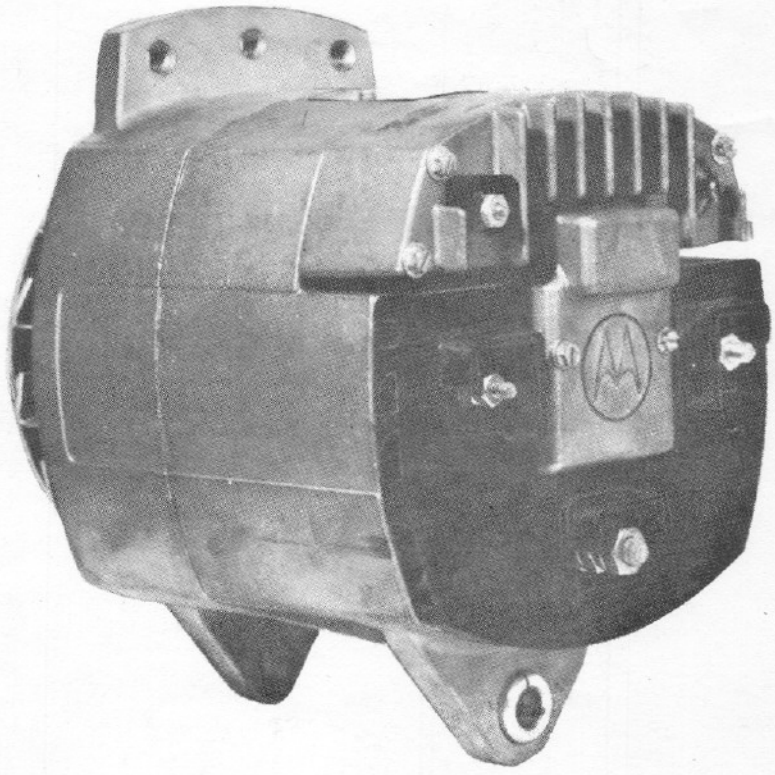
'SC' series

electronic alternator systems

service manual

12/24/32 volt models

this manual supersedes 25-97 and 25-111



MOTOROLA®

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INDEX

GENERAL INFORMATION

The Motorola "SC" Alternators are designed for 12, 24 and 32 volt heavy-duty truck, bus, industrial and marine applications where dependability and long service life are required. They employ standard slip-ring construction and include an integral regulator which can easily be removed if required. Also featured is an insulated (floating) output system for use in positive and negative ground applications. Additionally, high outputs are provided at comparatively low cut-in speeds and unit weight factors.

The integral regulators incorporate all silicon devices, an adjustable output voltage control, and protection circuitry against load dump and transients.

NOTE

Two versions of 12 volt alternators and associated regulators were fabricated. Version 1 alternators were earlier models and differed from current units (version 2) in internal wiring only, Figure 3. Physically, they appear to be the same but identification is possible by noting the code dates stamped on the units. Alternators bearing code dates 185-307 and lower are version 1 units, and higher codes are version 2.

Similarly, version 1 regulators used transistor/silicon controlled rectifier (SCR) circuitry and contained 4 leads. Version 2 regulators employed thick film type transistor circuits and had 3 leads. No code date stamping was used with the regulators but they can be identified by their lead arrangement.

ALTHOUGH THE ALTERNATORS AND REGULATORS APPEAR TO BE THE SAME, INTERCHANGEABILITY IS NOT POSSIBLE WITHOUT INTERNAL MODIFICATIONS TO THE REGULATOR TERMINAL BOARD ON THE ALTERNATOR REAR HOUSING ASSY.

This modification is described in the Overhaul Procedure of this manual.

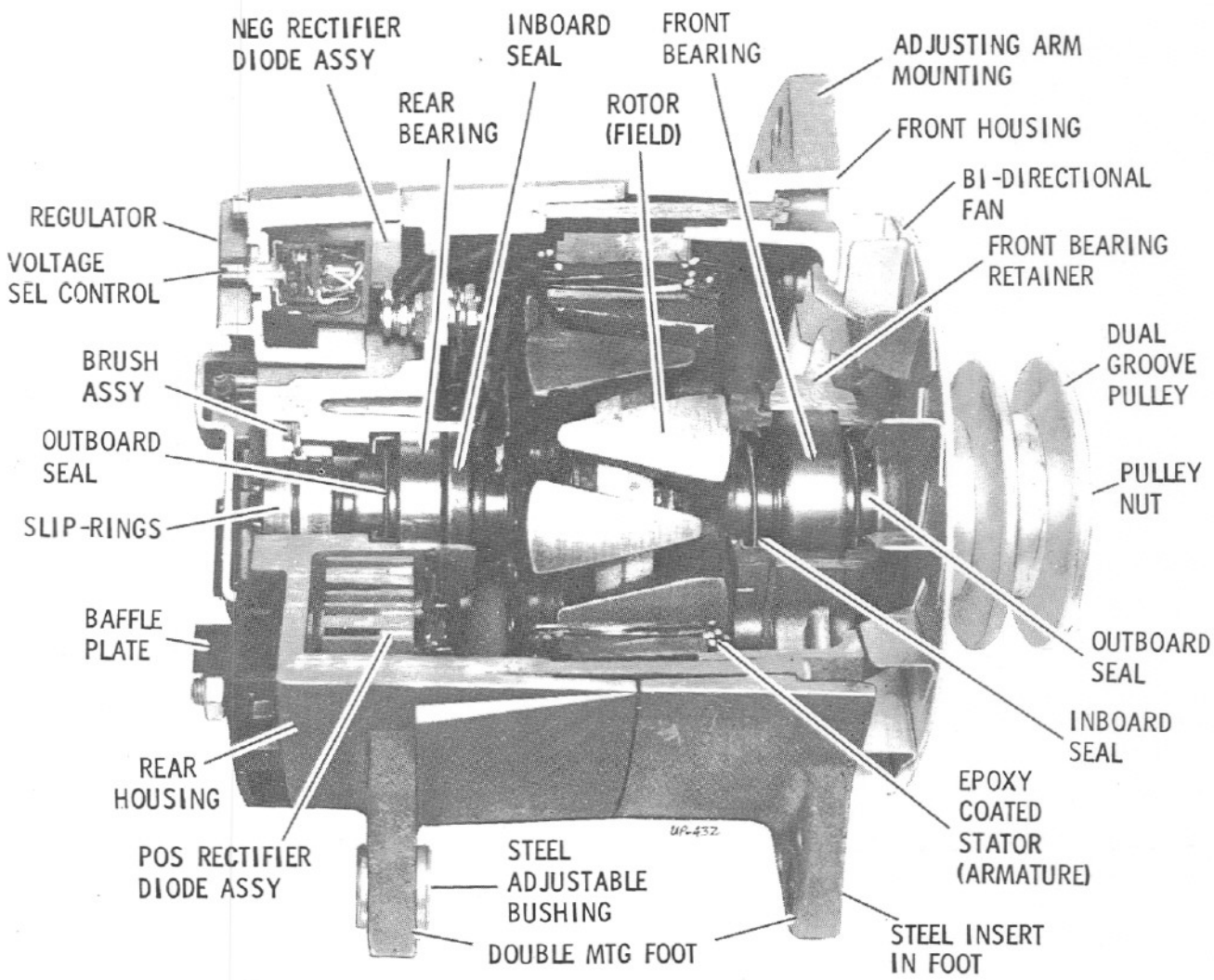


FIG. 1 CUTAWAY VIEW OF TYP. ALT.

DESCRIPTION

MODEL TABLE

ALTERNATOR	VOLTS	AMPS	REGULATOR
8SC2001R	12	88	8RL2003
8SC2004Z	12	160	8RL2003
8SC3002U	24	100	8RL3004
8SC3003U	24	100	8RL3004
8SC3005V	24	120	8RL3004
8SC4006U	32	100	8RL4005

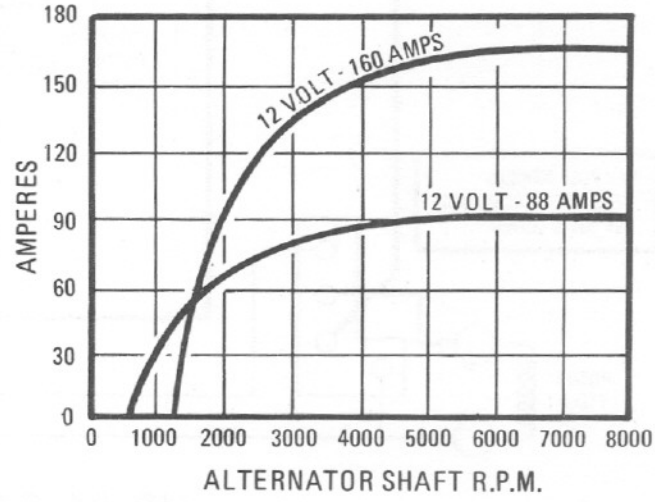
ALTERNATOR

The alternator design utilizes a 2-piece aluminum alloy housing reinforced at stress points for maximum strength and minimum weight, Figure 1. Total weight of the unit, minus drive pulley, is less than 25 pounds.

A 16 pole, dynamically balanced rotor (concentric field) provides smooth operation and has a current draw of approximately 2.4 amps. The 3-phase stator is epoxy-coated for superior insulation and improved durability. Three A.C. stator phase taps are available for use with alternating current activated instruments and other applications. The brush assembly can easily be removed with ordinary hand tools when inspection or replacement is required.

A heavy-duty bearing system provides separate outboard seals on both sides of the front and rear bearings. This design allows for an additional amount of lubrication which is essential for long service life. Unit cooling is provided by a bi-directional fan, making the unit operable in both clockwise and counterclockwise applications. Pulleys are a slip-fit on the shaft, positioned with a Woodruff key and secured by a lockwasher and hex nut. Maximum unit ambient temperature rating is -50°F to 212°F under continuous operating conditions.

The schematic diagram of the alternators is illustrated in Figure 3. Twelve rectifier diodes (6 positive and 6 negative) are connected to the stator in a 3-phase, full wave bridge configuration. The field diode assembly consists of three diodes connected to the stator terminals to supply regulator power and field current after initial excitation. Rated alternator output currents are achieved at approximately 6,000 rpm shaft speed, Figure 2.



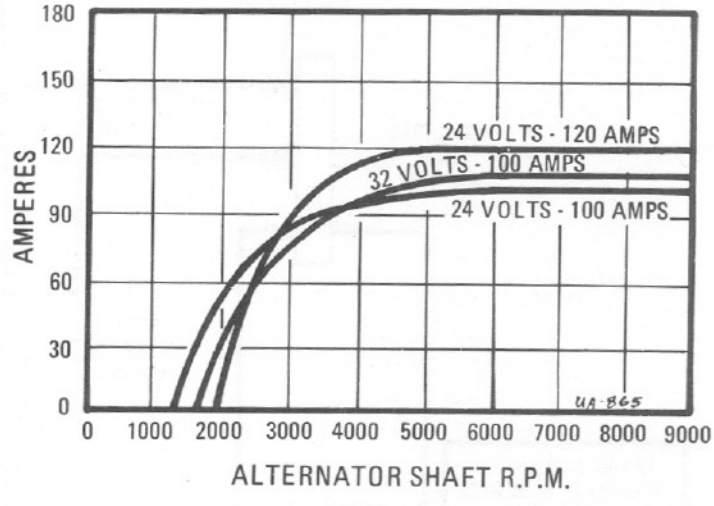
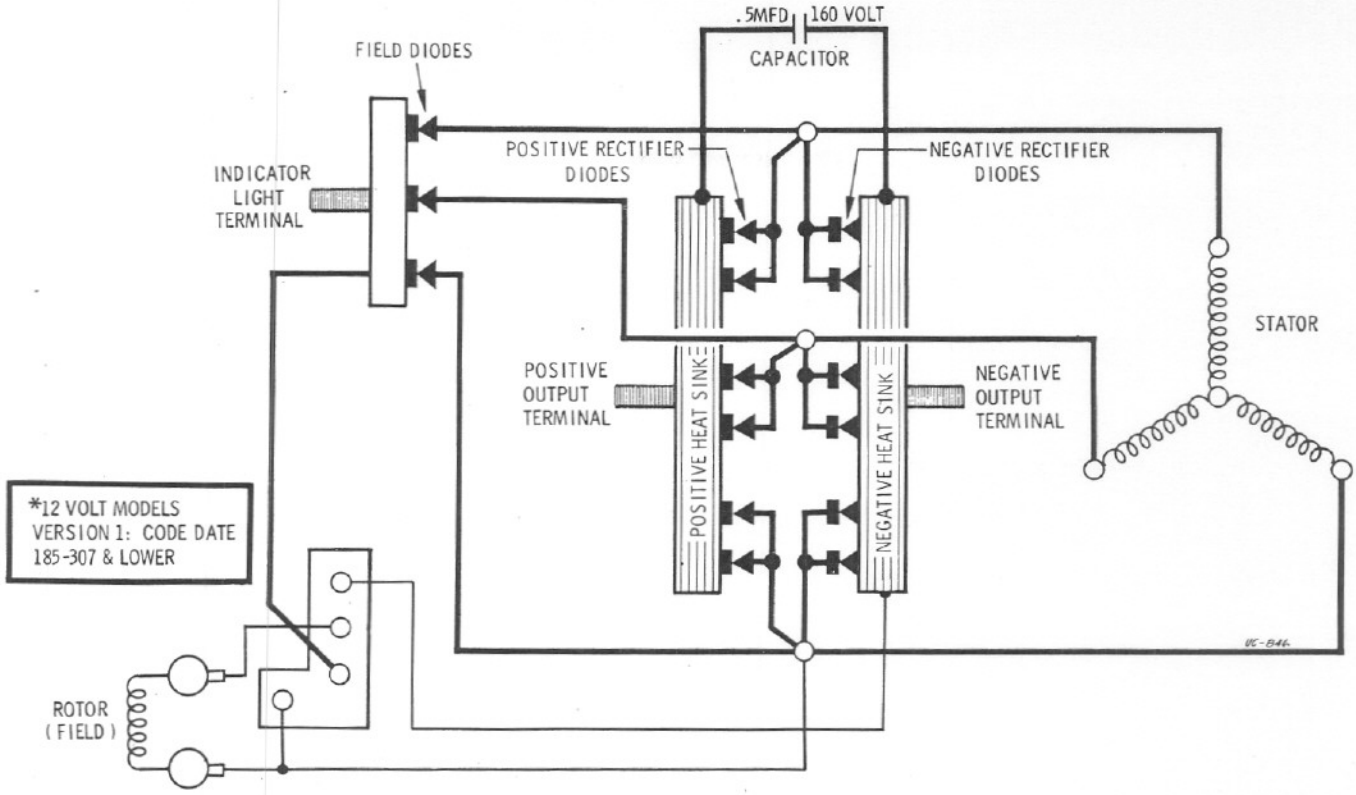
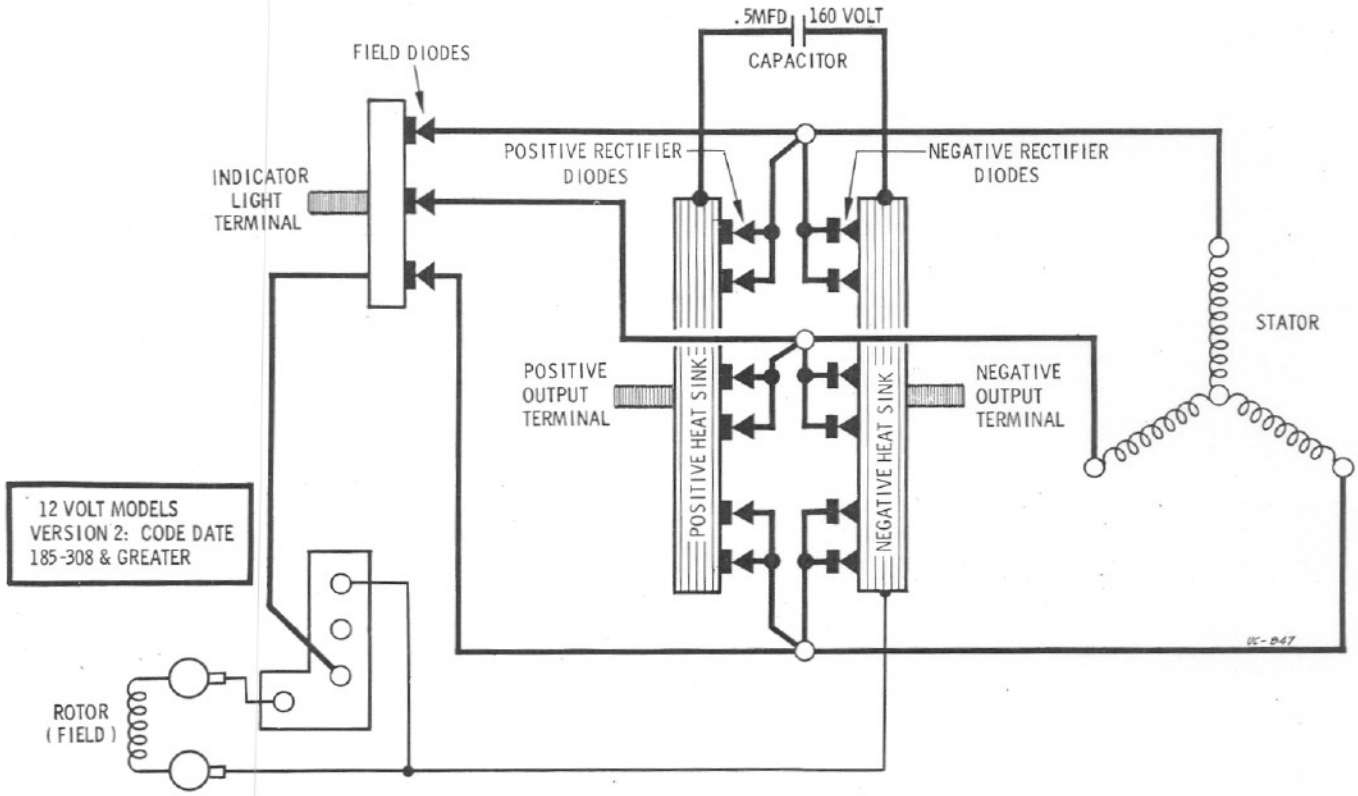


FIG. 2 TYPICAL OUTPUT CURVES AMBIENT TEMPERATURE: 75°F (23.8°C)



*12, 24, & 32 VOLT MODELS



12 VOLT MODELS

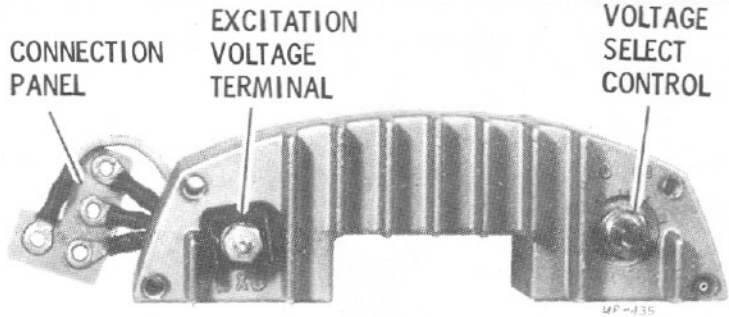
FIG. 3 ALTERNATOR SCHEMATIC DIAGRAMS

VOLTAGE REGULATOR

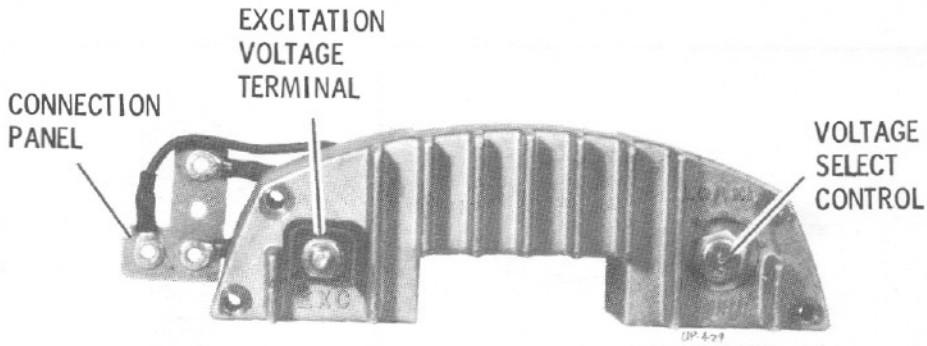
The voltage regulator is an electronic switching device with an external voltage adjusting switch. Five voltage select positions allow the technician to set the system's charging voltage (12 volt models: 13.2 to 14.4 volts, 24 volt models: 26.8 to 29.2 volts, and 32 volt models: 36.6 to 40.2 volts; see Figure 4 for location of voltage control. The regulator incorporates additional circuits for protection from damage due to voltage transients and from temporary loss of the battery circuit while the unit is charging (load dumping).

The voltage regulator assembly consists of two basic circuit sections: the voltage control circuit and the field switching circuit. The assembly is encased in a die-cast housing and is protected from vibration and moisture damage by epoxy encapsulation, Figure 4. Version 1 regulators utilize transistor/SCR circuitry, while version 2 units are thick-film type transistor circuits.

The voltage control circuit consists of a zener diode and driver switching transistor which constantly monitors system voltage level. The driver in turn controls operation of the field switching circuit which is composed of an SCR (version 1) or transistor (version 2) in series with the rotor field winding. When system voltage tends to drop (below zener "firing" voltage), the driver turns on the field switching circuit which then energizes the field winding to increase the system output. Conversely, when system voltage rises (to zener "firing" potential), the driver turns off the field switching circuit causing the field current to decrease, thus reducing the system output. This switching action occurs at a very rapid rate (up to several thousand times a second) and therefore maintains a constant voltage on the system.



12 (VERSION 1) / 24 / 32 VOLT REGULATOR



12 VOLT (VERSION 2) REGULATOR

FIG. 4 INTEGRAL REGULATOR

ALTERNATOR EXCITATION

A separate "EXCITATION" terminal is provided at the voltage regulator for controlled excitation or initiation of charge. This simple circuit requires the input from the POSITIVE battery terminal for excitation.

In a negative ground system, where the insulated circuit of the vehicle is positive, any two-terminal switch may be used to apply power to the excitation terminal, as shown in Figure 5.

A positive ground installation, where the insulated circuit is negative, requires a different switching system, since a positive potential is necessary for excitation. Figure 6 explains how two common devices may be applied to the positive ground system.

The system using the optional charge indicator lamp, as shown in Figure 7, provides the regulator with increased excitation current in addition to charge indication. When using an indicator lamp, in 24/32 volt systems, the appropriate Resistor Kit must be connected as shown in Figure 7.

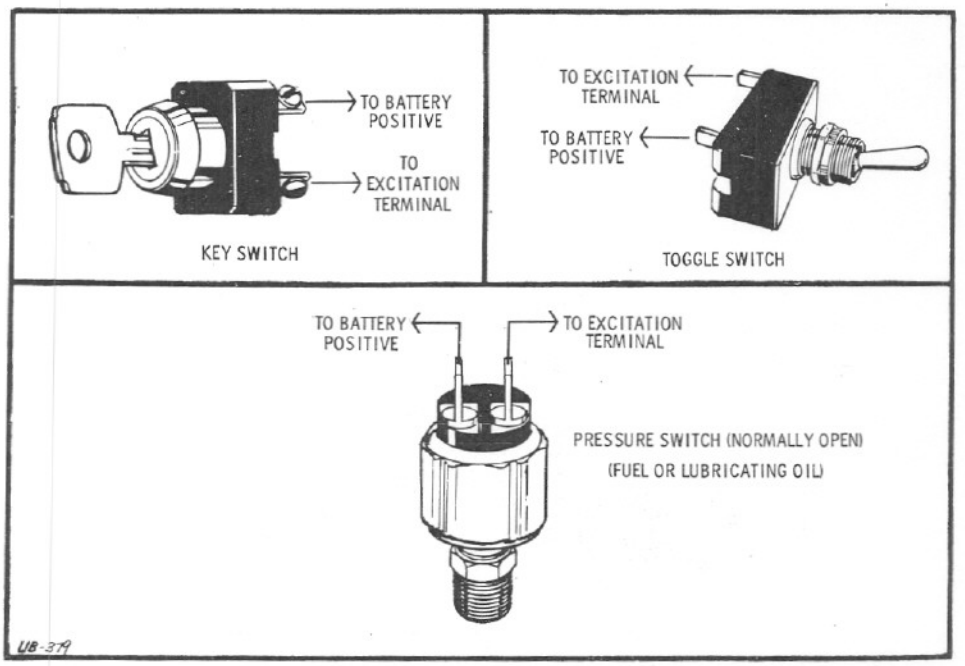


FIG. 5 EXCITATION SWITCHES, NEGATIVE GROUND SYSTEMS

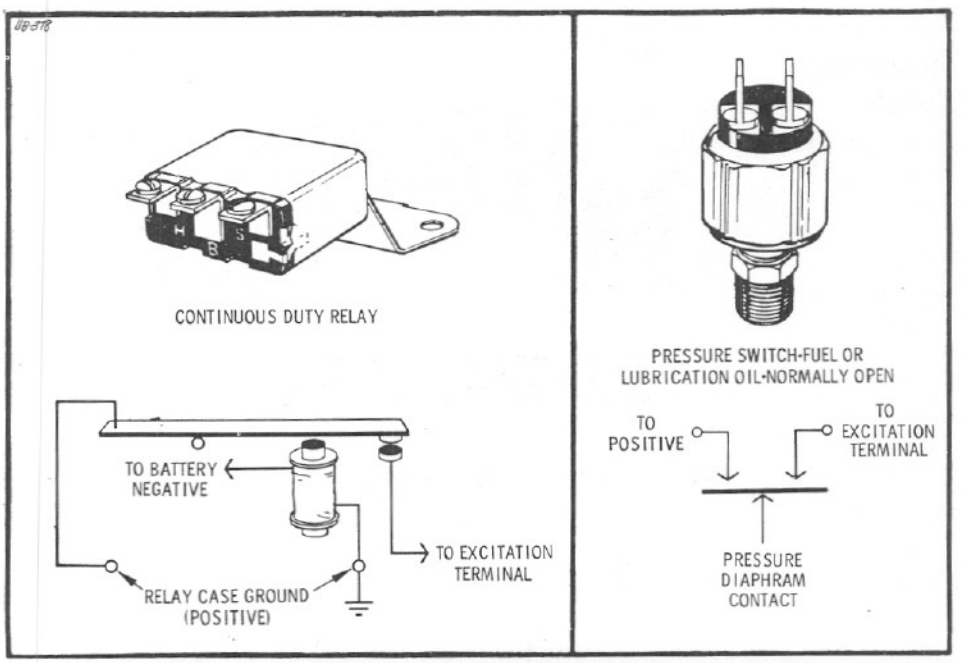
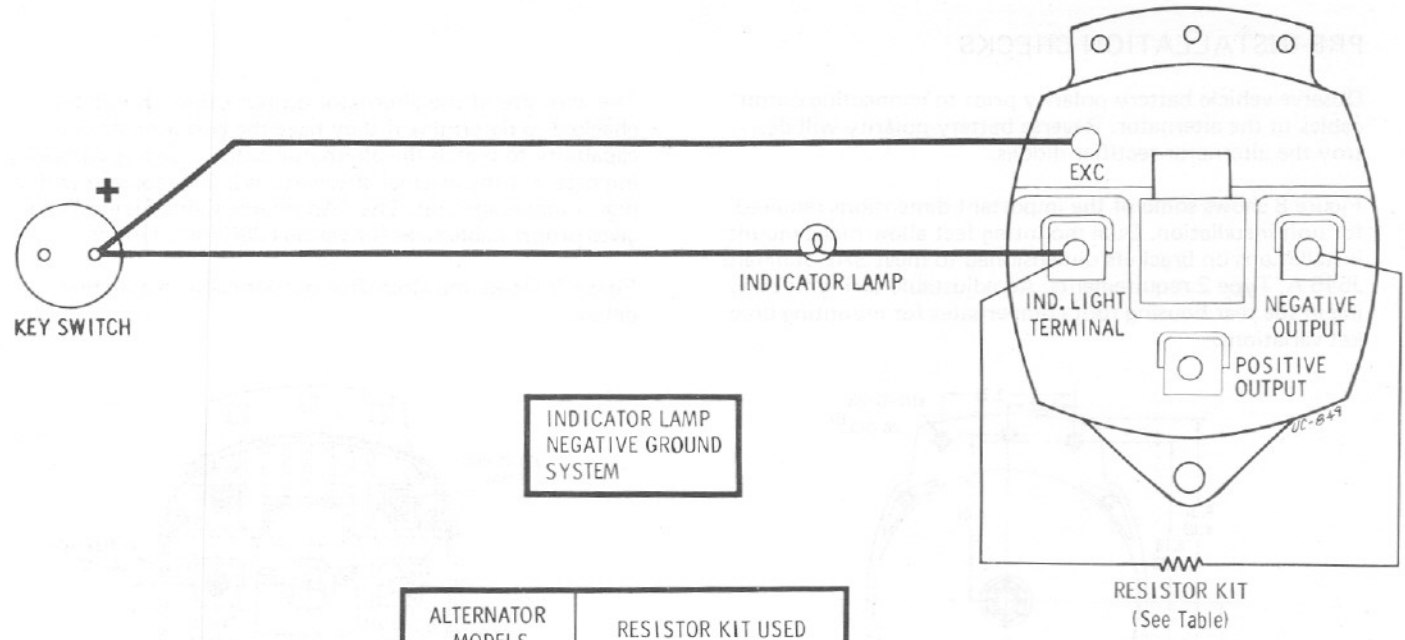
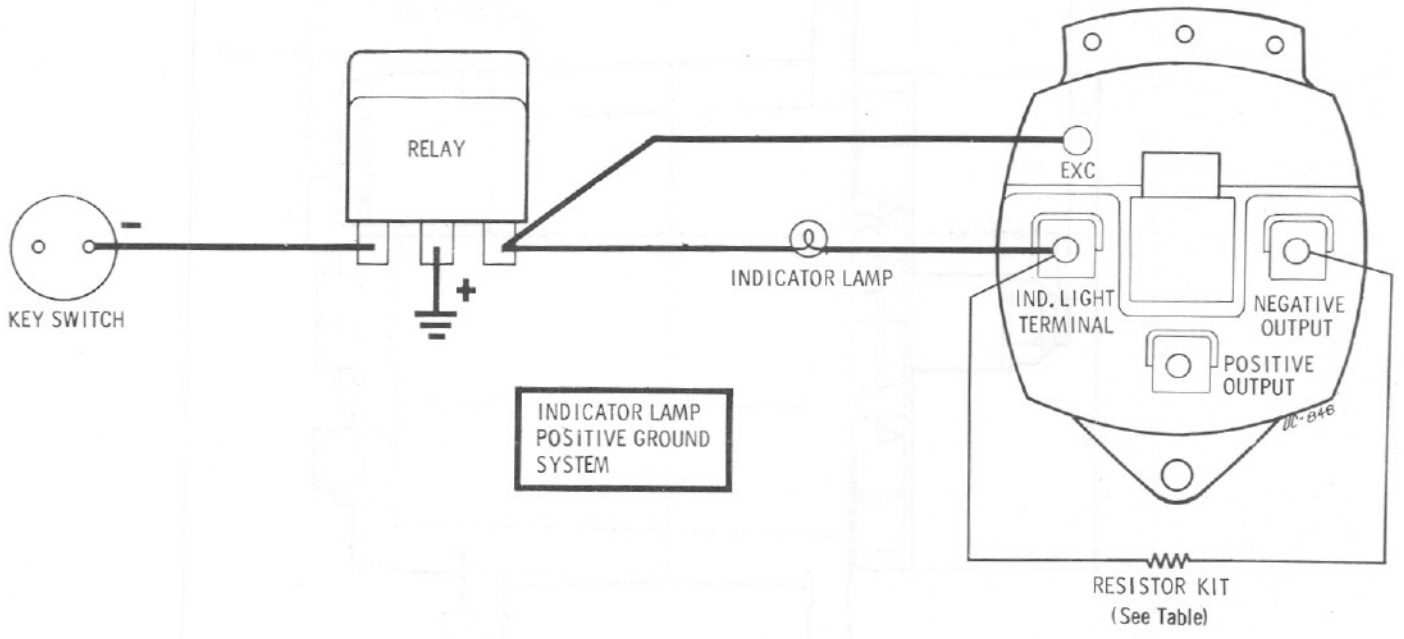


FIG. 6 EXCITATION SWITCHES,POSITIVE GROUND SYSTEMS



INDICATOR LAMP NEGATIVE GROUND SYSTEM

ALTERNATOR MODELS	RESISTOR KIT USED
8SC3002U 8SC3003U 8SC3005V	17-23 (47Ω 10% 25W) " "
8SC4006U	17-1 (75Ω 10% 25W)



INDICATOR LAMP POSITIVE GROUND SYSTEM

FIG. 7 INDICATOR LAMP CIRCUITS

INSTALLATION PROCEDURE

PRE-INSTALLATION CHECKS

Observe vehicle battery polarity prior to connecting output cables to the alternator. Reverse battery polarity will destroy the alternator rectifier diodes.

Figure 8 shows some of the important dimensions required for unit installation. Dual mounting feet allow hinge mount installations on brackets dimensioned to meet SAE standard J545-A, Type 2 requirements. An adjustable spring fit bushing in the rear housing foot compensates for mounting bracket variations.

The wire size of the alternator output cables should be checked to determine if they have the current carrying capability to match the alternator output. This is especially important if the original alternator is being replaced with a higher amperage unit. The "Alternator Cable Sizing Table" gives proper cable sizes for various 8SC installations.

Figure 9 shows the alternator output cable installation details.

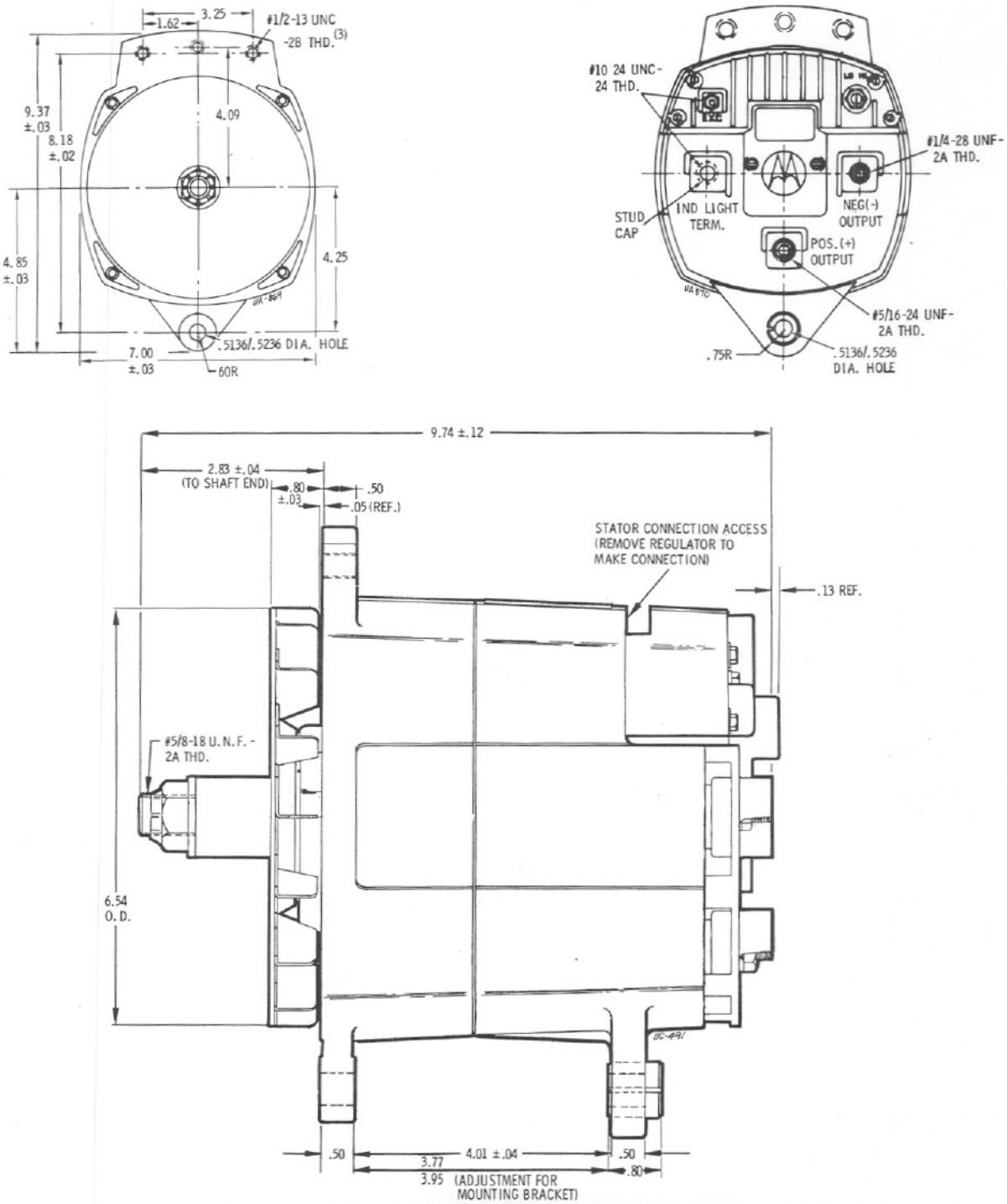


FIG. 8 ALTERNATOR MOUNTING DIMENSIONS

ALTERNATOR CABLE SIZING TABLE (HEAVY-DUTY)

TOTAL CABLE LENGTH - POS & NEG	12V-88AMP		24V-100AMP		32V-100AMP		24V-120AMP		12V-160AMP	
	*IDEAL	MIN*	*IDEAL	MIN*	*IDEAL	MIN*	*IDEAL	MIN*	*IDEAL	MIN*
1-5 ft.	8	10	8	10	10	10	8	10	6	8
5-10 ft.	6	8	6	8	8	10	6	8	2	4
10-20 ft.	2	4	4	6	6	8	4	6	00	2
20-30 ft.	1	2	2	4	4	6	2	4	NR*	0
30-40 ft.	0	1	0	2	2	6	0	2	NR*	00

*IDEAL — Cable size which would enable system to operate at maximum efficiency.

MIN — Minimum acceptable cable size which can be used with this system.

NR — Not recommended due to cable size and length.

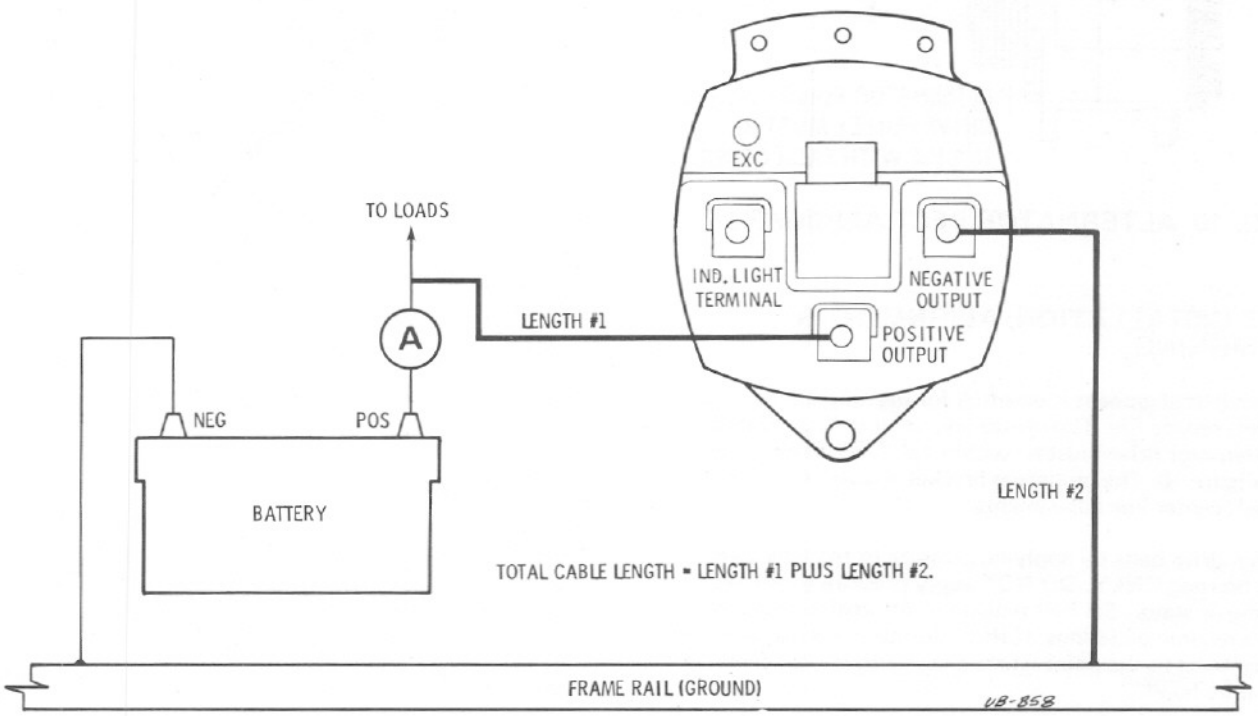


FIG. 9 TYPICAL ALTERNATOR CABLE INSTALLATION DIAGRAM (NEG. GRD.)

ALTERNATOR MOUNTING REQUIREMENTS

The requirements of the alternator mechanical installation are several: (1) solid, vibration-free attachment of the mounting bracket to the engine and alternator to the mounting bracket, (2) correct belt alignment, and (3) protection from road spray, or marine water spray and from engine exhaust system heat.

For a vibration-free solid mounting of the alternator to the engine, the mounting bracket must provide rigid support for the unit. The mounting bracket should be made of cast or malleable iron because of its high strength in compression and its vibration dampening qualities. Large radius, ribs and gussets should be used on bends or long brackets. Short thick sections with the minimum amount of overhang provides much better support then a long thin section. When mounting the bracket to the engine, keep the mounting hole spacing configuration as wide as possible and use HARDENED WASHERS over any slotted holes.

The adjusting strap should lie FLAT against the alternators mounting surface. The strap should be at least 1/4" to 3/8" thick and should be as short and straight as possible. If bends are needed for an offset mounting, gussets or ribs should be used to strengthen the bend areas. A long, bent or offset, strap may resonate and cause a severe vibration problem. Slot length for the mounting adjustment bolt should be kept to a minimum. A large slot is a stress concentration in the bracket, causing a weaker section which could fail.

The adjusting strap mounting bolts should have a large flat washer and lockwasher under it. The flat washer helps transmit the different loads to the bracket and gives a full flat surface to mate with the lockwasher and bolt.

Hardened steel flat washers should be substituted for spring lockwashers on bracket and alternator as mounting hardware. Flat washers tend to provide and retain greater surface tension while lockwashers, under vibration, wear the metal away and lose their locking ability. Lockwashers should be used against STEEL SURFACES.

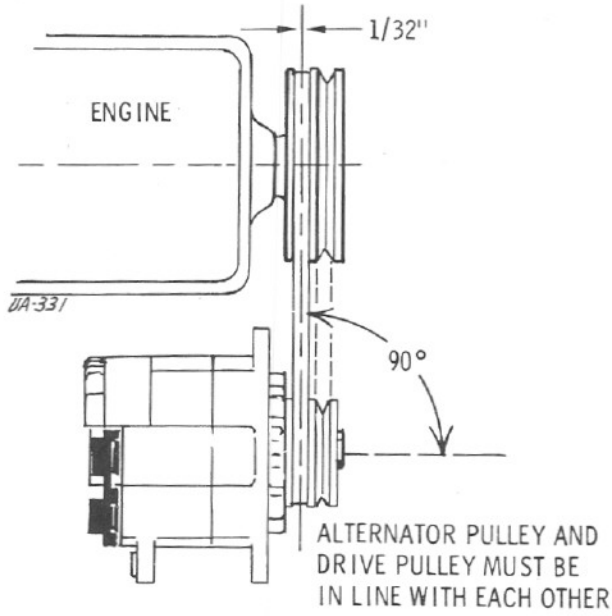


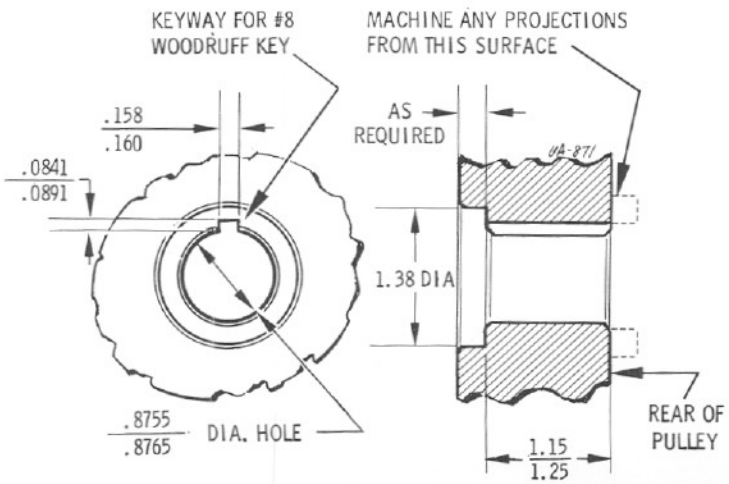
FIG. 10 ALTERNATOR BELT ALIGNMENT

BELT INSTALLATION, ALIGNMENT & TENSIONING

Correct belt alignment is essential for maximum alternator and belt service life. The center line of all pulleys related to the alternator drive must be within 1/32" of the true center line, Figure 10. The mounting bracket should allow for minor belt center line adjustments.

Tighten drive belts by applying pressure to the alternator front housing ONLY. DO NOT apply pressure to the rear housing or stator. Set belt tension to the engine manufacturer's recommendations. If this information is not available, tighten belts to the point where the alternator fan cannot be turned by hand.

Paired dual belts are recommended for heavy-duty alternators. Best results are obtained if the belts wrap the alternator pulley at least 100°. Lesser wraps induce belt slipping, belt and pulley wear and overheating of the front alternator bearing, Figure 11. A slipping belt will not drive the alternator to full output, eventually leading to battery discharge problems.



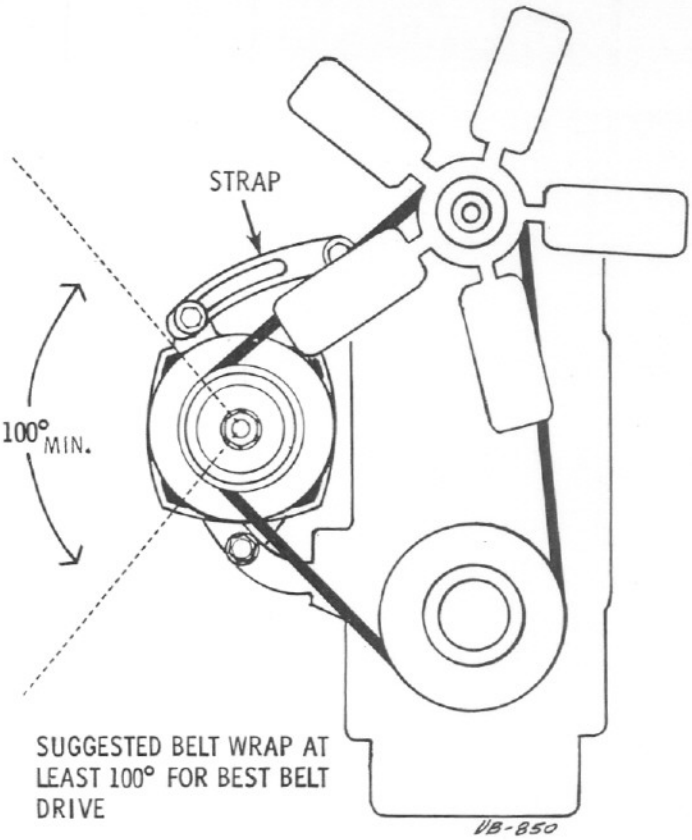


FIG. 11 ALTERNATOR BELT INSTALLATION

PULLEY RATIO

The ratio of the diameter of the alternator pulley and the drive pulley will determine the RPM of the alternator for a given engine speed. Correct pulley selection will permit the alternator to produce an acceptable current output at idle, yet, will not allow alternator overspeed at top engine operating RPM. Excess alternator speed over 8,000 RPM **will shorten bearing life.**

Figure 12 shows the dimensional detail for machining other pulleys to fit the Motorola rotor shaft. Consult your Motorola Distributor for information on pulleys and mounting brackets.

Tighten pulley nut to 40 - 50 foot pounds.

$$\frac{\text{ENG. PULLEY DIA.}}{\text{ALT. PULLEY DIA.}} \times \text{ENG RPM} = \text{ALT RPM}$$

FIG. 12 PULLEY DIMENSIONAL DETAIL

AMMETER

Ammeter requirements vary with application. An original equipment ammeter may be difficult to replace with a higher reading unit, due to limited panel space and the vehicle wiring system. For an ammeter to show alternator charge and accessory discharge, it must be connected as shown in Figure 13.

An accessory ammeter may be used if it provides 100-0-100 scale information. Such meters are available in two types: direct reading, and external shunt types. Internal shunt (direct reading) ammeters are not usually recommended for charging systems of high output capability due to the long heavy gauge wiring required. Failure to provide adequate wiring will result in poor system performance. Figure 14 explains their application and features.

All connections must be clean and tight, using terminal hardware capable of carrying the electrical load and physical stresses imposed by the installation.

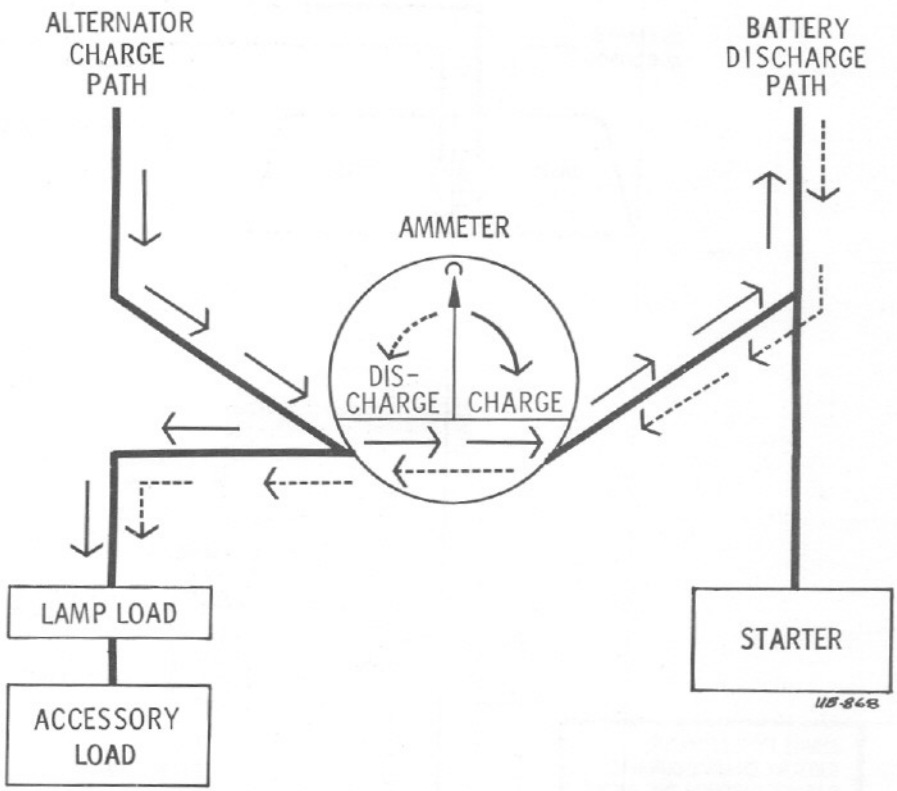
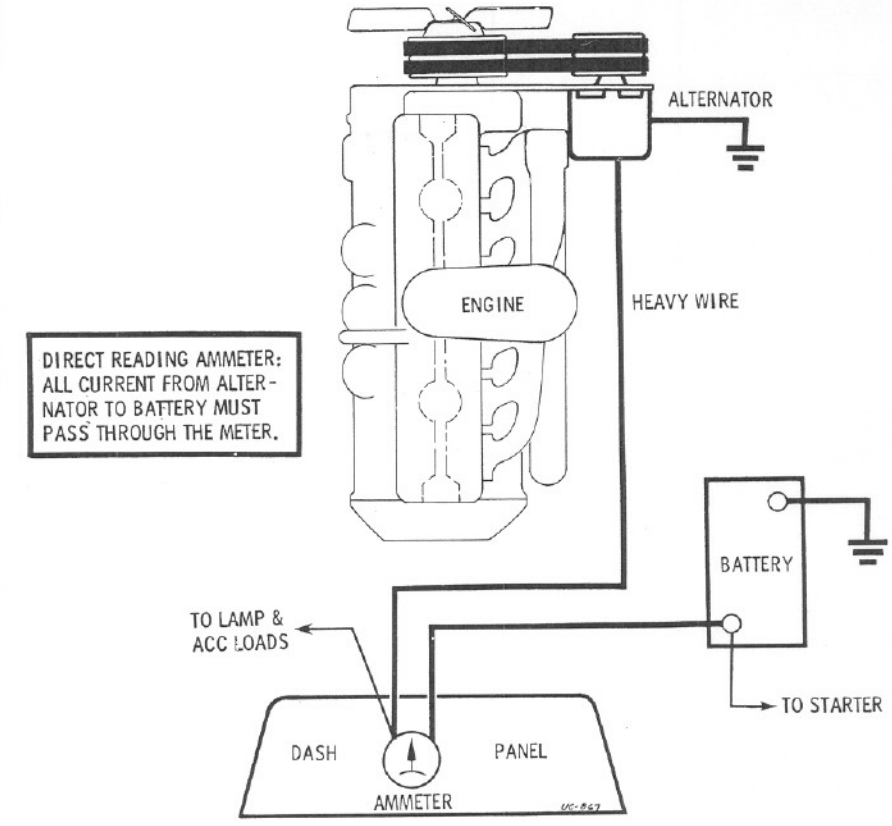


FIG. 13 AMMETER CHARGE & DISCHARGE CIRCUIT



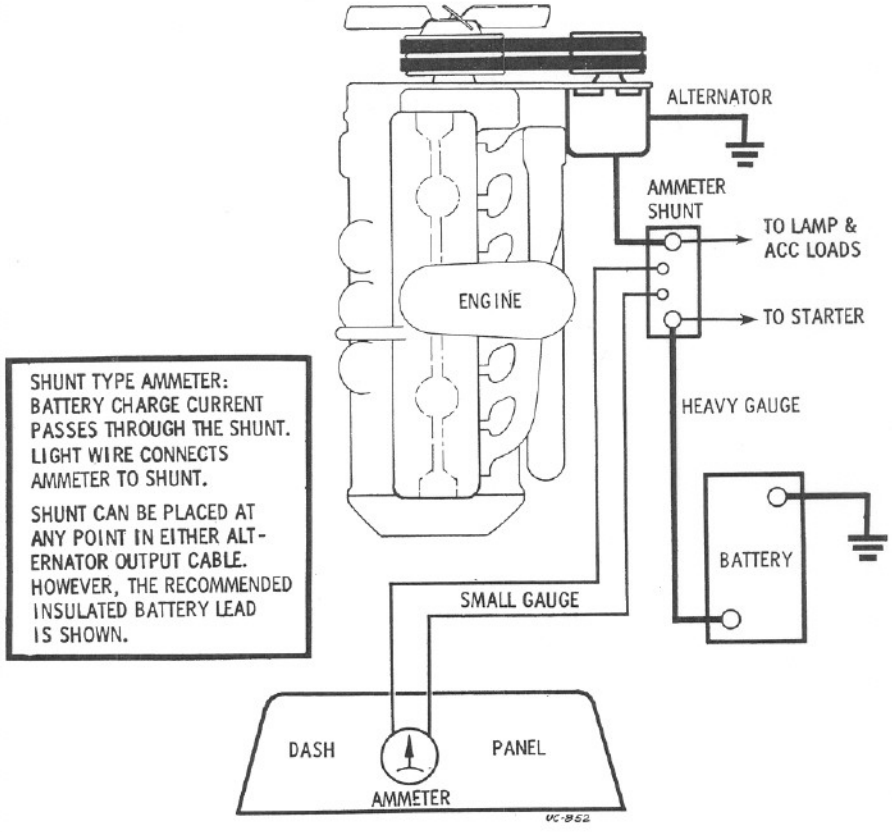


FIG. 14 ALTERNATOR & AMMETER INTERWIRING DIAGRAMS

ALTERNATOR / REGULATOR TEST PROCEDURE

GENERAL

This test procedure is applicable to negative or positive ground engine applications. The only major difference concerns the alternator excitation procedure and the observence of polarity when connecting test meters to the system.

Alternators and regulators should be tested on the vehicle, using circuit conductors and accessories that are a permanent part of the system. In-vehicle unit testing will then provide the technician with an operational test of the alternator or the voltage regulator. Pre-overhaul testing will advise the depth of needed repairs. Final pre-installation testing will prove the unit is restored to it's original operating condition.

Before actual in-vehicle testing commences, the charging system and battery must be checked to eliminate possible problems. All cables between the battery, starter and engine ground must be equal to or better in wire size than those listed in the chart on page 9. Wires and cables must be free of corrosion at points of junction. Heavy cables must be supported to reduce strain on battery posts.

All leads, junctions, switches and panel instruments that are directly related to the charging circuit must be in good condition. Connections for motor driven test fixtures should follow equipment manufacturers instructions for insulated ground alternators except:

A. The voltage regulator must be connected to the alternator circuit.
B. Connect 12, 24, or 32 volt positive lead to regulator excitation terminal.

TEST EQUIPMENT REQUIREMENTS

The Alternator and Regulator tests outlined require electrical test equipment to measure voltage, current and resistance. Individual meters are indicated, however, most commercial test equipment incorporates several testing devices in a single unit.

DC VOLTMETER: 0-20 & 0-50 Volt Scales.
DC AMMETER: 0-200 Amp for Alternator Output Tests.
OHMMETER: Any commercial type, like Simpson 260 or equivalent.
CARBON PILE: Sun Electric Y-20 or equivalent, variable from 0-200 Amp load.
BATTERY TEST EQUIPMENT: Any commercial type hydrometer, with temperature correction scale, or Motorola Electronic Battery Tester No. 7BT1181W.

STORAGE BATTERY

The vehicle storage battery circuit represents a continuous although variable electrical load to the alternator. If the circuit, positive or negative, is opened or broken while the alternator is charging, the loss of the battery will result in the charging voltage rising to unsafe levels.

High voltage may damage the alternator and regulator, as well as damage either electrical accessories and instruments.

BATTERY INSPECTION

The following table illustrates typical ranges of specific gravity for a cell in various states of charge. **THE BATTERY MUST BE AT LEAST 75% FULL CHARGE FOR EFFECTIVE ALTERNATOR TESTING.**

1.260 SP. GR. BATTERY	1.280 SP. GR. BATTERY	CHARGE STATE
1.260 Sp. Gr.	1.280 Sp. Gr.	100% Charged
1.230 Sp. Gr.	1.250 Sp. Gr.	75% Charged
1.200 Sp. Gr.	1.220 Sp. Gr.	50% Charged
1.170 Sp. Gr.	1.190 Sp. Gr.	25% Charged
1.140 Sp. Gr.	1.160 Sp. Gr.	Very Low Capacity
1.110 Sp. Gr.	1.130 Sp. Gr.	Discharged

For a fast, reliable battery check, use the Motorola Electronic Battery Tester No. 7BT1181W available at your local distributor.

IN-VEHICLE ALTERNATOR TROUBLESHOOTING GUIDE

PROBLEM	PROBABLE CAUSES	CORRECTIVE ACTION
A. Battery undercharged —ammeter (if used) indicates constant discharge. —indicator lamp (if used) remains on.	1. Defective cables, dirty battery posts, corroded terminals, etc. 2. Excite lead broken. 3. Worn or broken brushes. 4. Defective alternator system. 5. Loose or broken belts.	1. Check, clean, repair or replace as as needed. 2. Check for continuity and repair. 3. Replace brush assy. 4. Refer to problem area determination section. 5. Check belts.
B. Battery overcharges —excessive use of water. —indicator lamp (if used) off or slight glow. —ammeter (if used) shows constant excessive charge.	1. Defective alternator system	1. Refer to problem area determination section.
C. Battery charges at idle, but discharges under load conditions.	1. Slipping belts. 2. Alternator defective.	1. Check belts and adjust tension, refer to alternator mounting requirements section of this manual. 2. Disassemble, check diodes.
D. Indicator lamp does not lite even with key on and engine stopped.	1. Defective bulb and/or harness. 2. Resistor Kit (if used) circuit defective Fig. 7. 3. Defective alternator system (version no. 2(12V), see Fig. 3).	1. Check and repair or replace. 2. Replace resistor or repair circuit. 3. Refer to problem area determination section.

PROBLEM AREA DETERMINATION SECTION

These tests are applicable to both positive and negative ground systems. The figures and text cover tests for a typical negative ground system.

CONDITIONS: Engine idling and Regulator Voltage Selector Switch Set to No. 3 (center) Position for Tests.

BATTERY UNDERCHARGED

1. Version No. 1 Regulator * – perform regulator test, see Figure 15.
2. Version No. 2 Regulator * – indicator lite on (if used)
   A. When indicator lite is on it indicates that the regulator is o.k.
   B. Perform field diode test, see Figure 17.
3. Version No. 2 Regulator * – indicator lite off or no lite used.
   A. Perform field diode test, see Figure 17.
   B. If field diode test o.k., perform open regulator test, see Figure 16.
4. Further investigation requires disassembly of system and checking of all components.

BATTERY OVERCHARGED

1. Version No. 1 Regulator * –
   A. Perform field diode test, see Figure 17.
   B. If field diode malfunction is indicated, the alternator must be disassembled for repair.
2. Version No. 1* & No. 2 * – shorted regulator; replace unit.

*VERSION 1 REGULATORS include 12(early), 24 & 32 volt models. Version 2 regulators include 12 volt models only. To determine regulator type, refer to Figure 4.

TEST NO. 1 – OPEN REGULATOR TEST

CONDITIONS: ENGINE IDLING – Remove regulator from alternator housing, leaving terminals connected. TAKE CARE NOT TO LAY REGULATOR ON ELECTRICAL TERMINALS.

VERSION NO. 1 REGULATOR – Connect jumper from field terminal on alternator terminal board to the negative terminal on the board, Figure 15.

VERSION NO. 2 REGULATOR – Connect jumper from positive output terminal on the alternator to the field terminal (grn. wire) on the alternator terminal board, Figure 16.

CONNECT VOLTMETER LEADS TO POSITIVE & NEGATIVE OUTPUT STUDS ON ALTERNATOR

IF VOLTMETER READING DURING THIS TEST IS:
12.0 Systems – 13.0 Volts or Greater,
24.0 Systems – 27.0 Volts or Greater,
32.0 Systems – 35.0 Volts or Greater,
THE REGULATOR IS OPEN AND SHOULD BE REPLACED.

TEST NO. 2 – FIELD DIODE TEST

CONDITIONS: ENGINE IDLING – Connect jumper from alternator positive output stud to indicator lite terminal, Figure 17. Connect voltmeter leads to alternator positive and negative output studs.

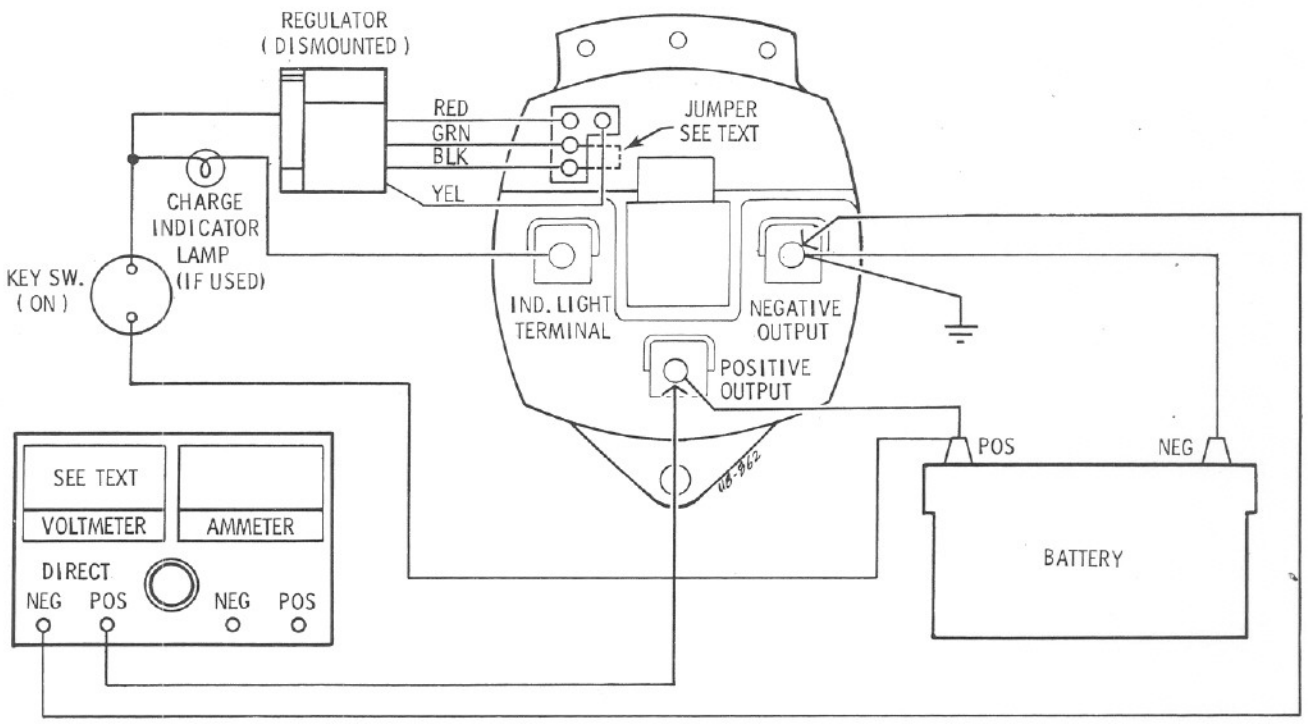


FIG. 15 VERSION 1 – OPEN REGULATOR TEST

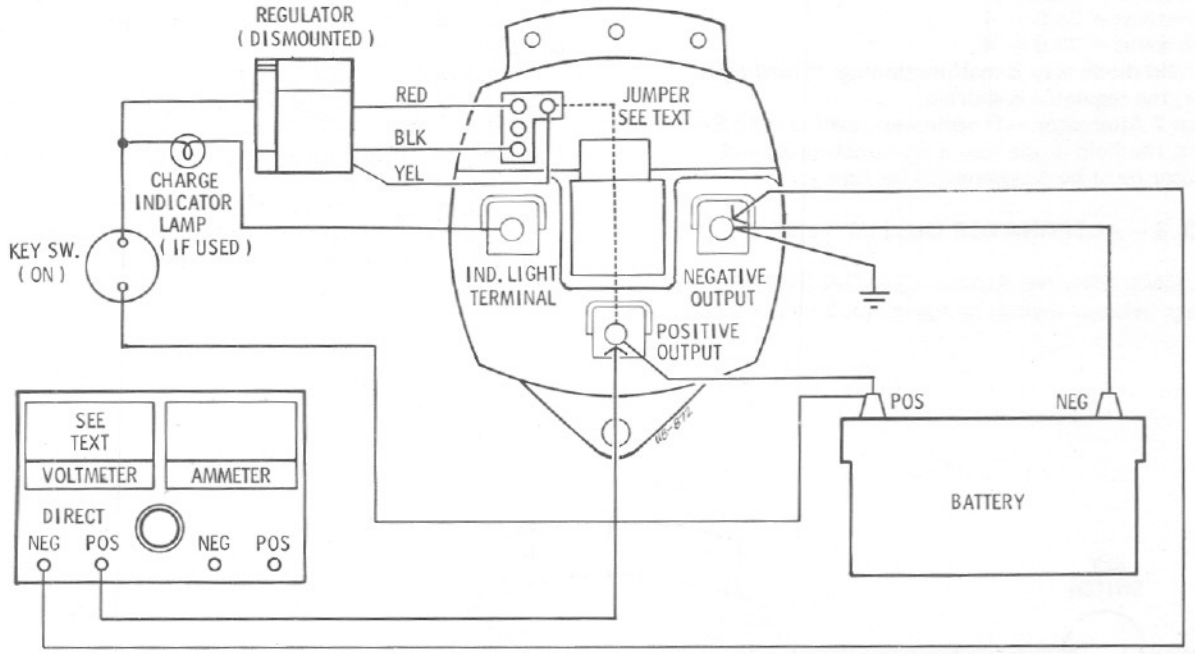


FIG. 16 VERSION 2 – OPEN REGULATOR TEST

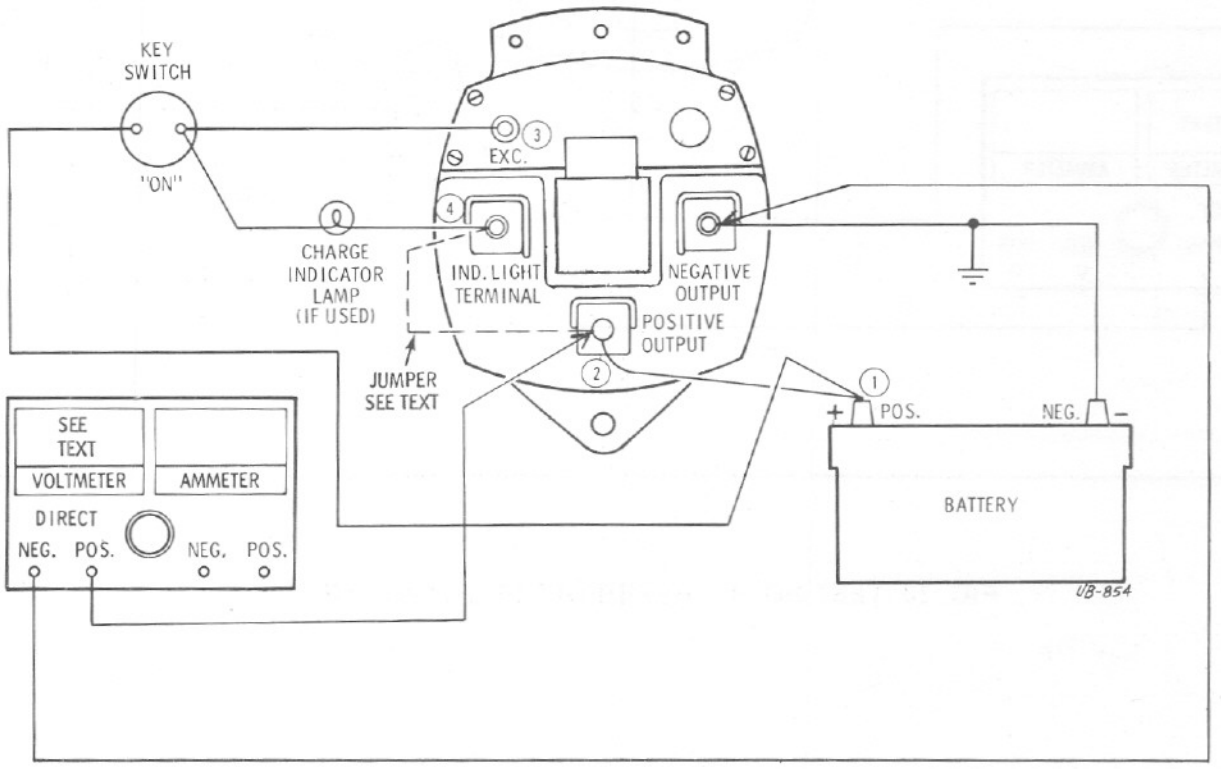


FIG. 17 TEST NO. 2 – FIELD DIODE TEST

1. Version 1 Alternator – If voltmeter reading is:
   12.0 Systems – 13.8 ± .3
   24.0 Systems – 28.0 ± .4
   32.0 Systems – 38.0 ± .4
   Then field diode assy is malfunctioning. If reading is greater, the regulator is shorted.
2. Version 2 Alternator – If voltmeter reading is 13.8 ± .3 volts, the field diode assy is malfunctioning and alternator must be disassembled for repair.

TEST NO. 3 – ALTERNATOR OUTPUT TEST

CONDITIONS: ENGINE RUNNING @ OPERATING RPM – Set Voltage Selector Switch on reg in No. 3 (center) position. Connect voltmeter leads to battery terminals, Figure 18. Run engine at operating RPM and turn on vehicle loads (lights, heater motor, etc.). The battery voltage should not go below:

12.0 Systems – 12.6 Volts
24.0 Systems – 25.2 Volts
32.0 Systems – 32.6 Volts

If voltage goes below these limits, the causes could be:

1. Slipping belts.
2. Pulley ratio incorrect (refer to installation section).
3. Alternator rating too small for vehicle loads.
4. Cable size incorrect (refer to cable sizing table in installation section).

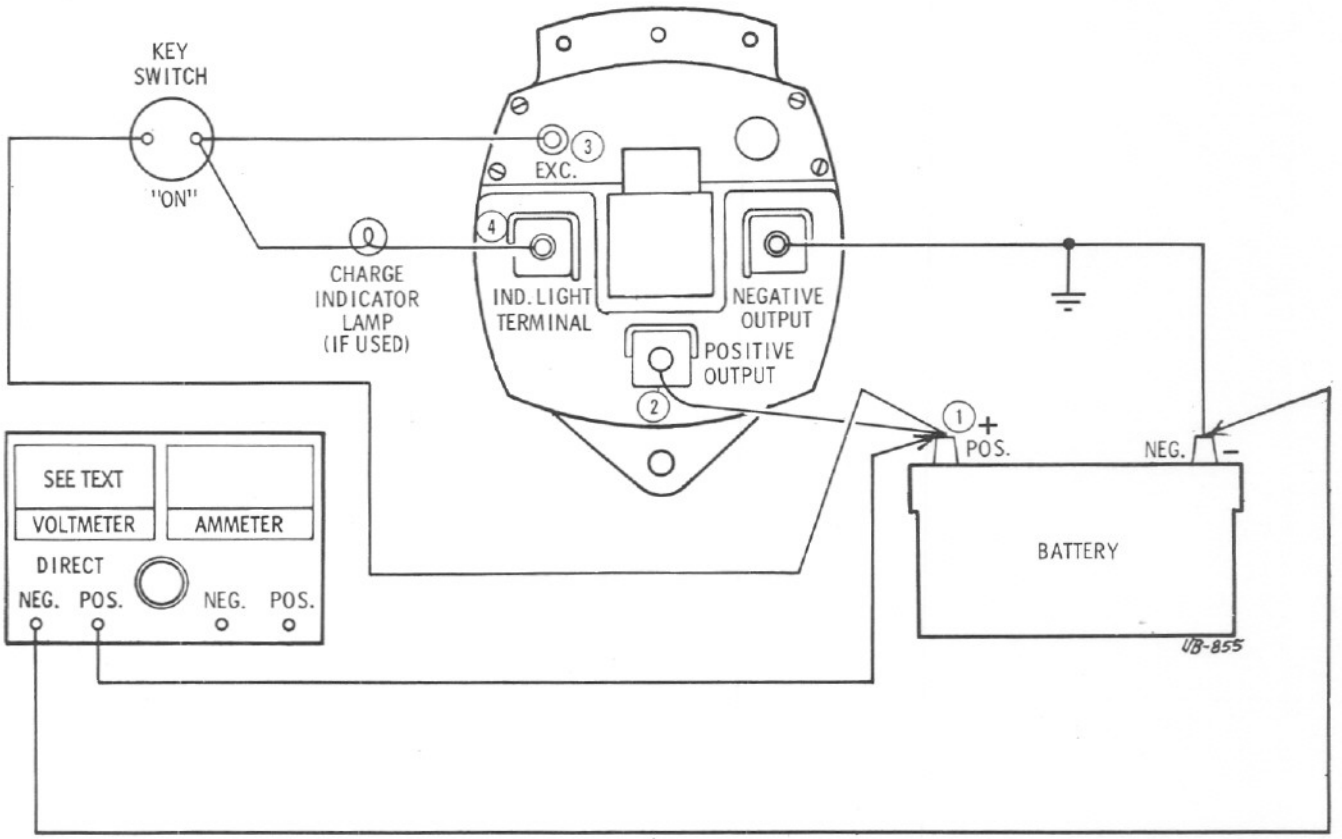


FIG. 18 TEST NO. 3 – ALTERNATOR OUTPUT TEST

DISASSEMBLY

REMOVE VOLTAGE REGULATOR ASSEMBLY

Remove four mounting screws from regulator, hold regulator away from rear housing; remove hex nuts and lockwashers from terminal board, detach regulator connecting panel, see Figure 19 for details.

Replace complete unit in the event of regulator malfunction.

BRUSH ASSEMBLY REMOVAL -

1. Remove two brush cover retaining screws.
2. Disconnect yellow and green leads from brush terminals.
3. Remove two brush assembly mounting screws, and then brush assembly, see Figure 20.

BRUSH INSPECTION & TESTING -

Figure 21 shows a dual terminal brush arrangement and testing procedure. Brush material is copper-graphite composition.

The original brush set may be reused if the brushes are 3/16" or longer, and if brushes are not oil soaked, cracked or show evidence of grooves on the sides of the brushes caused by vibration.

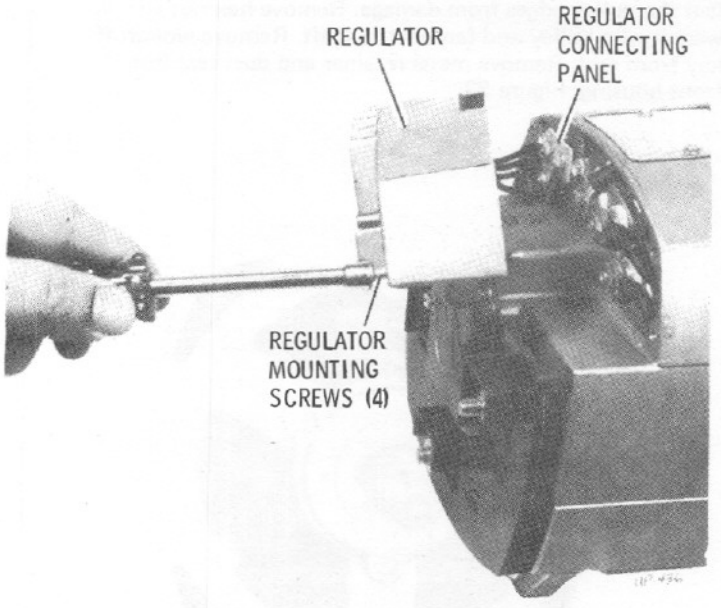


FIG. 19 REMOVAL OF VOLTAGE REGULATOR

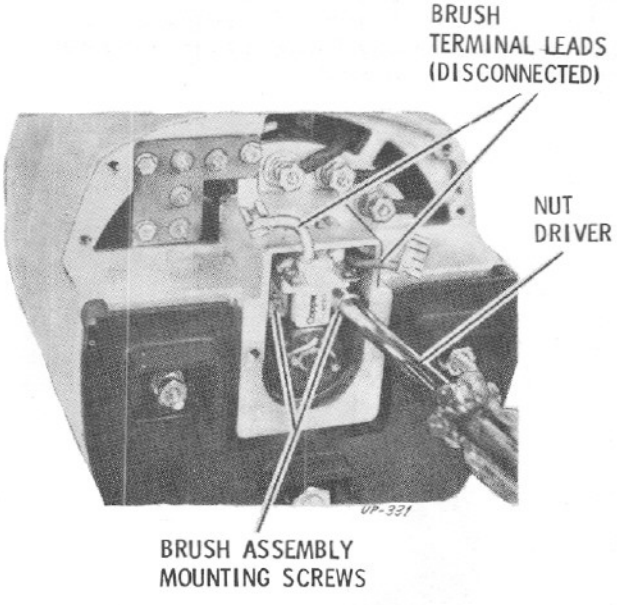


FIG. 20 BRUSH ASSEMBLY REMOVAL

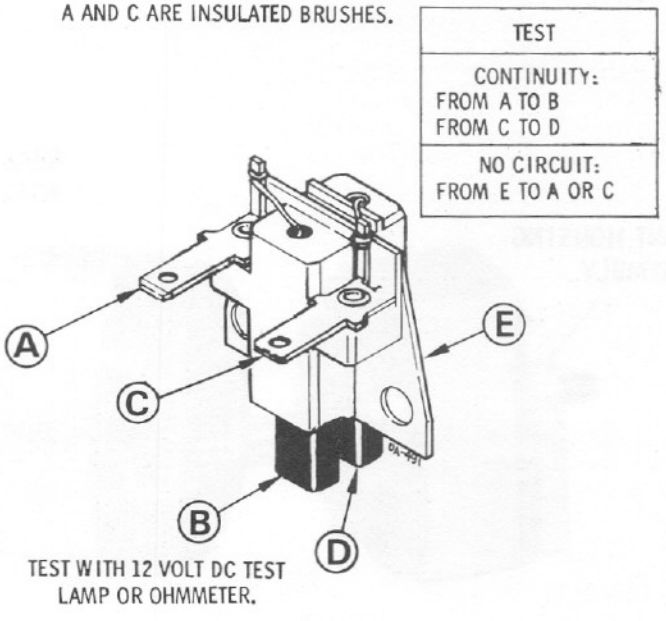


FIG. 21 DUAL TERMINAL BRUSH TEST

REMOVE PULLEY & FAN -
Clamp the pulley in a vise, using an old oversize belt to protect the pulley edges from damage. Remove hex nut and flat washer, slip pulley and fan off the shaft. Remove woodruff key from seat. Remove metal retainer and dust seal from front housing, Figure 22.

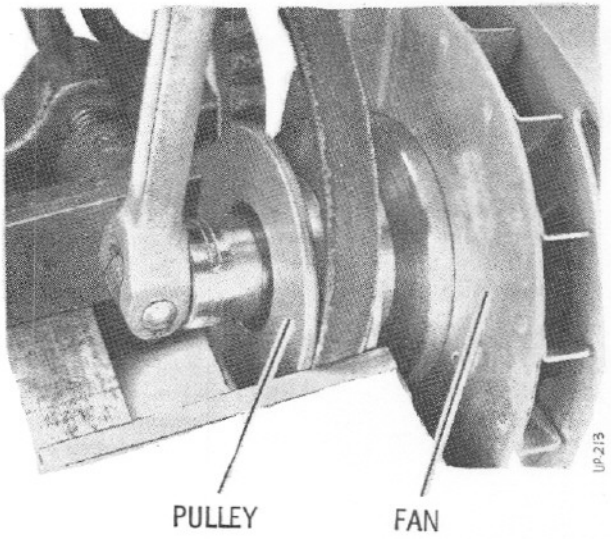


FIG. 22 PULLEY & FAN REMOVAL

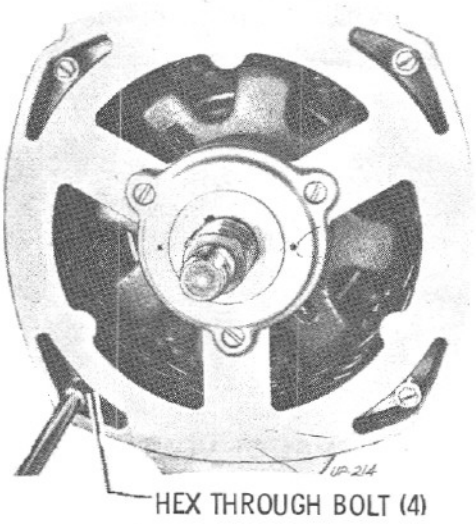


FIG. 23 REMOVAL OF THROUGH BOLTS

SEPARATE HOUSING -
Remove four through bolts Figure 23, separate the front and rear housings; with the rotor and front housing as one assembly and the stator and rear housing as another assembly, refer to Figure 24.

A wood dowel and hammer may be used to dislodge the stator if it tends to stick in the front housing; place the dowel on the lamination only, Figure 25 (front housing was removed for illustration purposes).

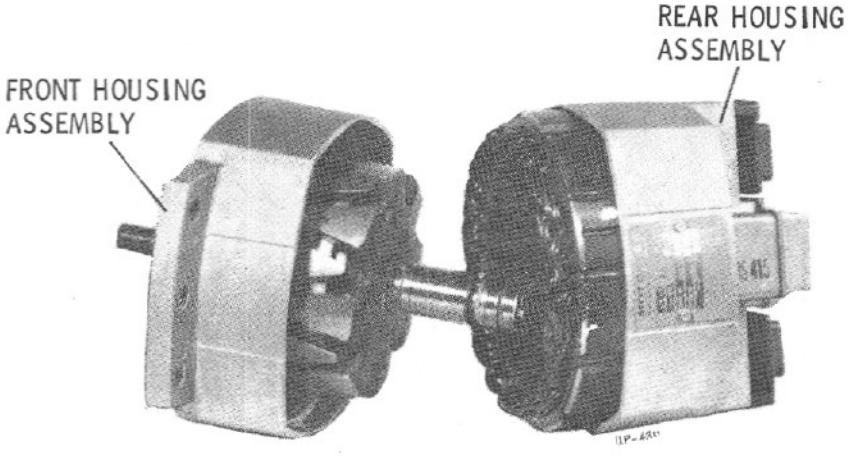


FIG. 24 HOUSING SEPARATION

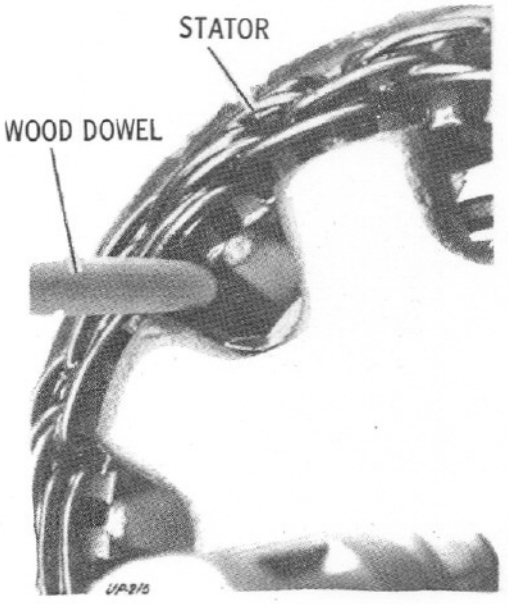


FIG. 25 DISLODGING STATOR USING DOWEL TOOL

REMOVE STATOR FROM REAR HOUSING -
Remove three hex nuts and lockwashers from A.C. terminals, straighten stator leads to pass through housing. Separate stator from the housing, see Figure 26.

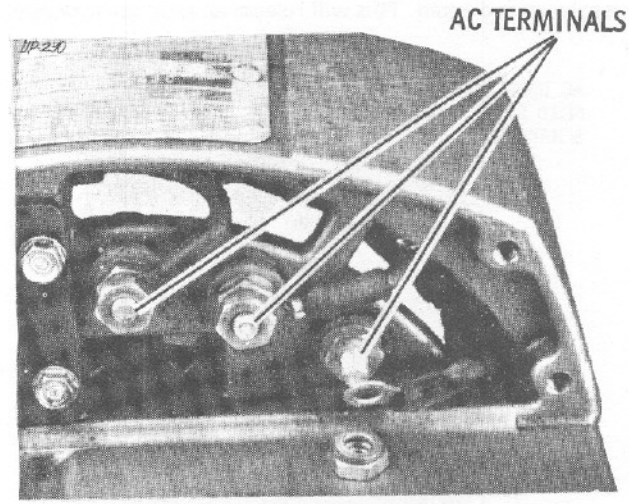


FIG. 26 STATOR LEAD REMOVAL

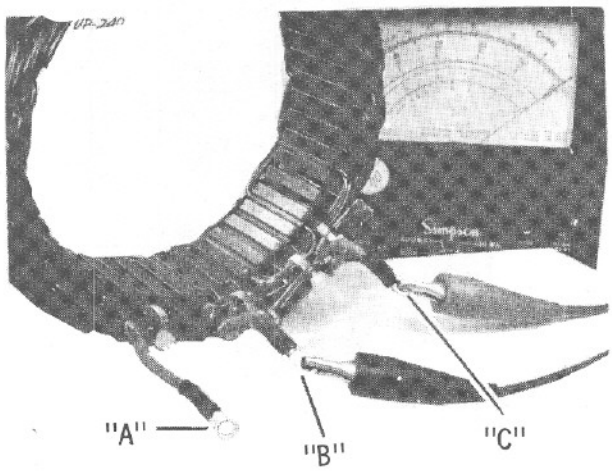


FIG. 27 STATOR WINDING CONTINUITY TEST

ELECTRICAL TESTING OF STATOR ASSEMBLY -
Using a VOM, test stator windings for continuity that should exist between terminals "A" and "B", "B" and "C", and "A" and "C", Figure 27. There should be no circuit between any winding and the laminations, Figure 28.

A 120 volt A.C. test lamp using a 25 watt bulb may be used for stator continuity and ground testing. Do not use this device where transistors or diodes are connected to the circuit being tested.

An obvious discoloration of the wire coating is evidence of overheating that may result in shorted coils or a grounded winding. If the stator is reused, clean with solvent, rinse with soap and water, and blow dry with low pressure compressed air.

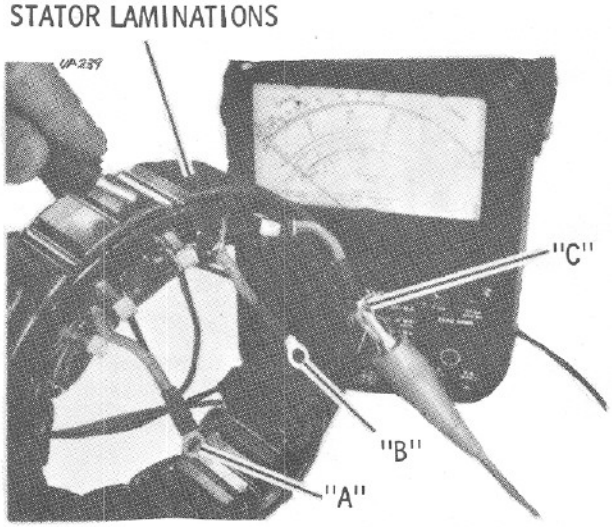


FIG. 28 STATOR WINDING GROUND TEST

REMOVE RECTIFIER DIODE & FIELD DIODE LEADS -

There are five connections related to this operation, remove hardware indicated. This will release all rectifier leads and regulator leads from the A.C. terminals as shown in Figure 29. Disconnect the capacitor lead from the positive heat sink and the terminal lead from the negative heat sink.

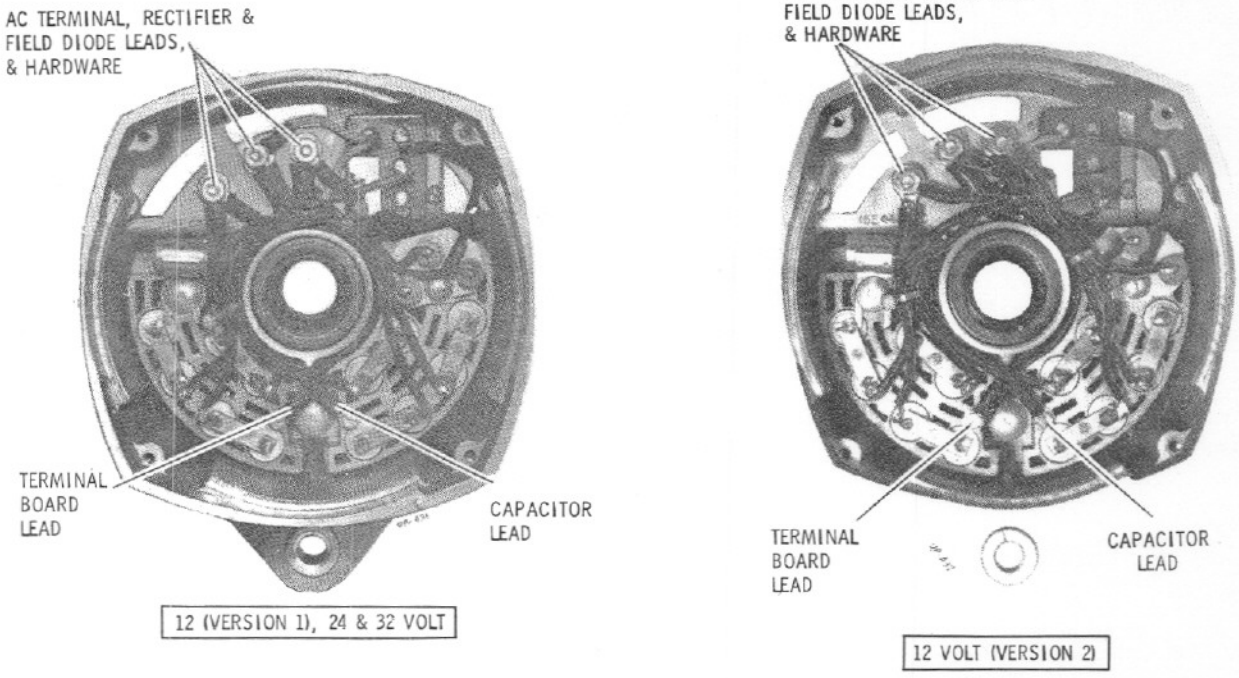


FIG. 29 RECTIFIER & FIELD DIODE LEAD REMOVAL

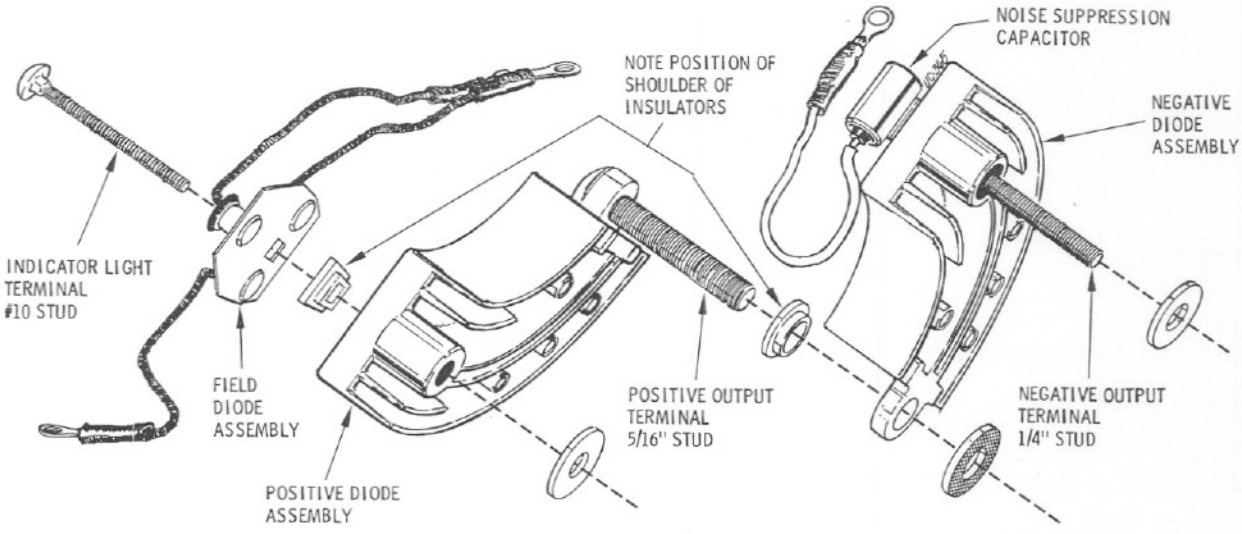


FIG. 30 REMOVING FIELD DIODE ASSEMBLY

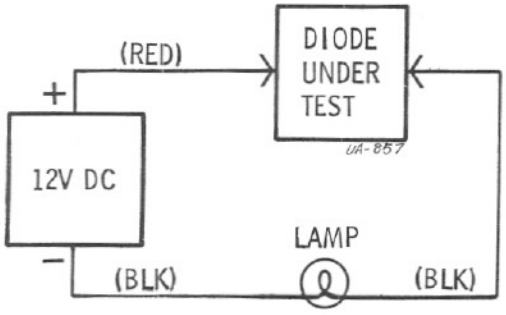


FIG. 31 TEST LAMP CIRCUIT

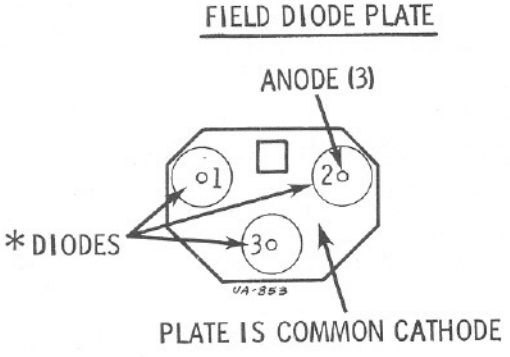
REMOVE FIELD DIODE ASSEMBLY -

Remove external hex nut and hardware from the indicator lamp/field diode assembly from the positive rectifier heat sink, Figure 30.

TEST FIELD DIODE ASSEMBLY -

Use diode tester, ohmmeter or 12 volt D.C. test lamp to test the diodes in this assembly, see Figures 31 & 32. All diodes should test alike. Replace the entire diode assembly if one diode tests open or shorted.

OHMMETER/LAMP LEAD PLACEMENT RED(+)	BLACK(-)	OHMMETER RANGE	READING	LAMP ON	OFF
Anode	Cathode	RX1	5-15ohm	X	
Cathode	Anode	RX100	Infinity		X



* REPEAT TEST FOR ALL 3 DIODES

FIG. 32 FIELD DIODE TEST

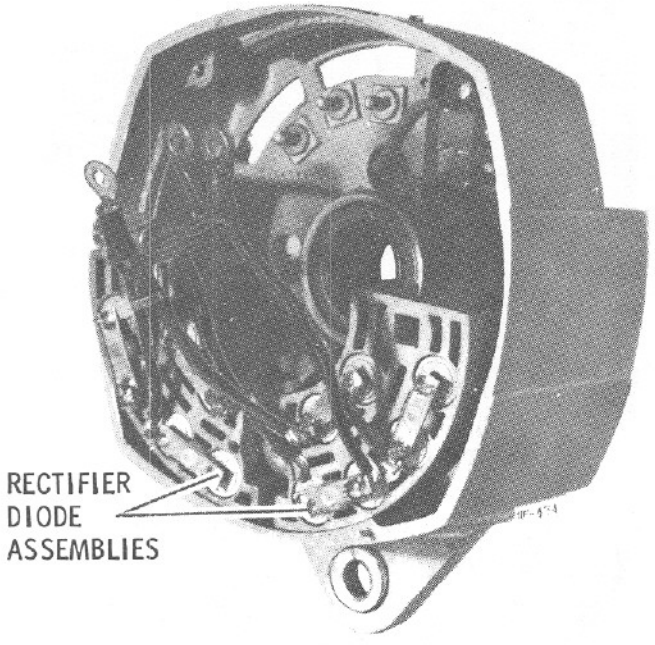


FIG. 34 TYPICAL REMOVAL OF RECTIFIER DIODE ASSEMBLY

REMOVE RECTIFIER DIODE ASSEMBLIES - Remove hex nuts and washers from the positive and negative output terminals, then remove baffle plate per Figure 33. Lift both rectifier diode assemblies from the alternator rear housing, Figure 34.

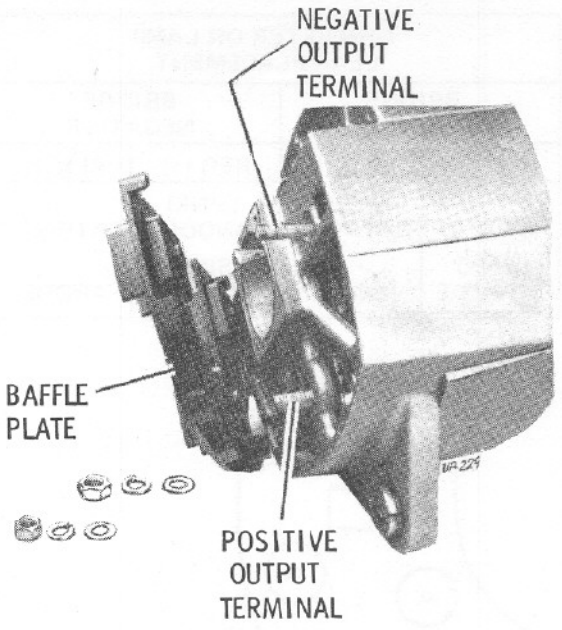


FIG. 33 BAFFLE PLATE REMOVAL

TESTING RECTIFIER DIODES - Each rectifier heat sink contains six individual diodes of the same polarity. Two adjacent diodes are connected in parallel with a soldered link. One stator lead is soldered to this link in the positive rectifier group, with the second stator lead connected to a pair of negative diodes. All stator leads are connected in this manner, forming a full wave, three-phase rectifier bridge.

The connecting link, paralleling two adjacent diodes, should be disconnected from one diode during testing, otherwise, an open diode would not be detected, Figure 35. Unsolder connecting link from the diode away from the stator lead, bending the connecting link to clear the diode terminal. Use a heat dam to protect the diodes during soldering operations.

Test each diode, using a commercial diode tester, ohmmeter or 12 volt D.C. test lamp. Refer to Figures 31 & 36 for test details.

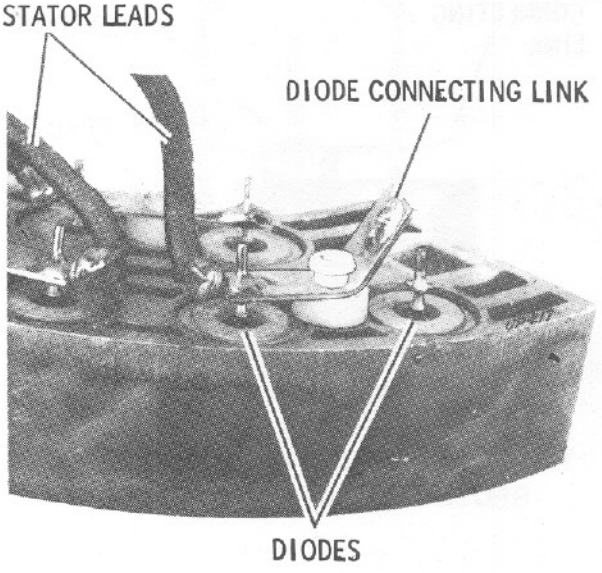
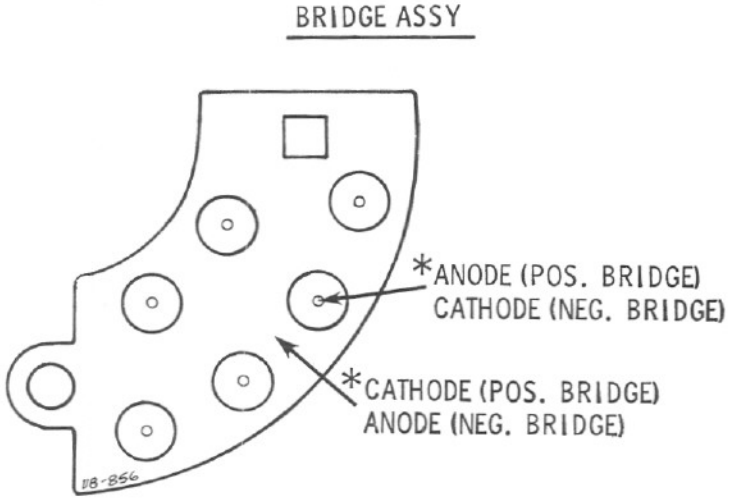


FIG. 35 RECTIFIER DIODE TESTING

OHMMETER OR LAMP LEAD PLACEMENT							
BRIDGE POSITIVE		BRIDGE NEGATIVE		OHMMETER SCALE	OHMMETER	LAMP	
RED (+)	BLK (-)	RED (+)	BLK (-)	RX	READING	ON	OFF
ANODE	(SINK) CATHODE	(SINK) ANODE	CATHODE	1	5-15 OHM	X	
(SINK) CATHODE	ANODE	(SINK) CATHODE	ANODE	100	INFINITY		X



* TEST DIODES WITH CONNECTING LINKS REMOVED.

FIG. 36 RECTIFIER BRIDGE DIODE TEST

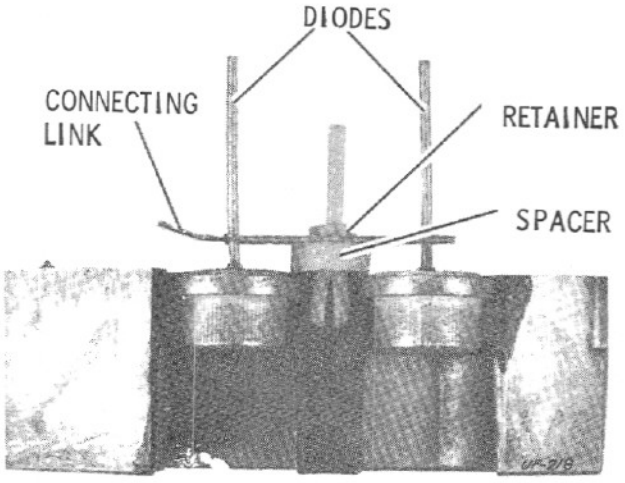


FIG. 37 INSTALLATION DETAILS OF RECTIFIER DIODE ASSEMBLY

RECTIFIER DIODE REPLACEMENT -

Remove connecting link retainer (Figure 38) by cutting off retainer head. Unsolder both diode terminals, remove connecting link, remove old retainer and spacer assy. from heat sink, Figures 38 & 39. Finally, press out defective diode.

Press in new diode and reassemble connecting link using a NEW connecting link retainer. The connecting link retainer and spacer assembly serves as a vibration damper and MUST BE USED. Refer to Figure 37 for details of completed rectifier diode assembly installation.

The rib-necked terminal screws may be replaced if necessary. Place fluted area of new bolt in the grooves formed by the original unit.

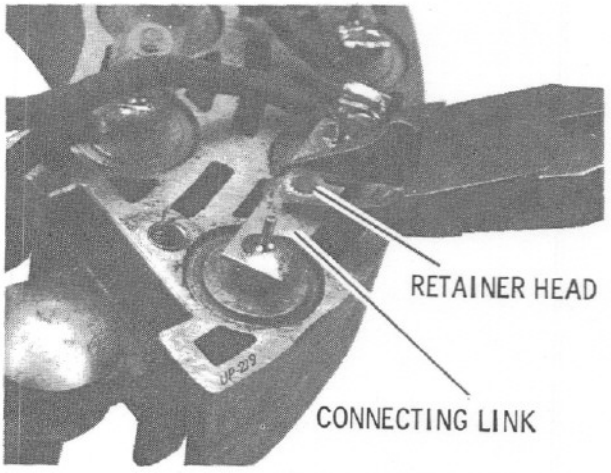


FIG. 38 RETAINER REMOVAL

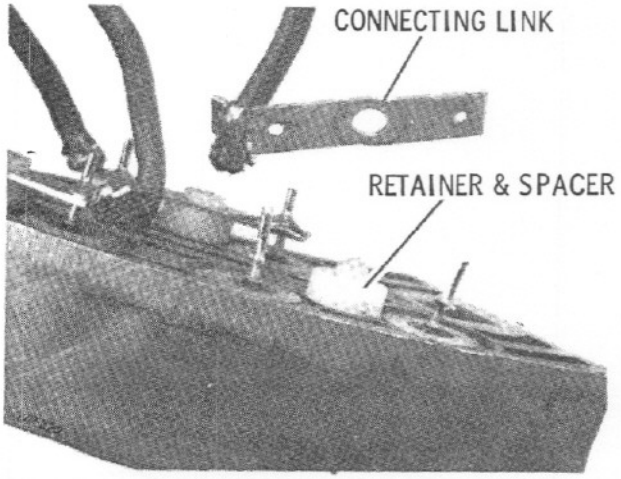


FIG. 39 REMOVAL OF CONNECTING LINK

CAPACITOR TEST -

The capacitor may be tested for insulation breakdown with an ohmmeter. Place meter switch on RX1 scale. Replace capacitor if it is shorted, test from center lead to shell.

REMOVE REAR HOUSING TERMINALS -

Figure 40 shows the attaching hardware used to mount the three A.C. terminals and the regulator terminal board.

REMOVE REAR BEARING & SEALS -

Support the rear housing in an arbor press as shown in Figure 41. Use a driver that will pass the housing cavity to drive the bearing and both seals out in one operation.

Check rear housing for cracks, stripped threads and evidence of any wear in the bearing core, replace if necessary.

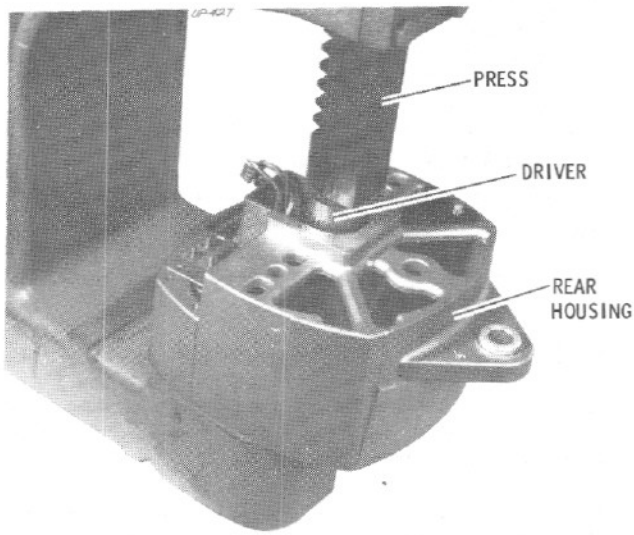


FIG. 41 REMOVING REAR BEARING & SEALS

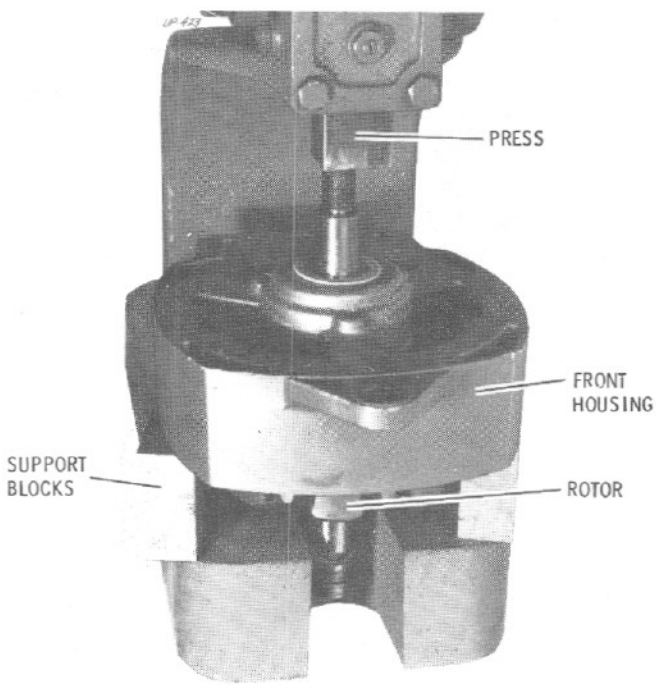


FIG. 42 ROTOR SEPARATION FROM FRONT HOUSING

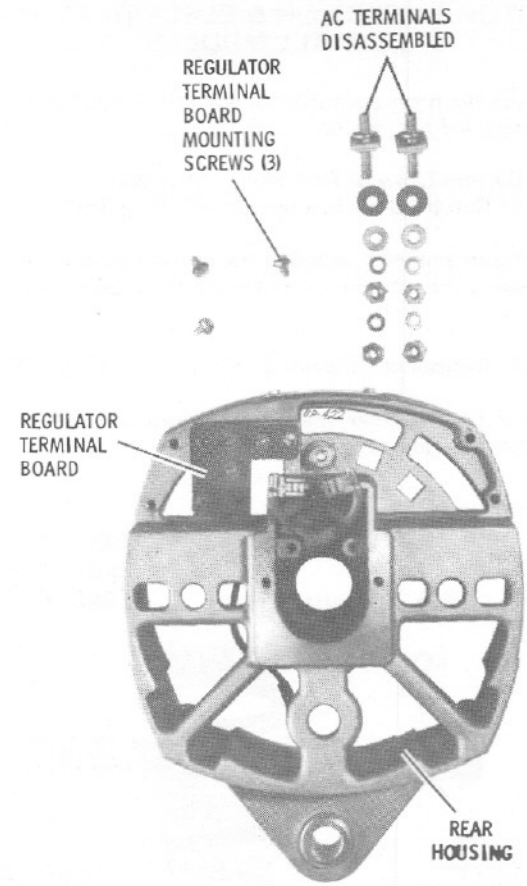


FIG. 40 TYPICAL REAR HOUSING TERMINAL REMOVAL

SEPARATE ROTOR & FRONT HOUSING -

Remove bearing retainer screws. Place assembly in an arbor press, push rotor, with front bearing and retainer out of the housing, Figure 42.

Place bearing puller jaws around the bearing retainer in order to remove bearing and retainer in one operation, Figure 43. Use pin punch to extract grease seals from front housing and retainer. The seals are alike and interchangeable.

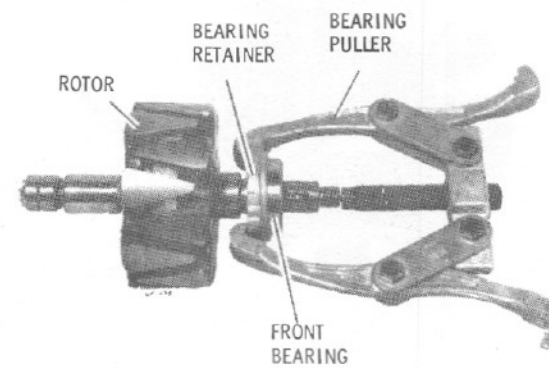


FIG. 43 FRONT BEARING & RETAINER REMOVAL

ROTOR INSPECTION & ELECTRICAL TESTING- ALL MODELS

Check the rotor assembly for the following electrical properties, see Figure 44.

A. Current Draw or Resistance of the Winding.
1. Current draw in amperes, @ 70° to 80°F.

Using an ammeter, measure the current draw of the rotor winding; correct current draw is 2.10 to 2.50 amperes at 10 volts.

2. Resistance of winding in ohms, @ 70° to 80°F.

Using an ohmmeter, measure the rotor winding resistance; correct resistance is 4.0 to 4.6 ohms.

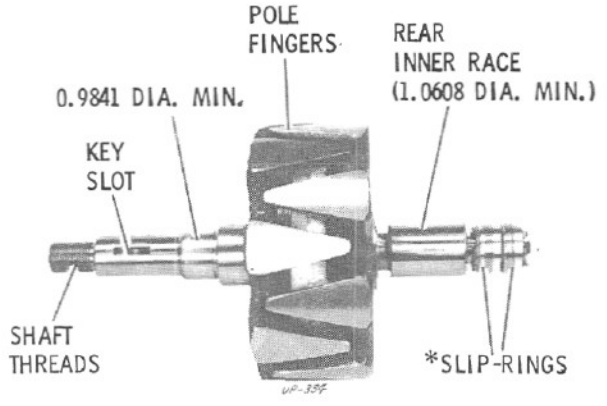


FIG. 44 ROTOR INSPECTION & ELECTRICAL TESTS

B. Grounded Slip Ring or Winding.

Use 12 volt DC test lamp, ohmmeter, or 110V AC test lamp. Place one test lead to the rotor body and the other on either slip ring. Open circuit from either slip ring to the rotor body is a correct condition. Replace rotor assembly if winding is open, shorted or grounded.

C. Condition of Slip Rings.
1. Clean brush contacting surfaces with fine crocus cloth, wipe dust and residue away.
2. If surfaces are worn beyond this restoration, replace the slip ring assembly.

D. Rotor Shaft & Body.
1) Stripped threads on shaft
2) Worn key slot
3) Worn bearing surface
4) Scuffed pole fingers
5) Worn inner race
6) Check rotor mechanical dimensions

Replace rotor assembly if any of the above faults are noted with the exception of item (5).

NOTE: New rotors include a new inner race and new slip rings as part of the assembly.

E. Remove Slip-Rings from Rotor. (If necessary.) -

Unsolder the rotor leads from the slip ring terminals, Figure 45. Carefully unwind the ends of the rotor coil leads from the slip ring terminals.

Remove cap screw from end of shaft; this will separate the slip ring assembly from the rotor shaft, Figure 46.

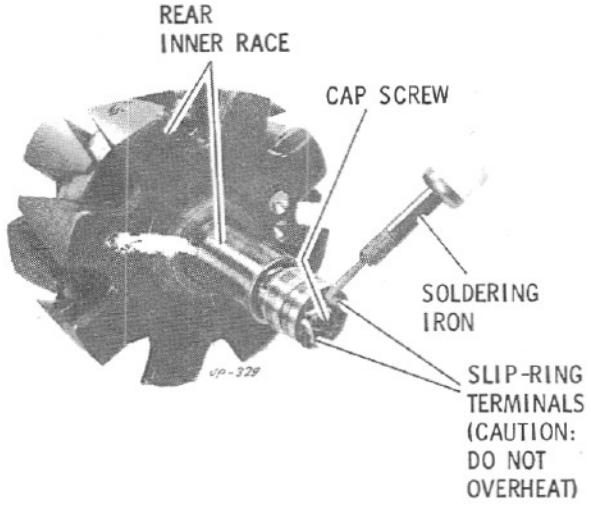


FIG. 45 UNSOLDER ROTOR LEADS FROM SLIP-RINGS

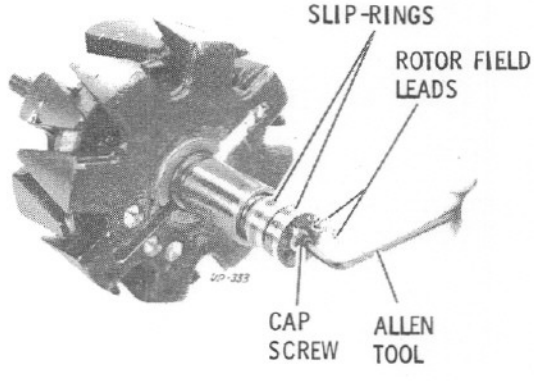


FIG. 46 SLIP-RING REMOVAL

REMOVE INNER RACE -

The sleeve-type bearing race is a press-fit on the rotor shaft. Surface discoloration does not necessarily indicate a defective unit. A flat spacer must be used to protect the end of the rotor shaft from possible tool damage, Figure 47.

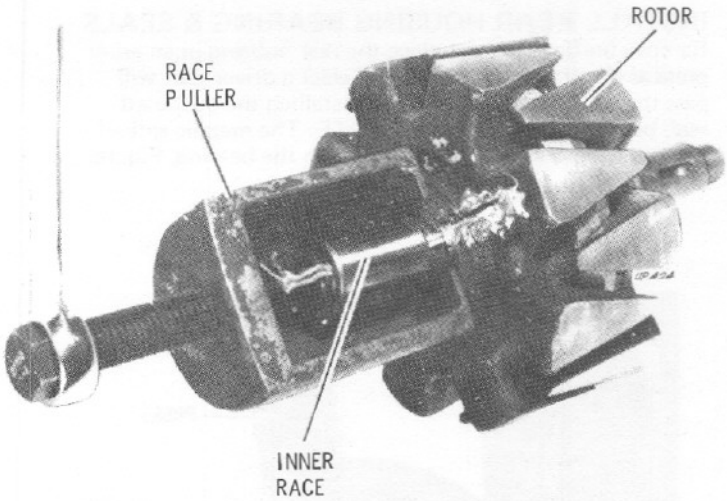


FIG. 47 INNER RACE REMOVAL

RE-ASSEMBLY

INNER RACE INSTALLATION -

Figure 44 lists the dimensions of the race; replace the unit if worn in excess of minimum dimension, Figure 48.

INSTALL SLIP-RING ASSEMBLY -

NOTE: This operation should follow Inner Race replacement.

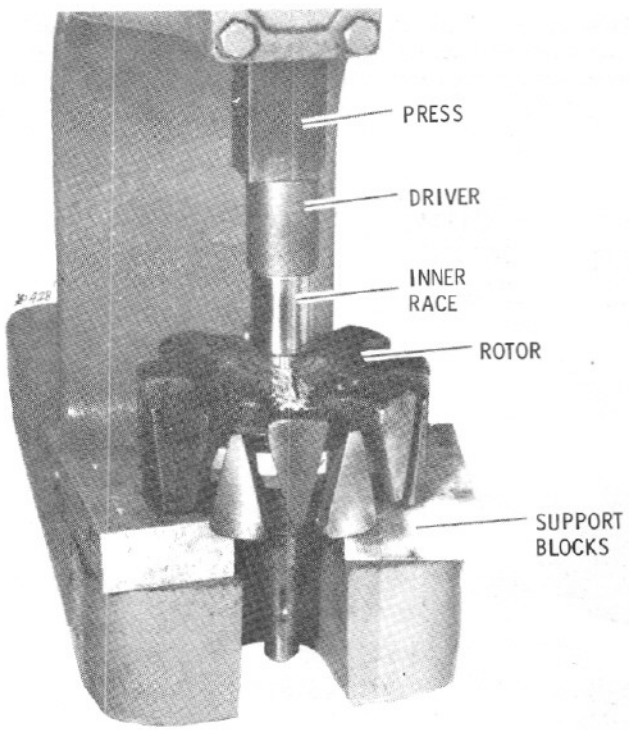


FIG. 48 INNER RACE INSTALLATION

Guide both rotor winding leads through a single square passage in the slip ring hub. Hand press the slip-rings on the shaft while maintaining alignment of winding leads and passage. Install cap screw and lockwasher, tighten to 45 inch pounds; Figure 49 shows details of completed assembly.

Wrap leads around slip-ring terminals, solder with rosin core solder, DO NOT overheat. Secure wires to the end of the rotor with a synthetic sealer, like G.E. Silicon Rubber.

Retest electrical circuit to insure that a short circuit or ground did not develop during repair operation.

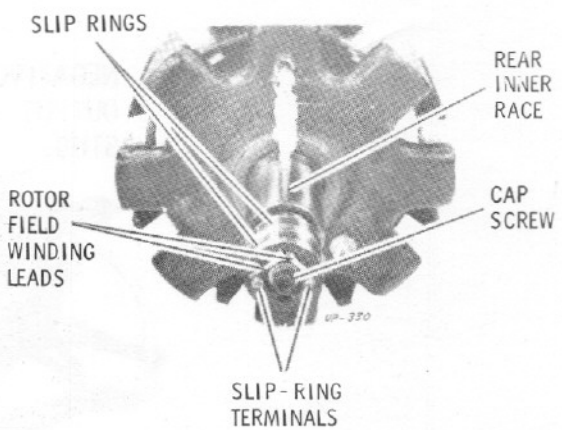


FIG. 49 SLIP-RING INSTALLATION DETAIL

INSTALL REAR HOUSING BEARING & SEALS -

Remove baffle plate and place the rear housing in an arbor press as illustrated in Figure 50. Select a driver that will pass thru the bearing bore while installing the outboard seal, bearing and inboard seal. NOTE: The metalic side of the seal should always face away from the bearing, Figure 51.

Pack each rear bearing seal cavity 2/3 full of specified grease (BRB-No. 2 or equivalent), in addition to lubricating the seal lips.

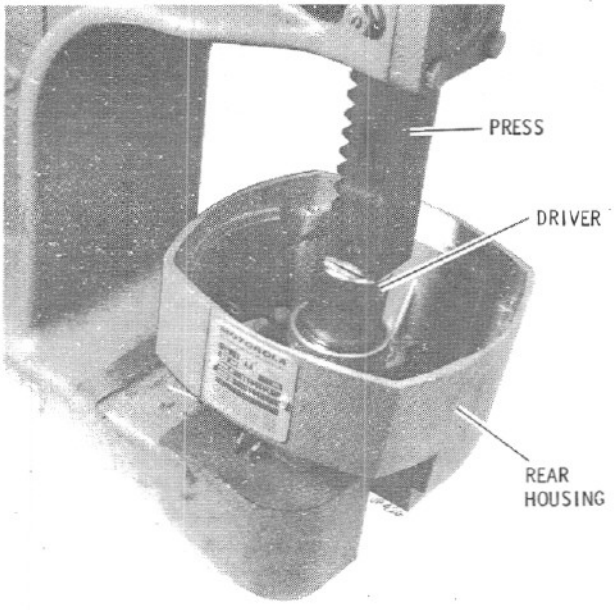


FIG. 50 INSTALLING REAR BEARING & SEAL ASSEMBLY

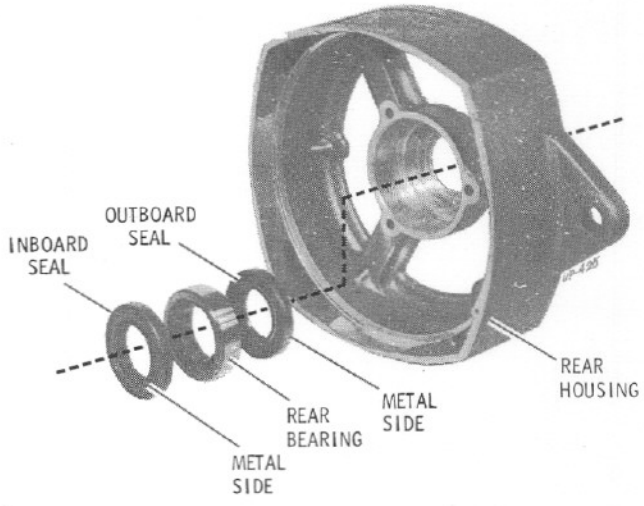


FIG. 51 REAR BEARING & SEAL ASSEMBLY DETAIL

ASSEMBLE RECTIFIER DIODES -

Figure 52 shows the arrangement of the rectifier diode heat sinks and insulators. Note that the negative output stud is a metal to metal contact with the negative rectifier heat sink. The positive output stud provides the same contact with the positive output heat sink.

The stud used for the indicator light terminal is insulated from both rectifier heat sinks but makes contact with the heat sink of the regulator diode assembly.

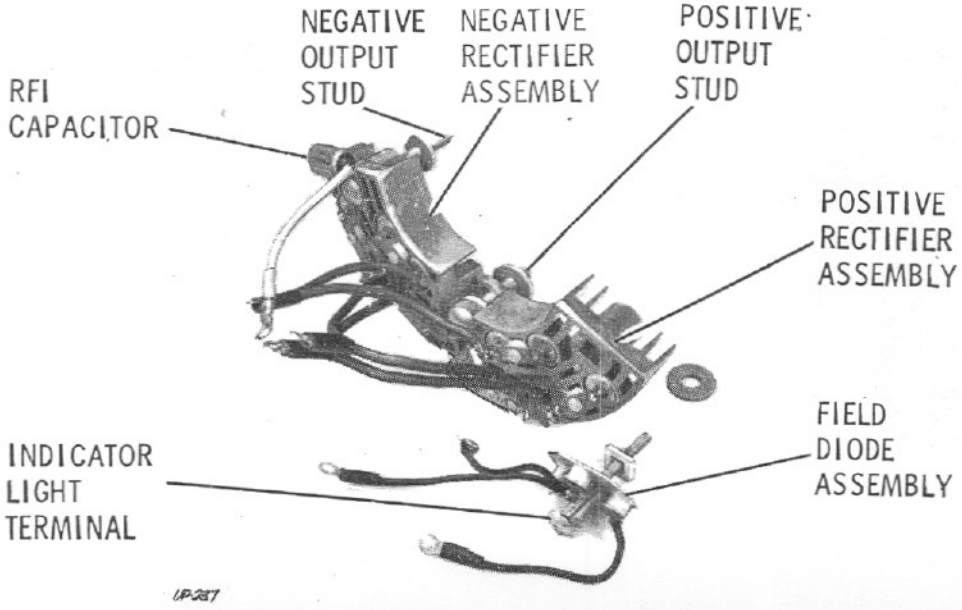


FIG. 52 RECTIFIER DIODE ASSEMBLY

Assemble insulating washers over positive and negative output studs, install this rectifier assembly in the rear housing. Temporarily hold this assembly in place by placing 5/16" flatwasher and hex nut over the positive output stud,tighten enough to hold the assembly in the housing. Place the square insulator in the matching opening of the positive rectifier heat sink. Assemble the lead from terminal plate, with 1/4" ring terminal, the number 10 carriage bolt and regulator diode assembly, over the square insulator. Push the bolt through the heat sink, then place the insulating washer between the heat sink and the rear housing as shown in Figure 53.

Hold this entire assembly in the housing, remove 5/16" hex nut and flatwasher. Place baffle plate over the studs, position so the shoulders on the baffle fit into the rear housing. Install and carefully tighten hex nuts on all studs. Insulating bushings are not used over terminal studs.

Assemble internal leads to AC terminals as shown in Figure 54. The capacitor lead and the terminal board negative lead are the last to be installed. DRESS LEADS DOWN AND SECURE WITH WIREWRAP TO AVOID CONTACT WITH THE ROTOR ASSEMBLY, FIGURE 55.

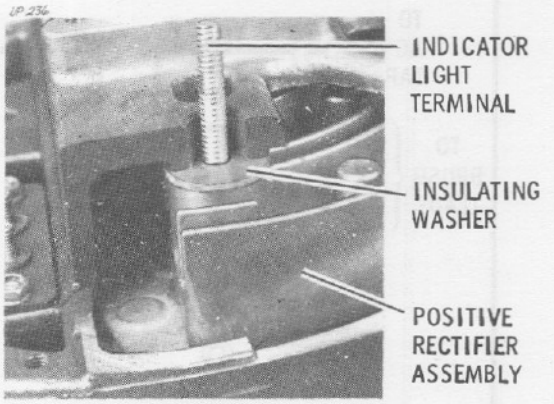
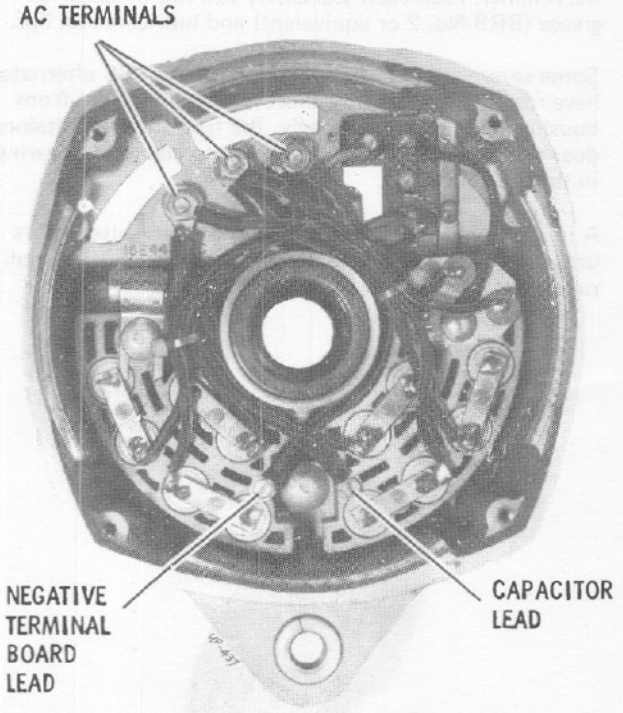


FIG. 53 CUTAWAY VIEW OF INDICATOR LIGHT TERMINAL



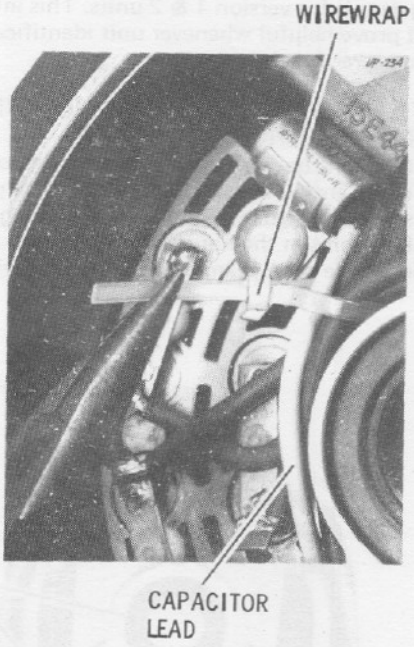


FIG. 55 LEAD DRESS

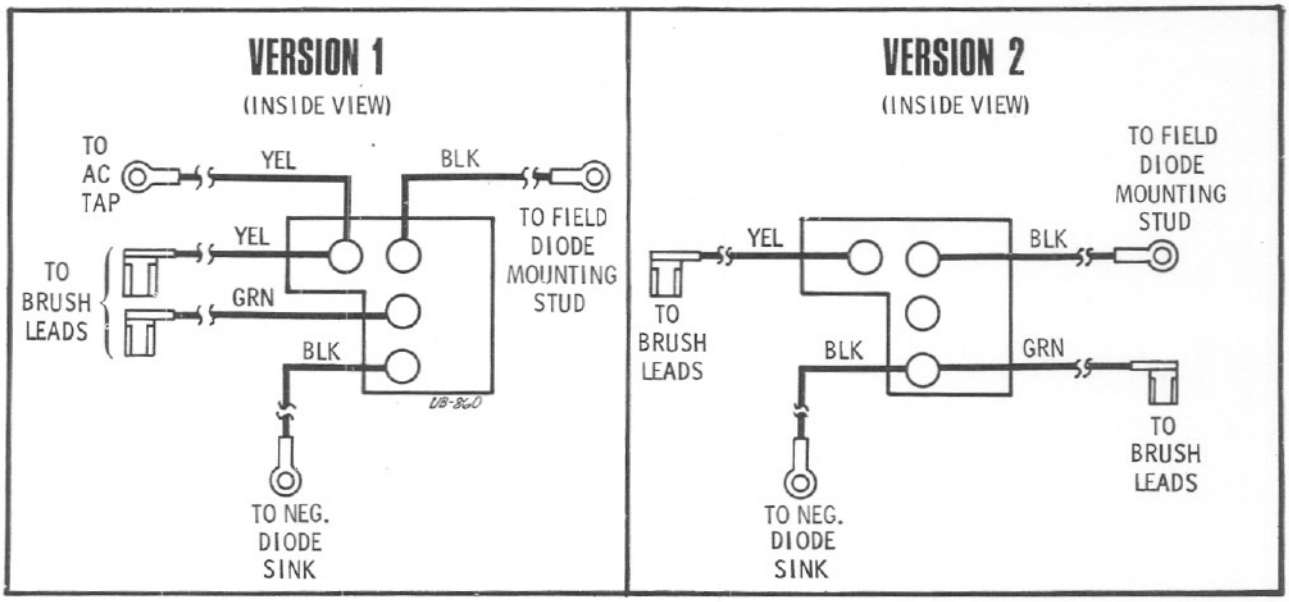


FIG. 56 INTERNAL REGULATOR TERMINAL BOARD WIRING TO ALTERNATOR

REGULATOR TERMINAL BOARD WIRING - Figure 56 shows the internal regulator terminal board wiring details for version 1 & 2 units. This information should prove helpful whenever unit identification or rewiring is required.

INSTALL SEALS IN FRONT HOUSING & FRONT BEARING RETAINER - Place the front housing exterior side down, on bed of arbor press. Install new seal in housing with grease cavity up as shown in Figure 57. Press on outer edge only until seal bottoms in the housing. Install a seal in the bearing retainer in the same manner, with grease cavity away from the retainer. Pack each seal cavity 2/3 full of specified grease (BRB-No. 2 or equivalent) and lubricate seal lips.

Some severe alternator applications of the 8SC alternators have resulted in relatively short service life of the front housing assembly. Specifically, the front bearing retainer does not provide a satisfactory lock to clamp the bearing in the housing.

A new bearing retainer is available for these alternators under part no. 11-55, and can be identified by the small raised rib, as shown in Figure 58.

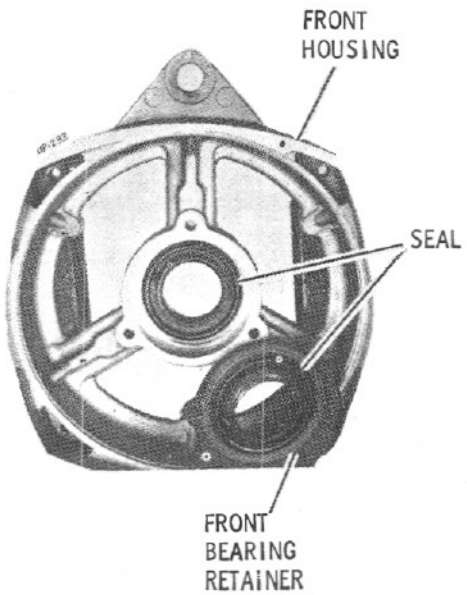


FIG. 57 INSTALLATION OF SEALS

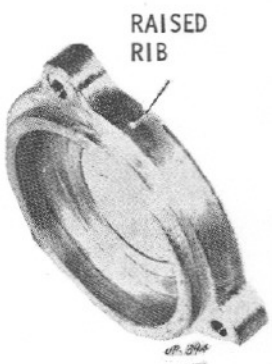


FIG. 58 NEW FRONT BEARING RETAINER

When replacing the retainer, it is advisable to perform all of the regular service procedures listed below:

1. Remove bearing retainer, note condition of lubricant if it "balls-up" around the seal area, with little or no grease around the bearing balls, the grease is probably contaminated from foreign material.
2. Remove the bearing, then remove the grease seals from the front housing and bearing retainer. Wash all grease from the bearing and housing.
3. Install new seals in the housing and in the new bearing retainer. Pack the grease seal cavity and lip areas with BRB No. 2 lube, see Figure 59.
4. Pack one side of the bearing with the same lube as shown in Figure 60, then install bearing and retainer in the front housing.
5. Before installing the three bearing retainer screws, add loctite 290 or 242 medium strength retaining compound to the threaded section of the screws. Install the retainer screws and tighten to 30-35 inch pounds.
6. Re-assemble front housing to alternator as shown in Figure 61.

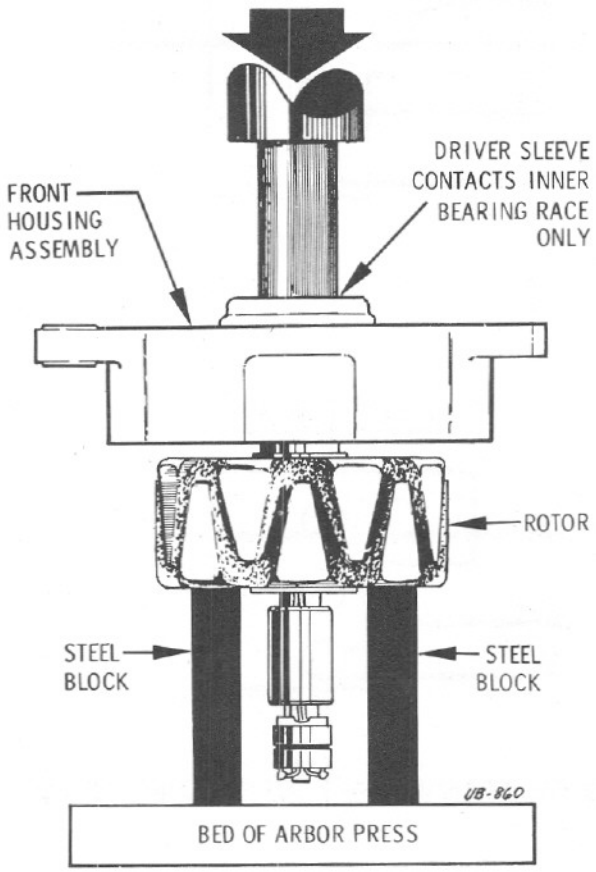


FIG. 61 ASSEMBLE FRONT HOUSING TO ROTOR

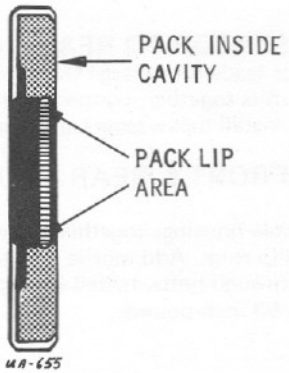


FIG. 59 PACKING GREASE SEAL AREAS WITH LUBE

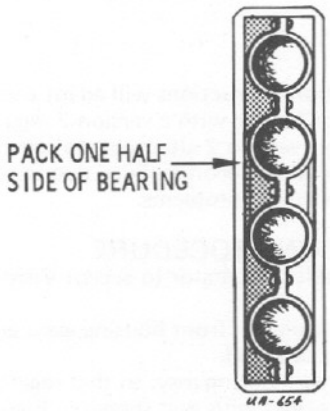


FIG. 60 PACKING ONE SIDE OF BEARING WITH LUBE (BRB NO. 2)

INSTALL FRONT BEARING -

Pack one side of the bearing full of specified grease (BRB-No. 2 or equivalent). Using driver that contacts only the outer race, press bearing into front housing until bearing contacts seal.

Place retainer gasket and retainer on front housing and secure with three retaining screws and lockwashers.

ASSEMBLE FRONT HOUSING ON ROTOR -

Support the rotor, as shown in Figure 61.

Press the front housing and bearing assembly on the rotor shaft, using a driver that contacts only the inner bearing race, until the bearing contacts the rotor shoulder.

Install spacer, fan, pulley and attaching hardware. Tighten pulley to 50-60 foot pounds, using an old oversize belt to protect pulley surface.

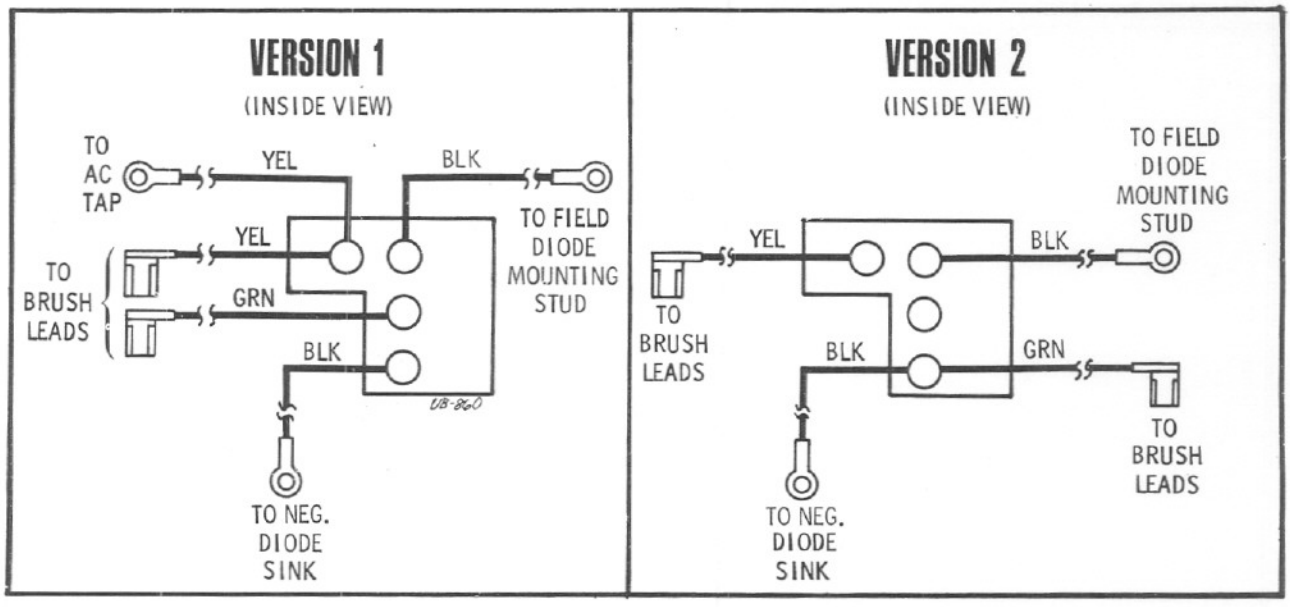


FIG. 56 INTERNAL REGULATOR TERMINAL BOARD WIRING TO ALTERNATOR

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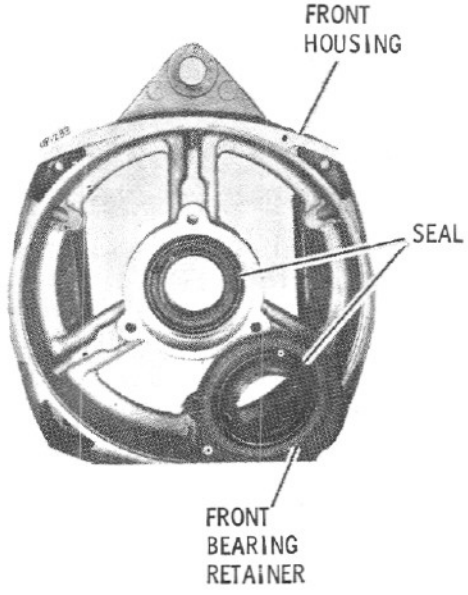

FIG. 57 INSTALLATION OF SEALS

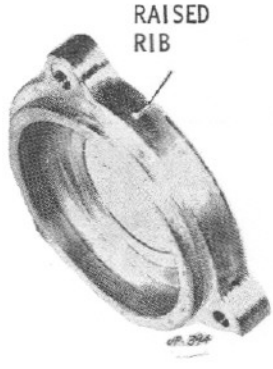

FIG. 58 NEW FRONT BEARING RETAINER

PRE-INSTALLATION OUTPUT TEST

This test will determine the output of the repaired alternator.

Mount the alternator in a test fixture capable of providing 4000 alternator RPM. Select required battery voltage and circuit polarity. Connect fixture leads and instruments to the alternator terminals as shown in Figure 63. The carbon pile or resistive load bank and ammeter must be capable of handling the alternator rated output current. Regulator voltage selector in no. 3 Pos (center) with carbon pile or resistive bank off, turn drive motor on, adjust to 4000 alternator RPM.

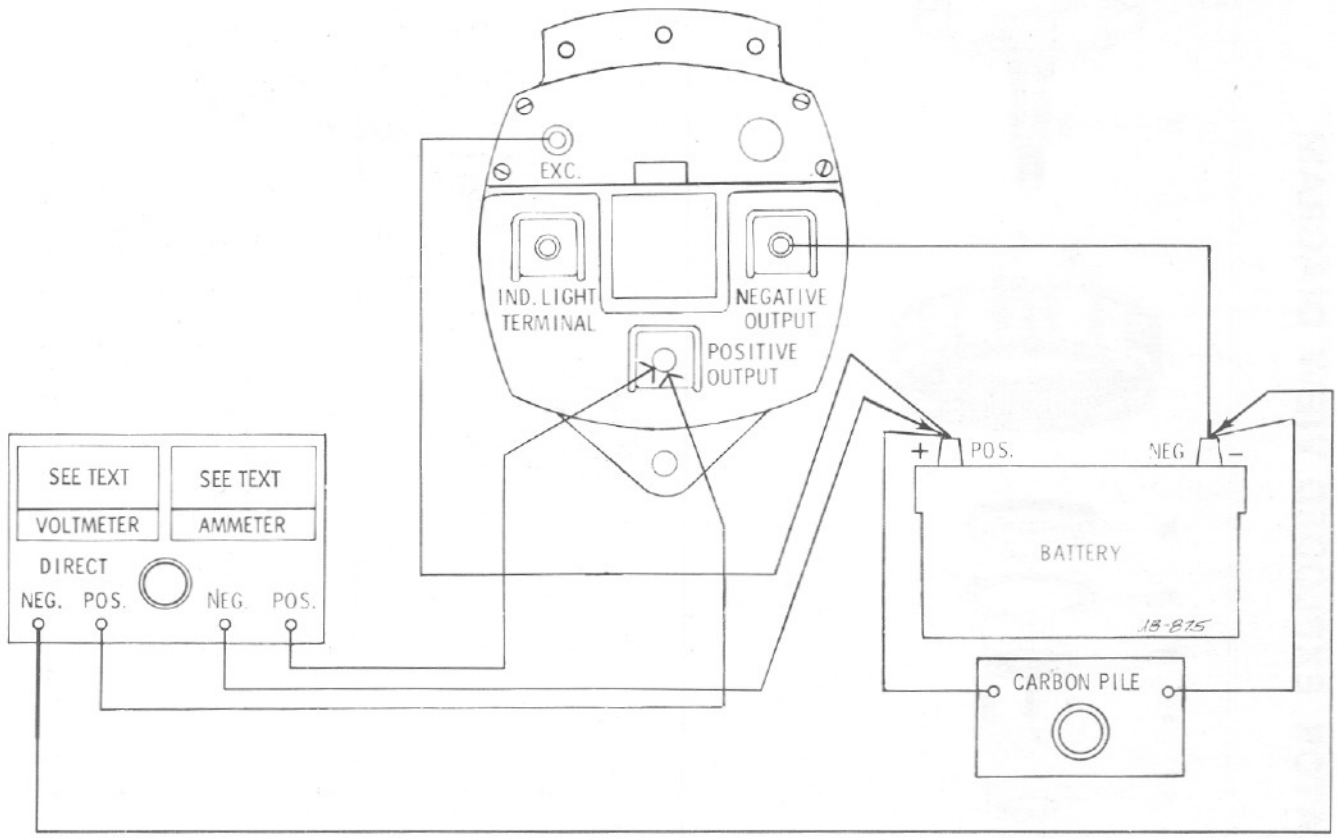

FIG. 63 PRE-INSTALLATION OUTPUT CURRENT TEST

Voltmeter should read the following: 13.8± .2V–12V Sys.
28.0± .2V–24V Sys.
38.4± .3V–32V Sys.

Now slowly increase load while observing ammeter and maintaining 4000 RPM. Increase load until a maximum output current is obtained. The minimum acceptable output current is shown in the following chart for the various alternator models.

MINIMUM ACCEPTABLE OUTPUT VALUES WITH REGULATOR VOLTAGE CONTROL SWITCH IN THE NO. 3 (CENTER) POSITION.

ALT. MODEL	VOLTAGE	CURRENT
8SC2001R	13.80± .2V	75AMPS
8SC2004Z	13.80± .2V	125AMPS
8SC3002U	28.0± .2V	70AMPS
8SC3003U	28.0± .2V	70AMPS
8SC3005V	28.0± .2V	90AMPS
8SC4006U	38.4± .3V	70AMPS

ALTERNATOR EXPLODED VIEW DIAGRAM

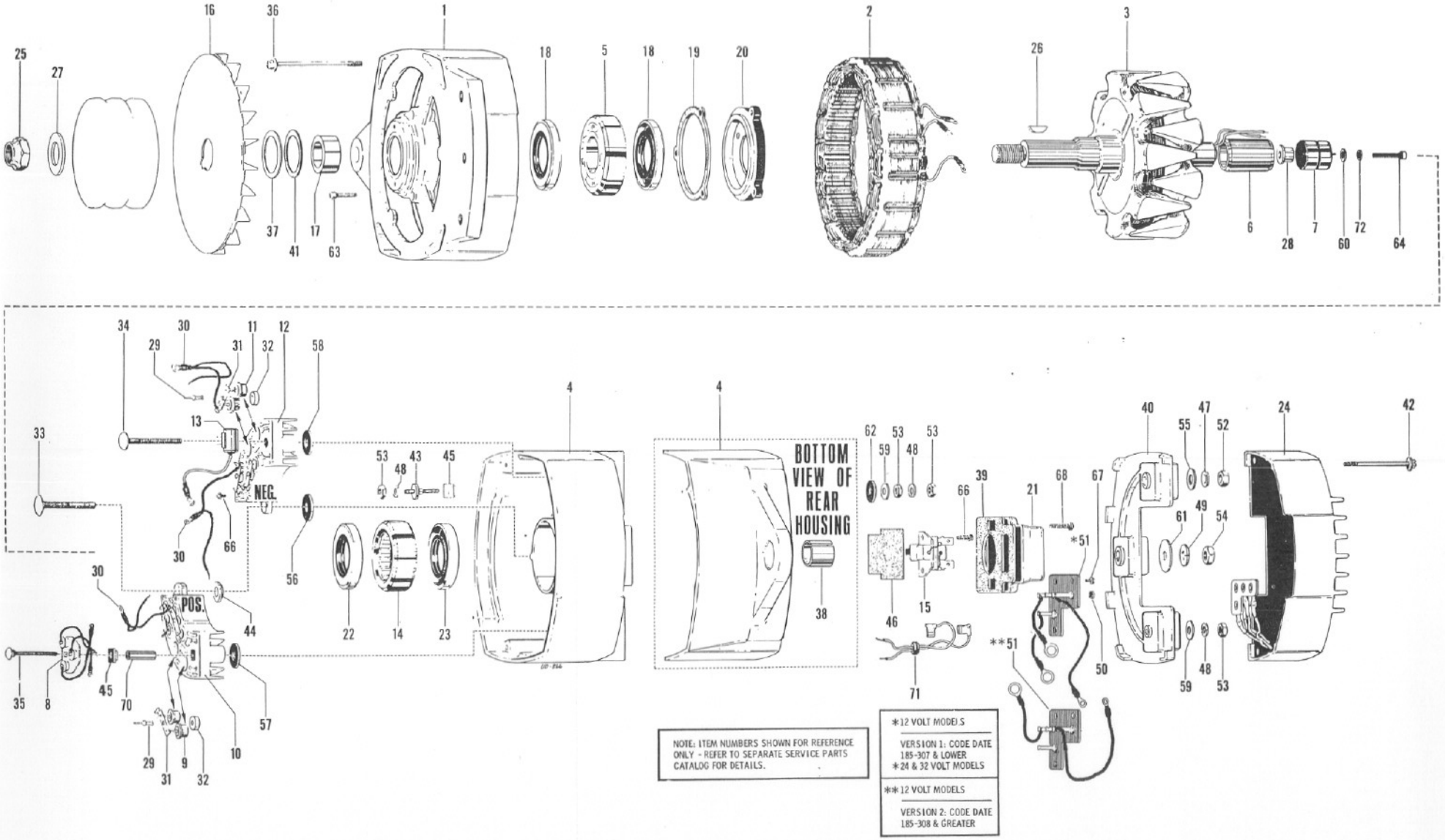

FIG. 64 12, 24 & 32 VOLT ALTERNATOR EXPLODED VIEW DIAGRAM