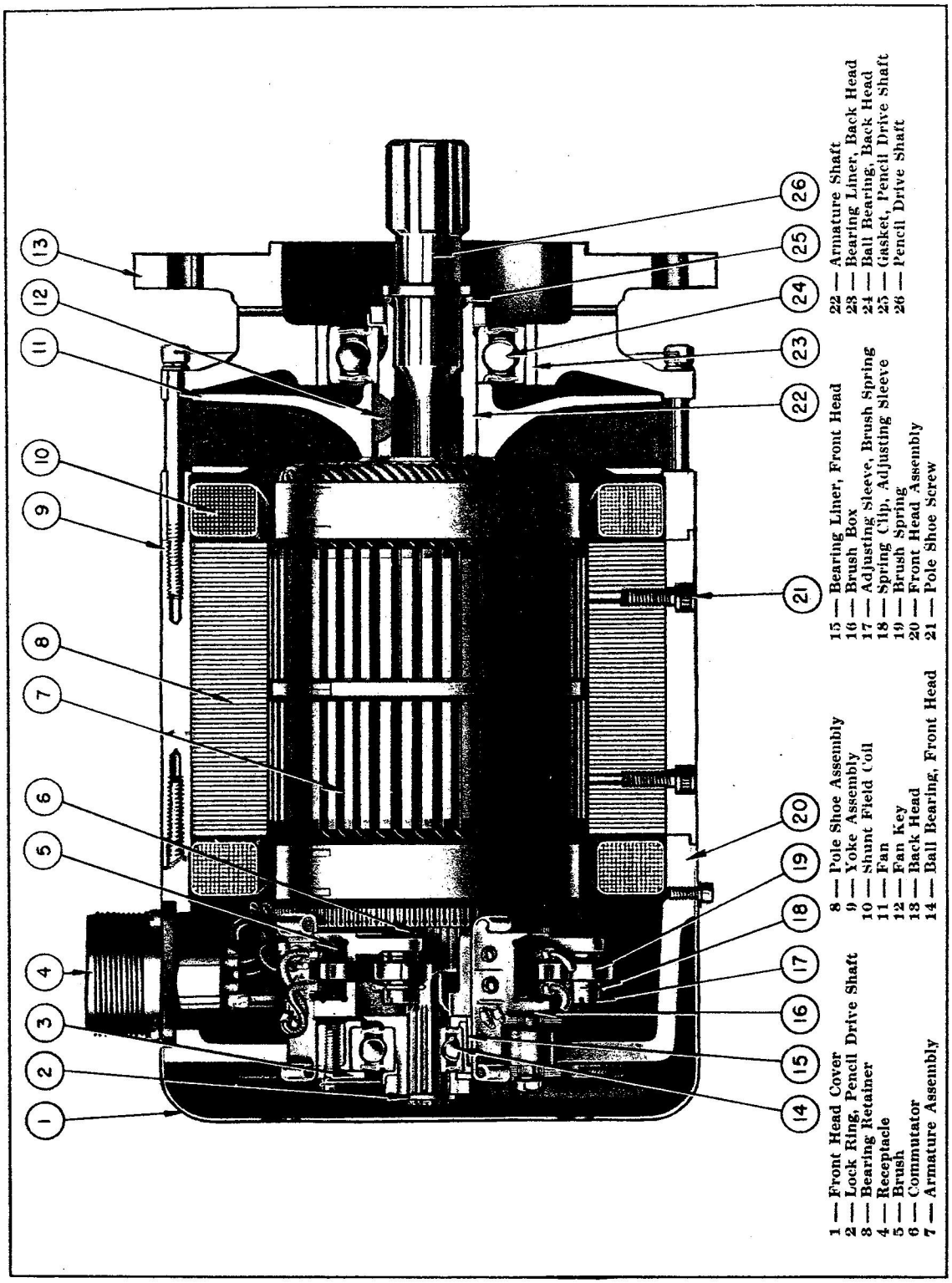

Figure 1-1 Sectional View Drawing - AAF Type M-3 Generator

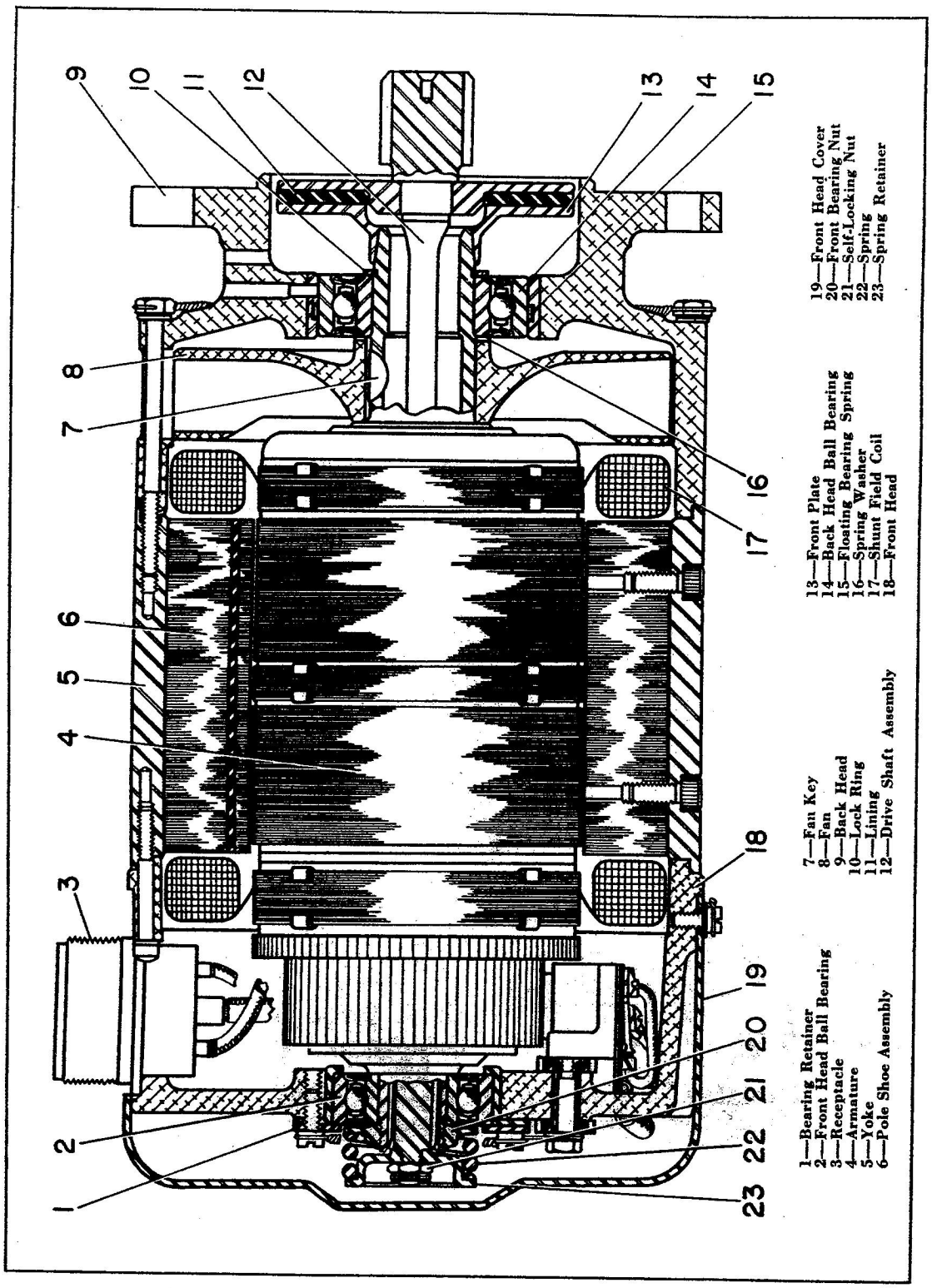

Figure 1-2 Sectional View Drawing - Eclipse-Pioneer Type 30E01-1-A Generator

PART 2

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INSTALLATION

TYPE M-3

General

1 In order to assure efficient operation, the general instructions outlined in this Part should be observed when the equipment is being installed. For complete details, refer to the installation drawings in the Handbook prepared by the aircraft manufacturer.

INSPECTION AND PREPARATION FOR USE

Suitability

2 Check the specifications of the generator, as listed in Table 1, against the corresponding requirements of the particular aircraft in which it is to be installed.

CAUTION

Do not install the generator in a system for which a generator of either higher or lower output is specified; a change in generator capacity necessitates additional system changes.

Flashing the Field

3 The field circuit of all generators, except those being installed directly after overhaul, must be flashed with a 12-volt battery to insure that the magnetic circuit of the generator retains sufficient residual magnetism to allow the generator to "build up" properly. Connect the negative battery terminal to the "E" receptacle contact. Connect the positive battery lead through a single-pole, single-throw knife switch to the "A" receptacle contact. Apply battery current to the field for a period of 5 seconds, by closing and then opening the knife switch. Repeat the operation several times to insure that the field is properly flashed.

CAUTION

It is necessary that a knife switch be used when flashing the field, since opening of the circuit at the generator or battery terminals can easily result in severe damage to the terminals or explosion of the battery.

Mechanical Check

4 Remove the front head cover, pull up the brush springs, and lift out the brushes from the brush boxes. Then check the mechanical condition of the generator. If any fault is found return the generator to a service station or overhaul base for complete overhaul, unless otherwise specified.

(a) Examine all parts visible through the brush box windows for rust and corrosion.

(b) Rotate the armature assembly by hand, and check for rubbing, binding, or audible noise. The armature should rotate with a very slight and uniform drag caused by the grease in the ball bearings.

(c) Replace the brushes in their original positions in the brush boxes, making certain not to twist the brush leads. Make certain that the brushes are a free fit in the brush boxes, and that the brush springs bear centrally on the top of the brushes, to insure full brush contact with the face of the commutator. Clean binding brushes, and the brush boxes, with a cloth moistened in unleaded gasoline.

(d) Make sure that all internal wiring connections are clean and tight.

(e) Attach the front head cover to the head and then safety-wire the cover mounting screws.

MOUNTING THE GENERATOR

5 Mount the generator as follows:

(a) Remove the cover plate and gasket from the engine mounting pad.

(b) Wipe the pad clean and then replace the gasket.

(c) Determine the best mounting position of the generator for alignment and attachment of the shielded conduit. The generator may be rotated in increments of 30 degrees to the desired mounting position.

(d) Coat the drive spline of the generator with grease, Specification AN-G-5.

(e) Place the generator on the engine mounting studs and screw on the mounting stud nuts; tighten the nuts securely.

ACCESSORIES AND CONTROL EQUIPMENT

see Figure 2-1

6 For satisfactory control of generator operation, it is necessary that the system include the associated equipment described in paragraphs 7, 8 and 9. However, for complete details relative to the installation, electrical connection, and operation of the particular equipment used, refer to the applicable Handbooks covering the aircraft accessories and control equipment.

Voltage Regulator

7 The Eclipse type 1042 model 17 voltage regualtor is recommended for controlling the generator output voltage. Refer to EO 40-15BB-2A for complete details of this regulator.

Reverse Current Output

8 The system must include a reverse current output for each generator to prevent battery current from feeding back into the generators at low engine speeds or when the engine is not operating.

Switches

9 A generator switch is normally used to connect and disconnect the generator from the electrical circuit of the aircraft.

10 In parallel systems, some means must be provided for closing and opening the equalizer circuit of each generator. Since the generator and equalizer switches must be opened and closed simultaneously, it is recommended that each generator switch and its corresponding equalizer switch be combined in a single double-pole switch.

NOTE

In a parallel system which has only two generators, a single (separate) equalizer switch may be used to control both generators.

ELECTRICAL CONNECTIONS

11 For all electrical connections and recommended wire sizes, refer to the installation drawings in the Handbook prepared by the aircraft manufacturer. For a schematic circuit diagram, see Figure 2-1.

NOTE

In parallel systems, the ground straps connected to the "E" contact of each generator receptacle must provide exactly 5-volt drop at full rated generator output.

INSTALLATION CHECK

12 After installation and electrical connection of the generator and its associated equipment has been completed, check the system for satisfactory operation. It is recommended that operation of the generator and its control equipment be checked at the same time, since the functions of these units are complementary to each other. Refer to the applicable Handbooks covering the particular control equipment used.

Single Generator System

13 Check single generator system as follows:

(a) Connect an accurate portable voltmeter (range 0 to 50 volts) between the positive and negative busses on insulated electrical systems or between the positive bus and ground on grounded electrical systems.

(b) Start the engine and increase its speed until the generator is operating at or above 2,500 rpm.

NOTE

The proper engine speed may be determined from the ratio of generative-drive speed to engine crankshaft speed, as given in the engine manufacturer's Handbook.

(c) Open the master battery switch and leave it open throughout the check.

(d) Switch off all load possible.

(e) Close the generator switch.

(f) Check the reading of the portable voltmeter. If the system voltage is not within the limits specified for the particular installation by the AAF or Bureau of Aeronautics, adjust the voltage regulator as outlined in the applicable Handbook covering the control unit. If such adjustment fails to correct the voltage, refer to Part 4, paragraph 16 for aid in locating and correcting the cause of the trouble.

(g) Apply d-c load to the generator by switching on lights or some other load. The reading of the portable voltmeter should remain within the specified limits and the system ammeter should indicate that the generator i delivering current. If, however, the readin of either instrument is not as described, refe to Part 4, paragraph 16 and to the applicabl Handbook covering the control equipment used

Parallel Generator System

14 Check parallel generator system as fol lows:

(a) Open the master battery switch and al generator and equalizer switches. Leave th master battery switch open throughout th check.

(b) Check each generator singly and mak any necessary adjustments to the voltage, a outlined in paragraph 13. The voltage of al control units should be adjusted as closely a possible to the same value to simplify the par alleling adjustments.

(c) With all generators operating at o above 2,500 rpm, close the generator an equalizer switches of all generators in the sys tem. If separate equalizer switches are used they must be closed simultaneously with th corresponding generator switches.

(d) Switch on a total load approximatel equal to the full-load rating of one generator.

(e) Check the readings of the portable volt meter and system ammeters. The voltag should be within the specified limits and th ammeters should indicate that each generato is carrying its proportional share of the load within plus or minus 10 percent of its rate output current.

NOTE

If, at any time during the checking procedure, the portable voltmeter does not indicate the proper voltage or if the load does not divide within the specified limits, adjust the voltage regulators as outlined in the applicable Handbook covering the control units used. If such adjustment fails to correct the difficulty, refer to Part 4, paragraph 16 for aid in locating and correcting the cause of the trouble.

(f) Switch on load approximately equal t half load per generator.

(g) Again check the readings of the portable voltmeter and system ammeters as described in paragraph 14 (e). All readings should be within the values specified.

(h) Switch all load possible, up to full load per generator.

(j) Repeat the check of voltmeter and ammeter readings described in paragraph 14 (e). All readings should be within the values specified.

NOTE

At full load per generator, it is permissible for each generator to carry its proportional share of the load within plus or minus 15 percent of its rated output current.

TYPE 30E01-1-A

15 Installation procedure for type 30E01-1-A generators is the same as that for type M-3 generators.

Voltage Regulator

16 The Eclipse-Pioneer type 1042 model 17 voltage regulator is recommended for controlling generator output voltage.

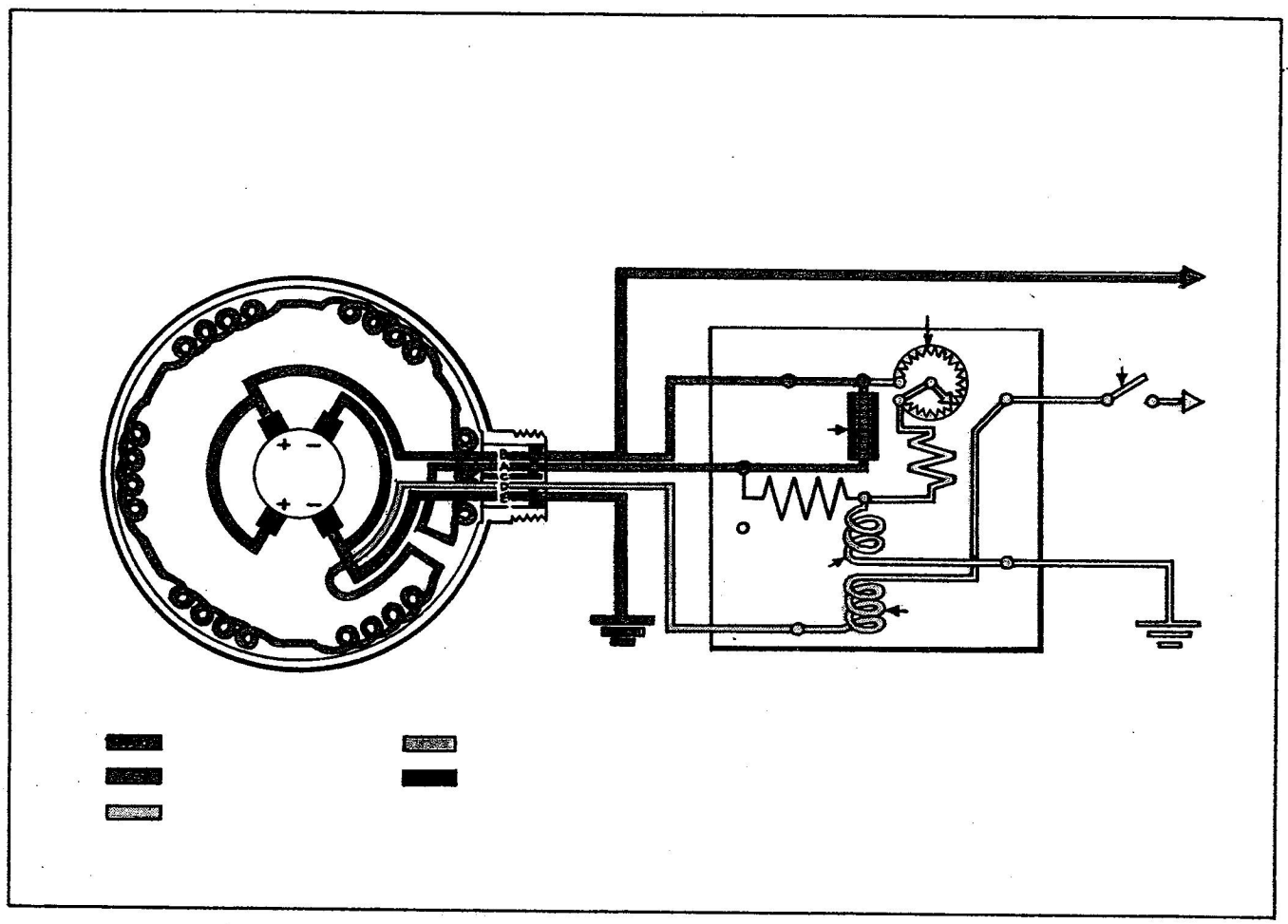

Figure 2-1 – Schematic Circuit Diagram–AAF Type M-3 Generator With Eclipse Type 1042-2 Voltage Regulator

PART 3

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OPERATION

PRINCIPLES OF OPERATION

1 These generators are self-excited and have a shunt connected field coil assembly. The negative terminal of the field coil assembly is directly connected to the negative brushes. The positive terminal is connected to an external voltage regulator and thence to the positive brushes, see Figure 2-1.

2 When the engine-driven armature assembly (7) Figure 1-1, is rotated within the yoke assembly (9), its armature coils cut the residual magnetic field existing in the magnetic circuit of the generator. The small voltages then induced in the armature coils are collected from the commutator (6) by the brushes (5). Although the induced voltages reverse in each coil as the armature rotates the commutator acts as a rotating switch to maintain constant polarity at each brush. These small voltages therefore cause a flow of direct current through the field coils (10), increasing the intensity of the magnetic field. Increased field intensity in turn leads to higher induced voltages, increased field current, and still higher field intensity. Since the value of the induced voltages is also proportional to speed of armature rotation, this "building up" of generated voltage continues as the speed of the generator increases, until a value predetermined by the setting of the voltage regulator is reached. At this point the regulator prevents further increase in field current, maintaining a constant generated voltage by automatically adjusting the field circuit resistance. The regulator allows the field current to increase, however, when the voltage decreases due to the application of load or a decrease in speed.

OPERATION INSTRUCTIONS

Single Generator System

3 With the generator operating at or above minimum rated speed of 2,500 rpm, operation of the generating system is completely automatic, upon manual closing of the generator switch.

NOTE

A common misunderstanding regarding the operation of the generating system is that the system is not functioning properly when the ammeter shows little or no charging current. This may or may not be true. Since the voltage of the generator is maintained at an almost constant value by the voltage regulator, the current output depends entirely upon the condition of the battery and the amount of external load. Therefore, when the battery is fully charged and there is no load on the system, the difference in voltage between the generator and the battery is so small that little or no current flows between them.

4 To prevent chattering of the control equipment contacts, leave the generator switch open when taxiing or idling the engine, However, be sure to close the generator switch before opening the throttle for take-off.

5 In all cases of failure or improper operation of the generating system, open the generator switch immediately to prevent further damage to the system.

6 Open the generator switch before shutting down the engine, to prevent damage to the system in the event that the reverse current cutout fails to open.

Parallel Generator System

7 With the generators operating at, or above, minimum rated speed of 2,500 rpm, operation of a parallel system is completely automatic upon manual closing of the generator and equalizer switches. However, the detailed procedure outlined in paragraphs 8 to 14 should be followed.

NOTE

The operating procedure outlined in paragraph 3 applies to all generating systems.

Parallel System Having Two Generators

8 To connect a single generator, simply close the generator switch.

NOTE

If a single equalizer switch is used to control both generators, do not close this switch for single operation of either generator. To do so will result in a lowered output voltage.

9 To connect both generators, close the generator and equalizer switches for both generators.

NOTE

If two separate equalizer switches are used, close each generator switch and its corresponding equalizer switch simultaneously. If a single, separate equalizer switch is used to control both generators, close both generator switches and the equalizer switch simultaneously.

10 To disconnect a single generator from the system with both generators operating, open both the generator switch and corresponding equalizer switch. In the event a single equalizer switch is used it must be opened.

NOTE

Failure to open the equalizer circuit will result in a lowered system voltage.

11 To disconnect both generators, open all generator and equalizer switches.

Parallel System Having More Than Two Generators

NOTE

In the event that each generator is controlled by a combined generator and equalizer switch, simultanous opening and closing of the generator and equalizer circuit for each generator will be accomplished automatically. If, however, combined switches are not used, when closing a generator switch also close the corresponding equalizer switch at the same time.

12 To connect a single generator, simply close the generator switch. Even if the generator switches are combined with the equalizer switches, the equalizer circuit will remain open until additional generators are connected. System voltage will be unaffected by closing one equalizer switch only.

13 To connect two or more generators, simultaneously close the generator and equalizer switches controlling the generators to be connected.

CAUTION

Failure to close any one of the corresponding equalizer switches will result in improper paralleling of the generators.

14 To disconnect one or more generators from a system which is already in operation, open all generator and equalizer switches controlling the generators to be disconnected.

CAUTION

Failure to open any one of the corresponding equalizer switches will result in a lowering of the system voltage.

PART 4

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SERVICE INSPECTION, MAINTENANCE AND LUBRICATION

SERVICE TOOLS REQUIRED

1 The procedure outlined in this Part does not require the use of special tools.

MINOR INSPECTION

2 Check generators for security of mounting and cracked or broken mounting flanges; that wiring is in good condition and properly secured.

MAJOR INSPECTION

General

3 Remove the front head cover from the generator. Closely examine the inside of the cover and the interior of the generator for presence of brush and copper particles and engine oil. Absence of such matter usually indicates that the generator is operating properly. Presence of brush and copper particles indicates unsatisfactory condition of the brushes or commutator. Presence of engine oil may indicate that engine oil is leaking into the generator through the back head ball bearing. If any such matter is found, replace the generator.

Housing and Mounting Flange

4 Give the generator a thorough visual inspection for cracks and failures of the housing and mounting flange. Replace the generator if cracks or failures are found.

Brushes

5 Check the brushes for free fit in the brush boxes. Clean binding brushes, and the brush boxes, by wiping them with a cloth moistened in unleaded gasoline or any other suitable solvent.

CAUTION

Do not use carbon tetrachloride as its use will cause rapid brush wear.

6 Examine the brush lead sleeving. If it is scuffed or burned, it should be replaced. Resolder or replace loose or broken terminals. Check the length of each brush. The maximum permissible wear of the brushes is 5/16" from a new length of 13/16", or when the length of brush remaining is 1/2". Replace worn brushes before their maximum wear limit is reached, to insure satisfactory operation until the next inspection period. Make certain not to twist the brush leads when the brushes are being replaced in the brush boxes.

Brush Springs

7 Measure the tension of any accessible brush spring with a 0- to 6-pound standard spring scale. Hook the scale underneath the spring, and lift the end of the spring into a position 1/8" above the top of the brush box,

see Figure 4-1. The tension should then measure 20 to 24 ounces. If the tension does not measure within the specified limits, alter the position of the adjusting sleeve to obtain the proper tension. Hold the sleeve from turning and remove the cotter pin or spring clip, see Figure 4-2. Alter the position of the sleeve as necessary and then replace the cotter pin or spring clip.

NOTE

In the event no brush spring is accessible for tension measurement with a scale, test any spring for loss of tension by lifting with the finger.

Commutator

8 Closely inspect the contact surface of the commutator. An even, highly burnished copper color indicates satisfactory condition. If the commutator has a dirty appearance, it should be cleaned with a cloth moistened in unleaded gasoline or any other suitable solvent. Do not use carbon tetrachloride. If solvent fails to clean the commutator, or if the contact surface is rough, pitted, or badly scored, the generator should be replaced.

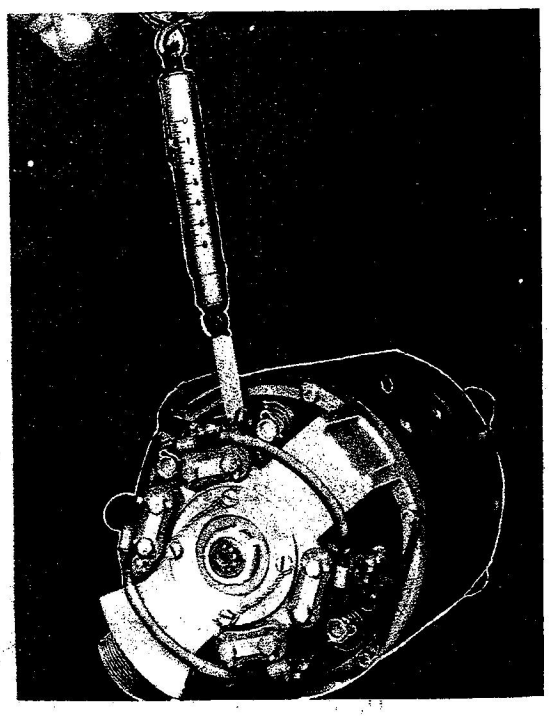

Figure 4-1 Checking Brush Spring Tension

Internal Connections

9 Check all internal wiring connections to make sure they are clean and tight. Replace any wiring which has scuffed, burned, or frayed insulation. Resolder or replace loose or broken terminals. Replace the AN receptacle if it has cracked or burned insulation or loose contacts.

External Connections

10 Check all external wiring connections to make sure they are clean and tight. Replace any wiring which has scuffed, burned, or frayed insulation. Resolder or replace loose or broken terminals. Replace the AN plug if it has cracked or burned insulation, or loose prongs. Make certain that the plug is properly tightened.

Output Check

11 After the mechanical condition of the generator has been checked, check the generator for proper electrical output.

NOTE

It is recommended that operation of the generator and its control equipment be checked at the same time, since the functions of these units are complementary to each other. Refer to applicable Handbooks covering the particular control equipment used.

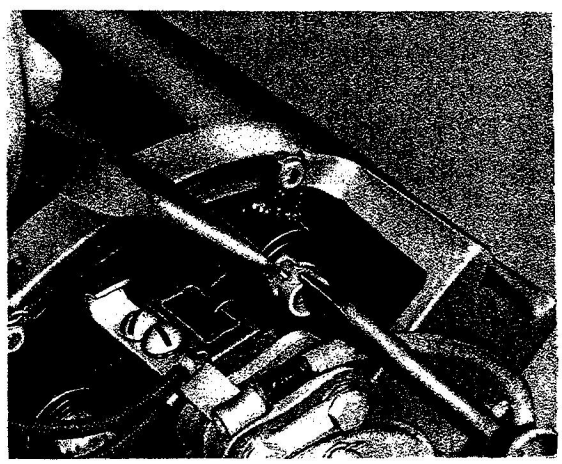

Figure 4-2 Correcting Brush Spring Tension

Single Generator System

12 Connect an accurate, portable voltmeter (range 0 to 50 volts) between the positive and negative busses on insulated electrical systems or between the positive bus and ground on grounded electrical systems.

(a) Start the engine and increase its speed until the generator is operating at or above 2,500 rpm, approximately 1,200 rpm engine speed.

NOTE

The proper engine speed may be determined from the ratio of generator-drive speed to engine crankshaft speed, as given in the engine manufacturer's Handbook.

(b) Open the master battery switch and leave it open throughout the check.

(c) Switch off all load possible.

(d) Close the generator switch.

(e) Check the reading of the portable voltmeter. If the system voltage is outside the limits specified for the particular installation by the AAF or Bureau of Aeronautics, adjust the voltage regulator as outlined in the manufacturer's Handbook covering the control unit. If such adjustment fails to correct the voltage, refer to paragraph 16 for aid in locating and correcting the cause of the trouble.

(f) Apply load to the generator by switching on lights or other d-c equipment. The reading of the portable voltmeter should remain within the specified limits, and the system ammeter should indicate that the generator is delivering current. If, however, the reading of either instrument is not as described, refer to the applicable Handbook covering the voltage regulator, see paragraph 16.

Security of Mounting and Safety Wire

13 After completion of all tests, make certain that the generator is securely attached to the engine mounting pad. Attach the front head cover to the front head and then replace any external safety wire which has been removed.

MAINTENANCE

14 The generator does not require any maintenance other than that outlined in paragraphs 2 and 3.

LUBRICATION

15 The generator does not require lubrication of any kind.

SERVICE TROUBLES AND REMEDIES

16 In all cases of failure or improper operation, disconnect the generator immediately by opening the generator switch to prevent further damage to the system. If equalizer switches are used, also open the corresponding equalizer switch. Do not attempt to operate equipment which is not functioning properly; investigate the trouble as soon as possible.

NOTE

Do not disassemble faulty generators in the field; forward them to an authorized repair depot or overhaul base for inspection, repair, and test.

17 When trouble is being investigated, use an accurate, portable voltmeter for test purposes. Connect the positive terminal of the voltmeter to the positive line at any accessible point between the generator and voltage regulator. Connect the negative terminal of the voltmeter to the negative line (or ground in grounded systems) at any accessible point.

NOTE

Observe that the d-c voltmeter connections for trouble-shooting differ from those made for routine checking.

18 Table 2 is provided to assist in locating and correcting difficulties.

NOTE

Throughout the trouble chart, it is assumed that the trouble occurs when the generators are operating at or above minimum rated speed.

For performance of all remedies marked with an asterisk (*), refer to Part 5.

TABLE 2 TROUBLE CHART

Trouble	Probable Cause	Remedy
WITH GENERATOR AND EQUALIZER (IF USED) SWITCHES OPEN, TEST VOLTMETER INDICATES LOW OUTPUT VOLTAGE	Faulty or improperly adjusted voltage regulator	Refer to applicable Handbook covering this voltage regulator.
	High resistance internal or external connections in generator circuit.	Service the connections. Refer to paragraphs 9 and 10.
	Binding, worn, improperly seated, or loosely fitting brushes	Service the brushes. Refer to paragraph 5.
	Low brush spring tension	Readjust or replace the brush springs. Refer to paragraph 7.
	Dirty commutator	Service the commutator. Refer to paragraph 8.
	Scored or pitted commutator.	*Resurface the commutator.
	Shorted, grounded, or open armature.	*Test and, if necessary, replace the armature assembly.
TEST VOLTMETER INDICATES HIGH GENERATOR VOLTAGE	Voltage regulator not in proper operating conditions	Refer to the applicable Handbook covering the voltage regulator.
WITH GENERATOR AND EQUALIZER (IF USED) SWITCHES OPEN, TEST VOLTMETER INDICATES ERRATIC OR FLUCTUATING GENERATOR OUTPUT VOLTAGE	Unstable operation of voltage regulator	Refer to the applicable Handbook covering the voltage regulator.
	High resistance internal or external connections in generator circuit	Service the connections. Refer to paragraphs 9 and 10.
	Binding, worn, improperly seated, or loosely fitting brushes	Service the brushes. Refer to paragraph 5.
	Low brush spring tension	*Readjust or replace the brush springs. Refer to paragraph 7.
	Dirty commutator	Service the commutator. Refer to paragraph 8.
	Scored or pitted commutator	*Resurface the commutator.
	Shorted, grounded, or open armature	*Test and, if necessary, replace the armature assembly.

*For performance of remedies marked with an asterisk, refer to Part 5

TABLE 2 TROUBLE CHART (Cont'd)

Trouble	Probable Cause	Remedy
WITH GENERATOR AND EQUALIZER (IF USED), SWITCHES OPEN, D-C TEST VOLTMETER READS OFF SCALE IN WRONG DIRECTION	Generator field magnetized in the wrong direction	Flash the field in the proper direction. Refer to Part 2, paragraph 3.
	External wiring not properly connected	Refer to the aircraft wiring diagram in the manufacturer's Handbook, and check all wiring connections. Service the connections as outlined in paragraph 10.
	Improper operation of generator cutout.	Refer to the applicable Handbook covering the generator cutout.
WITH GENERATOW SWITCH CLOSED, SYSTEM AMMETER INDICATES ZERO OUTPUT CURRENT	Open generator circuit breaker or blown generator fuse	Locate the cause of the overload, and then close the breaker or replace the fuse.
	Improper operation of generator cutout	Refer to the applicable Handbook covering the generator cutout.
	Generator field demagnetized	Flash the field in the proper direction. Refer to Part 2, paragraph 3.
	Burned-out ammeter	Refer to the applicable Handbook covering the ammeter.
	Faulty generator switch	Refer to the applicable Handbook covering the generator switch.
	Faulty or improperly adjusted voltage regulator	Refer to the applicable Handbook covering the voltage regulator.
	High resistance, loose, grounded, or broken internal connections	Service the connections. Refer to paragraph 9.
	Shunt field coil, assembly open, shorted, or grounded	*Test and, if necessary, replace the field coil assembly.
	Generator field demagnetized	Flash the field in the proper direction. Refer to Part 2, paragraph 3.
	Shorted, grounded, or open armature	*Test and, if necessary, replace the armature assembly.
	Faulty aircraft wiring	Refer to the wiring diagram in the aircraft manufacturer's Handbook. Check all wiring connections.

*For performance of remedies marked with an asterisk, refer to Part 5

TABLE 2 TROUBLE CHART (Cont'd)

Trouble	Probable Cause	Remedy
SYSTEM AMMETER INDICATES LOW OUTPUT CURRENT. REFER TO NOTE PART 3, PARA. 3.	Faulty or improperly adjusted voltage regulator	Refer to the applicable Handbook covering the voltage regulator.
	High resistance internal or external connections in generator circuit	Service the connections. Refer to paragraphs 9 and 10. Also check the external connections.
	Binding, worn, improperly seated, or loosely fitting brushes	Service the brushes. Refer to paragraph 5.
	Low brush spring tension	Readjust or replace the brush springs. Refer to paragraph 7.
	Dirty commutator	Service the commutator. Refer to paragraph 8.
	Scored or pitted commutator	*Resurface the commutator.
	Shorted, grounded, or open armature	*Test and, if necessary, replace the armature assembly.
SYSTEM AMMETER OR VOLTMETER READS OFF SCALE IN THE WRONG DIRECTION	Generator field magnetized in the wrong direction	Flash the field in the proper direction. Refer to Part 2, paragraph 3.
	External wiring not properly connected	Refer to the wiring diagram in the aircraft manufacturer's Handbook and check all wiring connections. Service the connections as outlined in paragraph 10.
	Improper operation of generator cutout	Refer to the applicable Handbook covering the generator cutout.
SYSTEM AMMETER OR VOLTMETER FLUCTUATES EXCESSIVELY	Improper operation of generator cutout	Refer to the applicable Handbook covering the generator cutout.
	Improper adjustment of voltage regulator	Refer to the applicable Handbook covering the voltage regulator.
	Loose connection or grounds in aircraft wiring	Refer to the aircraft manufacturer's Handbook and check for loose connections and grounds.
EXCESSIVE SPARKING AT GENERATOR BRUSHES	High resistance internal or external connections in generator circuit.	Service the connections. Refer to paragraphs 9 and 10.
	Binding, worn, improperly seated, or loosely fitting brushes.	Service the brushes. Refer to paragraph 5.

* For performance of remedies marked with an asterisk, refer to Part 5.

TABLE 2 TROUBLE CHART (Cont'd)

Trouble	Probable Cause	Remedy
EXCESSIVE SPARKING AT GENERATOR BRUSHES (Cont'd)	Low brush spring tension	Readjust or replace the brush springs. Refer to paragraph 7 .
	Dirty commutator	Service the commutator. Refer to paragraph 8.
	Scored or pitted commutator	*Resurface the commutator.
	Shorted or open armature	*Test and, if necessary, replace the armature assembly.
SHORT BRUSH LIFE	Binding, worn, improperly seated, or loosely fitting brushes	Service the brushes. Refer to paragraph 5.
	Low brush spring tension	Readjust or replace the brush springs. Refer to paragraph 7.
	Dirty commutator	Service the commutator. Refer to paragraph 8.
	Scored or pitted commutator	*Resurface the commutator.
	Shorted, grounded, or open armature	*Test and, if necessary, replace the armature assembly.
	Wrong type of brush being used	Replace the brushes with brushes of the proper type.
	Ball bearings worn or rough turning	*Replace the ball bearings.
NOISY RADIO OPERATION	Faulty capacitors in filter circuit (if used)	Refer to the applicable Handbook covering the filter capacitors.
	Discharged battery	Replace the discharged battery
	Excessive sparking at generator brushes	Check for cause of sparking. Repair as necessary.
LOAD DOES NOT DIVIDE PROPERLY (PARALLEL SYSTEM)	Improper operation or adjustment of voltage regulator	Refer to the applicable Handbook covering the voltage regulator.
	Generator ground straps (if used) not properly installed	Refer to the aircraft manufacturer's Handbook covering the ground strap installation.
	Equalizer switch (if used) inoperative	Refer to the applicable Handbook covering the equalizer switch.
	High resistance internal or external connections	Service the connections. Refer to paragraphs 9 and 10.
	Inaccurate or burned-out system ammeter	Refer to the applicable Handbook covering the system ammeter.

*For performance of remedies marked with an asterisk, refer to Part 5

PART 5

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PART 5

DISASSEMBLY, CLEANING, INSPECTION, REPAIR AND RE-ASSEMBLY

OVERHAUL TOOLS REQUIRED

1 In order to facilitate servicing of the generators, the tools listed in Table 3 are recommended for the disassembly, re-assembly, and adjustment of the various parts. The equipment shown in Figures 6-1 and 6-2 is recommended for testing the generator, with the exception noted in Part 6, paragraph 2.

NOTE

The part numbers applying to overhaul tools have been changed since this handbook was originally issued. The new numbers listed in Table 3 are referred to in paragraphs pertaining to type 30E01-1-A generators. Newly listed tools should be used to facilitate overhaul of both type generators.

TYPE M-3

DISASSEMBLY, see Figure 7-1

Separation of Generator into Basic Components

2 Disassemble generator as follows:

(a) Remove all external safety wire. Then detach and remove the front head cover.

(b) Disconnect the brush lead terminals, pull up the brush springs, and remove the brushes from the brush boxes. Mark each corresponding brush and brush box in such a manner as to facilitate the return of each brush found satisfactory for further use to its original position in the brush box from which it was removed. Refer to paragraph 38.

NOTE

This procedure is important, the purpose being to eliminate reseating which is necessary if the brushes are returned to boxes other than the ones from which they were removed.

(c) Release the tab locks underneath both of the armature shaft nuts. Remove the nut at the drive end of the shaft with wrench EQ7115, holding the armature from turning with wrench EQ7153, see Figure 5-17. Then, remove the nut at the commutator end of the shaft, see Figure 5-18.

(d) Pry off the lock ring from the commutator end of the pencil drive shaft, see Figure 5-19. Then withdraw the pencil shaft from the drive end of the tubular armature shaft, see Figure 5-20. Remove and discard the pencil drive shaft gasket, see Figure 5-21.

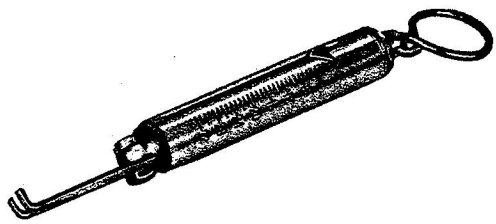


Figure 5-1 Spring Scale QC80004-1

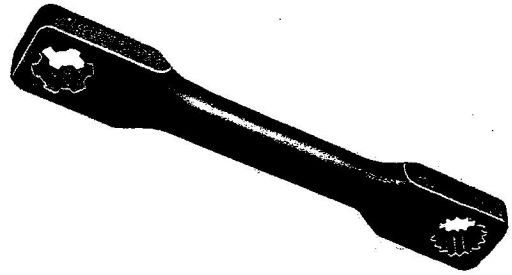


Figure 5-2 Wrench QC80059-1

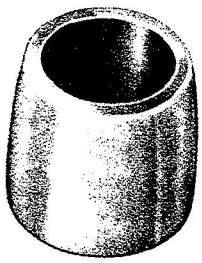


Figure 5-3 Bearing Pilot QC80061-7

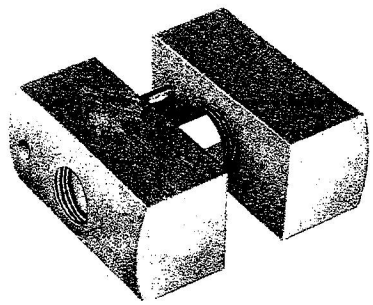


Figure 5-7 Pole Shoe Expander QD80008-4

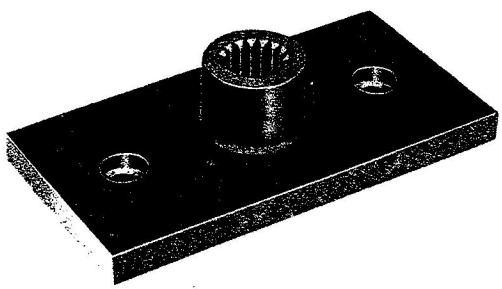


Figure 5-4 Six-Spline Bench Holder QC80063-2

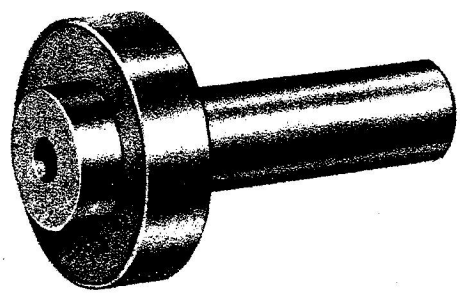


Figure 5-8 Piloted Bearing Pusher QD80009-4

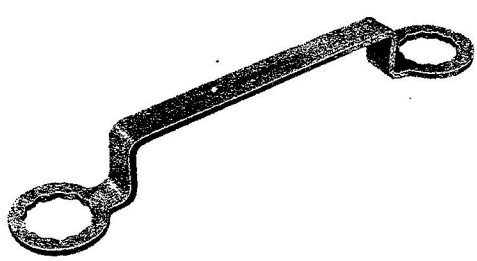


Figure 5-5 Wrench QC80077-1

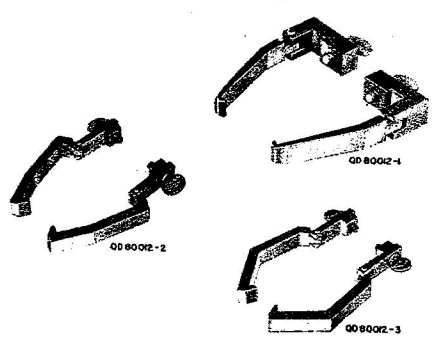


Figure 5-9 Puller Jaw QD80012

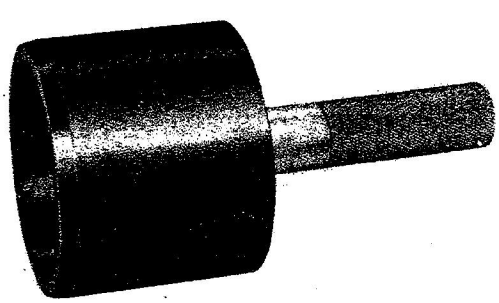


Figure 5-6 Plug Gauge QD80005-16

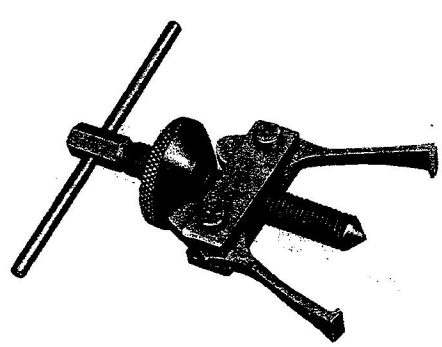


Figure 5-10 Bearing Puller QD80015-1

TABLE 3 OVERHAUL TOOLS

New Part Number	Old Part Number	Figure Number	Nomenclature	Application
QC80004-1		5-1	Spring scale	To check brush spring tension
QC80059-1	EQ7153	5-2	Wrench	To hold drive shaft spline (when QC80063-2 is not available)
QC80061-7		5-3	Bearing pilot	To lead bearing into liner
QC80063-2		5-4	6-spline bench holder	To hold drive shaft spline
QC80077-1	EQ7115	5-5	Wrench	To install or remove nut at drive end of armature shaft (type M-3 only)
QD80005-16	EQ7212	5-6	Plug gauge	To check alignment of pole shoes
QD80008-4	EQ4139	5-7	Pole shoe expander	To expand pole shoes against yoke
QD80009-4		5-8	Piloted bearing pusher	To install bearings into generator heads
QD80012-1) QD80012-2) QD80012-3)		5-9	Puller jaw (one pair of each required)	To remove bearings from shaft and to remove head from housing. Used with screwdriver press QR80000-1
QD80015-1		5-10	Bearing puller	To pull bearing from armature shaft. Used only if QD80012-1, 2, 3 are not available
QD80028-1		5-11	V-block adaptor	To support unit while removing or tightening pole shoe screws
QD80029-1		5-12	Ratchet torque wrench	To tighten head to yoke screws
QD80038-10		5-13	Bearing pusher	To push bearing out of head and to push bearing onto shaft
QD80110-1		5-14	Swivel adaptor	To install bearings used with QR80000-1
QR80000-1	EQ7080	5-15	Screwdriver press	To remove pole shoe screws
QR80010-1	EQ7080-7	5-16	Screwdriver bit	To remove pole shoe screws

(e) Remove the back head to yoke mounting screws and lightly tap the armature shaft out of the front head ball bearing. Then separate the back head and armature assembly, as a unit, from the front head and yoke assemblies, see Figure 5-22.

(f) Press the armature shaft out of the back head ball bearing, separating the back head from the armature assembly, see Figure 5-23.

(g) Disconnect all leads from the brush boxes, see Figure 5-24.

(h) Remove receptacle mounting screws, see Figure 5-25. Pull the receptacle as far away from the front head as the lead from the "A" contact of the receptacle to the field coil assembly will permit. Unsolder the lead from the "A" contact of the receptacle, see Figure 5-26. Completely remove the receptacle, carefully withdrawing the attached leads through the receptacle mounting holes, see Figure 5-27.

(j) Remove the safety wire and insulating sleeving from the front head to yoke mounting screws. Then remove the mounting screws and separate the front head assembly from the yoke assembly, see Figure 5-28.

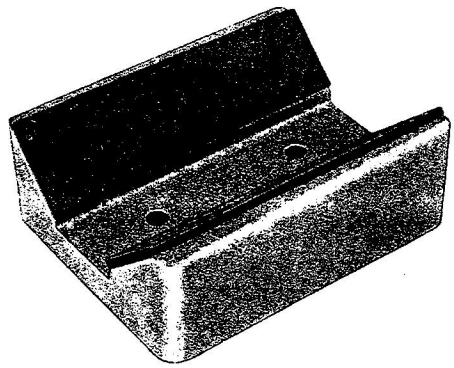


Figure 5-11 V-Block Adaptor QD80028-1

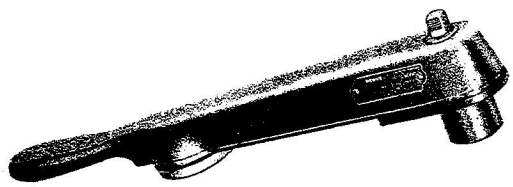


Figure 5-12 Ratchet Torque Wrench QD80029-1

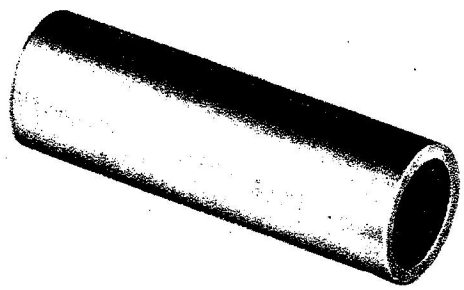


Figure 5-13 Bearing Pusher QD80038-10

Figure 5-14 Swivel Adaptor QD80110-1

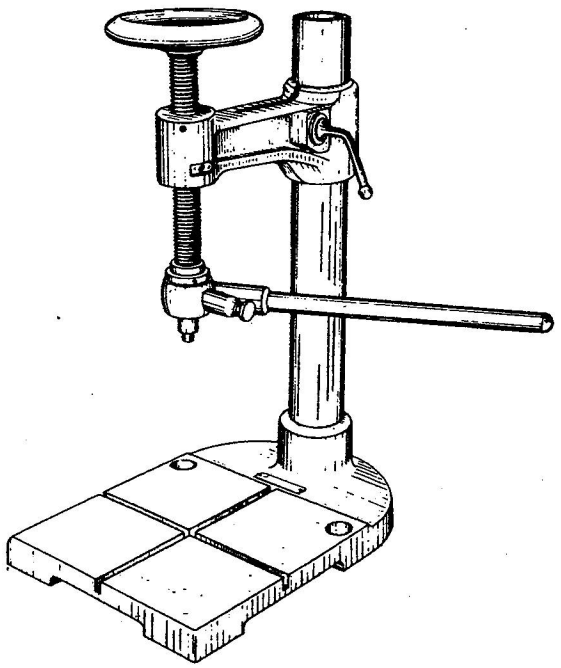


Figure 5-15 Screwdriver Press QR80000-1

Figure 5-16 Screwdriver Bit QR80010-1

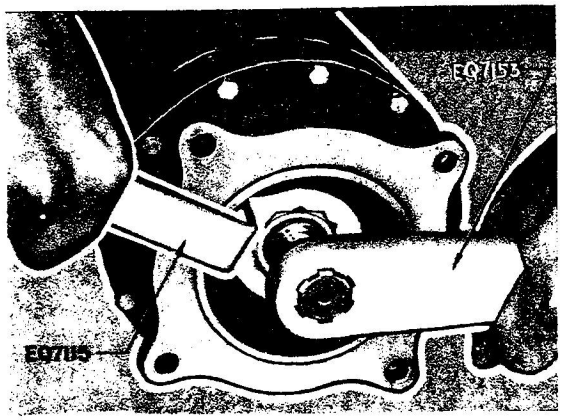


Figure 5-17 Removal of Nut From Drive End of Armature Shaft

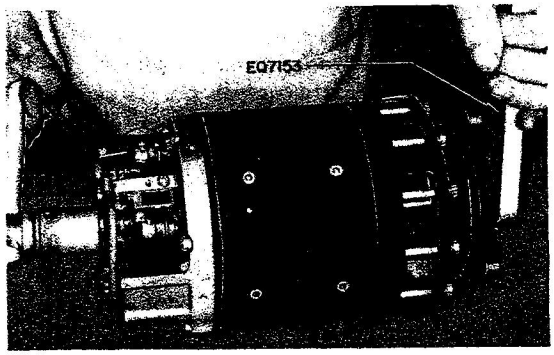


Figure 5-18 Removal of Nut From Commutator End of Armature Shaft

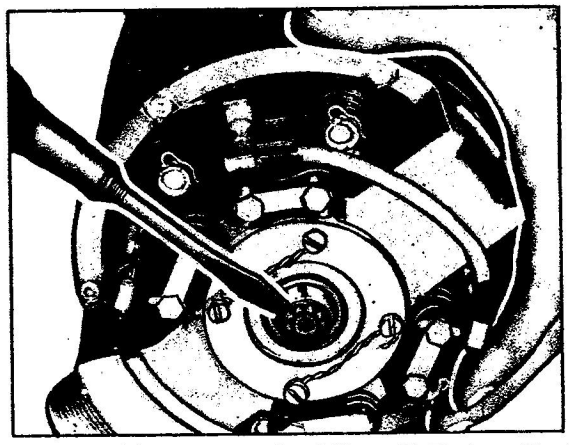


Figure 5-19 Removal of Pencil Drive Shaft Lock Ring

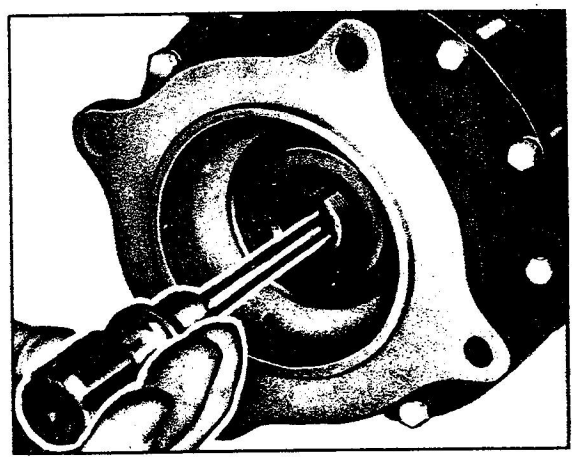


Figure 5-20 Removal of Pencil Drive Shaft

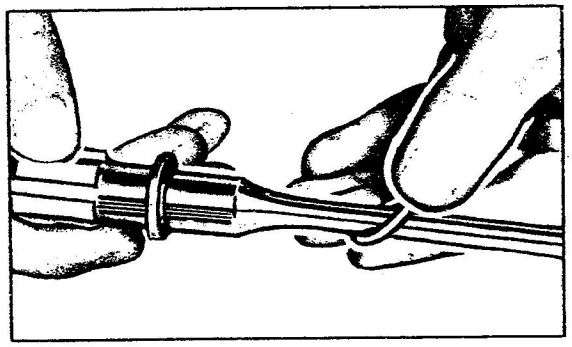


Figure 5-21 Removal of Pencil Drive Shaft Gasket

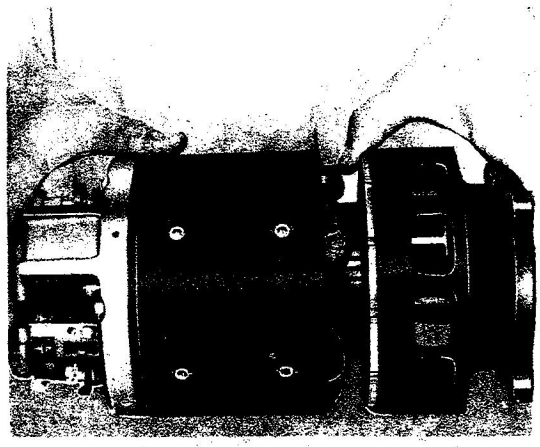


Figure 5-22 Separation of Armature Assembly and Back Head, as a Unit, From Front Head and Yoke Assemblies

DISASSEMBLY OF BASIC COMPONENTS

Armature Assembly

3 Remove the cooling fan and its key from the armature shaft, see Figure 5-29. Further disassembly of the armature is never recommended. If it is found unsatisfactory upon inspection, the complete armature assembly must be replaced. Refer to paragraphs 9 to 33.

Back Head

4 Press out the ball bearing for inspection of the bearing and back head liner, see Figure 5-30.

Front Head Assembly

5 Remove the bearing retainer from the front head, see Figure 5-31. Press out the ball bearing for inspection of the bearing and front head liner, see Figure 5-32. No further disassembly of the front head assembly is necessary, unless faulty parts are found upon inspection as described in paragraphs 42 to 44, which covers the replacement procedure for replacement of faulty parts.

Yoke Assembly

6 No further disassembly of the yoke assembly is necessary, unless faulty parts are found upon inspection as outlined in paragraph 48, which covers the complete procedure for replacement of faulty parts.

CLEANING, INSPECTION, TESTING AND REPAIR, see Figures 5-33 through 5-45

7 After the generator has been completely disassembled, clean all parts except the ball bearings (following paragraph 35) in unleaded gasoline, or any other suitable solvent, and dry off with compressed air.

NOTE

Do not use carbon tetrachloride, since its use will result in rapid brush wear, excessive sparking at the commutator, and corrosion of other parts.

8 Examine and test the parts as outlined in following paragraphs 9 through 53.

NOTE

A series test lamp circuit is specified for performing the electrical checks outlined in following paragraphs 9 to 53. Use sharp-pointed prods on its test leads to assure good contact to anodized or painted parts. Connect a lamp in series with one lead and plug the circuit into a 110-volt a-c source.

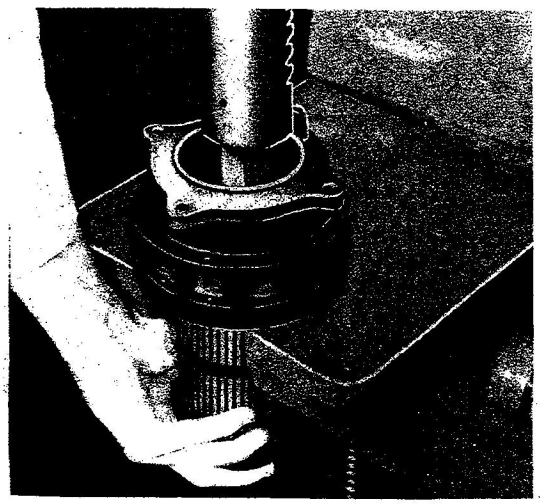


Figure 5-23 Separation of Back Head From Armature Assembly

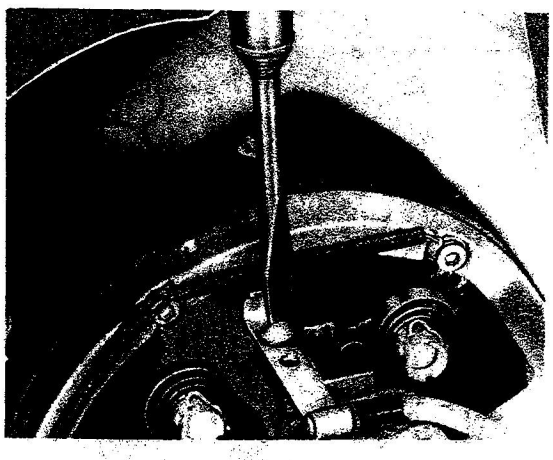


Figure 5-24 Removal of Brush Box Connections

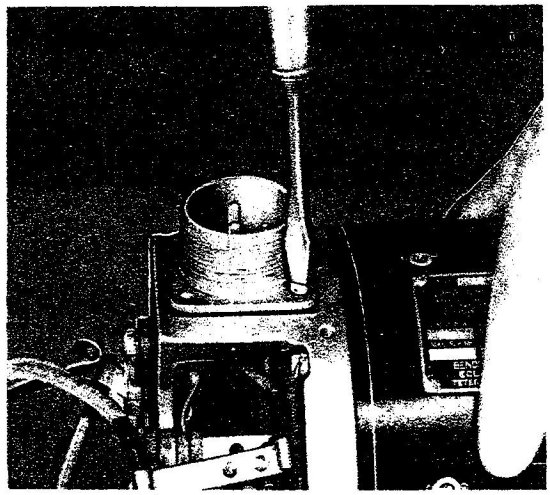


Figure 5-25 Removal of Receptacle Mounting Screws

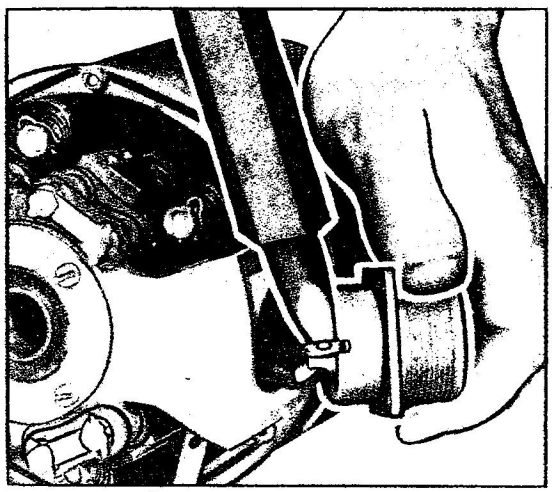


Figure 5-26 Unsoldering of Lead at "A" Receptacle Contact

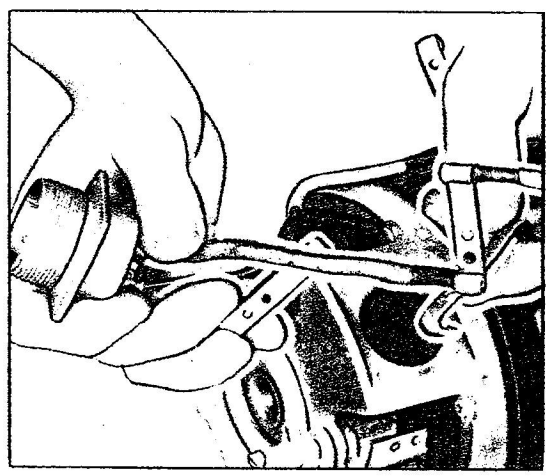


Figure 5-27 Removal of Receptacle with Jumpers Attached

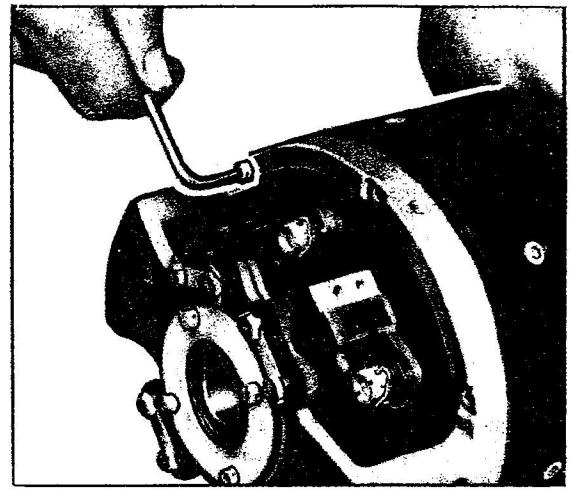


Figure 5-28 Removal of Front Head to Yoke Mounting Screws

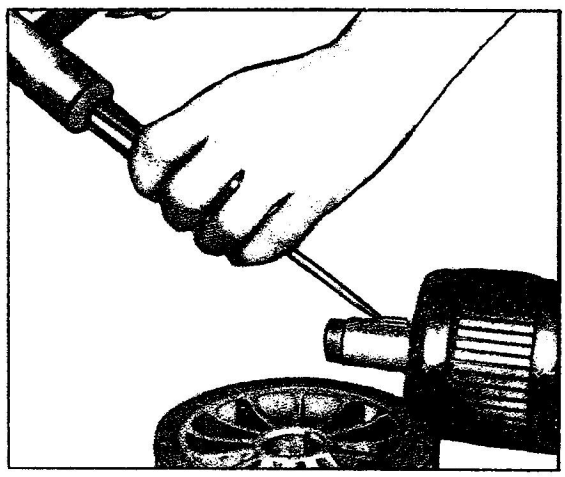


Figure 5-29 Removal of Cooling Fan and Key From Armature Shaft

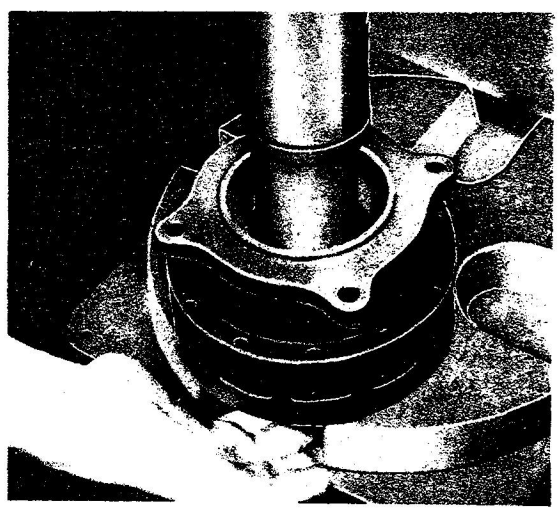


Figure 5-30 Removal of Back Head Ball Bearing

ARMATURE ASSEMBLY

Cleaning

9 Dip the armature assembly in a container of unleaded gasoline or any other suitable solvent and wash thoroughly with a paint brush. DO NOT SOAK THE ARMATURE. Make certain to remove any brush or copper particles which are imbedded in the mica insulation between the commutator bars.

Visual Inspection

10 Make a thorough visual inspection of the armature assembly, as outlined in following paragraphs 11 through 16. If the assembly is found to be in satisfactory physical condition, proceed with further servicing as outlined in paragraphs 17 to 21. If any fault is found, replace the entire armature assembly unless otherwise specified.

Armature Shaft Bearing Surfaces

11 Check the fit of the armature shaft bearing surfaces in the ball bearings. If a clearance exceeds the permissible worn value specified in Table 4, replace the armature assembly only if the excessive clearance is due to a worn shaft.

Armature Shaft Spline

12 Closely examine the spline, inside the commutator end of the armature shaft, for scoring. As an additional check, assemble the pencil drive shaft into the armature shaft. If the armature shaft spline is scored to the extent that the drive shaft does not fit freely, replace the armature assembly. Refer to paragraph 45.

Banding Wire and Clips

13 Make certain that the banding wire and clips are tight and firmly soldered.

Commutator

14 Make certain that the commutator bars are tight and in alignment.

NOTE

Replace the armature assembly if high commutator bars are found.

15 Inspect the contact surface of the commutator. Satisfactory condition is indicated by an even, highly burnished, copper color. If, however, the contact surface is rough, pitted, scored, burned, or darkened by a hardened film of carbon or oil which cleaning fails to remove, resurface the commutator upon satisfactory completion of the remaining steps of armature assembly inspection. Refer to paragraph 21.

NOTE

Badly burned commutator bars are an indication of open circuited armature coils. If such bars are found, do not resurface the commutator; replace the armature assembly.

Windings

16 Inspect the windings for burned, charred, cracked, or frayed insulation. Check to make certain that all conductors are firmly soldered into the commutator risers. The depths of the conductors in the slots of the armature core should be approximately equal. Each conductor should be firmly fixed in its slot. Check for flaring of the conductors at the drive end of the armature core.

Baking

17 If the armature assembly proves to be in satisfactory physical condition, bake for two to four hours at 93°C(200°F), to remove all oil and moisture.

Electrical Check

18 After the armature assembly has been baked, check the armature for grounds and shorts. If grounds or shorts are found, replace the entire armature assembly.

Grounded Armature

19 Test the armature for grounds with a series test lamp circuit. Touch one test point of the test lamp circuit to the armature shaft; touch the other test point to any bar of the commutator. If a ground exists, the lamp will light.

CAUTION

Do not touch the test point to the contact surface of the bar since this may result in pitting of the surface.

Shorted Armature

20 Use a "growler", to test the armature for short circuits. Place the armature assembly in the "growler", hold a thin strip of steel (such as a hacksaw blade) over the armature core, and then rotate the armature slowly. The steel strip will vibrate if a short circuit exists.

Resurfacing the Commutator

21 If inspection, as described in preceding paragraph 14, has disclosed that the contact surface of the commutator is dirty, being darkened with a hardened film of carbon or oil which cannot be removed by washing, resurface the commutator as outlined in paragraph 22. However, if the commutator is rough, pitted, scored, or burned, resurface it as outlined in paragraphs 27 to 29.

NOTE

Do not attempt to resurface commutators which obviously will require turning beyond a minimum diameter of 2.365 inches; replace the armature assembly.

Dirty Commutator

22 Mount the armature assembly in a lathe, on the armature shaft centers, and check that the bearing surfaces of the shaft run true. If necessary, true up the centers.

NOTE

As an alternate method, for use when centers are not true, chuck the drive end of the armature shaft and mount the commutator end in a steady rest. Adjust the position of the armature assembly until the bearing surfaces of the shaft run true.

23 See Figure 5-33 for details of a suitable carboloy tipped commutator-cutting tool; mount the tool as shown in Figure 5-34.

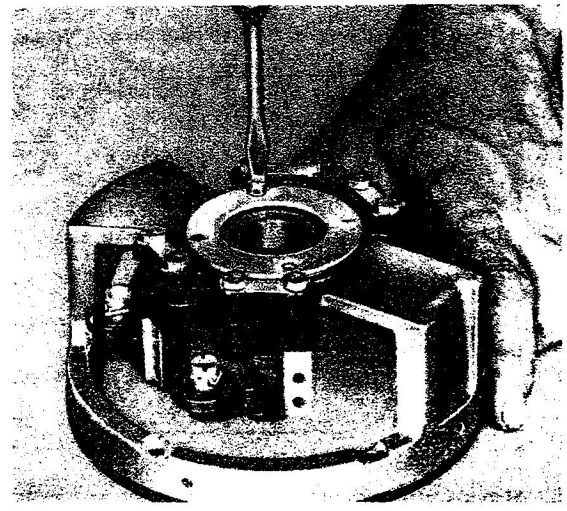


Figure 5-31 Removal of Front Head Ball Bearing Retainer

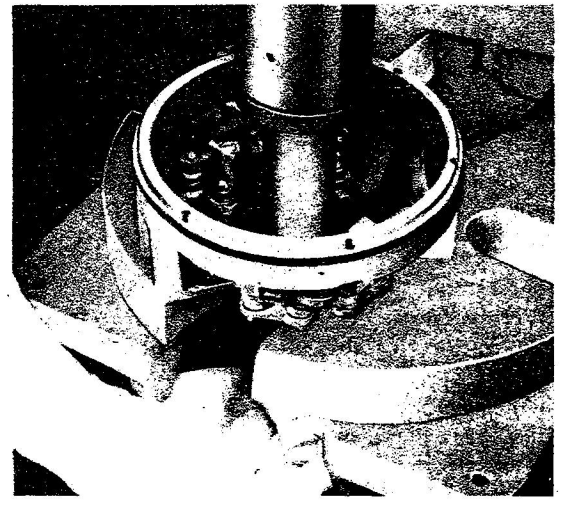


Figure 5-32 Removal of Front Head Ball Bearing

24 Take a SINGLE LIGHT CUT across th face of the commutator, at a speed of approxi mately 600 surface feet per minute, to remov the surface film.

NOTE

The cut must be made carefully with a freshly honed cutting tool to insure a smooth and even cut. Use of any form of abrasive to polish the contact surface is not permissible.

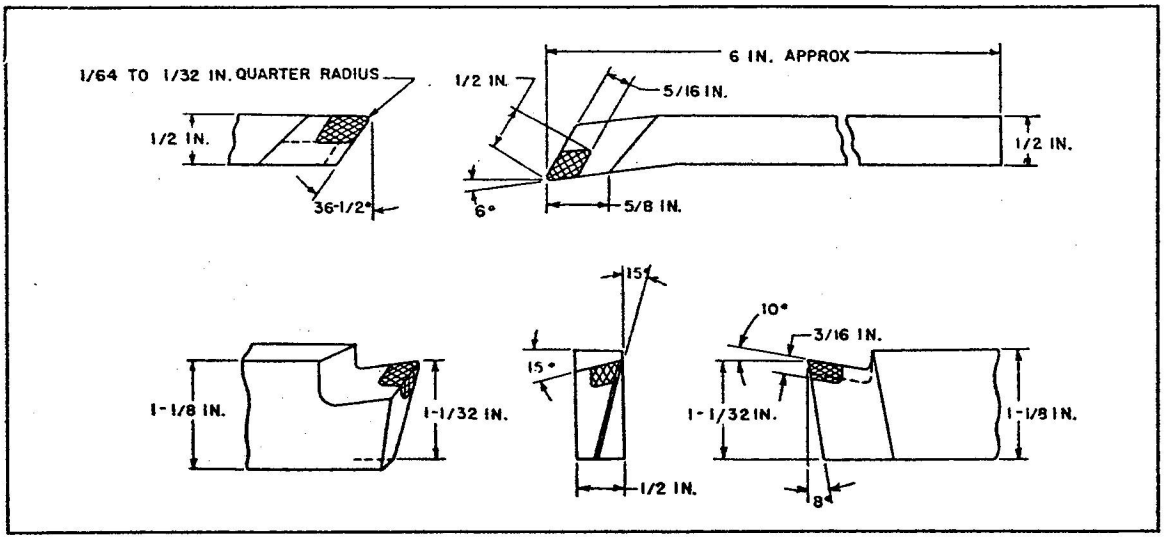


Figure 5-33 Commutator-Cutting Tool

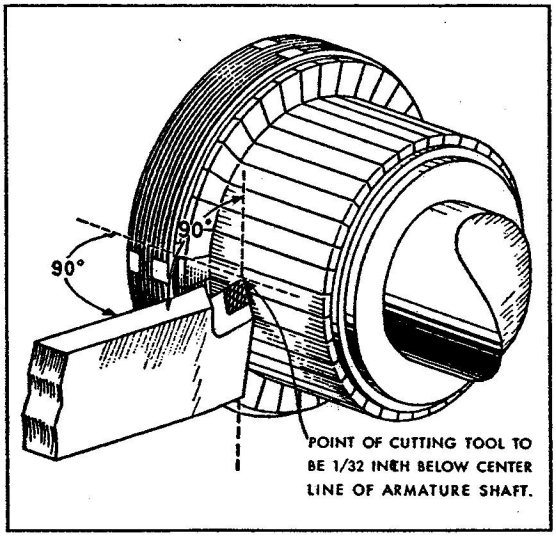


Figure 5-34 Mounting of Commutator-Cutting Tool

25 Check that the contact surface of the commutator runs concentric with the armature shaft bearing surfaces within .0005-inch full indicator reading.

26 Repeat the electrical checks described in this Part, paragraphs 18 and 20.

Rough, Pitted, Scored, or Burned Commutator

27 Mount the armature assembly and a suitable cutting tool in a lathe as outlined in this Part, paragraphs 22 and 24.

28 Take a series of light cuts across the face of the commutator at a speed of approximately 200 surface feet per minute, continuing until all evidence of pitting and scoring has been removed.

NOTE

Should the turned diameter of the commutator prove to be less than 2.365 inches, replace the armature assembly.

29 After the commutator has been turned, measure the depth of the undercut between the commutator bars. If the depth is less than .031 inch, carefully undercut the mica to a depth of .031 to .046 inch.

NOTE

The undercutting tool should be .036 inch wide, to assure complete removal of the mica, which is .032 inch thick.

30 After the mica has been undercut, take a final cut of not more than .001 inch across the face of the commutator, to remove all burrs from its contact surface.

CAUTION

The final cut must be made carefully with a freshly honed cutting tool, at a cutting speed of approximately 600 surface feet per minute, to insure a smooth, even cut. Use of any form of abrasive to polish the contact surface is not permissible.

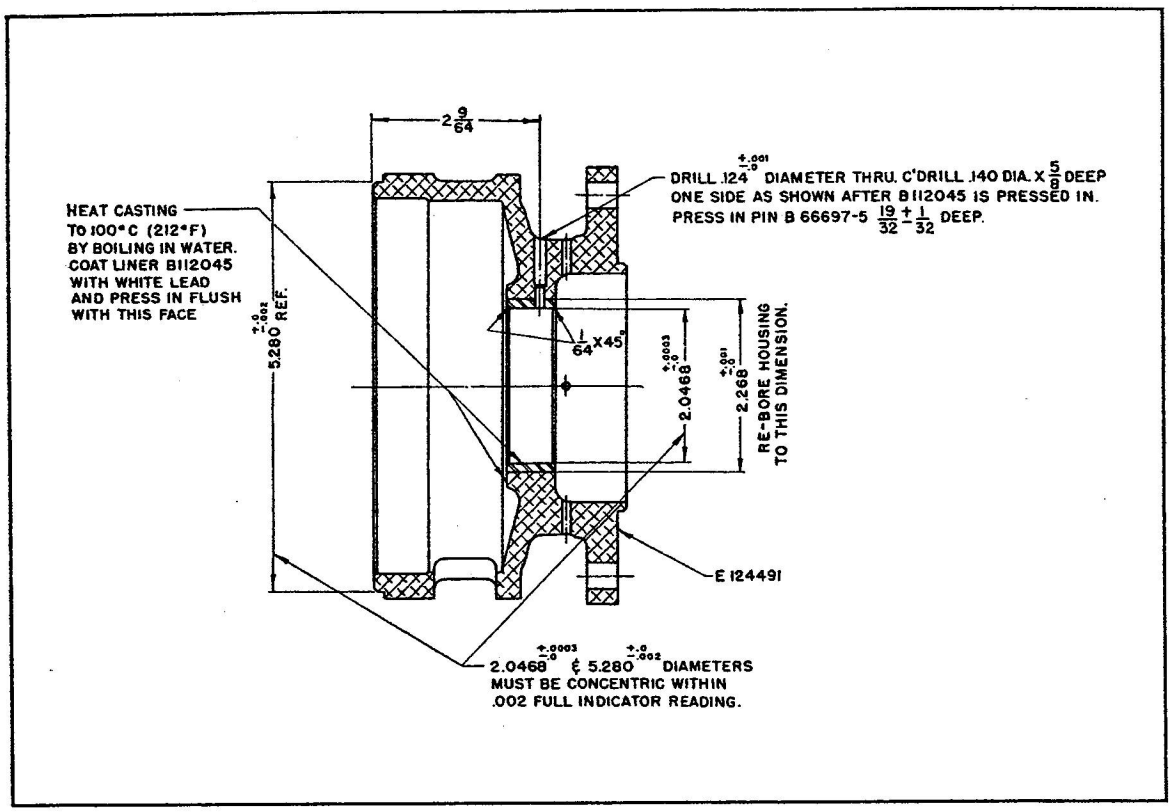


Figure 5-35 Replacement of Bearing Liner in Back Head of AAF Type M-3 Generator

31 After the final cut has been made, remove undercutting burrs from between the commutator bars with a strip of fiber.

32 Check that the contact surface of the commutator runs concentric with the armature shaft bearing surfaces within .0005-inch full indicator reading.

33 Repeat the electrical checks described in paragraphs 19 and 20.

BACK HEAD

34 Examine the back head closely. If there is excessive corrosion, or if cracks or breaks are found, replace the head. Check the inside diameter of the bearing liner against the maximum worn dimension specified in Table 4. If the liner is excessively worn, install a new liner, see Figure 5-35.

BALL BEARINGS

35 Clean the ball bearings by wiping with a cloth moistened in unleaded gasoline or any other suitable solvent.

CAUTION

Do not immerse the ball bearings into the cleaning fluid. Do not use compressed air to dry the bearings.

36 After the bearings have been cleaned check for roughness of balls and races. If the bearings are excessively loose or rough turning, install new bearings when the generator is re-assembled.

NOTE

Ball bearings which are worn beyond the permissible worn dimension specified in Table 4 should be replaced.

37 The ball bearings are completely sealed and are prepacked with sufficient lubricant for the life of the bearing. DO NOT ATTEMPT TO LUBRICATE. However, coat the bearing with a light film of spindle oil, to prevent rusting.

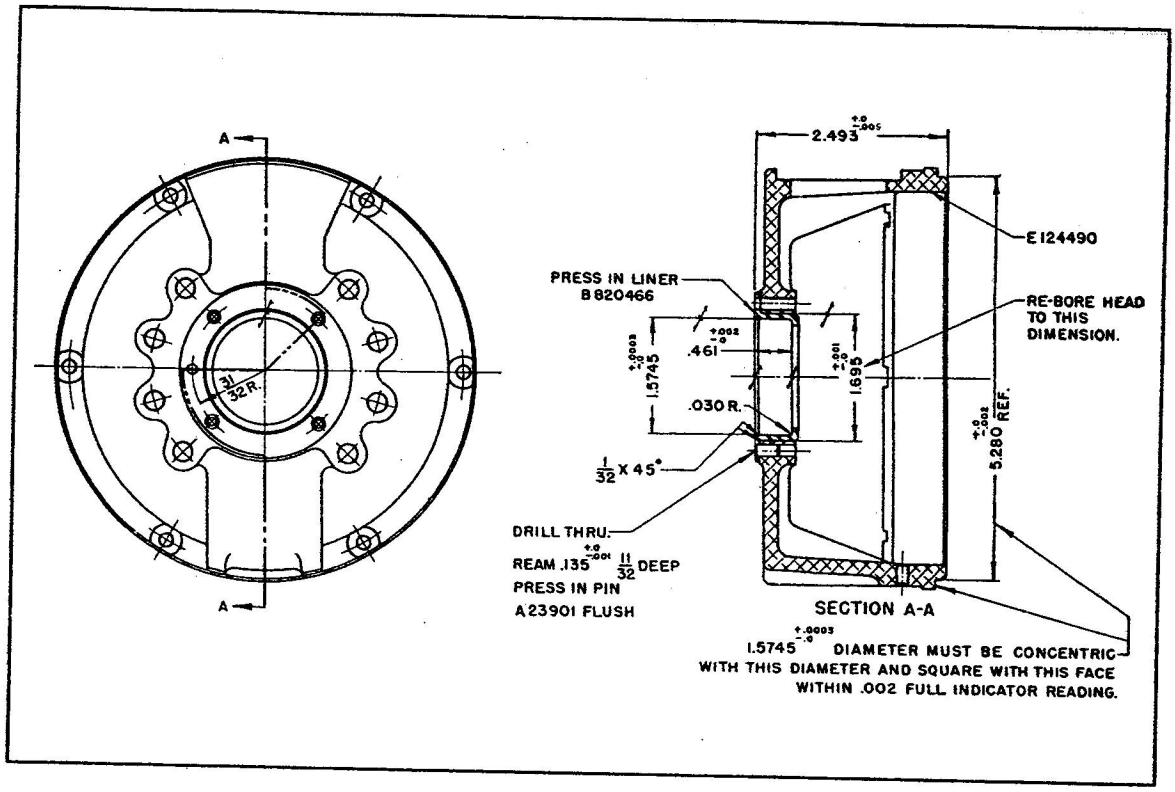


Figure 5-36 Replacement of Bearing Liner in Front Head of AAF Type M-3 Generator

BRUSHES

38 Maximum permissible wear of brushes is 5/16 inch from a new length of 13/16 inch, or when the remaining brush length is 1/2 inch.

CAUTION

Replace brushes before their maximum wear limit is reached, to assure proper operation until the next routine inspection.

39 Closely examine both ends of each brush lead for broken strands. If broken strands are found, replace the brush. Replace worn, burned, or cracked insulation and replace or resolder broken or loose terminals. If new brushes are installed, seat them as outlined in Part 6, paragraphs 9 through 17. Under the following conditions the old brushes must be reseated: installation of new armature assembly, resurfacing of commutator, and return of brushes to brush boxes other than those from which they were removed.

FAN

40 Examine the fan closely to make certain that all accumulations of foreign particles, which might tend to unbalance the fan, have been removed. Replace fans in which cracks or breaks are found.

Fan Key

41 Replace the fan key if it is bent or twisted.

FRONT HEAD ASSEMBLY

Front Head

42 Carefully inspect the front head. If there is excessive corrosion, or if cracks or breaks are found, replace the head. Make sure that all foreign matter such as copper chips, solder and carbon dust has been removed from the head. Check the inside diameter of the bearing liner against the maximum worn dimension specified in Table 4. If the liner is excessively worn, install a new liner, see Figure 5-36.

Brush Boxes

43 Closely inspect the brush boxes. Replace brush boxes which are excessively corroded or burned. Make certain that each brush box

is firmly attached to the front head, and that all terminals are tight. Test for grounds with a series test lamp circuit. Touch one test point of the test lamp circuit to the front head and touch each brush box in succession with the other test point. If a brush box is grounded, the lamp will light and the faulty insulating parts must be replaced. Remove the screws that attach the brush boxes to the front head, see Figure 5-37. Then remove and replace the faulty insulating parts, see Figure 5-38. After replacement of the faulty insulating parts, coat the new insulating parts and the surrounding area with red glyptal lacquer, Specification AN-TT-V-118 or AN-TT-V-116, see Figure 5-39. Then, repeat the test for grounds. Also check for continuity of each jumper by touching the test points to the jumper terminals. If the lamp fails to light the jumper is open, and must be replaced.

Brush Springs

44 Check the tension of each brush spring with a 0- to 6-pound standard spring scale. Hook the scale underneath each spring; then lift the end of the spring to a position 1/8 inch above the top of the brush box, see Figure 5-40. The tension should then measure 20 to 24 ounces. If the tension measured does not fall within the specified limits, the position of the adjusting sleeve must be altered to obtain the proper tension. Hold the sleeve from turning and remove the spring clip. Alter the position of the sleeve as necessary and replace the spring clip, see Figure 5-41.

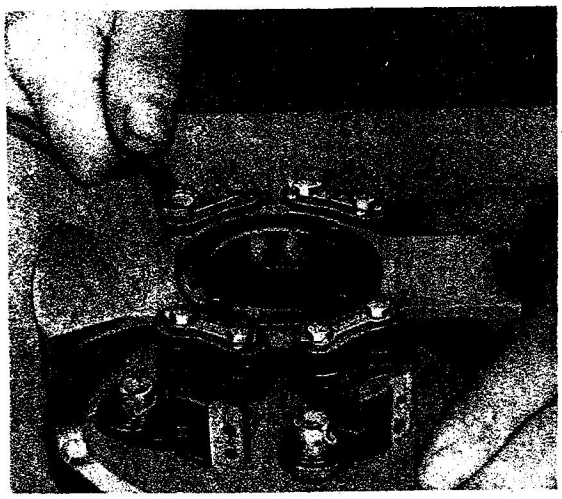


Figure 5-37 Removal of Brush Box Mounting Screws

PENCIL DRIVE SHAFT

45 Closely examine the pencil drive shaf for scoring of its splines, and for discolor ation which indicates a weakened shaft. Assemble the drive shaft into the tubular armatur shaft. The drive shaft should fit freely. If however, the shaft is discolored, either splin is scored, or the shaft does not fit freely, re place the shaft. Refer to paragraph 12. Chec the teeth of the drive spline for wear. If th width of any tooth is less than .199 inch, re place the drive shaft.

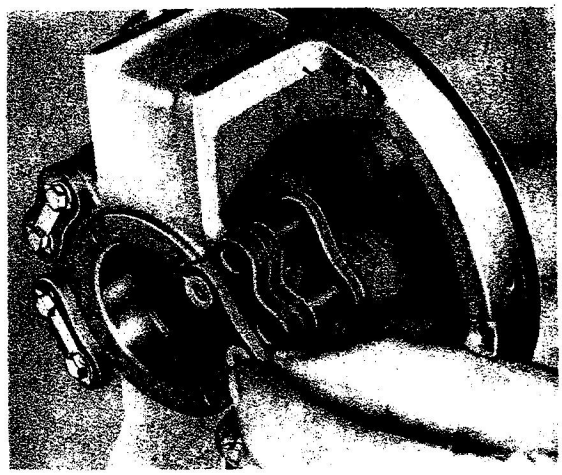


Figure 5-38 Removal of Brush Box Insulating Parts

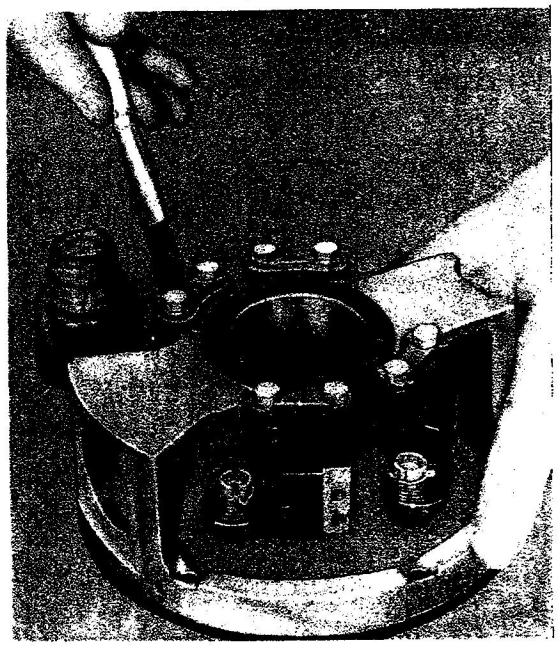


Figure 5-39 Lacquering Brush Box Insulating Parts

NOTE

In addition to the procedure described in paragraph 45, the drive shaft should be "magnafluxed" to reveal cracks, and must be discarded if the slightest indication of cracks is found.

PENCIL DRIVE SHAFT GASKET

46 Replace the drive shaft gasket at every overhaul.

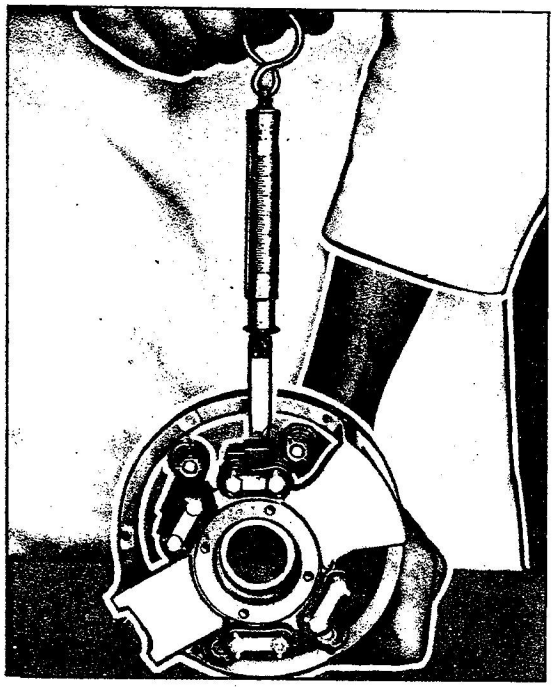


Figure 5-40 Measuring Brush Spring Tension

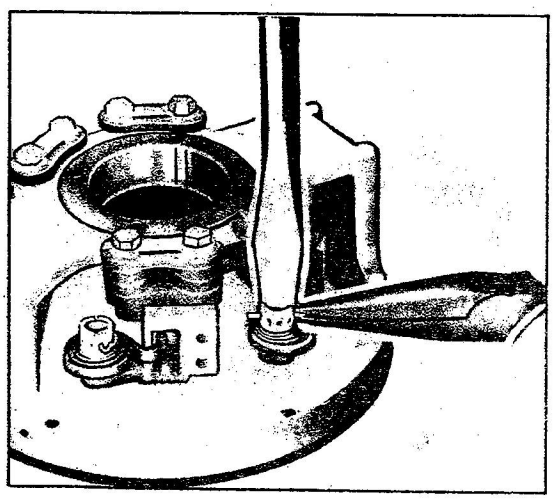


Figure 5-41 Adjusting Brush Spring Tension

RECEPTACLE AND LEADS

47 Closely examine the receptacle for stripped threads, cracked bakelite inserts, and burned or loose contacts. Replace the receptacle if any such condition is found. Replace jumper leads having burned or cracked insulation, broken or corroded terminals. Test for continuity of each lead with a series test lamp circuit. Touch one test point to each end of the lead. If the lamp fails to light, the lead must be replaced.

YOKE ASSEMBLY

48 Closely examine the shunt field coil assembly. If the insulation is worn, burned, or cracked, replace the assembl, as outlined in following paragraph 52. Replace or resolder broken or loose terminals. If the pole shoe screws are loose, expand any two opposite pole shoes against the yoke with pole shoe expander EQ4139. Then, use screwdriver press EQ7080 with adaptor EQ7080-7, to tighten the pole shoe screws of the expanded pole shoes, see Figure 5-42. Repeat this operation for the remaining pole shoes. Check to make certain that plug gauge EQ7212 "goes", to insure proper armature clearance, see Figure 5-43.

NOTE

The inside diameter between opposite pole shoes must be between 3.282 and 3.286 inches.

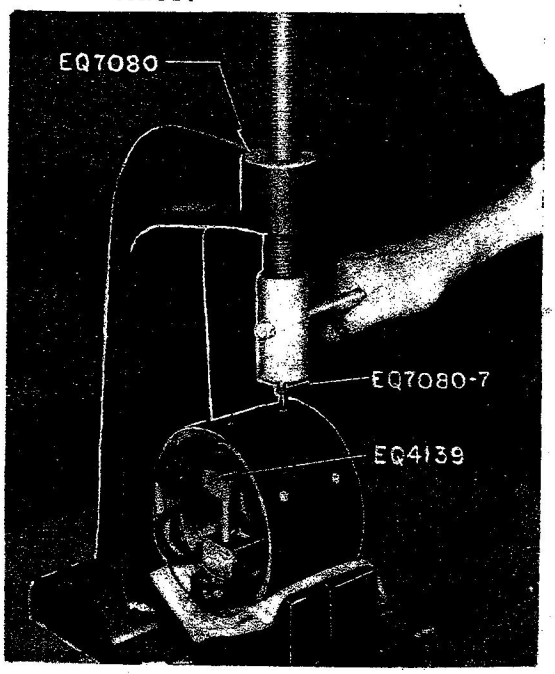


Figure 5-42 Tightening of Pole Shoe Screws

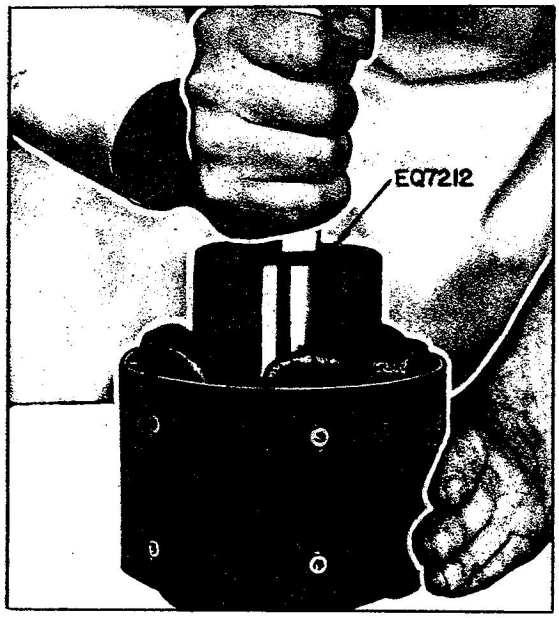


Figure 5-43 Checking Alignment Of Pole Shoes

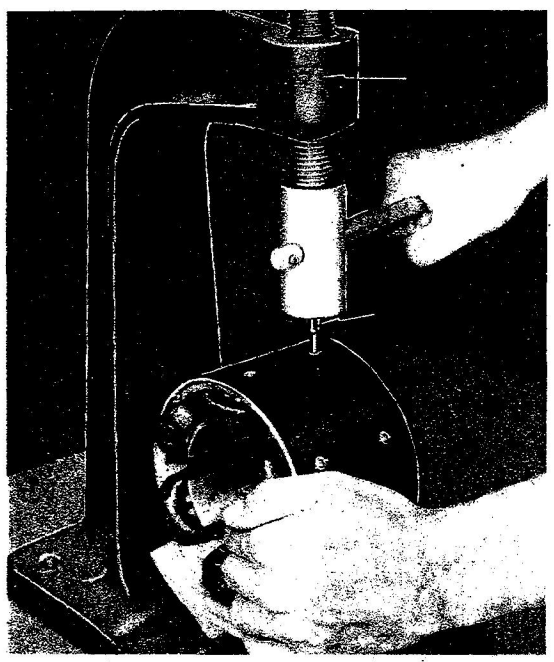


Figure 5-44 Removal of Pole Shoe Screws

49 If the yoke assembly is found in satisfactory physical condition, proceed with the electrical tests outlined in following paragraphs 50 and 51. If the field coil assembly proves faulty, it must be replaced as outlined in following paragraph 52.

CAUTION

When the resistance of the field coil assembly is checked by means of any device using a d-c source, it is important that each terminal of the device be connected to the field coil assembly terminal of like polarity. This is necessary to prevent the generator field from being reversed or demagnetized.

Resistance Measurement of Field Coil Assembly

50 Measure the resistance of the field coil assembly with a Wheatstone bridge or similar resistance measuring device. The resistance should measure between 2.7 and 3.3 ohms. If the resistance does not measure within the specified limits, the field coil assembly is either opened or shorted.

Ground Test of Field Coil Assembly

51 Use a series test lamp circuit to test the field coil assembly for grounds. Touch one test point of the test lamp circuit to the yoke. Touch the other test point to either terminal of the field coil assembly. If the lamp lights, the field coil assembly is grounded.

Replacement of Faulty Field Coil Assembly

52 Replace as follows:

(a) Use screwdriver press EQ7080 with adaptor EQ7080-7 to remove the pole shoe screws, see Figure 5-44.

(b) Place an identifying mark on each pole shoe so it may be readily returned to its original position.

(c) Remove the field coils and pole shoes from the yoke, noting the position of the insulating strip on each of the five spliced connections of the field coils, see Figure 5-45. Separate the field coils from the pole shoes.

(d) Place the new field coils on their proper respective pole shoes and assemble loosely into the yoke with the pole shoe screws. Make sure to return each pole shoe to its original position.

(e) Replace the insulating strips on the field coil connections, in the positions noted at disassembly. Refer to preceding sub-paragraph (c). Then tighten the pole shoe screws sufficiently to hold the coils in place.

(f) Bake the entire yoke assembly at 127°C (260°F) for a period of two hours.

NOTE

Replacement field coils assemblies are dipped in Harvel Varnish 512-C (specific gravity .830 to .840) and partially baked before shipment. Additional baking causes the varnish to soften and flow into the crevices between the parts attached to the yoke, forming a well bonded assembly.

(g) While the yoke assembly is still hot from baking, use pole shoe expander EQ4139 to expand any two opposite pole shoes and coils against the yoke. With the expander in place, use screwdriver press EQ7080 with adaptor EQ7080-7 to tighten the pole shoe screws of the expanded pole shoes, see Figure 5-42. Repeat this operation for the remaining pole shoes and coils. Then remove the expander and check to make certain that plug gauge EQ7212 "goes", to insure proper armature clearance, see Figure 5-43.

NOTE

The inside diameter between opposite pole shoes must be between 3.282 and 3.286 inches.

(h) Repeat the tests described in preceding paragraphs 50 and 51, to make sure the new field coil assembly has not been grounded during assembly into the yoke.

(j) Stake each pole shoe screw to the yoke in two places.

TOLERANCE TABLE

53 Table 4 is provided as an aid in checking dimensions when inspecting generators at overhaul. If the clearance between any two mating surfaces exceeds the permissible worn clearance, replace the part or parts which are worn beyond the permissible worn dimensions.

LUBRICATION

54 Clean and inspect in accordance with the applicable EOs of the 75-10 series pertaining to cleaning, inspection, and greasing of ball bearings. Lubricate with Grease, Type AN-G-5a.

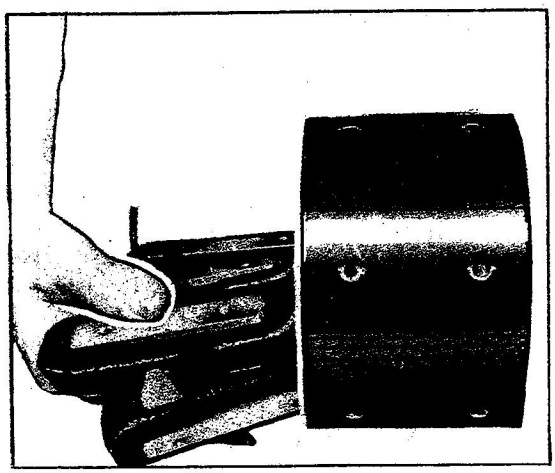


Figure 5-45 Removal of Field Coils and Pole Shoes

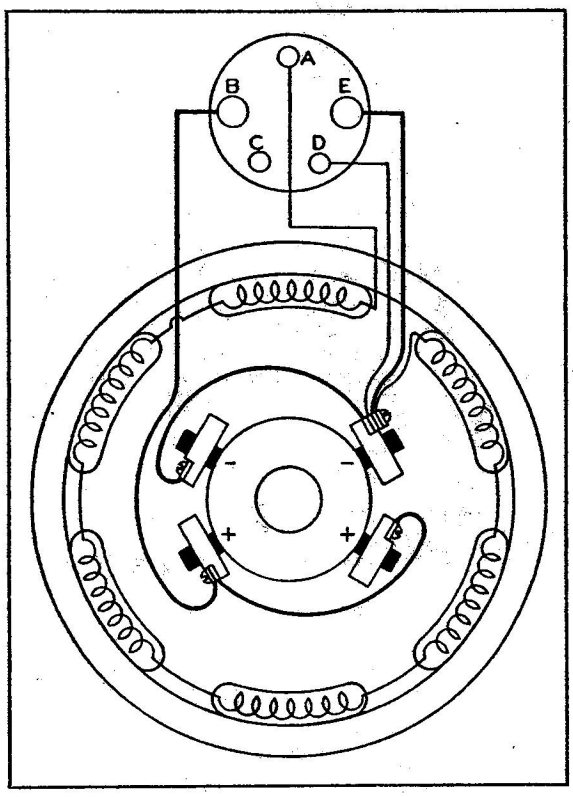


Figure 5-46 Schematic Internal Wiring Diagram - AAF Type M-3 Generator

TABLE 4 TOLERANCE TABLE

Part Nomenclature		New Dimensions		New Clearance	Permissible Worn Dimensions		Permissible Worn Clearance
		Minimum	Maximum		Minimum	Maximum	
Armature shaft in front head ball bearing	Armature shaft OD	.6688"	.6691"	.0001T to .0005L	.6688"	.....	.0005L
	Ball bearing ID	.6690"	.6693"		.....	.6693"	
Armature shaft in back head ball bearing	Armature shaft OD	.9837"	.9840"	.0001T to .0006L	.9837"	.....	.0006L
	Ball bearing ID	.9839"	.9843"		.....	.9843"	
Ball bearing in front head bearing liner	Ball bearing OD	1.5744"	1.5748"	.0003T to .0004L	1.5744"	.....	.0004L
	Bearing liner ID	1.5745"	1.5748"		.....	1.5748"	
Ball bearing in back head bearing liner	Ball bearing OD	2.0467"	2.0472"	.0004T to .0004L	2.0467"	.....	.0004L
	Bearing liner ID	2.0467"	2.0471"		.....	2.0471"	

Figure 5-47 Mounting the Back Head on Armature Shaft

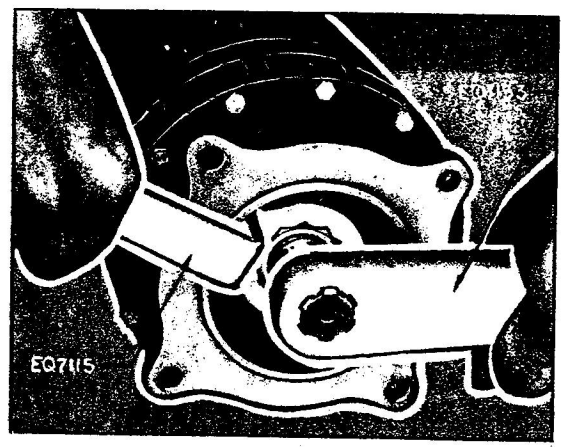


Figure 5-48 Tightening the Nut at the Drive End of the Armature Shaft

RE-ASSEMBLY, see Figures 5-46 through 5-49

55 When the generator is being re-assembled, make certain to replace all tab locks, flat washers, and lockwashers. Wipe the pole shoe assemblies, armature shaft, and pencil drive shaft with an oiiy cloth, to prevent rusting.

CAUTION

Take care not to get oil on the commutator.

56 Re-assemble generator as follows:

(a) Press the front head ball bearing into the front head liner. Then attach the retainer and safety-wire the retainer mounting screws.

(b) Fit the front head and yoke assemblies together and re-assemble the mounting screws. Replace the safety wire (with insulating sleeving) on the screws.

(c) Pull the leads attached to the receptacle into the front head. Solder the positive field coil assembly lead to the "A" contact of the receptacle. Make certain that all leads to the receptacle are firmly soldered in place. Then attach the receptacle to the front head. Complete the internal wiring connections as shown schematically in Figure 5-46. Make certain all connections are clean and tight.

(d) Press the back head ball bearing into the back head liner.

(e) Assemble the fan key into the armature shaft keyway and then re-assemble the fan on the shaft. Make certain to assemble the fan so that its recessed face is adjacent to the armature shaft shoulder. Assemble the back head on the armature shaft, lightly tapping the head to snugly seat the ball bearing on the shaft, see Figure 5-47. Assemble a tab lock on the drive end of the armature shaft, then screw on the nut finger tight.

(f) Insert the commutator end of the armature shaft through the yoke assembly and into the front head ball bearing. Align the back head and yoke mounting holes and then tap the head lightly to fit the head and yoke together. Re-assemble the back head to yoke mounting screws.

(g) Assemble a new gasket on the pencil drive shaft. Insert the smaller spline of the shaft into its mating spline inside the armature shaft. Assemble the lock ring on the commutator end of the shaft.

(h) Use wrench EQ7115 to tighten the nut at the drive end of the armature shaft, holding the armature from turning with wrench EQ7153, see Figure 5-48. Assemble a tab lock on the commutator end of the shaft, screw on and tighten the nut, see Figure 5-49. Then bend out the tabs of both tab locks.

(j) Rotate the armature assembly by hand and check for rubbing, binding, or audible noise. The armature should rotate with a very slight and uniform drag caused by the grease in the ball bearings. If the armature does not rotate freely, disassemble the generator and recheck the clearances specified in Table 5.

CAUTION

Do not run the generator on test until such faults as described above have been corrected.

(k) Lift the brush springs and insert the brushes into the brush boxes. Make certain that the brushes fit freely, and that the brush springs bear centrally on the top of the brushes, assuring full brush contact with the face of the commutator. Reconnect the brush lead terminals, making certain not to twist the brush leads. Safety-wire the brush box connections.

NOTE

If the old brushes are being re-used, install each brush in the box from which it was removed and in the same position as noted at disassembly.

(l) Do not replace the front head cover until instructed to do so in Part 6.

TYPE 30E01-1-A

DISASSEMBLY, see Figure 7-1

Separation of Generator into Basic Components

57 Disassemble generator as follows:

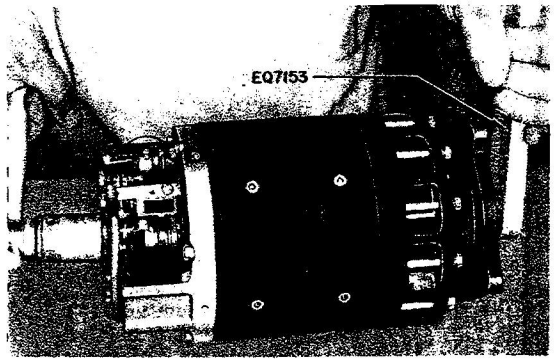


Figure 5-49 Tightening the Nut at the Commutator End of the Armature Shaft

(a) Remove all external safety wire. Disassemble the front head cover (46), removing the screws (47) and washers (48).

(b) Disconnect the brush lead terminals by removing the screws (8) and lockwashers (9). Pull up the brush spring assemblies (1F2), and remove the brush assemblies (10) from the brush boxes (1F1). Mark each corresponding brush and brush box in such a manner as to facilitate the return of each brush found satisfactory for further use to its original position in the brush box from which it was removed.

NOTE

This procedure is important, the purpose being to eliminate reseating which is necessary if the brushes are returned to boxes other than the ones from which they were removed.

(c) Remove the self-locking nut (32) with a standard 3/8" socket wrench, holding the armature from turning with spline wrench QC80059-1. Disassemble the spring retainer (31) and spring (30) from the pencil drive shaft. Remove the stake pin from the front bearing nut (29) with a small punch or chisel, being careful not to damage the threads on the armature shaft. Unscrew the front bearing nut with a standard 7/8" open end wrench, holding the spline shaft with wrench QC80059-1 or bench spline holder QC80063-2. Withdraw the pencil drive assembly shaft (27) from the drive end of the armature shaft. Disassemble the lining (28) from the shaft.

NOTE

Do not attempt to separate the pencil shaft and the back plate. To do so will result in damage to the parts.

(d) Remove the front plate (26) and the loc ring (25) from the armature shaft. Disassembl the back head (33) from the yoke (13A), remov ing the screws (34), washers (35), and lock washers (36). Slip the spring washer (23) fror the armature shaft. Separate the back head an armature assembly (20), as a unit, from th front head and yoke assemblies (13).

(e) Press the armature shaft out of the bac head ball bearing (37), separating the back hea from the armature assembly.

(f) Disconnect all jumper terminals (4A 5A, 5B, 6A and 7A) by removing the screws (11 and lockwashers (12) from the brush boxe (1F1). Do not unsolder the jumper assemblie (5 and 6) and lead assembly (7) from the recept acle unless they require replacement. Remov jumper assembly (4).

NOTE

The wiring of the brush box assemblies has been changed by the substitution of two jumper assemblies (4 and 6) for the single jumper assembly formerly used to connect the brush boxes to the "B" receptacle terminal.

(g) Disassemble the receptacle (2) fron the front head removing the screws (3). Pul the receptacle as far away from the front hea as the lead from the "A" contact of the re ceptacle to the field coil assembly will permit Unsolder the lead from the "A" contact of th receptacle. Completely remove the receptacle carefully withdrawing the attached lead through the receptacle mounting holes.

(h) Remove the safety wire and insulatin sleeving from the front head to yoke mountin screws (14). Then remove the mounting screw and separate the front head assembly (1) fron the yoke assembly (13).

DISASSEMBLY OF BASIC COMPONENTS

Armature Assembly

58 Remove the fan (21) and the Woodruff key (22) from the armature shaft. Further disassembly of the armature is never recommended. If it is found unsatisfactory upon inspection, the complete armature assembly must be replaced. Refer to paragraphs 9 to 33.

Back Head

59 Press the ball bearing (37) out of the back head using bearing pusher QB80038-10. Remove the floating bearing spring (24) from its seat in the back head (33).

Front Head Assembly

60 Disassemble the bearing retainer (17) from the front head, removing the screws (18) and the lockwashers (19). Press out the ball bearing (16) using pusher QB80037-10. No further disassembly of the front head assembly (1) is necessary unless faulty parts are found upon inspection as described in paragraphs 42 to 44.

Yoke and Field Coils Assembly

61 No further disassembly of the yoke and field coils assembly (13) is necessary, unless faulty parts found upon inspection as outlined in paragraph 48.

CLEANING, INSPECTION, TESTING AND REPAIR

62 Procedures for cleaning, inspecting, testing and repairing type 30E01-1-A generators are similar to those described in paragraph 7, for type M-3 generators. In addition, the following checks should be made.

Vibration Damper Assembly

63 Inspect the vibration damper spring for cracks or distortion, and replace it if any defects are found. Examine the drive shaft assembly for scoring of the splines, and for discoloration which indicates a weakened shaft. The back plate should be firmly fixed to the drive shaft. If any looseness is evident, replace the drive shaft assembly with a new one.

Front Head Assembly, see Figure 7-1

64 The front head assembly (1) of type 30E01-1-A units has been changed from that described in paragraph 48, by incorporating the brush boxes and springs into four brush spring and box assemblies (1F). To disassemble this assembly, remove the cotter pin (1F3) and separate the brush spring assembly (1F2) from the brush box assembly (1F1).

Yoke and Field Coil Assembly, see Figure 7-1

NOTE

Refer to the list of overhaul tools, Table 3, for the new part numbers of the tools recommended to overhaul the yoke and field coil assembly (13).

65 When this handbook was originally issued, five fish paper insulators were incorporated in the field coil assembly. Six shims (13C) have been substituted for the fish paper insulators.

LUBRICATION

66 Since the ball bearings are of sealed construction and are prelubricated with sufficient lubricant for the life of the bearing, lubrication of the generator is not required.

RE-ASSEMBLY, see Figure 7-1

67 Re-assemble generator as follows:

(a) Wipe the pole shoe assemblies, armature shaft and drive shaft with an oily cloth to prevent rusting.

CAUTION

Take care not to get oil on the commutator.

(b) Fit the floating spring (24) into the back head bearing bore. Attach swivel adaptor QD80110-1 to screwdriver press QR80000-1. Slip the back head ball bearing (37) on bearing pilot QC80061-7. Push the bearing into the bore in the back head (33), using piloted bearing pusher QD80009-4 with the screwdriver press and swivel adaptor.

(c) Press the front ball bearing (16) into the front head (1A). Secure the retainer (17) with the screws (18) and lockwashers (19), then safety-wire the screws.

(d) Fit the front head assembly (1) to the yoke and field coil assembly (13) and re-assemble with screws (14) and washers (15). Use ratchet torque wrench QD80029-1 to apply a torque of 19 to 21 inch-pounds to tighten each screw. Replace safety wire on the screws.

(e) Pull the leads attached to the receptacle (2) into the front head (1A). Solder the positive field coil assembly lead to the "A" contact of the receptacle. Make certain that all leads to the receptacle are firmly soldered in place. Attach the receptacle to the front head with the screws (3). Complete the internal wiring connections as shown schematically in Figure 5-46. Make certain that all connections are clean and tight.

(f) Secure the fan (21) to the armature shaft with the Woodruff key (22). Make certain that the recessed face of the fan is adjacent to the armature shaft shoulder. Slip the spring washer (23) on the armature shaft. Assemble the back head (33) on the armature shaft, lightly tapping the head with a soft-faced hammer to seat the ball bearing snugly on the shaft, see Figure 5-47. Fit the lock ring (25) in the groove in the armature shaft, then fit the front plate (26) on the shaft.

(g) Insert the commutator end of the armature shaft through the yoke and field coil assembly (13) into the front head ball bearing (16). Align the back head and yoke mounting holes, then tap the head lightly to fit the head and yoke together. Secure with the screws (34) and lockwashers (35). Use ratchet torque wrench QD80029-1 to apply a torque of 36-inch-pounds to tighten each screw.

(h) Assemble the lining (28) on the drive shaft assembly (27). Insert the drive shaft into the drive end of the armature shaft, engaging the spline of the drive shaft with the female spline inside the commutator end of the armature shaft.

(j) Assemble a new front bearing nut (29) on the commutator end of the armature shaft and tighten with a standard 7/8" open-end wrench, holding the drive end spline with spline holder QC80063-2 or splined wrench QC80059-1. Stake the nut in place. Slip the spring (30) and the spring retainer (31) on the pencil drive shaft. Tighten the self-locking nut (32) with a standard 3/8" socket wrench, holding the drive end spline with either spline holder QC80063-2 or splined wrench QC80059-1.

(k) Re-assemble the brush spring assemblies (1F2) on the brush box assemblies (1F1) and secure with the cotter pins (1F3). Re-assemble the insulating tubes (1L), insulators (1K), washers (1J), and lock tabs (1H) on the brush box screws (1G) and tighten the screws.

(l) Replace the brush assemblies (10) in the brush boxes from which they were removed. Secure the terminals of the jumper assemblies (4, 5, 6 and 7) with the four screws (8) and lockwashers (9), inserting the screws through the outside holes of the terminals. Secure the brush lead terminals to the brush boxes with the screws (11) and lockwashers (12), inserting the screws through the brush lead terminals and through the inside holes of the jumper terminals.

PART 6

TABLE OF CONTENTS

TEST PROCEDURE

GENERAL

1 After the procedure outlined in Part 5 has been completed check the generator for satisfactory operation as outlined in this Part.

NOTE

Throughout the tests, rotation of the generator must be counterclockwise as viewed at the generator drive end.

TEST EQUIPMENT, see Figures 6-1 and 6-2

2 Test procedure for type 30E01-1-A generators is identical with that described in this section for type M-3 generators. Note, however, that the Eclipse-Pioneer type 1042 model 17 carbon pile regulator is recommended to control the output voltage of the type 30E01-1-A generator.

3 For a complete list of recommended test equipment including a carbon pile voltage regulator for automatic regulation of generator output voltage see Figure 6-1. In the event that a suitable control unit is not available, substitute the equipment listed in Figure 6-2, which includes field rheostats for manual control of output voltage. Refer to paragraphs 4 to 8 for detailed descriptions of the recommended equipment and its operation.

NOTE

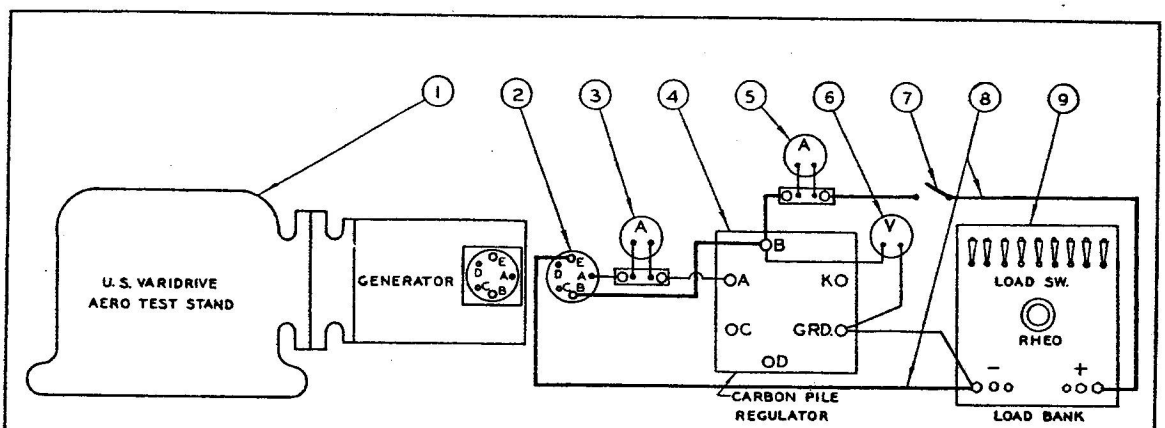
When this EO was originally issued, the manufacturer recommended the US Varidrive Test Stand or Testometer for testing the generators. The equipment now being used and recommended for this purpose is Model OTB Type 30-600, Aircraft Generator Testometer, Unadco Manufacturing Company, New Haven, Connecticut.

NOTE

Upon addition of a field ammeter and a suitable voltage control device, a US Varidrive Testometer may be used in lieu of the specified equipment.

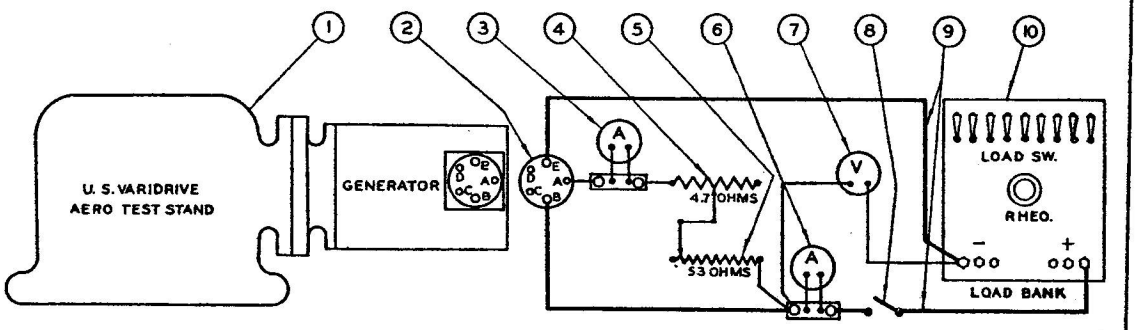
TEST STAND

4 Both the US Varidrive Aero Test Stand and the US Varidrive Testometer include a test bench, an electrical tachometer, and generator mounting adaptors. The testometers, only, also includes a line voltmeter, load ammeter and load bank.



1 — U. S. Varidrive Aero Test Stand—U. S. Electrical Motors, Inc., N. Y., N. Y.
2 — Specification No. AN 3106-22-12S Plug
3 — D-C Ammeter (Field) With 15-Ampere External Shunt—Weston Instrument Co., Model 45
4 — Carbon Pile Voltage Regulator—Eclipse-Pioneer Division, Bendix Aviation Corp., Type 1042 Model 2
5 — D-C Ammeter (Load) With 75-Ampere External Shunt—Weston Instrument Co., Model 45
6 — D-C Voltmeter (Line)—Weston Instrument Co., Model 45, Range: 0 to 30 Volts
7 — Suitable Single-Pole, Single-Throw Knife Switch (Load)
8 — B & S Size 8 Cable
9 — Load Bank (Refer to this section, paragraph 2. *d.*)

Figure 6-1 Schematic Test Diagram - AAF Type M-3 Generator With Carbon Pile Regulator for Voltage Regulation



1 — U. S. Varidrive Aero Test Stand—U. S. Electrical Motors, Inc., N. Y., N. Y.
2 — Specification No. AN 3106-22-12S Plug
3 — D-C Ammeter (Field) With 15-Ampere External Shunt — Weston Instrument Co., Model 45
4 — Slide Contact Rheostat (Field)—Herman H. Sticht Co., Inc., N. Y., N. Y., Rex Rheostat, Type A-6, Catalog No. 218, Rating: 4.7 Ohms, 16 Amperes
5 — Slide Contact Rheostat (Field)—Herman H. Sticht Co., Inc., N. Y., N. Y., Rex Rheostat, Type A-6, Catalog No. 213, Rating: 53 Ohms, 4.7 Amperes
6 — D-C Ammeter (Load) With 75-Ampere External Shunt — Weston Instrument Co., Model 45
7 — D-C Voltmeter (Line)—Weston Instrument Co., Model 45, Range 0 to 30 Volts
8 — Suitable Single-Pole, Single-Throw Knife Switch (Load)
9 — B & S Size 8 Cable
10 — Load Bank (Refer to this section, paragraph 2. *d.*)

Figure 6-2 Schematic Test Diagram - AAF Type M-3 Generator with Field Rheostats for Voltage Regulation

CONTROL EQUIPMENT

Carbon Pile Voltage Regulator, see Figure 6-1

5 It is recommended that an Eclipse type 1042 model 2 carbon pile regulator (4) be used to control the output voltage of the generator during testing. Adjust the regulator for regulation at 27.8 to 29.2 volts, as outlined in chapter 74, Part B, of Technical Order 03-1-6.

NOTE

If a suitable voltage regulator is not available, use field rheostats, as described in paragraph 6 for voltage control.

Field Rheostats, see Figure 6-2

6 For manual control of generator output voltage, the use of two rheostats (4) and (5) is desirable in order to facilitate exact voltage adjustments. Proper adjustment of the rheostats is as follows:

(a) Prior to starting the driving motor for any test, adjust the 53-ohm rheostat (5) for maximum resistance. Set the slide contact of the 4.7-ohm rheostat (4) approximately midway between the ends of the rheostat or for one-half maximum resistance.

(b) To adjust output voltage, first manipulate the 53-ohm rheostat (5) until the line voltmeter reads approximately 28.5 volts, then use the 4.7-ohm rheostat (4) to adjust the voltage to exactly 28.5 volts.

(c) At any time that adjustment of the driven speed for applied load is made, it will be necessary to re-adjust both rheostats to maintain the output voltage at 28.5 volts.

(d) Prior to opening the load switch or shutting down the driving motor, return the rheostats to the positions described in operation (a).

Instruments, see Figures 6-1 and 6-2

7 It is recommended that the d-c ammeters be procured without internal shunts, in order that these instruments may be used with suitable external shunts for a wide range of application.

CAUTION

Make certain that the millivolt drop rating of ammeter and shunt correspond. Use calibrated shunt leads.

Load Bank, see Figures 6-1 and 6-2

8 Any load bank may be used which has graduated load steps and a continuous rating of at least 50 amperes at 30 volts.

PREPARATION FOR TEST

9 Mount the generator on the test stand mounting bracket and proceed as outlined in paragraphs 10 through 13 following the sequence shown.

Flashing the Field

10 Flash the field circuit of the generator using a 12-volt battery, to insure that the magnetic circuit of the generator retains sufficient residual magnetism to allow the generator to "build up" properly. Connect the negative battery terminal to the "E" contact of the generator receptacle. Connect the positive battery terminal through a single-pole, single-throw knife switch to the "A" receptacle contact. Apply battery current to the field for a period of about five seconds, by closing and then opening the knife switch. Repeat the operation several times to insure that the field is properly flashed

CAUTION

It is absolutely necessary that a knife switch be used when flashing the field, since opening of the circuit at the generator or battery terminals can easily result in severe damage to the terminals, or explosion of the battery.

Yoke Thermometer Attachment

11 Use a laboratory-type thermometer to determine the temperature rise of the generator during testing. Insert the bulb of the thermometer through a slotted felt pad. Set the bulb against a pole shoe screw and tie the pad firmly in place, see Figure 6-3.

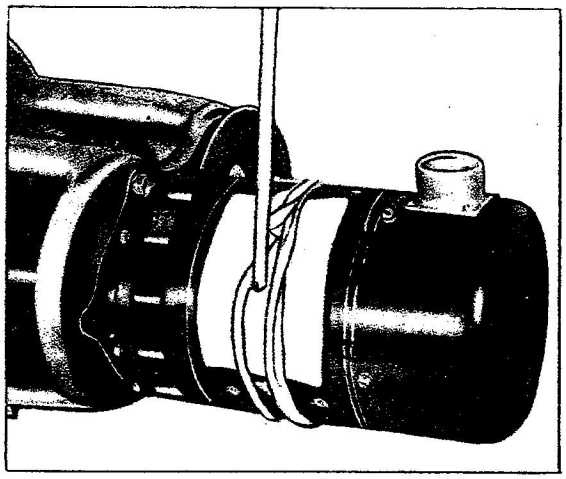


Figure 6-3 Attachment of Thermometer to Yoke

Electrical Test Connections

12 Complete the electrical connections to the generator and test equipment as shown schematically in Figure 6-1 when a carbon pile regulator is being used for voltage regulation, or as in Figure 6-2 when field rheostats are being used. Use flexible, insulated cables; keep all connections as short as conveniently possible. Use B & S size 8 cable for the generator output circuit. Use B & S size 16 wire for all other circuits.

NOTE

It is recommended that a Specification AN-3106-22-12S plug be used to make the test connections to the generator receptacle.

Initial Running Check

13 In order to make certain that the generator is in safe operating condition, a short running check should be made with front head cover removed from the generator. Refer to Table 5 for the proper voltage, current, and speed values. Make certain that the load switch and all load bank switches are open. Proceed as outlined in paragraph 15 when a carbon pile regulator is being used for voltage control, or as outlined in paragraph 16 when field rheostats are being used.

CAUTION

If at any time during this or any other test, smoking or excessive sparking is observed, or if undue noises are heard, immediately open all switches and shut down the driving motor. Do not proceed with the check until the cause of the trouble is located. If visual inspection fails to disclose the cause of the trouble, disassemble the generator and repeat the inspection procedure outlined in Part 5.

14 The generator may be considered in satisfactory running condition for further testing, if load can be applied as described without undue effects.

Procedure Using a Carbon Pile Regulator

15 Proceed as follows:

(a) Start the driving motor. Gradually increase the driven speed of the generator to any speed within the rated speed range of 2,500 to 4,500 rpm.

(b) The line voltmeter should then read between 27.8 and 29.2 volts.

(c) Close the load switch and apply a load of approximately 10 amperes by closing the appropriate load bank switch. The line voltmeter reading should remain within the specified limits, and the load ammeter should read approximately 10 amperes.

(d) If the generator operates satisfactorily, increase the load to not more than 50 amperes, by closing additional load bank switches. The line voltmeter reading should remain within the specified limits. The field current, as read on the field ammeter, should not exceed 4.8 amperes.

(e) When the check has been completed, open the load switch and all load bank switches, and shut down the driving motor.

Procedure Using Field Rheostats

16 Proceed as follows:

(a) Start the driving motor and gradually increase the driven speed of the generator to any speed within the rated speed range of 2,500 to 4,500 rpm. Manipulate the field rheostats until the line voltmeter reads 28.5 volts.

NOTE

Refer to paragraph 5 and 6, for instructions outlining adjustment of rheostats.

(b) Close the load switch and apply a load of approximately 10 amperes, by closing the appropriate load bank switch. Manipulate the field rheostats until the line voltmeter again reads 28.5 volts. The load ammeter should then read approximately 10 amperes.

(c) If the generator operates satisfactorily, gradually increase the applied load to not more than 50 amperes, by closing additional load bank switches. It will be necessary to continuously lower the resistance of the field rheostats to maintain the line voltmeter reading at 28.5 volts. However, the field current, as read on the field ammeter, should not exceed 4.8 amperes.

(d) When the check has been completed, adjust the 53-ohm rheostat for maximum resistance. Then open the load switch and all load bank switches and shut down the driving motor.

Seating the Brushes

17 Under the following conditions brushes should be "run-in" until properly seated: installation of new brushes or armature assembly, resurfacing of the commutator, and replacement of brushes in brush boxes other than those from which they were removed.

NOTE

The use of abrasives of any description to aid in seating the brushes is not permissible.

18 See Table 6 for the proper voltage, current, and speed values; proceed as follows:

CAUTION

Check to make certain that the voltage, current, and temperature values specified in Table 6 are not exceeded during the brush seating run.

(a) Make sure that the load switch and al load bank switches are open, and that the fron head cover is removed from the generator.

(b) Start the driving motor and adjust th driven speed of the generator to 2,500 rpm.

(c) Close the load switch and apply not mor than 25 amperes load, as indicated on the loa ammeter, by closing suitable load bank swit ches. If field rheostats are being used for volt age control, manipulate the rheostats until th line voltmeter reads 28.5 volts.

(d) Continue operation of the generator i this manner for about 1/2 hour, then apply ful rated load of 50 amperes and continue until a least 75 percent of the contact surface of eac brush is seated.

NOTE

At intervals of 15 minutes, discontinue operation of the generator and examine the brush seats.

TABLE 5 PRELIMINARY RUNNING CHECK

Speed	Field Ammeter	Load Ammeter	Line Voltmeter	
			Volts	
	Amperes Maximum	Amperes Maximum	With Control Unit	With Field Rheostats
2,500 to 4,500 rpm	4.8	50	27.8 to 29.2	28.5

TABLE 6 BRUSH SEATING RUN

Speed	Field Ammeter	Load Ammeter		Line Voltmeter		*Maximum
		Amperes		Volts		
	Amperes Maximum	First Half Hour	Balance of Run	With Control Unit	With Field Rheostats	
2,500 rpm	4.8	25	50	27.8 to 29.2	28.5	100°C (212°F)

*The maximum temperature specified should not be confused with normal rise in temperature. Operation of the generator at temperatures exceeding the value specified may result in damage to its windings.

(e) When the brushes have been properly seated, open the load switch and all load bank switches and shut down the driving motor.

CAUTION

When field rheostats are being used, adjust the 53-ohm rheostat for maximum resistance before opening load switch,

TESTS

19 Attach the front head cover to the head (if it has not already been re-assembled) and then test the generator for proper electrical operation. If at any time during the test procedure the generator fails to meet any one of the specified values of performance, discontinue the test. Disassemble the generator as outlined in Part 5, and correct the trouble before proceeding.

Heat Run

20 It is recommended that a 1/2 hour heat run be made to prove the capacity of the generator to carry full rated load of 50 amperes at minimum rated speed of 2,500 rpm without overheating. However, a heat run of 15 minutes (minimum) may be made if the full 1/2 hour run proves impracticable. Refer to Table 7 for the proper voltage, current, and speed values.

NOTE

Under no circumstances should the yoke temperature be permitted to rise above 100°C (212°F), since operation above this temperature may damage the generator windings.

PROCEDURE USING A CARBON PILE REGULATOR

21 Proceed as follows:

(a) Note the temperature indicated on the yoke thermometer.

(b) Start the driving motor and adjust the driven speed of the generator to 2,500 rpm.

(c) Apply full load of 50 amperes and operate the generator for the desired period. Throughout the run, check to make certain that the reading of the field ammeter does not exceed 4.8 amperes.

(d) At the conclusion of the desired heat run period, again note the reading of the yoke thermometer, in order to check the rise in temperature of the yoke. The final temperature should not exceed the initial temperature noted as instructed in paragraph 21(a) by more than the amount specified in Table 7. If the temperature rise has proved excessive, disassemble the generator and repeat the overhaul procedure to locate the trouble. If, however, all heat run values have been satisfactory, proceed with the minimum speed check outlined in operations (e) through (h).

(e) Open the load switch and reduce the driven speed of the generator to approximately 2,000 rpm.

(f) Short out the carbon pile by connecting a jumper between the "F+" and "G+" regulator terminals.

(g) Close the load switch and then gradually increase the driven speed of the generator until the line voltmeter reads 28.5 volts. The driven speed at this point should not exceed 2,200 rpm; that is, with full voltage applied to the shunt field, the generator must carry full load of 50 amperes at 2,200 rpm or less.

(h) When the minimum speed check has been completed, proceed with the commutation check outlined in paragraph 23.

Procedure Using Field Rheostats

22 Proceed as follows:

(a) Note the temperature indicated on the yoke thermometer.

(b) Start the driving motor and adjust the driven speed of the generator to 2,500 rpm.

(c) Apply full load of 50 amperes and operate the generator for the desired period. Throughout the run, check to make certain that the reading of the field ammeter does not exceed 4.8 amperes.

(d) At the conclusion of the desired heat run period, again note the reading of the yoke thermometer, in order to check the rise in temperature of the yoke. The final temperature should not exceed the initial temperature noted as instructed in paragraph 22(a) by more than the amount specified in Table 7. If the temperature rise has proved excessive, disassemble the generator and repeat the overhaul procedure to locate the trouble. If, however all heat run values have been satisfactory, proceed with the minimum speed check outlined in operations (e) through (j).

(e) Adjust the 53-ohm rheostat for maximum resistance and then open the load switch.

(f) Reduce the driven speed of the generator to approximately 2,000 rpm.

(g) Adjust both rheostats for minimum resistance.

(h) Close the load switch and then gradually increase the driven speed of the generator until the line voltmeter reads 28.5 volts. The driven speed at this point should not exceed 2,200 rpm; that is, with full voltage applied to the shunt field the generator must carry full load of 50 amperes at 2,200 rpm or less.

(j) When the minimum speed check has been completed, proceed with the commutation check outlined in paragraph 23.

Commutation Check

23 With the generator and test equipment operating, as described in paragraph 20, check for satisfactory commutation as follows:

(a) If a control unit is being used for voltage control remove the shorting jumper from its "F+" and "G+" terminals.

(b) With the load switch closed and the load bank adjusted for 50 amperes load, increase the driven speed successively to 2,500, 3,500, 4,000, and 4,500 rpm; check for sparking between the brushes and commutator at each speed.

NOTE

If field rheostats are being used for voltage control, manipulate the rheostats at each value of driven speed to adjust the reading of the line voltmeter to 28.5 volts.

(c) Small pin point sparks under the brushes are permissible, especially at the higher speeds. If, however, excessive sparking is observed, refer to Part 5, paragraphs 9 to 34 and 38 to 42.

(d) When the commutation check has been completed, open the load switch and all load bank switches, and then proceed with the overspeed run outlined in paragraph 24.

NOTE

If field rheostats are being used, return the field rheostats (if used) to their original positions, see paragraph 6(a), before opening the load switch.

Overspeed Run

24 Test as follows:

(a) Disconnect all test leads from the generator by removing the AN plug from the generator receptacle.

TABLE 7 15- TO 30-MINUTE HEAT RUN

Speed	Field Ammeter	Load Ammeter	Line Voltmeter Volts		Maximum Temperature Rise	* Maximum Final Yoke Temperature	Minimum Speed Hot
	Amperes Maximum	Amperes Maximum	With Control Panel	With Field Rheostats			
2,500 rpm	4.8	50	27.8 to 29.2	28.5	40°C(72°F)	70°C(158°F)	2,200 rpm

* The maximum final temperature specified is based on an initial temperature of 30°C (86°F).

(b) Increase the driven speed of the generator (with field circuit open; no load applied) to 5,500 rpm.

(c) Run the generator at the specified speed for five minutes.

(d) Upon conclusion of the run, shut down the driving motor. Detach the thermometer from the yoke and then dismount the generator from the test stand mounting bracket. Proceed with the hot ground test outlined in paragraph 25.

Hot Ground Test

25 While the generator is still hot from the preceding test runs, check for grounds with a series test lamp circuit, using a 110-volt a-c source. Touch one test point of the test lamp circuit to the housing of the generator. Touch the other test point to each generator receptacle contact in succession. If a ground exists, the lamp will light. In this event, locate and replace the faulty part upon disassembly of the generator for visual inspection, as outlined in following paragraphs 26 to 29.

Visual Inspection After Test Runs

NOTE

In the event that either the shunt field coil assembly or armature are found faulty, replace the faulty part and then repeat the entire test procedure outlined in this Part.

26 Partially disassemble the generator as follows:

(a) Remove the front head cover from the front head.

(b) Pull up the brush springs and lift out the brushes from the brush boxes.

(c) Release the tab lock underneath the armature shaft nut at the commutator end of the armature shaft. Then use wrench EQ7153 on the drive spline to keep the armature assembly from turning, and remove the nut, see Figure 6-4.

(d) Remove the back head to yoke mounting screws.

(e) Tap the commutator end of the armature shaft lightly, to separate the armature assembly, pencil drive shaft, and back head, as a unit, from the yoke and front head assemblies, see Figure 6-5.

27 Make a thorough visual inspection of the generator as follows:

(a) Closely examine the interior of the front head and yoke for "thrown" solder and copper particles.

(b) Closely inspect the armature assembly as follows:

(1) Examine the commutator for high bars.

(2) Make certain that all armature conductors are securely soldered into the commutator risers. The depths of the conductors in the slots of the armature core should be approximately equal. Each conductor should be firmly fixed in its slot. Check for flaring of the conductors at the drive end of the armature core.

(3) Make sure that the banding wire and clips are tight and securely soldered.

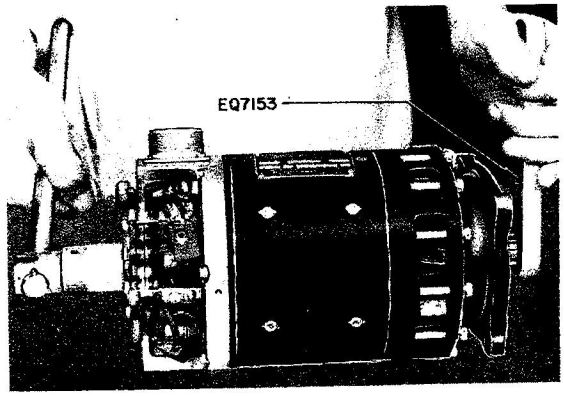


Figure 6-4 Removal of Nut at Commutator End of Armature Shaft for Partial Disassembly of Generator After Test Runs

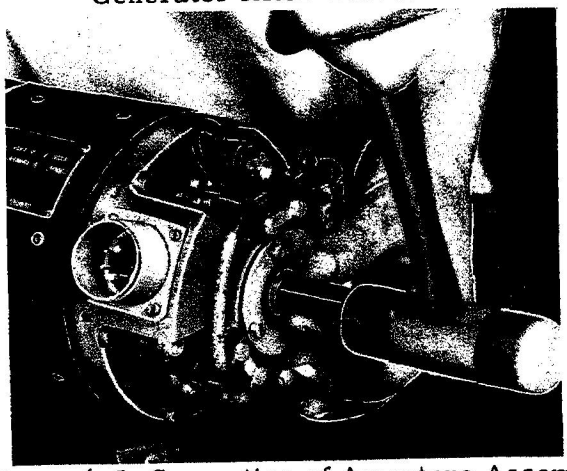


Figure 6-5 Separation of Armature Assembly, Pencil Drive Shaft and Back Head, as a Unit, From the Yoke and Front Head Assemblies

(c) If a grounded circuit was found during the hot ground test paragraph 5, examine all parts which comprise the grounded circuit. Upon location of the grounded part, repair or replace the part as required.

NOTE

In the event that the shunt field coil assembly proves faulty, refer to Part 5, paragraphs 7 to 53 for replacement procedure.

28 Re-assemble the generator as follows:

(a) Insert the commutator end of the armature shaft through the yoke assembly and into the front head ball bearing. Tap the back head lightly, firmly seating the bearing surface of the armature shaft in the ball bearing, and fitting the back head to the yoke.

(b) Align the mounting holes in the back head with the yoke mounting holes. Replace and tighten the back head to yoke mounting screws.

(c) Assemble the tab lock on the commutator end of the armature shaft. Use wrench EQ7153 on the drive spline to keep the armature assembly from turning, then replace and tighten the armature shaft nut. Bend out the tabs of the lock.

(d) To make certain that the generator has been properly re-assembled, rotate the armature assembly by hand and check for rubbing binding, or audible noise. The armature should rotate freely.

(e) Pull up the brush springs and replace the brushes in the brush boxes.

(f) Attach the front head cover to the front head and then replace all external safety wire.

29 Repeat the test for grounds outlined in paragraph 25.

Polarity Check

30 After satisfactory completion of the procedure outlined in paragraphs 20 to 29, remount the generator on the test stand mounting brackets and plug the electrical test connections into the generator receptacle. Make certain the positive and negative terminals of the line voltmeter are connected to the "B" and "E" receptacle contacts respectively. Drive the generator at any speed within the rated speed range of 2,500 to 4,500 rpm. Should it be necessary to reverse the voltmeter connections to obtain a reading in the proper direction, the polarity of the generator has been reversed, and its magnetic circuit must be flashed in the proper direction as described in paragraph 10.

PART 7

PART LIST

SECTION 1 - INTRODUCTION

1 The Part List lists and illustrates the parts for the AF type M-3 and the Eclipse-Pioneer type 30E01-1-A d-c generators.

2 The exploded view Figure 7-1 shows the complete breakdown of all procurable parts, including the breakdown of subassemblies. Index numbers have been assigned to all procurable parts and subassemblies. Component parts of subassemblies are identified by a letter following the index number. In order to identify all parts, apply the index numbers to the corresponding index numbers in the Group Assembly Part List.

3 The Group Assembly Part List, Section 2, consists of a breakdown into subassemblies and detailed parts of the complete unit. Each assembly listed is directly followed by its component parts properly indented to show their relationship to the assembly. The quantities specified are those used at the specific location and are not necessarily the total number used in the complete unit. The total quantity for a complete unit will be the sum of the individual listings of the same part number. The part number column and the manufacturer's drawing numbers for all except those parts which have AN numbers. In such cases, the AN number appears in the part number column and the manufacturer's drawing number immediately follows the nomenclature. An asterisk (*) immediately preceding a part number denotes that the part is not procurable separately. Oversize part numbers are indented one space and immediately follow the listings for the corresponding standard parts. The quantity designation "AR" for oversize parts indicates that such parts may be procured "as required".

4 The Group Assembly Part List employs the following master coding list to cover the differences between the two generators treated in this handbook:

Type	Application Code
AF type M-3	A
30E01-1-A	B

SECTION 2

GROUP ASSEMBLY PART LIST

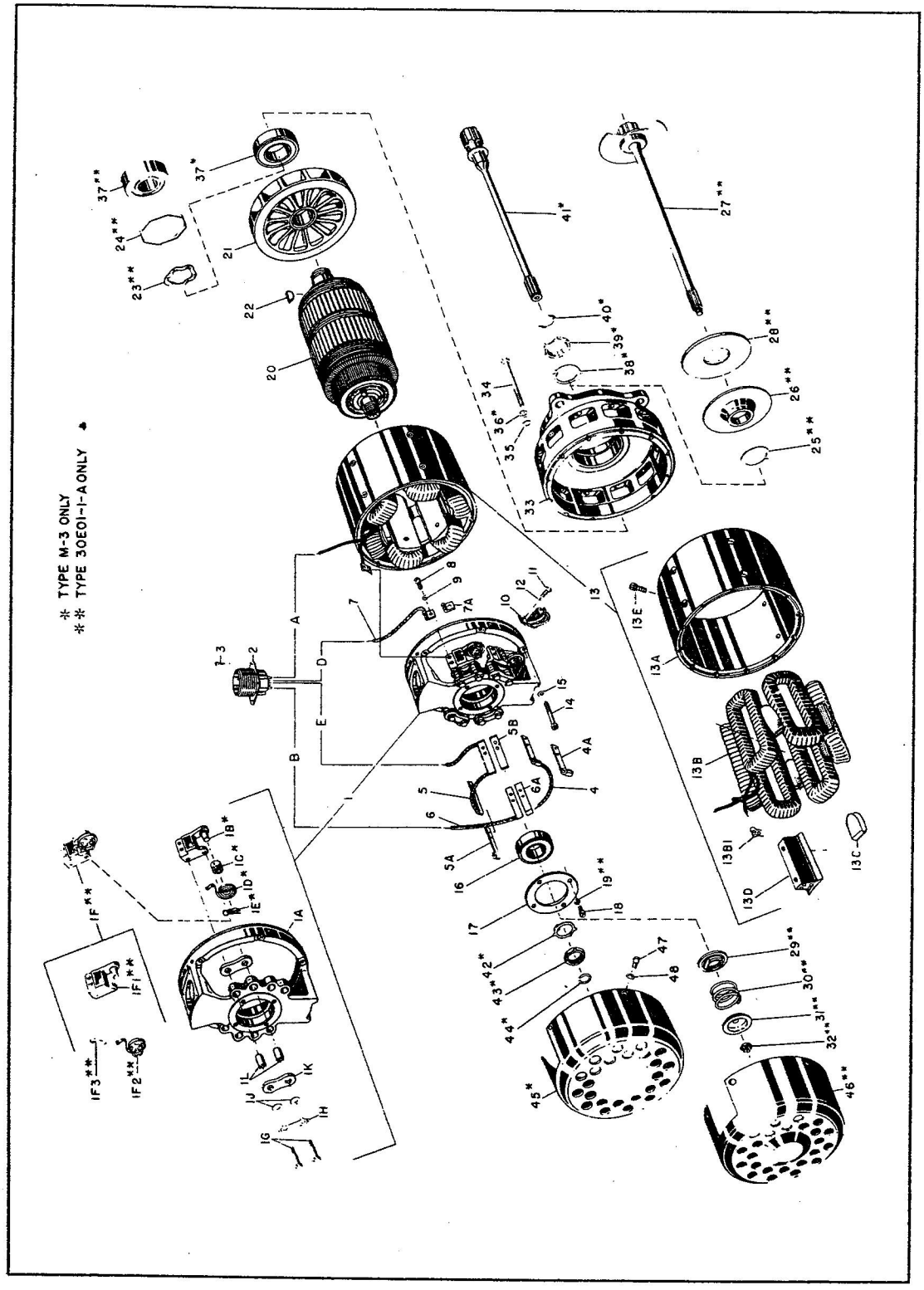


Figure 7-1 Exploded View Drawing, Types M-3 and 30E01-1-A D-C Generators

FIGURE and INDEX NUMBER	PART NUMBER	GROUP MAJOR ASSEMBLY ENGINE-DRIVEN SINGLE VOLTAGE D-C GENERATOR TYPE M-3 AND TYPE 30E01-1-A 1 2 3 4 5 6 7 NOMENCLATURE	Units Per Ass'y	Usage on Code
7-1	E124624	Generator - D-C, AF Type M-3		A
	30E01-1-A	Generator - D-C		B
-1	D124625	Head Assembly - Front	1	All
1A	E124490	Head - Front	1	All
1B	B105377	Box Assembly - Brush	4	A
1C	B91074	Sleeve - Brush spring adjusting	4	A
1D	B105383	Spring - Brush	4	A
1E	B112993	Clip - Brush spring	4	A
1F	B845107	Brush Spring and Box Assembly	4	B
1F1	B105377	Box Assembly - Brush	4	B
1F2	B853455	Brush Spring Assembly	4	B
1F3	AN380-2-2	Pin - Cotter (20503-10)	4	B
1G	B105384	Screw - Brush box	8	All
1H	B105385	Lock - Tab, brush box screw	4	All
1J	B19128	Washer - Brush box screw	8	All
1K	B105387	Insulator - Brush box	8	All
1L	B105388	Tube - Insulating	8	All
2	AN3102-22-12P	Receptacle (C91799)	11	All
3	AN500A4-5	Screw - Receptacle mounting (B61839)	4	All
4	B111879	Jumper Assembly - Brush box	1	All
4A	B830720	Terminal - Brush box	2	All
5	B111880	Jumper Assembly - Brush box to "E"	1	All
5	B105391	Terminal - Brush box	1	All
5B	B830719	Terminal	1	All
6	B830722	Jumper Assembly - Brush box to "B"	1	All
6A	B830721	Terminal	1	All
7	B111345	Lead Assembly - Brush box to "D"	1	All
7A	B25239	Terminal	1	All
8	AN515B8-6P	Screw - Brush lead terminal and jumper assembly terminal lug (B20502-2)	4	All
9	AN935B8	Washer - Lock, lead assembly terminal and jumper assembly lug (B20500-22)	4	All
10	B105393	Brush Assembly	4	All
11	AN515B8-6P	Screw - Brush lead terminal and jumper assembly terminal lug (B20502-2)	4	All
12	AN935B8	Washer - Lock, brush lead terminal and jumper assembly terminal lug (B20500-22)	4	All
13	D124615	Yoke and Field Coils Assembly	1	All
13A	D124494	Yoke	1	All
13B	D124523	Coil Assembly - Field	1	All
13B1	B25238	Terminal - Field coil lead	1	All
13C	B845157	Shim	6	All
13D	B105397	Shoe Assembly - Pole	6	All
13E	B85702	Screw - Pole shoe to yoke	12	All

FIGURE and INDEX NUMBER	PART NUMBER	GROUP ENGINE-DRIVEN SINGLE VOLTAGE D-C MAJOR ASSEMBLY GENERATOR TYPE M-3 AND TYPE 30E01-1-A 1 2 3 4 5 6 7 NOMENCLATURE	Units Per Ass'y	Usage on Code
7-1-14	B105403	Screw - Front head to yoke	6	All
15	B105404	Washer - Front head to yoke screws	6	All
16	B86277	Bearing - Ball, front head	1	A
16	C890112-7	Bearing - Ball, front head	1	B
17	B105405	Retainer - Front head ball bearing	1	All
18	AN500A8-6	Screw - Front head ball bearing retainer (B11558)	4	All
19	AN935-8	Washer - Lock (B20500-44)	4	B
20	D124626	Armature Assembly	1	A
20	B862177	Armature Assembly	1	B
21	C105422	Fan	1	All
22	B20521-7	Key - Woodruff, fan	1	All
23	B862164	Washer - Spring	1	B
24	B834163	Spring - Floating bearing	1	B
25	D92588-98	Ring - Lock	1	B
26	C862179	Plate - Front	1	B
27	C862180	Shaft Assembly - Drive	1	B
28	B862207	Lining	1	B
29	B847677	Nut - Front bearing	1	B
30	B847678	Spring	1	B
31	B847679	Retainer - Spring	1	B
32	C890108-29	Nut - Self locking	1	B
33	E124491	Head - Back	1	All
34	B118842	Screw - Back head to yoke	12	All
35	B18357	Washer - Back head to yoke screw	12	All
36	AN935-10	Washer - Lock, back head to yoke screw (B20500-1)	12	A
37	B20504-49	Bearing - Ball, back head	1	A
37	C890112-10	Bearing - Ball, back head	1	B
38	B89521	Lock - Tab, armature shaft nut drive end	1	A
39	B89520	Nut - Armature shaft, drive end	1	A
40	B110082	Gasket - Pencil drive shaft	1	A
41	D124493	Shaft - Pencil drive	1	A
42	B86279	Lock - Tab, armature shaft nut, commutator end	1	A
43	B86278	Nut - Armature shaft, commutator end	1	A
44	B120167	Lock-Ring, - Pencil drive shaft, commutator end	1	A
45	D105426	Cover - Front head	1	A
46	D862163	Cover - Front head	1	B
47	AN500A8-5	Screw - Front head cover (B28053)	5	All
48	AN960-8	Washer - Front head cover screw (B25103)	5	All