

**MODEL 646843
649304**

CONTINENTAL[®] ENGINE ACCESSORIES

**ALTERNATOR
SERVICE
SUPPORT
MANUAL**



Publication X30531-4

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AUG 2011

WARNING

(Please note the following statements from FAA Advisory Circular 20-62C entitled "ELIGIBILITY, QUALITY, AND IDENTIFICATION OF APPROVED REPLACEMENT PARTS"):

3. BACKGROUND. An increasing amount of replacement parts (including standard parts), materials, appliances, and instruments are offered for sale as being of aircraft quality when actually the quality and origin of these units are unknown. Users of such units are usually not aware of the potential hazards involved with replacement parts that are not eligible for use on certificated aircraft. Frequently such units are deceptively advertised or presented as "unused," "like new," or "remanufactured." This implies that the quality of such units is equal to an original or appropriately repaired or overhauled unit.

The performance rules for replacement of parts and materials used in the maintenance and alteration of U.S. certificated aircraft are specified in Federal Aviation Regulations (FAR) 43.13 and FAR 145.57. The responsibility for the continued airworthiness of the aircraft, which includes the replacement of parts, is the responsibility of the owner/operator as outlined in FAR 91.163, FAR 121.363, FAR 123.45, FAR 127.131 and FAR 135.143 (a).

4. IDENTIFICATION OF THE APPROVED PARTS. Approved serviceable replacement parts are identified as follows:

- a. By an FAA Form 8130-3 (Formerly FAA Form 186), Airworthiness Approval Tag. An Airworthiness Approval Tag identifies a part or group of parts that have been approved by authorized FAA representatives.
- b. By an FAA Technical Standard Order (TSO) number and identification mark that indicates the part or appliance has been manufactured under the requirements of FAR 37.
- c. By an FAA/PMA symbol, together with the manufacturer's name, trademark or symbol, part number, and the make and model of the type certificated product on which the part is eligible for installation, stamped on the part. An FAA Parts Manufacturer Approval (FAA/PMA) is issued under FAR 21.305. The make and model information may be on a tag attached to the part.
- d. By shipping ticket, invoice, or other document which provides evidence that the part was produced by a manufacturer holding an FAA Approved Production Inspection System issued under FAR 21, Subpart F, or by a manufacturer holding an FAA Production Certificate issued under FAR 21, Subpart G.
- e. By a certificate of airworthiness for export issued by a foreign government under the provisions of FAR 21, Subpart N.

11. KNOW YOUR SUPPLIER. It has come to our attention that many reproduced parts and components, particularly instruments which have been manufactured by persons other than the original manufacturer, are available for purchase and installation on U.S. certificated aircraft. Often, an original part is used as a sample to produce duplicates. The reproduced parts appear to be as good as the original part; however, there are many unknown factors to be considered that may not be readily apparent to the purchaser, i.e., heat treating, plating, inspections, tests and calibrations. All too often the faulty part is not discovered until a malfunction or an accident occurs.

12. SUMMARY. In accordance with FAR's, certification of materials, parts, and appliances for return to service, for use on aircraft, is the responsibility of the person or agency who signs the approval. The owner/operator, as denoted in paragraph 3 of this advisory circular, is responsible for the continued airworthiness of the aircraft. To assure continued safety in aircraft operation, it is essential that great care be used when inspecting, testing, and determining the acceptability of all parts and materials. Particular caution should be exercised when the identity of materials, parts, and appliances cannot be established or when their origin is in doubt.

SCOPE

Recommendations, cautions and warnings regarding maintenance of this equipment are not intended to impose undue restrictions. They are inserted to obtain maximum performance from the equipment in accordance with safety and efficiency. Abuse, misuse, or neglect of any piece of equipment can cause eventual failure. For an aircraft engine it is obvious that a failure may have disastrous consequences. Failure to observe the instructions, contained in this manual, constitutes unauthorized operation in areas unexplored during development of the engine, or in areas in which experience has proved to be undesirable or detrimental.

NOTES, *CAUTIONS* and **WARNINGS** are included throughout this manual. Application is as follows:

NOTE...Special interest information which may facilitate the operation of equipment.

CAUTION...Information issued to emphasize certain instructions or to prevent possible damage to engine or accessories.

WARNING...Information which, if disregarded, may result in severe damage to or destruction of the engine or endangerment to personnel.

BULLETINS. Bulletins that are issued to Distributors and subscribers from Teledyne Continental Motors are divided into three separate groups: (1) Customer Information Bulletins; (2) Service Bulletins, and (3) Mandatory Service Bulletins.

(1) Customer Information Bulletins are published to help provide the latest information on TCM marketing procedures, policies and product information.

(2) Service Bulletins provide current information related to service, maintenance and technical support of the product.

(3) Mandatory Service Bulletins are issued with required compliance information that may affect safety of flight.

These bulletins are also available to owners, operations or maintenance personnel on an annual subscription basis.

NOTE: Teledyne Continental Bulletins are easily distinguished by their title color:

- (1) Customer Information Bulletins --Blue;
- (2) Service Bulletins --Black;
- (3) Mandatory Service Bulletins --Red.

SERVICE REPORTS AND INQUIRIES. If for any reason you have an inquiry or require technical assistance beyond the scope of your service facility, contact your local TCM distributor or TCM field representative. Requests for copies of Teledyne Continental Aircraft Engine Service publications should be made through your distributor or Teledyne Continental Motors, P. O. Box 90, Mobile, AL 36601, Attn: Publications Department.

100% REPLACEMENT PARTS.

It is recommended that the following parts be replaced 100 percent during the major overhaul of any alternator: bearings, cotter keys, gaskets and seals.

SCHEDULED MAINTENANCE

It is recommended that at every 500 hours the alternator be removed, disassembled, inspected, repaired and tested to assure performance is in accordance with manufacturer's standards.

UNSCHEDULED MAINTENANCE

At any time the alternator does not perform in accordance with manufacturer's specification it should be removed and investigated for causes.

TABLE OF CONTENTS

WARNING	i
SCOPE	ii
BULLETINS.....	ii
SERVICE ROports AND INQUIRIES	ii
100% REPLACEMENT PARTS	ii
TBO	ii
INTRODUCTION	ii
DESCRIPTION	iv
CAUTION.....	iv
TABLE OF CONTENTS – 60 AMP (646843).....	vi
TABLE OF CONTENTS – 100 AMP (649304).....	18

SERVICE INSTRUCTIONS

INTRODUCTION

The following description and precautions pertain to both the 649304 and 646843 alternator. Consult the applicable section for disassembly, repair and test procedures pertaining to individual units.

DESCRIPTION

The alternator consists of five main subassemblies: (1) Drive-end housing, (2) Rotor and shaft assembly, (3) Stator assembly, (4) Rectifier and heat sink assembly and (5) Slip-ring end housing.

- (1) The drive-end housing provides the mounting flange for attachment to the engine and supports the ball bearing through which the rotor shaft protrudes to support the alternator drive.
- (2) The rotor and shaft assembly carries the rotating field coil enclosed within the rotor with two connecting wires terminated at a double slip-ring. The insulated slip rings, in conjunction with the brushes located in the slip-ring end housing provide a rotating connection through which the field coil may be energized.
- (3) The stator assembly contains the laminated steel core within which are wound three output windings which supply the three phase alternating voltage to the rectifier assembly.
- (4) The rectifier assembly consists of six rectifier diodes mounted three each in the positive and negative heat sinks. One stator terminal is extended to provide a connection to the "AUX" Terminal.
- (5) The slip-ring end housing contains the sealed roller bearing and the brush-holder assembly and supports the rectifier assembly positioned in such a manner as to provide cooling air for the rectifier diodes. The brush- holder assembly mounted within the slip-ring end housing contains the two brushes and their associated leads and terminal studs. Mounted within the slip-ring end housing is a capacitor connected across the output of the rectifier to protect the diodes from transient voltage peaks generated within the aircraft electrical system.

CAUTION

The following precautions must be observed when servicing the Alternator System or serious damage may be incurred by the Alternator or the Aircraft Electrical System.

1. Do not operate the Alternator without a connected load.
2. Make absolutely certain that the aircraft battery is installed with the negative terminal grounded.
3. When connecting a charger or booster battery to the aircraft battery, connect positive to positive and negative to negative.
4. Disconnect the aircraft battery before removing or servicing the alternator system.
5. Do not attempt to polarize the alternator.
6. Do not short to ground any terminal of the alternator whether it is rotating or not.

60 AMP (646843)

DISASSEMBLY (646843)	1
Preliminary Disassembly	1
Stator.....	1
Rectifier Disassembly.....	1
Brush Assembly Removal	2
Slip Ring End Bearing Removal.....	2
Rotor Removal	2
Drive End Bearing and Seal Removal.....	4
CLEANING AND TESTING COMPONENTS	5
Rectifier Tests	5
Stator Tests.....	5
Rotor Test and Service	5
Brush Inspection and Replacement	6
Capacitor.....	6
Seal Collar.....	6
RESASSEMBLY	7
Slip Ring End Bearing	7
Brush Holder Assembly.....	8
Rectifier Assembly	8
Drive End Bearing and Seal	10
Rotor	11
Final Assembly.....	11
Torque Specifications.....	12
Bench Testing	12
Test Procedures.....	13
Performance Curve	14
Table of Limits.....	14
Drive Coupling Inspection	15
Alternator Installation	15
Illustrated Parts Breakdown	16-17

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60 AMP 24 VOLT

P/N 646843

DISASSEMBLY

When servicing the alternator, complete disassembly may not be required. In most cases it will be necessary only to perform those operations which are required. However, adequate disassembly is covered step by step to provide detailed information necessary for the required operations.

NOTE:

Numbers in parenthesis correspond with their respective items on pages 16 and 17.

A. PRELIMINARY DISASSEMBLY:

1. Remove the safety wire and four through bolts.
2. The lip of the drive end housing (7) is a close fit over the stator core (12), to separate, use a screwdriver and mallet to tap the core out of the drive end housing. Do not attempt to drive the housing off the core. The core and slip-ring end housing must be removed together.
3. When the drive end housing and rotor (11) is pulled free of the drive end housing assembly, a clicking sound may be heard as the brushes drop off the slip ring (29). Brush springs will drop free of brushes. Retrieve and set aside. Do not attempt to reinstall the rotor without reinstalling springs and pushing the brushes (14) back into the holder (13) and installing the retaining pin or the brushes will be damaged.
4. It is advisable at this time to insert a plastic seal plug into the slip-ring end housing bearing (37) to prevent bearing contamination. If a plug is not available, use a piece of masking tape.

NOTE:

If alternator is being overhauled, bearing should be removed and replaced.

B. STATOR:

1. Remove three # 8-32 nuts (23) and washers (24) attaching the three stator leads to the rectifier assembly (28).

NOTE: Later stator terminals are lock-star type. Lock-washer not required on these types.

2. Lift stator (12) from the housing. Take care not to damage the stator leads.

C. RECTIFIER:

NOTE:

Rectifier does not have to be removed unless it tests faulty.

1. Remove the # 8-32 capacitor lead screw (16) from the rectifier heat sink (28).
2. Remove "AUX" lead (17) from the rectifier. Do not remove AUX wire from housing. Check and replace only if damaged.
3. Remove the nuts and insulator (25) from the 1/4 inch "BAT" terminal (20).
4. Remove the # 8-32 screw (27) attaching the rectifier assembly (28) to the housing (29).

5. Remove the rectifier assembly (28).
6. The capacitor (19) may be removed by removing the #8-32 attaching screw (15). Do not remove capacitor unless it tests defective (Page 5).

D. BRUSH ASSEMBLY REMOVAL: NOTE:

Inspect brush holder (13) and replace if worn or cracked. If brush holder is serviceable replace brushes (14) only.

1. Remove the nuts (36) and insulators (33) from the "F1" and "F2" terminals.
2. Remove the brush (13) and terminal assemblies (14).
3. Remove the brush springs (14).
4. The brush holder may be removed by removing the three #8-32 attaching screws (22).

E. SLIP-RING END BEARING REMOVAL:

Replace bearing (37) 100%.

1. Place the slip-ring end housing (29) in an arbor press. Support the rear housing at the area directly below the bearing boss, as shown, to prevent breakage or distortion of the housing.
2. Use special tools or fabricate tools to the dimensions shown and press the roller bearing (37) from the outside. Discard the bearing (See Figure 1.)

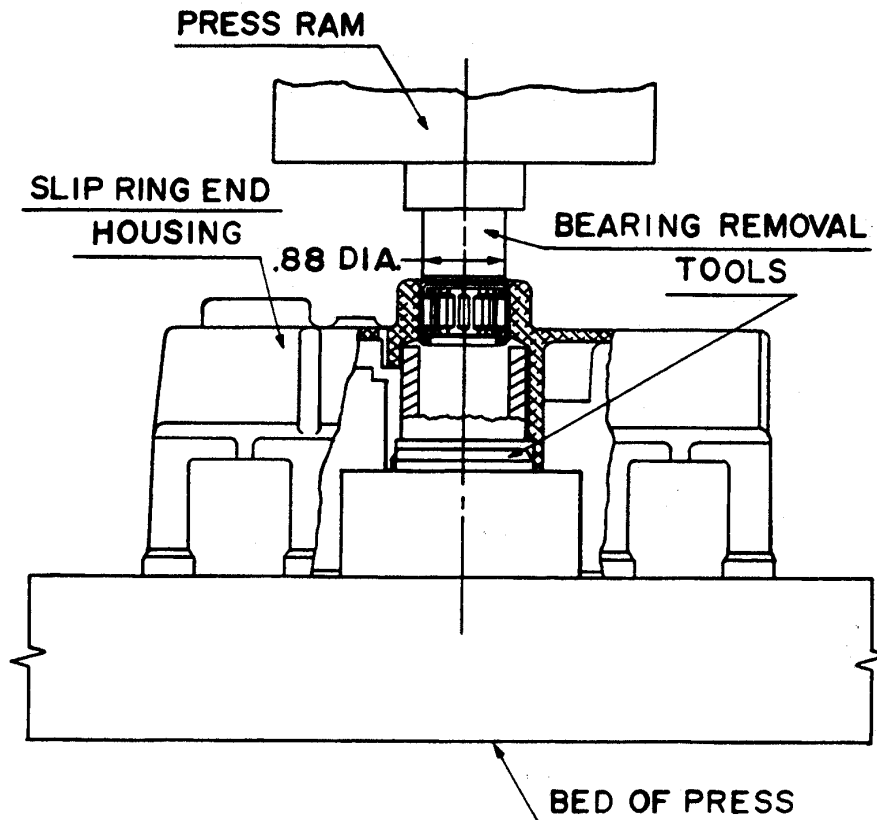


FIGURE 1

F. ROTOR REMOVAL

3. Remove the cotter pin (2), nut (1) (Figure 15) and drive coupling from the rotor shaft.

4. Remove woodruff key (10), "O" Ring (4), and seal (5) collar/spacer (6) as applicable. Discard "O" Ring.
5. Support the drive end housing (7) on an arbor press table and carefully press the rotor shaft (11) out of the drive end bearing (3). Take care not to damage the threads or drop the rotor. (See Figure 2.)

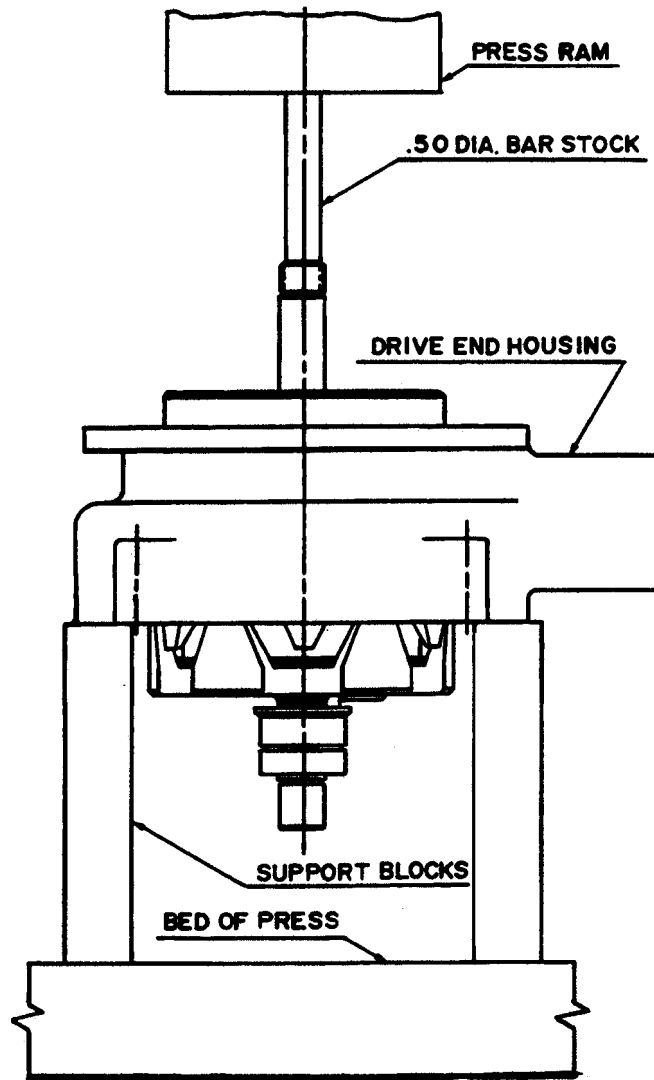


FIGURE 2

G. DRIVE END BEARING AND SEAL REMOVAL:

Replace oil seal (5), "O" Ring (4) and Bearing (3) 100% at overhaul. Remove bearing and seal only if new replacement bearing and seal are to be installed.

CAUTION:

If the seal has been leaking, the seal and bearing must both be replaced as the oil leak may wash the grease out of the ball bearing.

1. Remove the three retaining screws (9) and, the retainer plates (8). (See Figure 3.)

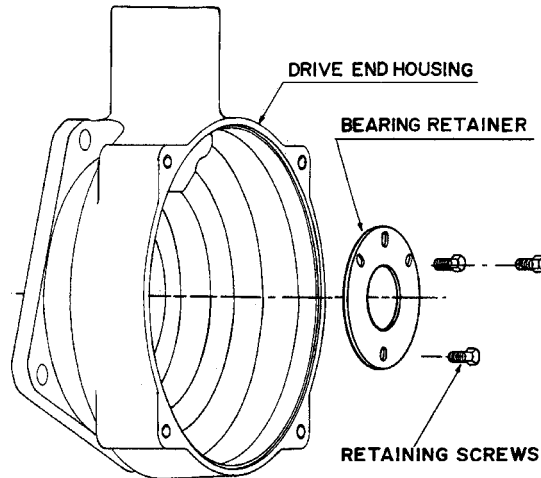


FIGURE 3

NOTE:

Remove retainer plates (8) from inside and out- side of housing (7).

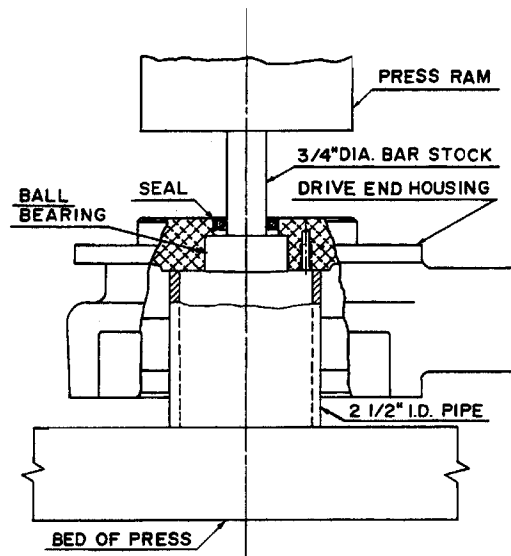


FIGURE 4

2. Use a 3/4 inch diameter length of bar stock against the bearing inner race to press bearing (3) from housing (7). Discard the bearing. (See Figure 4.)
3. Press the seal (5) out of the housing (7) or pull it with a hook type puller. Seal can be removed in either direction with retainer plates removed. Discard after removal.

CLEANING AND TESTING COMPONENTS

After completion of disassembly, all parts should be cleaned and inspected as follows:

A. RECTIFIER TESTS

1. Insure that bare diode leads or stator leads do not contact the heat sink.
2. Using a number 57 bulb in series with a 12 volt battery, place one test lead on a rectifier pin and the other lead on a rectifier heat sink. Change to the opposite heat sink. The bulb should show continuity to one heat sink but not the other. Reverse the leads and repeat.
3. If the bulb lights in both directions of any diode tested, the diode is bad. If bulb does not light in either direction for any particular diode tested, the diode is bad.
4. If a bad diode is found, the rectifier assembly must be replaced.

B. STATOR TEST

1. Using a pair of test leads in series with a 110 volt test lamp, test between the output leads of the stator and the laminations. The lamp should not light or flicker. Any indication of continuity between the windings and laminations constitutes a grounded winding and the stator assembly must be replaced.

WARNING:

Items to be tested are to be placed on a rubber matting so as not to come in contact with personnel or equipment. Do not touch the stator while performing this test, or electrical shock will occur.

2. Stator winding continuity may be checked using a number 57 bulb in series with a 12 volt battery. Bulb should light when test leads are connected between one stator lead and each one of the other 2 stator leads. Failure of the bulb to light indicates that one of the phase windings is open. Replace stator.
3. It is virtually impossible by field tests to determine if there are short circuits in the stator windings. Short circuits in the stator windings, will cause the alternator to growl during operation with reduced output. Usually a shorted winding will be evident on close visual inspection by the presence of burned wires or "hot spots". If all other electrical checks are normal and the alternator fails to supply rated output, it is safe to assume that the stator windings are shorted, in which case the stator assembly must be replaced.

C. ROTOR TEST AND SERVICE NOTE:

With the exception of slip-ring service noted in step 6, no service procedures are authorized on the rotor assembly. Failure to meet any of the acceptance criteria must be judged as a defective rotor and the entire assembly must be replaced.

1. Visually inspect roller bearing running surface (slip ring end of shaft) for pitting, uneven wear or other signs of distress. See Table of Limits (Figure 14) for shaft diameter.

WARNING:

In the following test, items to be tested are to be placed on a rubber matting, so as not to come in contact with personnel or equipment. Do not touch the rotor while performing this test, or electrical shock will occur.

2. Using the 110 volt test set-up as in B-1, place the test leads between the rotor shaft and a slip-ring. The test lamp must not light or flicker.

3. Place the test leads between the two slip-rings. The lamp should light steady with no flicker.
4. Measure rotor coil resistance using an accurate Ohmmeter. Resistance should be 11.5 - 14.0 OHMS at 20°C (70°F).
5. Failure of any of the above tests constitute failure and the rotor assembly must be replaced.
6. If the slip-rings are dirty, they may be cleaned with 600 grit sandpaper and finished with crocus cloth. (Do not use emery.) Spin the rotor in a lathe to sand the slip-rings. Do not sand them by hand. If the slip-rings are worn or out of round, they should be trued in a lathe to .001" TIR. Finish with 600 grit sandpaper and crocus cloth. Final finish should be between 32 and 50 micro-inches. Minimum allowable finished O.D. is 1.090 inches. (See Chart.)

D. BRUSH INSPECTION & REPLACEMENT:

Inspect condition of brushes. If they are broken, chipped or oil soaked, they must be replaced. It is advisable to replace brush assembly if brushes are 0.40 inch or less. in length, to eliminate later disassembly for brush replacement.

E. CAPACITOR:

1. Inspect capacitor (19) for cracks in insulation and broken or damaged leads.
2. With an Ohmmeter set on the highest range and the capacitor disconnected, measure the resistance between the capacitor lead and case. The meter should momentarily jump and then fall to infinity. Quickly reverse the test leads and repeat the measurement. The momentary meter excursion should be greater but still should fall to infinity. Any steady state value of readable resistance is cause for rejection and the capacitor must be replaced.

F. SEAL COLLAR:

1. Visually inspect seal collar (6) for damage or wear in the seal seating area.
2. Visually inspect seal collar for cracks or damage.
3. Replace any cracked, damaged or worn part.

REASSEMBLY

NOTE:

It is recommended that a light coating of #242 Loctite be applied to all stud and screw threads just prior to assembly or installation of nuts. Where specified. Loctite must be used.

A. SLIP-RING END BEARING: CAUTION:

Assure that new bearing has been pre-lubed by the manufacturer before installation.

1. Use an arbor press and the tool shown to install a new bearing (37). Support the housing (29) by the bearing boss to prevent breakage of the casting. Press the bearing in flush with the outer boss of the housing. Use extreme care to avoid misalignment or otherwise overstressing the bearing. (See Figure 5.)

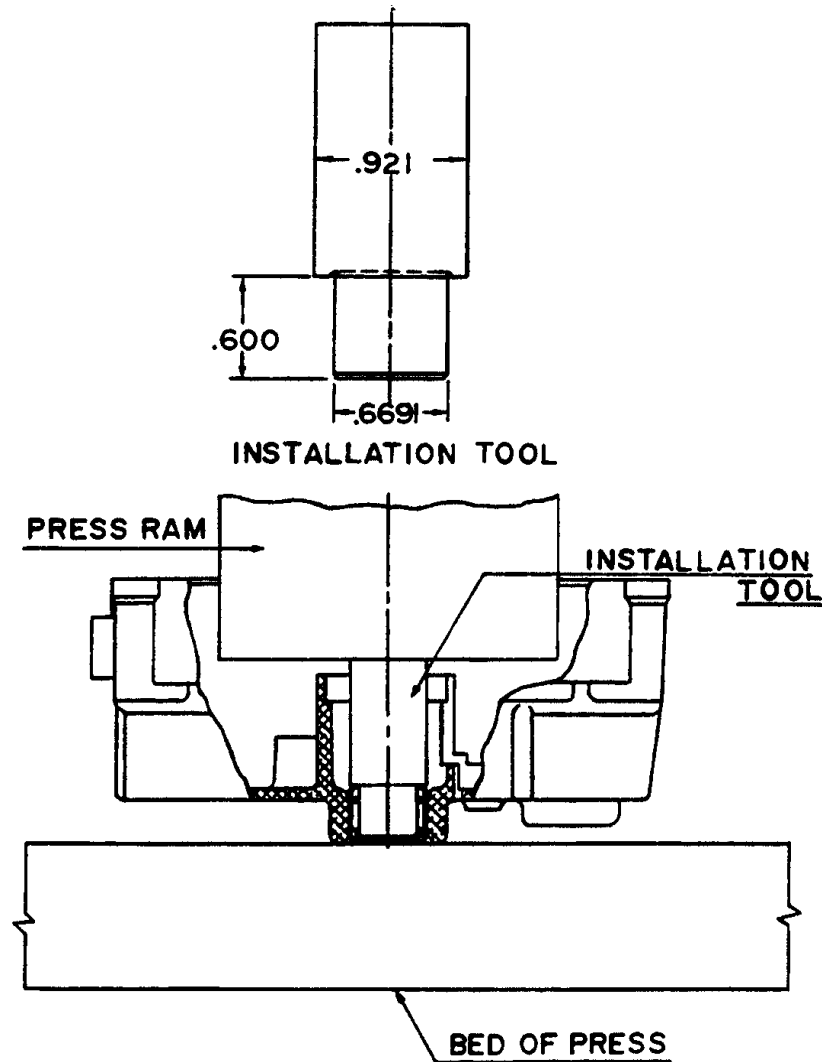


FIGURE 5

2. Protect the bearing with a seal plug or a piece of masking tape to prevent entry of dust or dirt.

B. BRUSH-HOLDER ASSEMBLY:

1. Hold the brushes in place in brush-holder assembly.

*NOTE:

If brush pin is not available, a wire of .041 diameter or a large paper clip may be used.

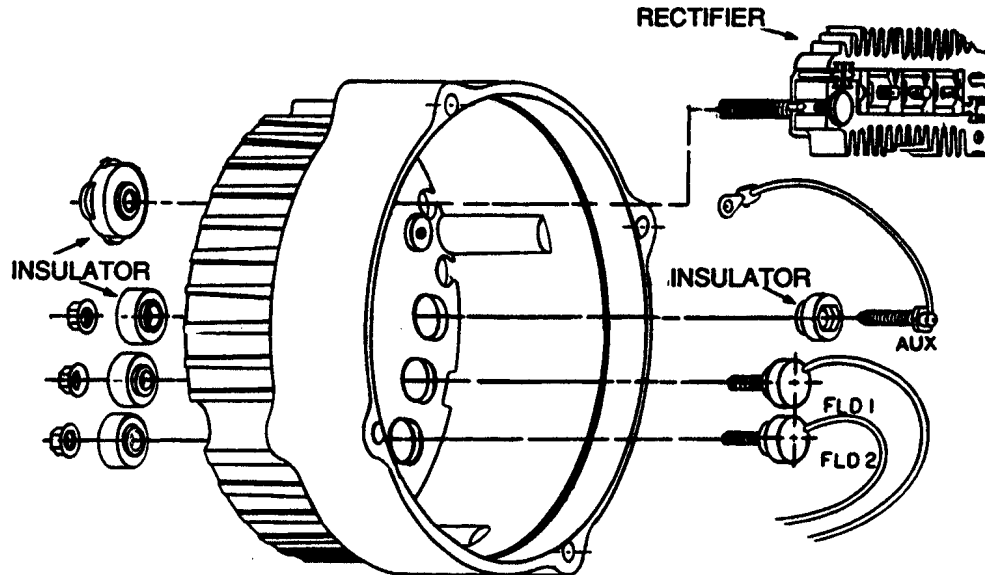


FIGURE 6

CAUTION:

Remove burrs from end of wire before insertion so as not to nick or scratch the brushes.

2. Coat surface of brush-holder which contacts housing, with silicone adhesive/sealant. Install the pre-assembled brush-holder assembly with the brush retaining pin* protruding through the small hole in the casting. Apply "Loctite #242" to #8 brush-holder attaching screws (22) and torque to 15-20 in.-lbs. Do not overtorque screws or cracked brush-holder may result.
3. Install the field terminal studs (14) with the insulator washers (33) outside the housing, making certain the stud is properly seated into the socket of the insulating washer with the brush leads routed as shown. (See Figures 6 & 7.)

CAUTION:

F1 (FLD 1) brush lead is secured across the capacitor between the screw and capacitor support post with silicone adhesive. Allow slack between the securing point and brush-holder assembly. See Figure 7.

4. Install and tighten the field-terminal stud nuts. Torque to 20 – 25 in. lbs.

C. RECTIFIER ASSEMBLY:

1. Install the capacitor (19) into the housing if it was removed. Apply "Loctite #242" to the #8 attaching screw (15) and torque to 15-20 inch pounds.
2. Install the "AUX" terminal stud (17) and insulator (34) inside the housing with the lead routed as shown. (See Figures 6 & 7.)

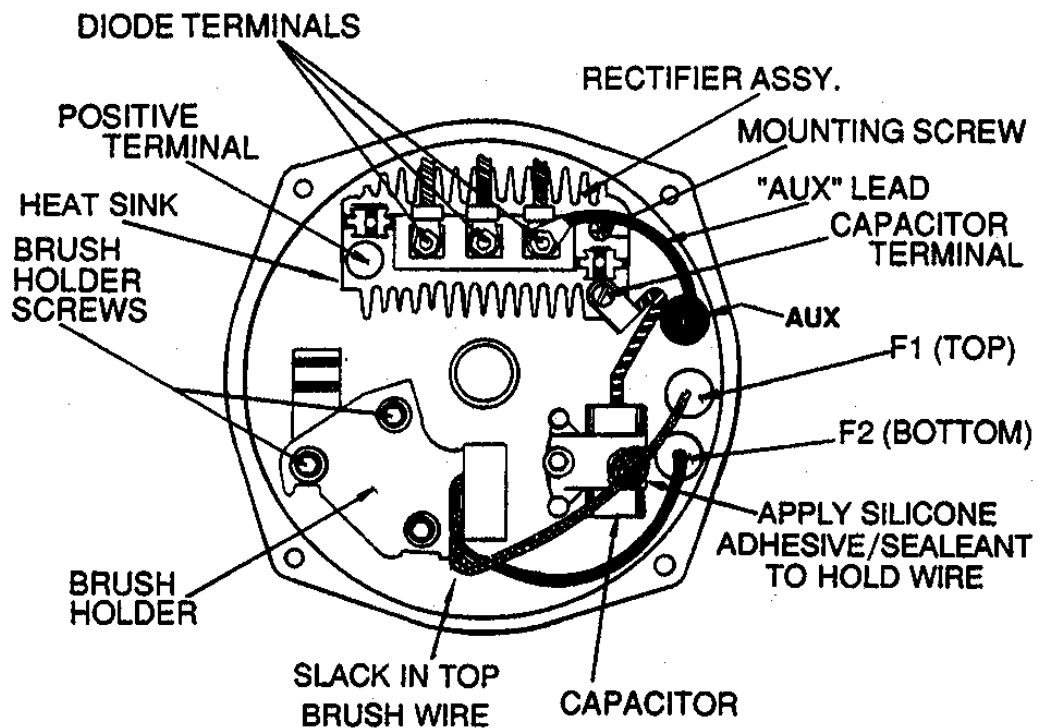


FIGURE 7

3. Install the black insulator (32) outside the housing on the "AUX" terminal. Install and tighten terminal nut (36). Torque to 20-25 in. lbs.
4. Place the rectifier assembly (28) in the housing (29).
5. Install the red insulator (25) and terminal nut (36) on the positive output stud (20) (BAT position).
6. Apply 1.octite # 242" to the # 8-32 rectifier mounting screw (27) and torque to 15-20 inch pounds.
7. Torque positive (BAT) terminal nut to 35-40 inch pounds.
8. Attach the capacitor terminal (19) to the positive heat- sink (heat-sink containing BAT terminal) with the #8-32 screw (16). Torque to 15-20 in.-lb.
9. Install (3) # 8 flat washers (24) on the diode terminals. Install the "AUX" lead on the diode terminal as shown in Figure 7 (Do not install nut on diode terminal).
10. Insert the stator assembly (12) into the housing. Orient the stator so that the leads fit the diode terminals and the through bolt clearance cutouts align with through bolt holes in the housing.
11. Attach the three stator leads and the "AUX" lead with washers (24) and three #8-32 nuts (23). Torque to 15-20 inch pounds. Insure that the stator leads do not touch the heat-sink. If leads touch heat-sink, a short may result.

D. DRIVE END BEARING AND SEAL:

1. Press the oil seal (5) into the drive end housing (7) with the seal lip toward the outside of the housing. Use an arbor press and a flat pressing tool at least 1.5 inch diameter. (See Figure 8.)
2. Press the ball bearing (3) into the drive end housing. Surface of bearing to be flush with inside surface of housing. Seating tool must press on outer-race of bearing during installation.
3. Install the bearing retainer plates (8) with 3 bolts (9) each. Apply "Loctite #242" to the 3 bolts (9), torque to 20-25 in. lb.

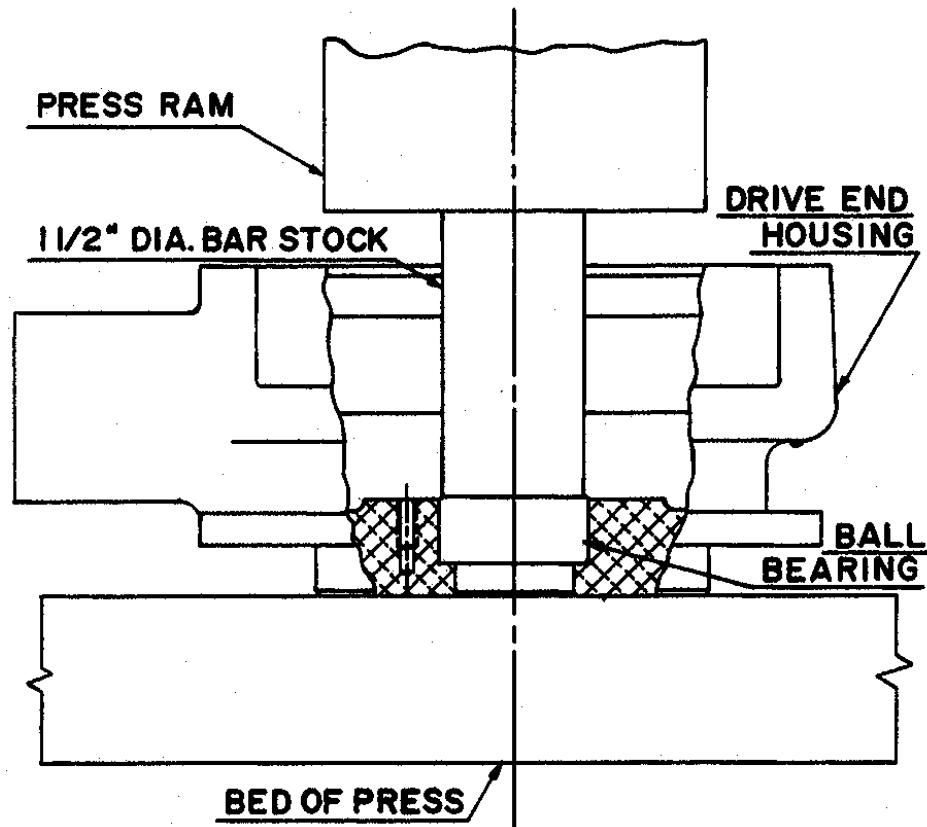


FIGURE 8

E. ROTOR:

1. Using an arbor press, press the shaft (11) into the drive end bearing (3) until it bottoms on the stop collar. Do not press against the bearing unsupported. Use a tool that fits over the shaft and supports the bearing inner race. (See Figure 9.)

NOTE:

Use care when inserting shaft through oil-seal to not cut or nick the seal.

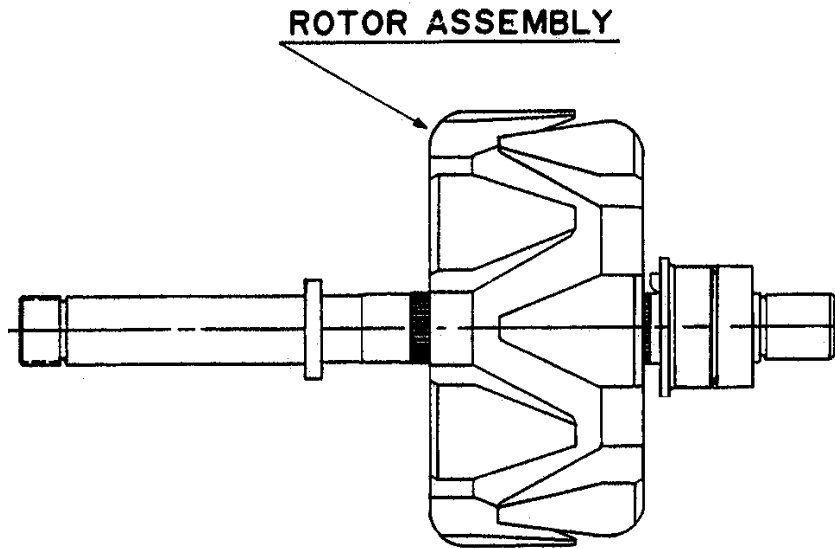


FIGURE 9

F. FINAL ASSEMBLY:

1. Remove the seal plug or tape from the slip-ring end bearing.
2. Position the alternator so that the drive end (7) is downward and carefully install the slip-ring housing (29), with the brushes installed and brushes held in place in the brush-holder assembly by the retainer pins, onto the shaft. Orient the housing so that the "AUX" terminal is located at the 9 o'clock position to the air inlet tube. See Figure 10.
3. Install the four through bolts (31), and washers (30) and torque to 30-35 in.-lb. Safety wire the through bolts.
4. Check for free turning of rotor. It should turn freely with no sound of striking or rubbing.

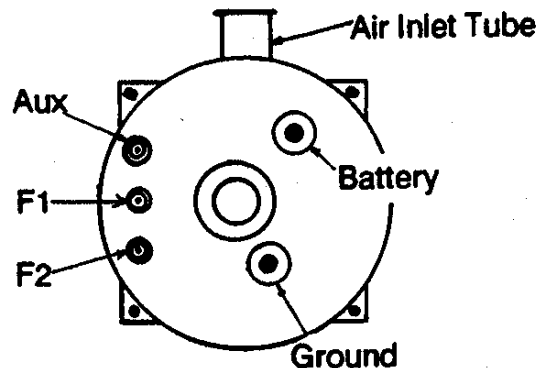


FIGURE 10

CAUTION:

If, while rotating the rotor, a ticking sound is heard, assure that the brush retaining pin is not inserted too far. If ticking persists, disassemble and investigate.

5. Pull the brush retaining pin from the brush holder (13).
6. Lubricate the seal surface of the seal collar (6) with light oil and press it onto the shaft (11) into the seal housing (7).

CAUTION:

Assure that seal spring does not dislocate itself during seal collar installation.

7. Carefully install the "O" ring seal (4) into the seal collar (6). Lightly oiling the "O" ring will facilitate installation.

G. TORQUE SPECIFICATIONS:

UNLESS OTHERWISE SPECIFIED!!

#10 Through Bolts	30-35 in. lbs.
1/4 in. Terminal Studs	35-40 in. lbs.
10-32 Terminal Stud Nuts	20-25 in.lbs.
#6 Screws	10-12 in. lbs.
#8 Screws	15-20 in. lbs.
#10Screws	20-25 in. lbs.

1. BENCH TESTING

CAUTION:

The alternators are forced air cooled units. Do not test at full rated load for more than 5 seconds unless adequate forced air cooling is provided.

Connect the alternator as shown in Figure 11. Adjust the load resistance to obtain the desired voltage. The alternator must meet or exceed limits specified in Figure 12.

CAUTION:

Do Not operate self-excited at high RPM without some load connected (at least the battery). To do so could destroy the alternator. Turn the alternator on and off with the field switch. The load switch is necessary to prevent battery discharge when circuit is not in use.

**TEST WIRING DIAGRAM
24 VOLT 60 AMP ALTERNATOR**

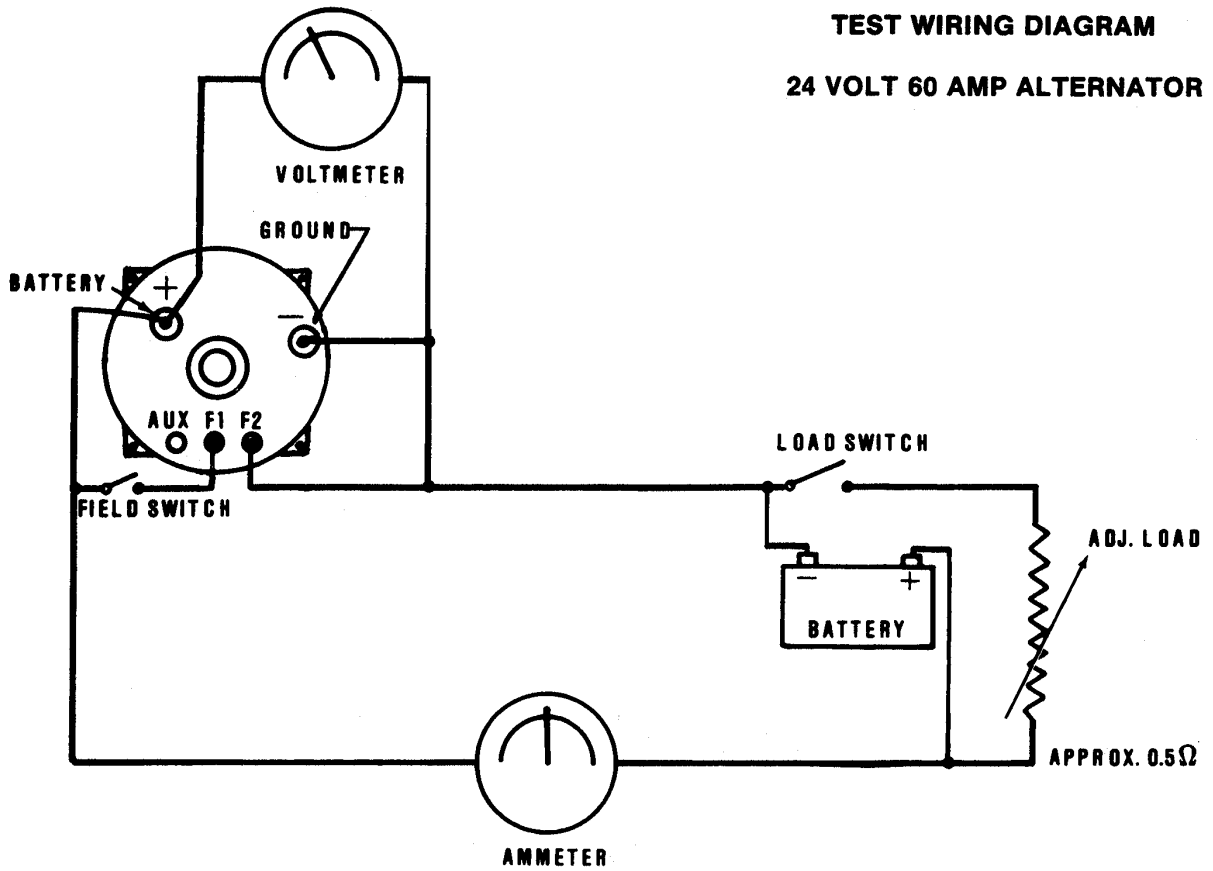
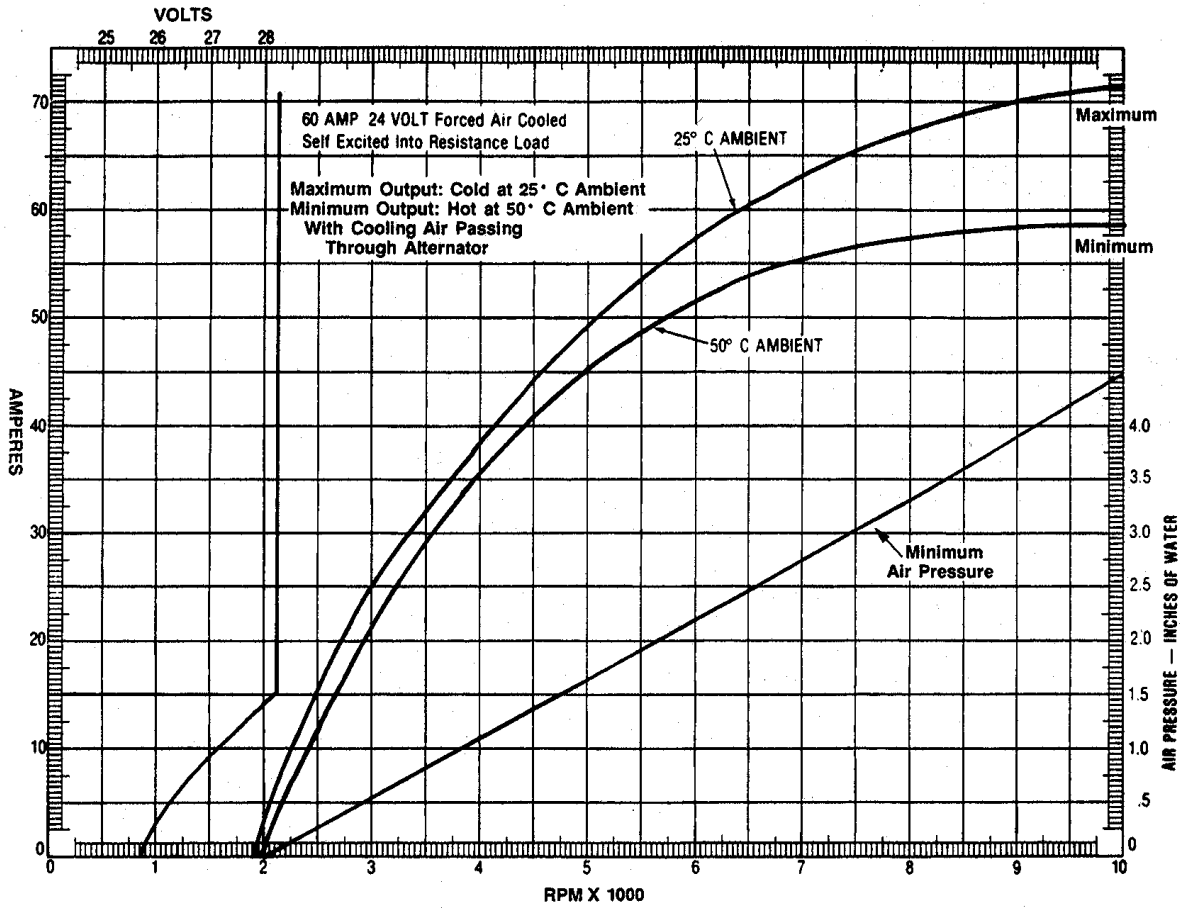


FIGURE 11

FIGURE 12

**MOUNT AND CONNECT ALTERNATOR TO TEST BENCH.
CONNECT FORCED COOLING AIR TO ALTERNATOR
ADJUST LOAD RESISTANCE TO OBTAIN DESIRED VOLTAGE
THE ALTERNATOR MUST MEET OR EXCEED THE FOLLOWING**

ITEM	VOLTS	AMPS (MIN)
3000	28 ± ¼ VOLT	22
4500	28 ± ¼ VOLT	41
6000	28 ± ¼ VOLT	51
8000	28 ± ¼ VOLT	57



(60 AMP) ALTERNATOR PERFORMANCE CURVE

FIGURE 13

TABLE OF LIMITS – 60 AMP				
		NEW		REBUILT
		MIN	MAX	SERVICE
<u>Drive End Housing</u>	Inside Diameter	1.5739	1.5735	1.5741
Bearing Bore				
<u>Slip-Ring End Housing</u>	Inside Diameter	.9370	.9360	.9372
Bearing Bore				
<u>Rotor Shaft Bearing Surface Dia.</u>	Outside Diameter	.6694	.6692	.6691
Drive End				
Slip-Ring End		.6699	.6694	.6693
<u>Slip-Rings</u>	Outside Diameter	1.160	1.110	1.090
Slip-Rings				

FIGURE 14

H. DRIVE COUPLING INSTALLATION

Install Woodruff key, coupling assembly and washer. The washer is a special thrust washer and must be installed with the bearing surface (copper color) toward the alternator. Install nut and tighten to 300 inch pounds (25 ft. lbs.) torque. If slots of nut do not align with cotter pin hole in alternator shaft, the nut may be tightened further but must not exceed 450 inch pounds (37.5 ft.-lb.). Do not back off on nut to align holes. Install cotter pin as shown to insure clearance when alternator is installed in engine. Figure 15.

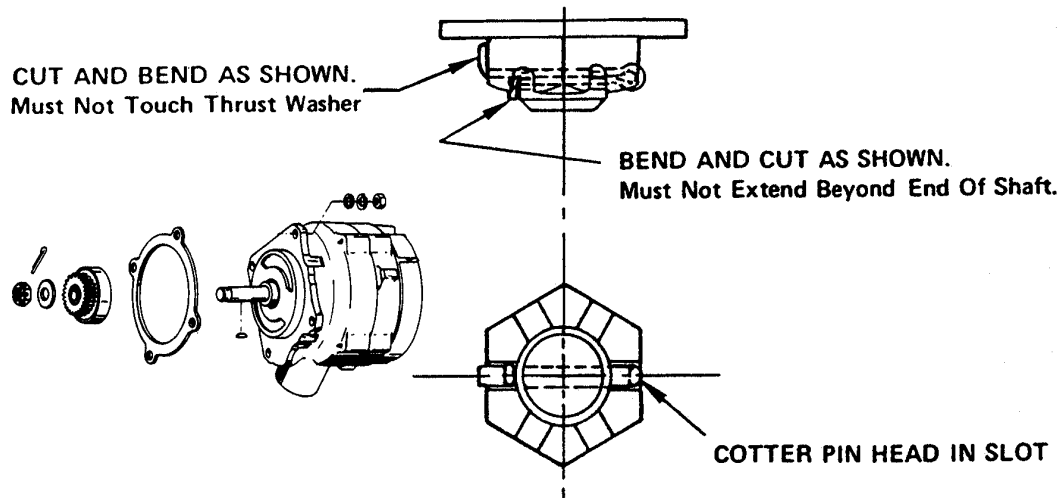


FIGURE 15

The elastomer coupling can be reused if it meets torque slippage requirements. The torque required to slip the coupling elastomer when new must be 180 in. lbs. (15 ft.-lb.) min. measured after 45° of revolution at a rate of 1 to 2 degrees per second. Slippage must occur at O.D. of elastomer with no apparent damage to the elastomer. For couplings which have been in service for more than 25 hours, the slippage torque cannot be less than 140 in.-lb. (11.7 ft.-lb.).

ALTERNATOR INSTALLATION

1.1 Pre-Installation Checks

Insure that the alternator slips into the crankcase without binding and that the mounting flange is properly seated against the crankcase before torquing the four (4) mounting nuts. Do not force the alternator into position as damage to the alternator and drive gears could result.

If there is stud interference with the mounting lug holes while mounting the alternator, do not force the alternator over the studs. Doing so could precipitate mount lug failure due to the resulting pre-load. If interference exists, it is permissible to enlarge the mount lug stud holes by drilling or reaming (as necessary) up to a maximum diameter of .387. Standard hole size is .337-.347.

Care must be taken during installation to assure that the alternator pilot rim enters the crankcase pilot bore squarely. Forcing entry with the attaching nuts may pre-stress the lugs to cause cracking and failure.

1.2 Installation

Install alternator gasket and alternator onto the engine. With the alternator pilot properly engaged in the pilot bore, run the attaching nuts up to the lug contact surfaces evenly and snug. Torque the nuts to 150-180 in. lbs. (12.5 to 15 ft.-lb.) in diagonally opposite pairs.

60 AMP/24 VOLT PARTS LIST

646843

FIG. INDEX	PART NUMBER	DESCRIPTION	QTY.
1	642589	Nut Hex.....	1
2	MS24665-302	Cotter Key.....	1
3	646492A1	Bearing Ball Seal Kit Drive End.....	1
4		.O-Ring.....	N/S
5		.O-Ring.....	N/S
6	646791	Collar Seal.....	1
7	646496	Drive End Housing.....	1
8	646790	Retainer Plate.....	2
9	628321-38	Bolt 10-24 UNC-3A.....	6
10	633342-10	Key Woodruff.....	1
11	642962	Rotor Assembly.....	1
12	642968	Stator Core.....	1
13	646851	Brush Holder Assembly.....	1
	.642970	Brush Holder.....	1
	.642972	Brush Spring.....	2
	.642971	Spacer Brush Holder.....	1
14	.646848-1	Brush.....	2
14A	643018	Washer.....	1
15	649083-9-6	Screw-Capacitor (8-32 UNC-2A).....	1
16	642986	Screw-Capacitor Terminal (8-32 UNC-2A).....	1
17	642976	Terminal Assembly AUX (108-32 UNF-2A).....	1
18	642985	Bracket Capacitor.....	1
19	642984	Capacitor.....	1
20	642617-2	Stud Positive (1/4-28 UNF-2A).....	1
21	642617	Stud Negative (1/4-28 UNF-2A).....	1
22	642975	Screws (8-32 UNC-2A).....	3
23	642979	Nut-Hex.....	3
24	643018	Washer-Rectifier Assembly.....	3
25	652032	Insulator Battery.....	1
26	652033	Washer.....	1
27	649083-8-16	Screw (8-32 UNC-2A).....	1
28	642978	Rectifier Assembly.....	1
29	642958	Slip-Ring Housing.....	1
30	AN960-10	Washer-Thru Bolt.....	4
31	AN500A10-32	Screw-Thru Bolt (10-32 UNF-2A).....	4
32	642448	Insulator-AUX Terminal.....	1
33	642448-1	Insulator-Field.....	2
34	642443	Insulator-Internal.....	1
35	642452	Nut .25-28 Washer Face.....	4
36	642451	Nut Washer Face.....	6
37	642438	Needle Bearing Slip-Ring Housing.....	1

** 642441 can be identified by six small radii on the outer circumference and should be replaced 652032 round insulator and 652033 washer.

Figure 15
 24 V., 60 AMP.
 TCM 646843

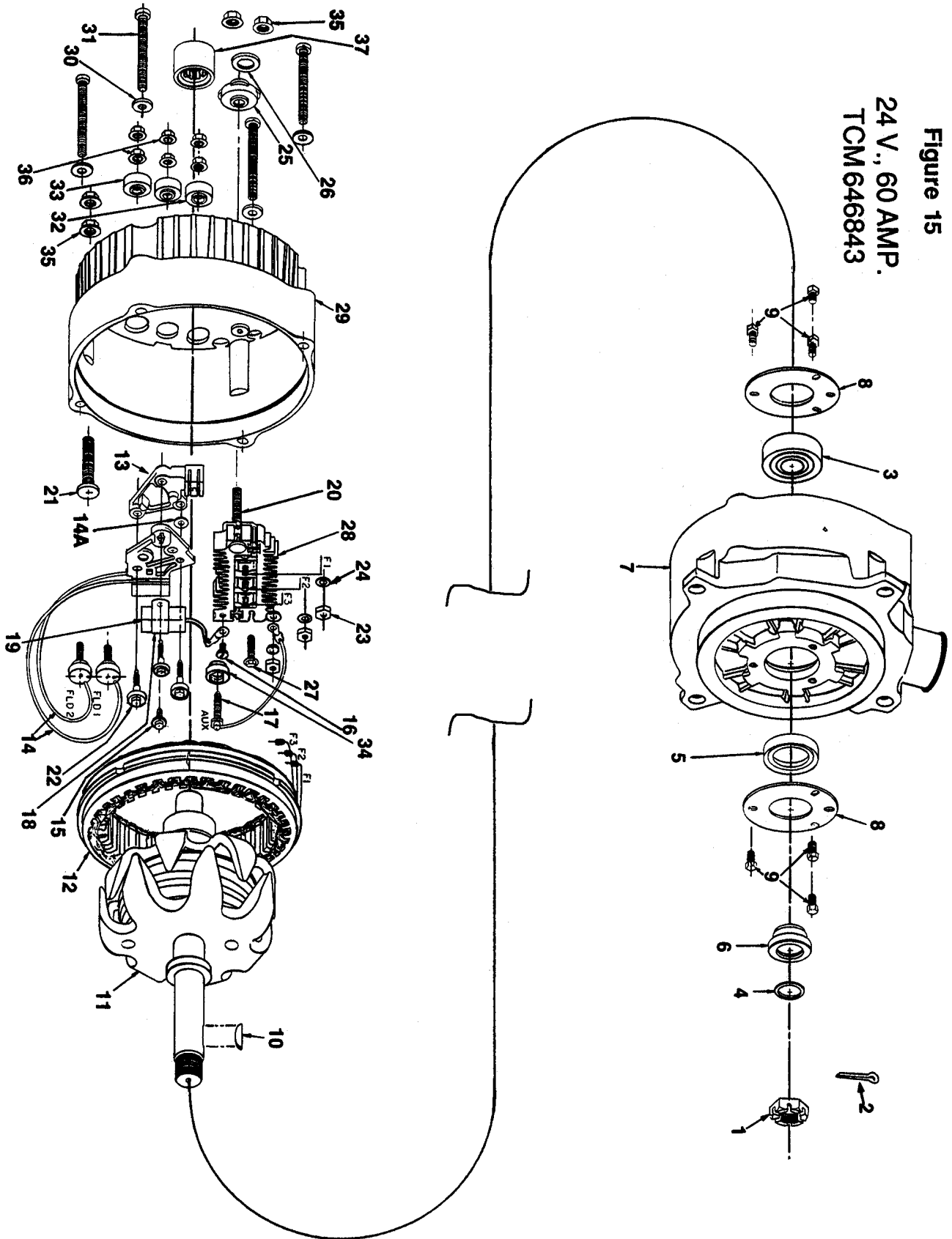


TABLE OF CONTENTS

100 AMP (649304)

DISASSEMBLY (649304)	19
Preliminary Disassembly.....	19
Stator, Rectifier and Brushes	19
Slip Ring End Bearing Removal.....	20
Rotor Removal.....	20
Drive End Bearing and Seal Removal	21
 CLEANING AND TESTING COMPONENTS	 22
Rectifier Tests	22
Stator Tests.....	23
Rotor Test and Service	23
Brush Inspection and Replacement.....	24
Capacitor.....	24
Seal Collar	24
 RESASSEMBLY	 25
Slip Ring End Bearing.....	25
Brush Holder Assembly	25
Stator-Rectifier Assembly	27
Drive End Bearing and Seal	29
Rotor	30
Final Assembly.....	31
Torque Specifications	31
Bench Testing	32
Performance Curve.....	33
Table of Limits.....	33
Drive Coupling Inspection	35
Alternator Installation	35
Illustrated Parts Breakdown	36-37

100 AMP 24-VOLT

P/N 649304

DISASSEMBLY

When servicing the alternator, complete disassembly may not be required. In most cases it will be necessary only to perform those operations which are required. However, adequate disassembly is covered step by step to provide detailed information necessary for the required operations.

NOTE:

Numbers in parenthesis correspond with their respective items on page 36-37.

A. PRELIMINARY DISASSEMBLY

1. Remove the safety wire and four thru bolts (34).
2. The lip of the drive-end housing (6) is a close fit over the stator core (11). To separate use a screwdriver and mallet to tap the core out of the drive-end housing. Do not attempt to drive the housing (30) off the stator core (11). The core and slip-ring end housing must be removed together.
3. When the slip-ring end housing (30) and stator assembly (11) is pulled free of the drive-end housing assembly (6), a clicking sound may be heard as the brushes (29) drop off the slip-ring. Do not attempt to reinstall the rotor (10) without pushing the brushes back into the holder and installing the retaining pin or the brushes will be damaged.
4. It is advisable at this time to insert a plastic seal plug into the slip-ring end housing bearing to prevent bearing contamination. If a plug is not available, use a piece of masking tape.

If alternator is being overhauled, slip-ring end bearing should be removed and replaced.

B. STATOR, RECTIFIER AND BRUSHES

1. Remove nuts (35) and insulators (28,32) from the "AUX" terminal. (Figure 21.)
2. Remove capacitor (16) only if it fails test on page 18.
3. Remove screws (15) attaching the positive and negative straps (25) to the rectifier plates.
4. Remove the four screws (12) that secure the rectifier plates (39) to the housing (30).
5. Lift the stator (11) and rectifier assembly (39) from the housing (30). Take care not to damage the leads connecting the stator to the rectifier and "AUX" terminal.
6. Remove nuts (35) and insulators (33) from the two field terminals.
7. Remove the two screws (27) that secure the brush holder to the housing and remove the brush holder (29) assembly .
8. Check terminal straps (25). Remove and replace if needed.

C. SLIP-RING END BEARING REMOVAL:

100% Replacement at Overhaul

1. Place the slip-ring end housing (30) in an arbor press. Support the rear housing at the area directly below the bearing boss. as shown, to prevent breakage or distortion of the housing. (See Figure 16.)
2. Use special tools or fabricate tools to the dimensions shown and press the roller bearing (36) from the outside. Discard the bearing.

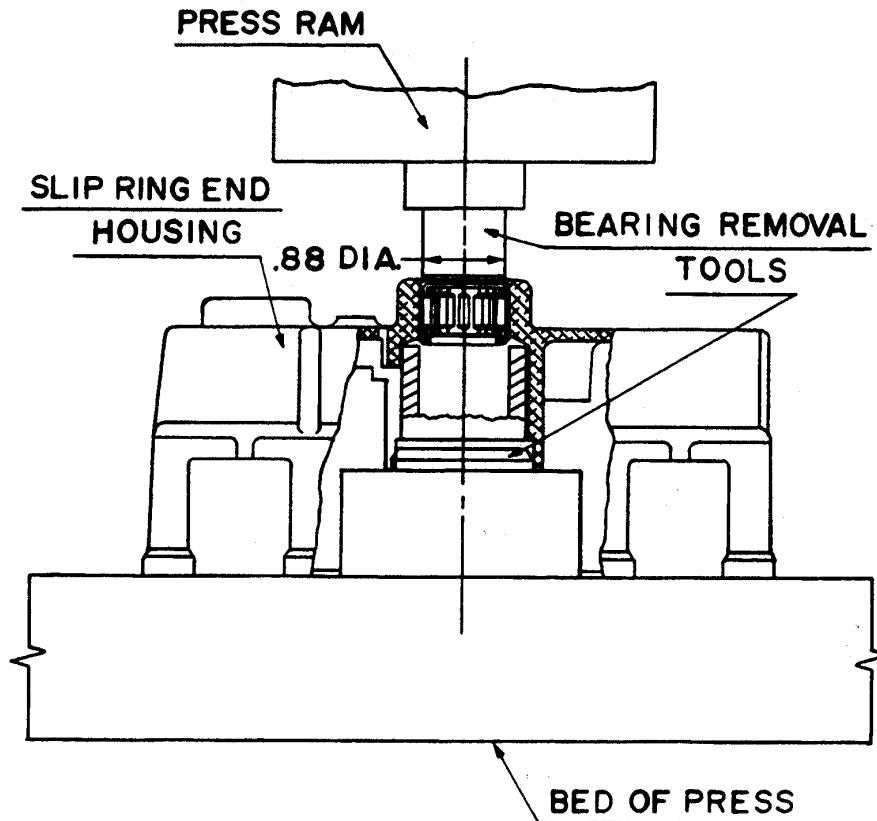


FIGURE 16

D. ROTOR REMOVAL

1. Remove the cotter pin (37), nut (1) (Figure 32) drive coupling and thrust washer from the rotor shaft.
2. Remove woodruff key (9), "O" Ring (3), and seal collar (5) as applicable. Discard "O" Ring.
3. Support the drive end housing (6) on the arbor press table and carefully press the rotor shaft (10) out of the drive end bearing (2). Take care not to damage the threads or drop the rotor. (See Figure 17.)

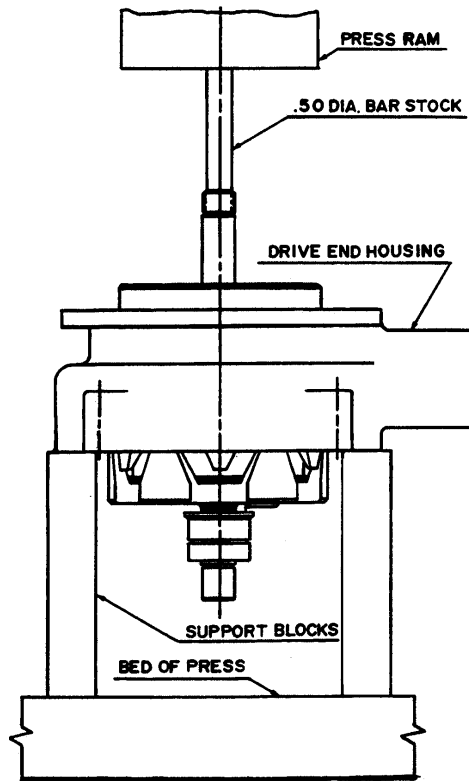


FIGURE 17

E. DRIVE END BEARING AND SEAL REMOVAL:

100% Replacement at O/H.

Remove bearing and seal only if new replacement bearings and seals are to be installed.

CAUTION:

If the seal has been leaking, the seal and bearing must both be replaced as the oil leak may wash the grease out of the ball bearing.

1. Remove the three retaining bolts (8) and the retainer plates (7). (See Figure 18.)

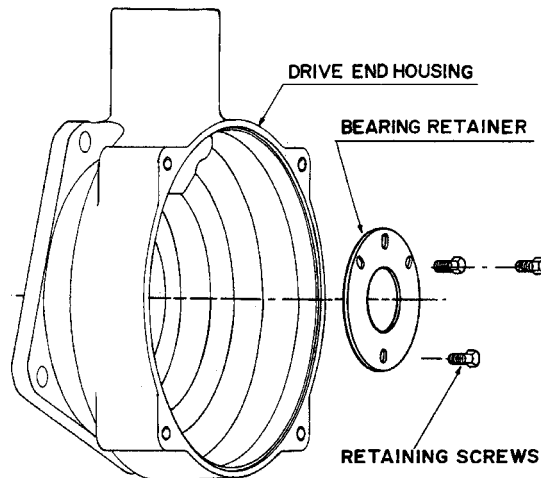


FIGURE 18

2. Use a 3/4 inch diameter length of bar stock against the bearing inner race to press bearing (2) from housing. Discard the bearing. (See Figure 19.)

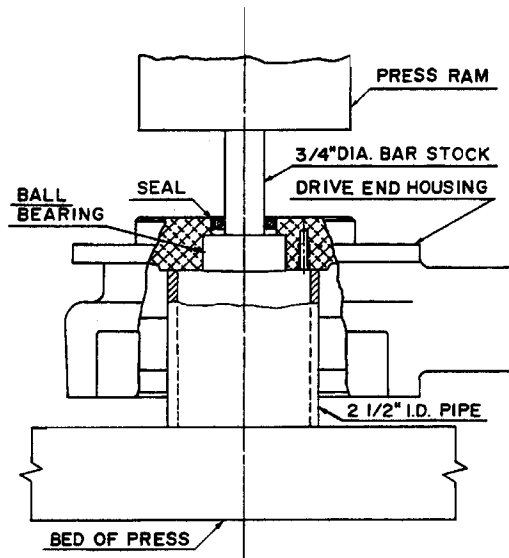


FIGURE 19

3. Press the seal (4) out of the housing (6) or pull it with a hook type puller. Seal can be removed in either direction with retainer plates removed. Discard after removal.

CLEANING AND TESTING COMPONENTS

After completion of disassembly, all parts should be cleaned and inspected as follows:

NOTE:

If either the stator or rectifiers fail to pass the following tests, they must be replaced as a unit. Individual service on either the rectifiers or the stator assembly is not authorized.

A. RECTIFIER TESTS

1. Visually inspect for broken rectifier/stator leads. Do not allow bare diode leads or stator leads to contact the rectifier plates.
2. Using a number 57 bulb in series with a 12 volt battery, place one test lead on a rectifier pin and the other lead on a rectifier heat sink. Change to the opposite heat sink. The bulb should show continuity to one heat sink but not the other. Reverse the leads and repeat.
3. If the bulb lights in both directions on any test, a diode is bad. If bulb does not light in either direction for any particular diode tested, diode is bad.
4. If a bad diode is found, replace rectifier/stator assembly.

B. STATOR TEST

NOTE:

Positive Diodes -Red

Negative Diodes -Black

1. Using a pair of test leads in series with a 110 volt test lamp, test between the output leads and the laminations. The lamp should not light or flicker. Any indication of continuity between the windings and laminations constitutes a grounded winding and the stator/rectifier assembly must be replaced.

WARNING

Items to be tested are to be placed on a rubber matting, so as not to come in contact with personnel or equipment. Do not touch the stator assembly while performing this test, or electrical shock will occur.

2. It is virtually impossible by field tests to determine if there are short circuits in the stator windings. Short circuits in the stator windings, will cause the alternator to growl during operation with reduced output. Usually a shorted winding will be evident on close visual inspection by the presence of burned wires or "hot spots".

If all other electrical checks are normal and the alternator fails to supply rated output, it is safe to assume that the stator windings are shorted, in which case the stator/rectifier assembly must be replaced.

C. ROTOR TEST AND SERVICE:

NOTE:

With the exception of slip-ring service noted in step 6, no service procedures are authorized on the rotor assembly. Failure to meet any of the acceptance criteria must be judged as a defective rotor and the entire assembly must be replaced.

1. Visually inspect roller bearing running surface of shaft (slip-ring end) for pitting, uneven wear or other signs of distress. See Table of Limits for shaft diameter.

WARNING

In the following test, Items to be tested are to be placed on rubber matting so as not to come in contact with personnel or equipment. Do not touch the rotor while performing this test, or electrical shock will occur.

2. Using the 110 volt test set -up as in B-1, place the test leads between the rotor shaft and a slip-ring. The test lamp must not light or flicker.
3. Place the test leads between the two slip-rings. The lamp must light steady with no flicker.
4. Measure rotor coil resistance using an accurate Ohm- meter. Resistance should be 11.5 - 14.0 OHMS at 20°(70°F).
5. Failure of any of the above tests constitute failure and the rotor assembly must be replaced.
6. If the slip-rings are dirty, they may be cleaned with 600 grit sandpaper and finished with crocus cloth. (Do not use emery.) Spin the rotor in a lathe to sand the slip-rings. Do not sand them by hand. If the slip-rings are worn or out of round, they should be trued in a

lathe to .001" TIR. Finish with 600 grit sandpaper and crocus cloth. Final finish should be between 32 and 50 micro-inches. Minimum allowable finished O. D. is 1.188 inches.

D. BRUSH INSPECTION & REPLACEMENT:

Inspect condition of the brushes (29). If they are broken, chipped or oil soaked, they must be replaced. It is advisable to replace brush assembly if brushes are 0.40 inch or less. Replacement is accomplished by replacing the entire brush-holder field-terminal assembly.

E. CAPACITOR:

1. Inspect capacitor (16) for cracks in insulation and broken or damaged leads.
2. With an Ohmmeter set on the highest range and the capacitor disconnected from diode heat-sink, measure the resistance between the capacitor lead and case. The meter should momentarily jump and fall to infinity. Quickly reverse the test leads and repeat the measurement. The momentary meter excursion should be greater but still should fall to infinity. Any steady state value of readable resistance is cause for rejection and the capacitor must be replaced.

F. SEAL COLLAR:

1. Visually inspect seal collar for damage or wear in the seal seating area.
2. Visually inspect seal collar for cracks or damage
3. Replace any cracked, damaged or worn parts.

REASSEMBLY

NOTE:

It is recommended that a light coating of "Loctite #242" be applied to all studs and screws just prior to assembly or installation of nuts. Where specified, "Loctite" will be used.

A. SLIP-RING END BEARING:

CAUTION:

Assure that bearing (36) has been pre-lubed by the manufacturer before installation.

1. Use an arbor press and the tool shown to install a new bearing. Support the housing (30) by the bearing boss to prevent breakage of the casting. Press in the bearing flush with the outer boss of the housing. Use extreme care to avoid misalignment or otherwise overstressing the bearing. (See Figure 20.)

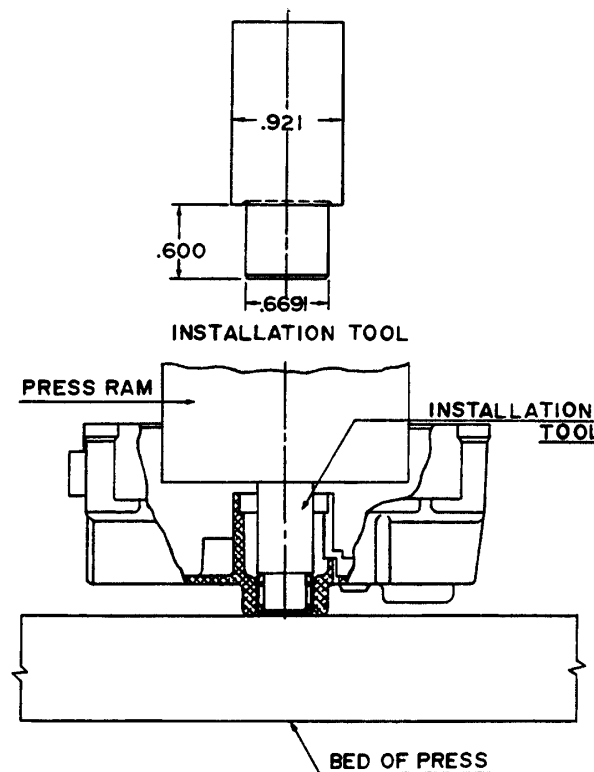


FIGURE 20

2. Protect the bearing with a seal plug or a piece of masking tape to prevent entry of dust or dirt.

B. BRUSH HOLDER ASSEMBLY:

1. Hold the brushes in place with a brush retaining pin.

*NOTE:

If brush pin is not available, wire of .041 diameter, or a large paper clip may be used.

CAUTION:

Remove burrs from the end of wire so as not to nick or scratch the brushes.

2. Install the pre-assembled brush holder (29) assembly with the brush retaining pin* protruding through the small hole in the casting. Apply "Loctite" #242 to #8 brush-holder attaching screws (27) and torque to 15-20 in. lbs. Do not over torque screws or cracked brush-holder may result.
3. Install the field terminal studs (29) with the insulator washers (33) outside the housing, with the brush leads routed as shown. (See Figure 21 & 22.)

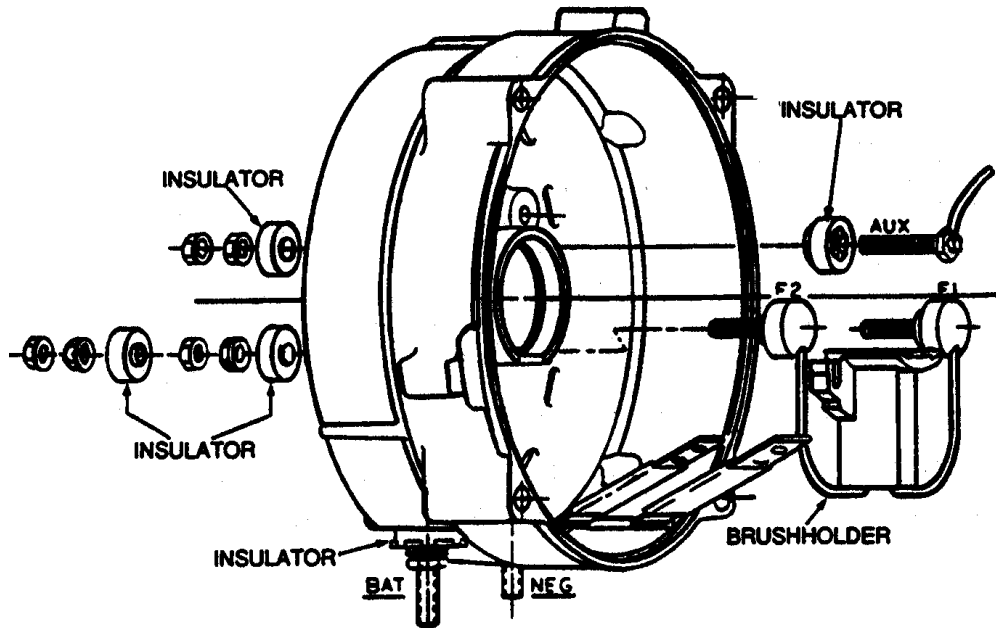


FIGURE 21

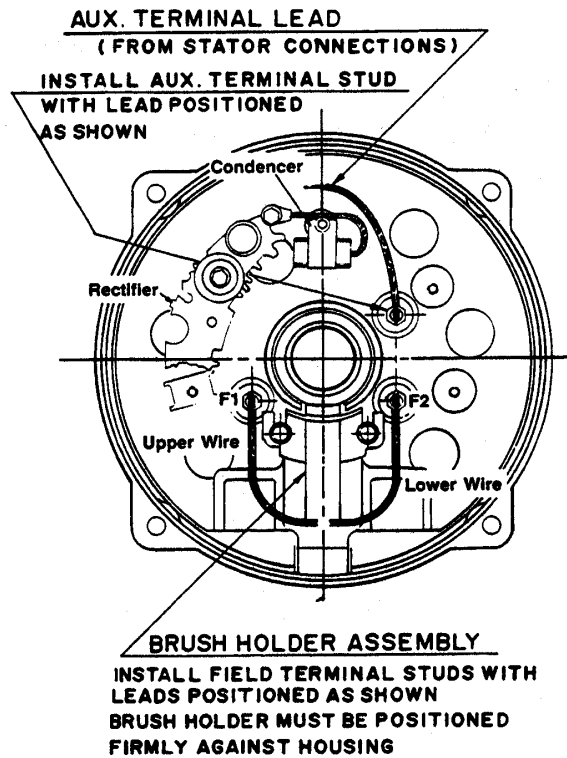


FIGURE 22

4. Install and tighten the field-terminal stud nuts (35). Torque to 20-25 in.-lbs.

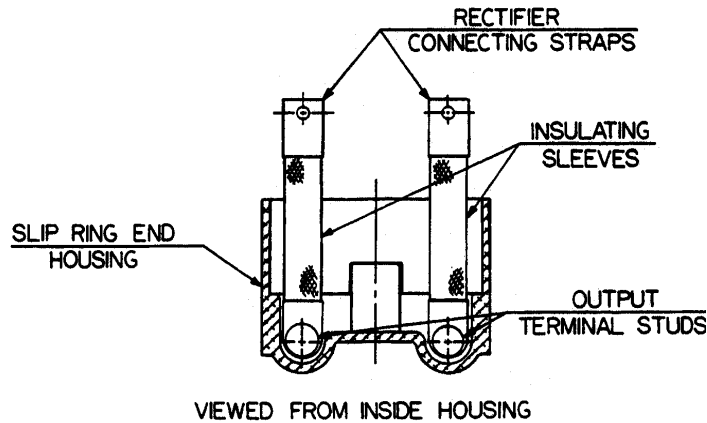


FIGURE 23

C. STATOR ASSEMBLY

1. Install the capacitor (16) into the housing (30) if it was removed. Apply "Loctite #242" to the #8 attaching screw (15) torque to 15-20 in.-lbs. See Figure 22. Attach the capacitor terminal (16) to the positive rectifier plate with screw (38). (Note -Earlier alternators required a 6-32 screw; later alternators require a 10-24 screw. Capacitor lead terminal hole, if too small should be enlarged to accept the 10-24 screw using a 13/64 drill.)

NOTE:

Capacitor lead must be attached to rectifier and rectifier installed into housing with capacitor assembled to it.

2. Install a rectifier connecting strap (25) on the negative output terminal (23). Install the output terminal in the housing (30) with the connecting strap routed as shown. (See Figure 23.)

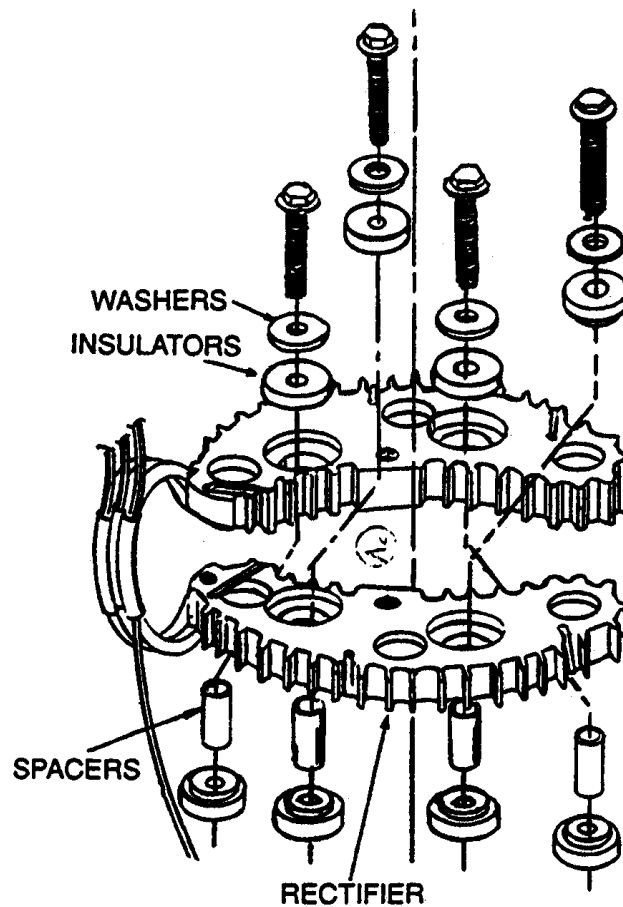


FIGURE 24

3. Install washer (31) over negative output stud. Apply Loctite #242 to stud threads. Install terminal nut (18) on stud (23). Torque to 35-40 in.-lbs.
4. Install a rectifier connecting strap (25) on the positive output terminal (22). Install insulator (20) on the terminal and install in the housing (30) with the connecting strap routed as shown. Verify that the positive strap does not contact the housing.
5. Install red insulator (21). Apply Loctite # 242 to stud threads. Install terminal nut (18) on the positive output stud (22). Torque to 35-40 in.-lbs.
6. Install insulation sleeves (24) on rectifier connecting straps (25).
7. Install internal insulators (28) onto AUX terminal stud. Install the AUX terminal stud through AUX terminal outlet hole in the back of slip-ring housing (30). Install external insulator (32). Install and tighten AUX terminal nut (35). Torque to 15-20 in.-lbs.
8. The stator-rectifier assembly (11) and AUX terminal must be installed as one unit. On the rectifier, install four rubber insulators (14) into the recessed portions on the back side, in such a manner that they do not dislocate themselves during installation. During installation, orient the stator-rectifier(11) so as to allow installation of the AUX terminal, alignment of the rectifier mounting screws (12) and proper location of the alternator assembly thru bolts (34). (See Figures 24 & 25.)

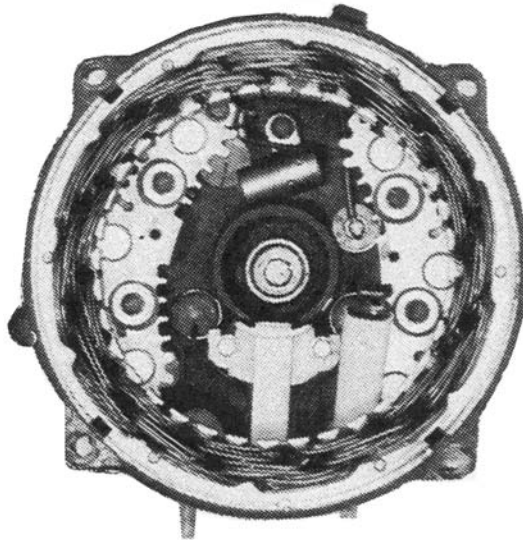


FIGURE 25

9. Install and align four spacers (26) and rubber insulators (14) to the top of the rectifier recessed areas and install and tighten the four rectifier installation washers (13) and screws (12).
10. Attach rectifier connecting straps (25) to rectifier plates with (2) screws (15). (Note -Earlier alternators require an 8-32 screw. Later alternators require a 10-24 screw.) Verify that the positive connecting strap does not contact the housing or any grounded surface.

D. DRIVE END BEARING AND SEAL:

1. Press the oil seal (4) into the drive end housing (6) with the seal lip toward the outside of the housing. Use an arbor press and a flat pressing tool at least 1.5 inch diameter. (See Figure 26.)

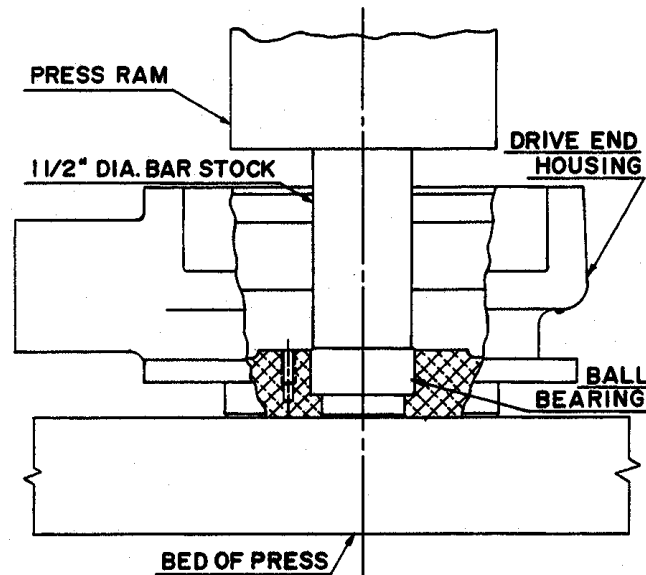


FIGURE 26

2. Press the ball bearing (2) into the drive end housing (6). Surface of bearing to be flush with inside surface of housing. Seating tool must press on outer-race of bearing during installation.

3. Install the bearing retainer plates (7) with 3 # 10 screws (8) each. Apply "Loctite". Torque to 25-30 in.-lbs.

E. ROTOR:

1. Using an arbor press, press the shaft (10) into the drive-end bearing (2) until it bottoms on the stop collar. Do not press against the bearing unsupported. Use a tool that fits over the shaft and supports the bearing inner race. (See Figure 27.)

NOTE:

Use care to not nick or cut the oil seal while installing the shaft.

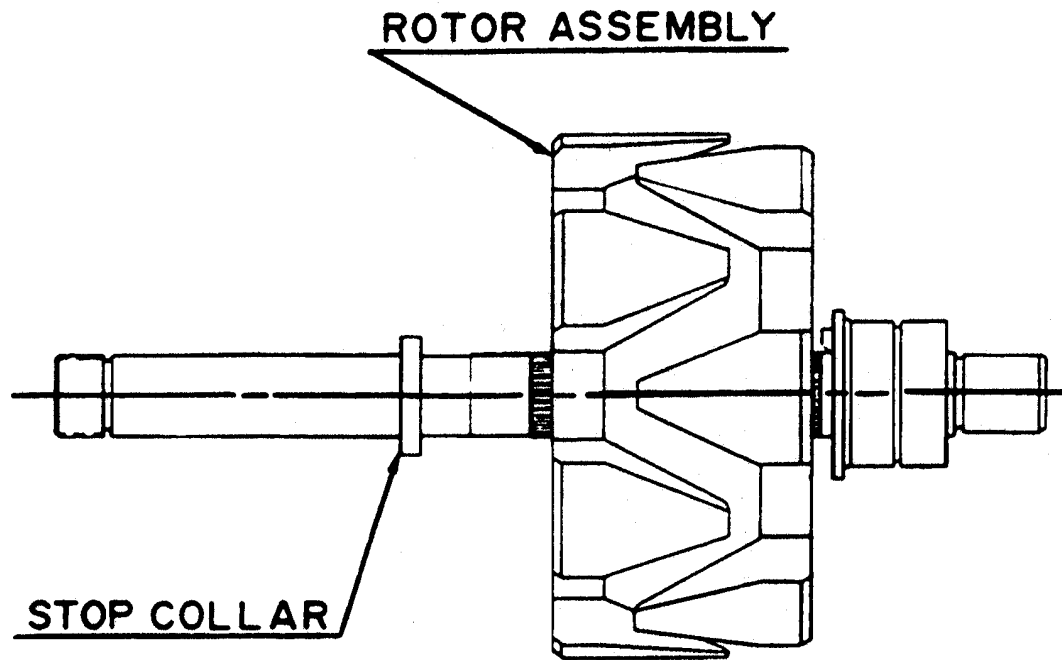


FIGURE 27

F. FINAL ASSEMBLY:

1. Remove the seal plug or tape from the slip-ring end housing bearing (36).
2. Position the alternator so that the drive end (6) is downward and carefully install the slip-ring housing (30), with the brushes (29) and brush pin installed, onto the shaft (10). Orient the "Bat" and "Ground" (23) terminals to the 6 o'clock position from the air inlet tube.

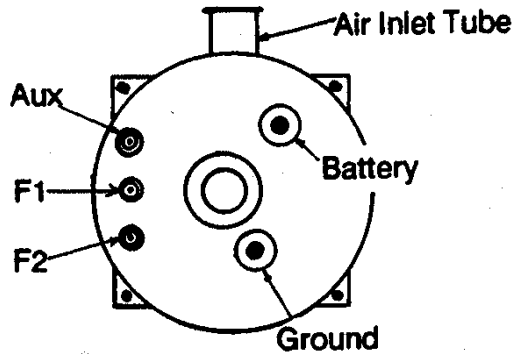


FIGURE 28

3. Install the four through bolts (34) and torque. Safety wire the through bolts.
4. Check for free-turning of rotor. It should turn freely with no sound of striking or rubbing.

CAUTION:

If, while rotating the rotor, a ticking sound is heard, disassemble and investigate.

5. Pull the brush retaining pin from the brush holder.
6. Lubricate the seal surface of the seal collar (5) and press it onto the shaft (10) into the seal (4).

CAUTION:

Assure that seal spring does not dislocate itself during seal collar installation.

7. Carefully install the "O" ring seal (3) into the seal collar (5). Lightly oiling the "O" ring will facilitate installation.

G. TORQUE SPECIFICATIONS:

UNLESS OTHERWISE SPECIFIED!!

#10 Through Bolts.	30-35 in. lbs.
1/4 In. Through Bolts.	80-85 in. lbs.
1/4 in. Terminal Studs.	35-40 in. lbs.
10-32 Terminal Stud Nuts.	20-25 in. lbs.
#6Screws	10-12in.lbs.
#8Screws	15-20in.lbs.
#10Screws	20-25in.lbs.

H. BENCH TESTING

CAUTION

The alternators are forced air cooled units. Do not test at full rated load for more than 5 seconds unless adequate forced air cooling is provided.

Connect the alternator as shown in Figure 29. Adjust the load resistance to obtain the desired voltage. The alternator must meet or exceed the following: Figures 29 & 30.

CAUTION:

Do Not operate self-excited at high RPM without some load connected (at least the battery). To do so could destroy the alternator. Turn the alternator on and off with the field switch. The load switch is necessary to prevent battery discharge when circuit is not in use.

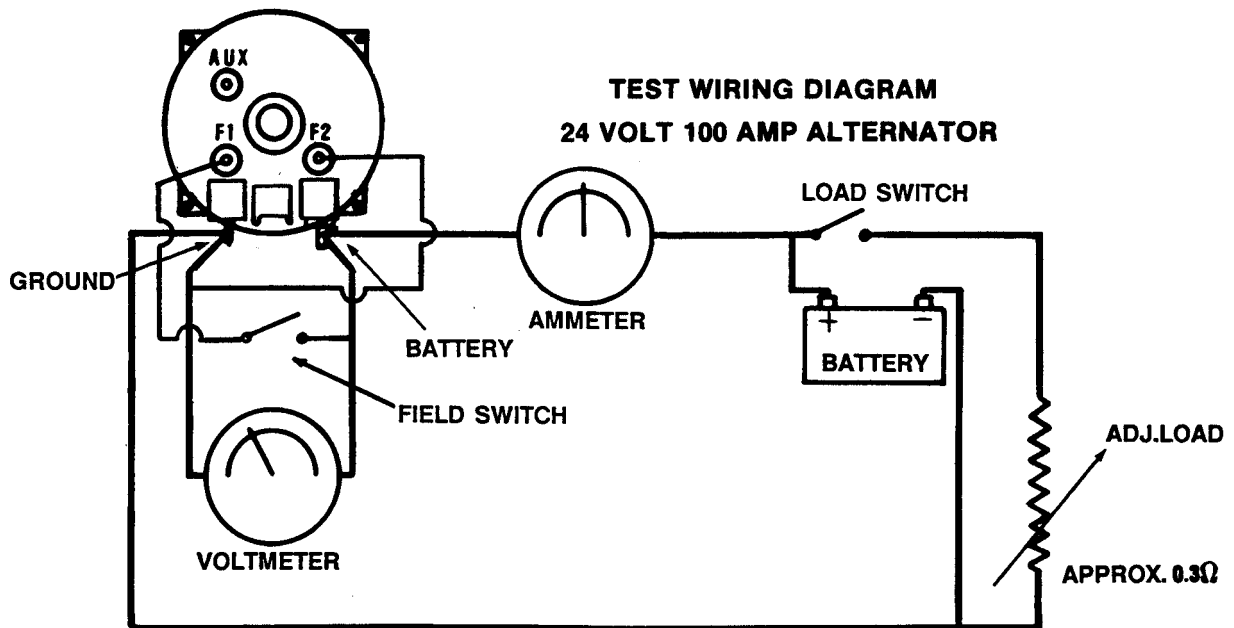
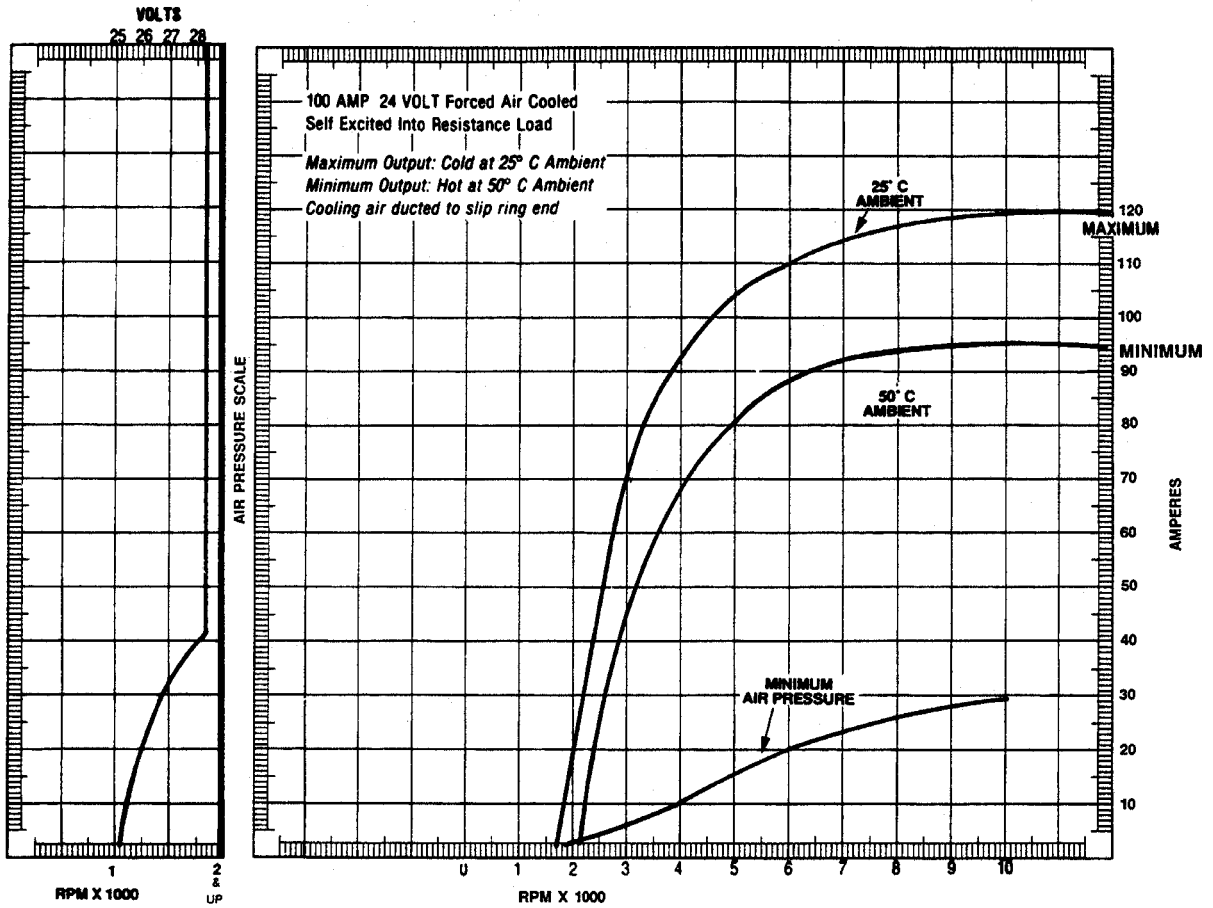


FIGURE 29 (100 AMP ALTERNATOR)

ITEM	VOLTS	AMPS (MIN)
3000	28 ± ¼ VOLT	45
4500	28 ± ¼ VOLT	75
6000	28 ± ¼ VOLT	87
8000	28 ± ¼ VOLT	94



ALTERNATOR PERFORMANCE CURVE

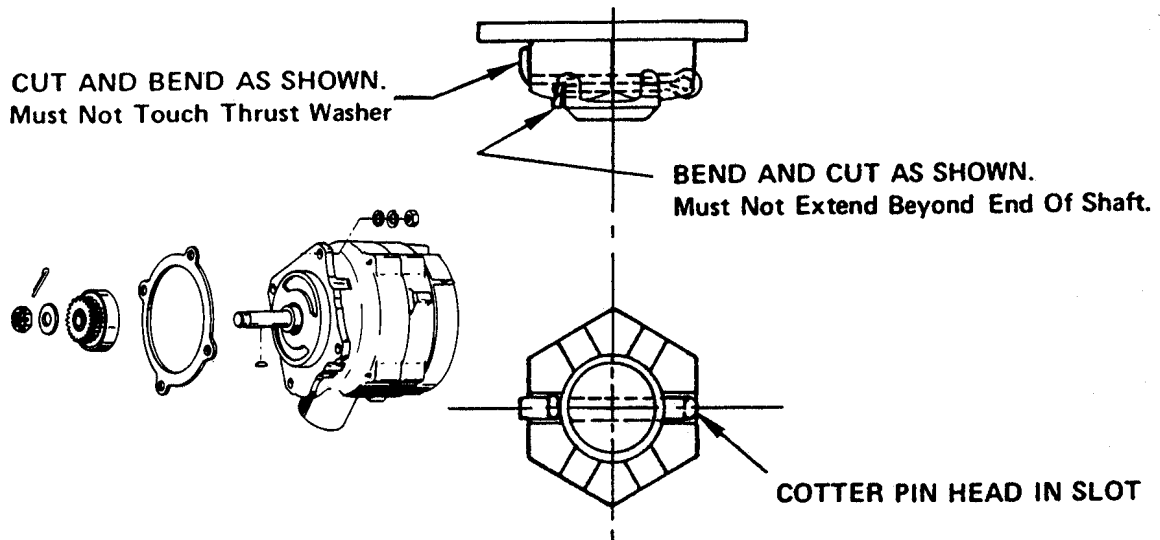
FIGURE 30

TABLE OF LIMITS – 100 AMP				
		NEW		REBUILT
		MIN	MAX	SERVICE
<u>Drive End Housing</u>	Inside Diameter	1.5739	1.5735	1.5741
Bearing Bore				
<u>Slip-Ring End Housing</u>	Inside Diameter	.9370	.9360	.9372
Bearing Bore				
<u>Rotor Shaft Bearing Surface Dia.</u>	Outside Diameter	.6694	.6692	.6691
Drive End Slip-Ring End		.6699	.6694	.6693
<u>Slip-Rings</u>	Outside Diameter	1.240	1.220	1.188
Slip-Rings				

FIGURE 31

I. DRIVE COUPLING INSTALLATION

Install Woodruff key, coupling assembly and washer. The washer is a special thrust washer and must be installed with the bearing surface (copper color) toward the alternator. Install nut and tighten to 300 inch pounds (25 ft. lbs.) torque. If slots of nut do not align with cotter pin hole in alternator shaft, the nut may be tightened further but must not exceed 450 inch pounds (37.5 ft.-lb.). Do not back off on nut to align holes. Install cotter pin as shown to insure clearance when alternator is installed in engine. Figure 32.



The elastomer coupling (646655) can be reused if it meets torque slippage requirements. The torque required to slip the elastomer coupling when new must be 180 in. lbs. (15 ft.-lb.) min. measured after 45° of revolution at a rate of 1 to 2 degrees per second. Slippage must occur at O.D. of elastomer with no apparent damage to the elastomer. For couplings which have been in service for more than 25 hours, the slippage torque cannot be less than 140 in.-lb. (11.7ft.-lb).

J. ALTERNATOR INSTALLATION

1.1 Pre-Installation checks

Insure that the alternator slips into the crankcase without binding and that the mounting flange is properly seated against the crankcase before torquing the four (4) mounting nuts. Do not force the alternator into position as damage to the alternator and drive gears could result.

If there is stud interference with the mounting lug holes while mounting the subject alternator(s), do not force the alternator over the studs. Doing so could precipitate mount lug failure due to the resulting pre-load. If interference exists, it is permissible to enlarge the amount lug stud holes by drilling or reaming (as necessary) up to a maximum diameter of .387. Standard hole size is .337-.347.

Care must be taken during installation to assure that the alternator pilot rim enters the crankcase pilot bore squarely. Forcing entry with the attaching nuts may pre-stress the lugs to cause cracking and failure.

1.2 Installation

Install alternator gasket and alternator onto the engine. With the alternator pilot properly engaged in the pilot bore, run the attaching nuts up to the lug contact surfaces evenly and snug. Torque the nuts to 150-180 in. lbs. (12.5 to 15 ft.-lb.) in diagonally opposite pairs.

**INTENTIONALLY
LEFT
BLANK**

100 AMP/24 VOLT PARTS LIST

649304

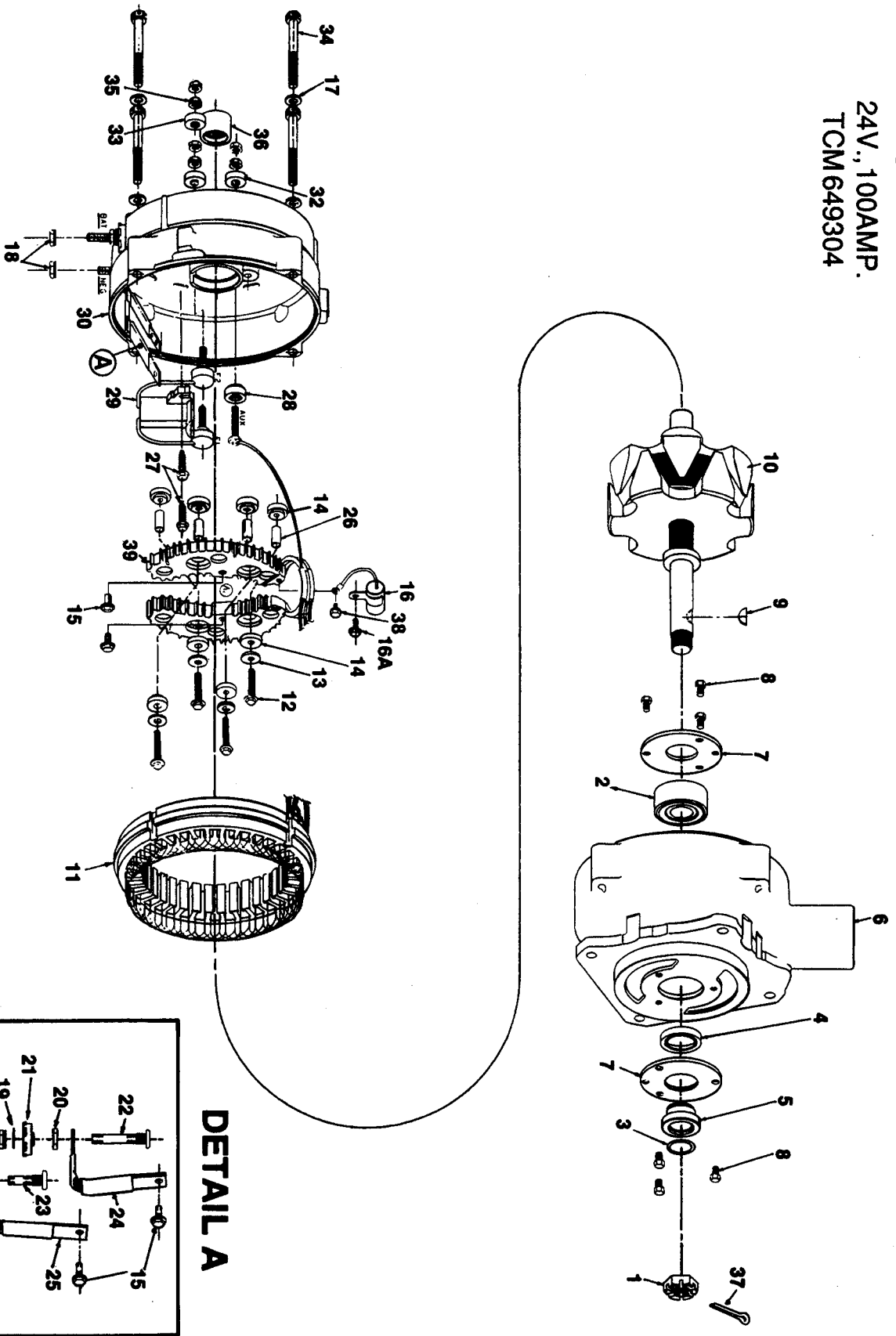
FIG. INDEX	PART NUMBER	DESCRIPTION	QTY.
1	642589	Nut Hex.....	1
2	646495A1	Bearing Ball Drive End Kit.....	1
3		.O-Ring	1
4		.O-Ring	1
5	646791	Collar Seal	1
6	646497	Drive End Housing.....	1
7	646790	Retainer Plates	2
8	628321-.38	Bolt 10-24 UNC-3A	6
9	633342-10	Key Woodruff	1
10	643704	Rotor Assembly.....	1
11	649303	*Stator-Rectifier	1
12	649083-8-20	Screw (8-32 UNC-2A).....	4
13	642436	Washer Flat	4
14	642614	Insulator-Rubber	8
15	649083-8-6	Screw (8-32 UNC-2A).....	3
1	649083-10-8	Screw (10-24 UNC-2A).....	3
16	642454	Capacitor	1
16A	649083-8-6	Screw (8-32 UNC-2A).....	1
17	2472	Washer	14
18	642452	Nut .25-28	4
19	652033	**Washer Insulator.....	1
20	642444	Spacer Insulator.....	1
21	652032	**Insulator Bat. Terminal.....	1
22	642617	Stud Positive (1/4-28 UNF-2A)	1
23	642617-1	Stud Negative (1/4-28 UNF-2A).....	1
24	642620-3	Sleeving (Straps)	2
25	642616	Straps	2
26	649298	Spacer Stator-Rectifier Assembly	4
27	649083-8-11	Brush Retaining Screw (8-32 UNC-2A)	2
28	642443	Int. Insulator	1
29	646853	Brush Holder Assembly	1
30	646852	Slip-Ring Housing	1
31	AN960-416	Washer	3
32	642448	Insulator- External AUX	1
33	642448-1	Insulator- External Field.....	2
34	642450	Bolt Thru (1/4-20 UNC-3A)	4
35	642451	Nut	6
36	642438	Needle Bearing	1
37	MS24665-302	Cotter Key.....	1
38	642456	Screw #6-32	1
	642438	Screw 10-24.....	
39		*Rectifier Plate	2

1 Refer to the Reassembly Section, Section C, Stator-Rectifier Assembly, paragraphs 1 & 10.

*Stator (11) Rectifier (39) are purchased as one unit. They are separated to enhance detail.

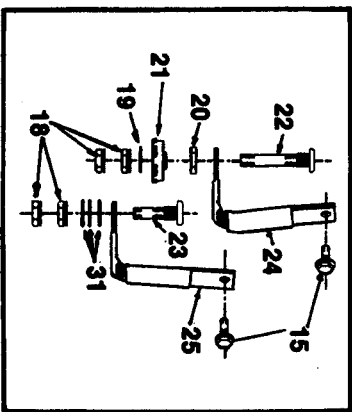
** 642441 can be identified by six small radii on the outer circumference and should be replaced 652032 round insulator and 652033 washer.

Figure 33
 24V., 100AMP.
 TCM 649304



* Stator (11) Rectifier (39) are purchased as one unit.
 They are separated to enhance detail.

DETAIL A



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