MAINTENANCE INSTRUCTIONS
5030RA REGULATOR
14 VOLT POSITIVE OR NEGATIVE GROUND SYSTEM

4.0 DESCRIPTION

This Leece-Neville Regulator is intended for use with alternators up to 205 amperes and up to 5 amps field current. It consists of a static voltage control, and a field relay element housed in an aluminum box.

The regulator was designed to be used with self-load limiting alternators, and does not contain a current limiting element. The regulator may be used with either positive or negative grounded systems, by simply changing the external connections.

The field relay is energized by the ignition switch or an oil pressure switch. If the regulator is to be used with a chargelight indicator, the field relay will be energized by the alternator "AC" or "Neutral" terminal. Closing the relay contacts connects battery voltage to the field circuit of the alternator and the output is then controlled by the fully static voltage control portion of the regulator.

The regulator is designed to operate from -55 degrees F. to +225 degrees F.

4.1 FIELD RELAY PROCEDURE & TESTS

4.1.1 Battery voltage applied to regulator terminals #5 and "GND" should cause the relay contacts to close. If the relay does not close, examine all wire and connections from terminals #5 and "GND" to the relay coil for loose connections, burns, or damage of any kind. Refer to Figure 4-1.

The relay coil resistance should be between 28.5 to 31.5 ohms measured at terminals #5 and "GND".

4.1.2 If the relay coil resistance is in the specified range or if the coil or wiring have been repaired, or the coil has been replaced; then check to be sure that the air gaps are set accurately according to the values shown in Figure 4-2. The three gaps are checked or set with the armature tension spring in place. If all the gaps are within the values shown in Figure 4-2 then proceed to the paragraph entitled "Closing Voltage Instructions".

4.2 AIR GAP ADJUSTMENT

4.2.1 Refer to Figure 4-2 for the following adjustments: To set the hinge gap, loosen the armature adjusting screw. Raise the armature assembly and insert the correct feeler gauge between the yoke and armature. While pressing down lightly on the armature, tighten the armature locking screw. Use a narrow feeler gauge to set the hinge gap (it may be necessary to grind one down) being careful to avoid the rivet heads near the hinge.

4.2.2 After the hinge gap has been properly set, adjust the core gap in the following manner. Lower the carrier block by loosening the locking screw and turning the cam screw counter-clockwise. Insert the proper feeler gauge between the coil core and armature, holding the feeler in place by light finger pressure on the armature. While the feeler is held in place, raise the carrier block by turning the cam screw clockwise until the contacts just touch. Lock the carrier block in position by tightening the locking screw and remove the feeler gauge.

After setting both the hinge and core gaps, the contact gap is adjusted by bending the armature stop up or down to obtain the specified gap.

4.3 CLOSING VOLTAGE INSTRUCTIONS

4.3.1 To check or adjust the closing voltage of the relay, a 12 volt battery, a variable resistor (0-75 ohm, 25 watt) voltmeter and a 12 volt light are needed. Connect this equipment as shown in Figure 4-3.

4.3.2 Start with all the resistance in (lowest voltage) and gradually increase the voltage by removing resistance until the light comes on. The voltage should be read and noted the instant the light comes on. This will be the closing voltage of the relay. The field relay should close between 2.9 to 3.1 volts.

4.3.3 If the closing voltage is not within the above tolerance, then the spring bracket must be bent until the correct voltage is obtained. To raise the closing voltage increase the spring tension, while to lower the voltage decrease the spring tension. See Figure 4-2.

4.4 VOLTAGE CONTROL UNIT ADJUSTMENT

4.4.1 After the field relay has been checked or repaired and the relay closes at the proper voltage, we can then check the voltage control or transistor portion of the regulator. Figures 4-4, 4-5, 4-6 and 4-7 show the necessary wiring for testing the 5030RA regulator on a test stand. These four external diagrams cover ammeter or chargelight circuits of both polarities. These circuits also apply to installation of the equipment on vehicles but with the exception of the test equipment used in the circuits. See Figure 4-8 for the correct wire size for vehicle applications.

WARNING

DO NOT "POLARIZE" THE FIELD BY CONNECTING A JUMPER BETWEEN THE REGULATOR FIELD TERMINAL AND GROUND. EVEN A MOMENTARY CONNECTION MAY SHORT OUT THE TRANSISTOR PERMANENTLY.

4.4.2 Mount the regulator on the test stand with the cover removed and wire as shown in one of the four external wiring diagrams. If possible, set this regulator using a 205 ampere alternator on the test stand. If a 205 ampere alternator is not available, use any Leece-Neville 14 volt (60 amps minimum) self current limiting alternator that is available.

4.5 CHARGELIGHT CIRCUIT

4.5.1 If Figures 4-6 or 4-7 are used, use a 14 volt chargelight #1895 for the test block circuit.

Close the ignition switch, the chargelight should light. Start the test block and increase the alternator speed slowly. The field relay should close and the chargelight should go out at or before 1100 alternator RPM.

A slight hum may be noticed, but the relay should not buzz or vibrate excessively.

If the relay does not operate properly, refer to section entitled "Field Relay Procedure & Test".

4.6 VOLTAGE ADJUSTMENT AND TEST

4.6.1 After the field relay has closed, increase the alternator speed to approximately 2000 RPM. Apply a load of 10 amperes and set the voltage at 13.8 to 14.2 volts. To adjust the voltage, insert a screwdriver in the potentiometer adjusting slot. See Figure 4-1 for reference. To increase the voltage, turn in a counter-clockwise direction.

4.7 VOLTAGE CONTROL TESTING PROCEDURE

4.7.1 If the regulator does not operate as previously described, perform the following tests in order to locate the defective components. An ohmmeter will be required for these tests.

4.7.2 The following tests were made with an ohmmeter powered with a 1 1/2 volt flashligh battery. There are many types of good ohmmeters, any one of which may produce a somewhat different test result. In these tests you will need to know which lead of the ohmmeter is positive and which is negative, this varies with the type of the instrument.

4.7.3 To determine which lead of the ohmmeter is positive or negative, an ordinary 1 1/2 volt flashlight battery may be used. With one prod of the ohmmeter touching the carbon end of the battery and the other prod on the case, a high resistance reading will indicate that the prod at the carbon end is positive (+). A no resistance reading will indicate that the lead at the battery carbon is negative (-).

4.7.4 WHENEVER OHMMETER TESTS ARE MADE, ALL EXTERNAL LEADS SHOULD BE DISCONNECTED FROM THE REGULATOR. A visual inspection of the regulator should be made for burned or broken leads, loosen connections and inspect all solder connections. The failure of one component may cause failure of others in the regulator.

4.8 REMOVAL OF CIRCUIT PANEL ASSEMBLY

4.8.1 With the regulator cover removed, place the regulator so that the power transistor and circuit panel are nearest to you. Remove the two green leads connected to two of the three terminal posts of the lower end of the circuit board. Note the location of these leads as they must be replaced exactly as removed. Refer to Figure 4-9 and note the lead connections to the circuit panel which are marked "R". Remove these seven (7) leads from their respective terminal posts. The circuit board may be removed for inspection and tests by removing the four nuts, lockwashers, and guard washers holding the corners of the board in place.

4.8.2 After removing the circuit board, examine all soldered joints, connections, wire, and the printed circuit on under side of the board for signs of burning or damage of any type.

4.9 POWER TRANSISTOR (Mounted on Vertical Heat Sink or Panel)

4.9.1 Connect the positive ohmmeter lead (as previously determined by the battery test) to the top pin lead of the power transistor. With the negative lead of the ohmmeter, touch the other pin lead and then touch the case of the power transistor. Both meter readings should show a low resistance value and both meter readings should be about the same value. A zero resistance would indicate a shorted transistor while no reading (infinity) would indicate an open transistor. Refer to Figures 4-1 and 4-9.

4.10 CIRCUIT PANEL

4.10.1 There are eleven components mounted on the circuit panel which are connected to the nine or ten copper strips or pads which are on the under side of the printed circuit panel. It would be impractical to separate the eleven components for individual test, so the following procedures will be group testing of the components.

NOTE

Figure 4-10 shows a portion of the copper circuits superimposed on one another. Some regulators have the sections, numbered 7 and 10, combined into one copper strip (number 7) as shown by the solid lines, while other panels are represented by the dotted lines showing sections numbers 7 and 10. Any difference in testing procedures will be noted.

To do the group tests refer to Figure 4-10 which shows the under side of the printed circuit panel, each section is numbered for further reference.

Table "A" shows the approximate results of the tests which are performed with an ohmmeter to determine if any of the components are faulty.

NOTE

The values shown as the test results are approximate because of the variables involved, such as type of an ohmmeter and the meter scale.

Sharp prods on the ohmmeter leads will help to make a good contact and make the test easier to perform. Press the sharp points of the prods firmly into the solder rather than into the copper strips.

The table below is used to trouble shoot the printed circuit panels of the 5030RA regulator.

TABLE "A"

Component	Test	Meter Lead	Panel Strip	Meter Lead	Panel Strip	Resistance Reading
DRIVER TRANSISTOR	A	Pos. to	1	Neg. to	5	Low
	B	Neg. to	1	Pos. to	5	High
	C	Pos. to	5	Neg. to	7	High
	D	Neg. to	5	Pos. to	7	Low
ZENER DIODE	A	Pos. to	1	Neg. to	3	Low
	B	Neg. to	1	Pos. to	3	High
FIELD DISCHARGE RECTIFIER	A	Pos. to	6	Neg. to	9	Infinity
	B	Neg. to	6	Pos. to	9	Low
POWER TRANSISTOR BASE RESISTOR (100 OHMS)	A	Pos. to	5	Neg. to	6	Actual (100)
	B	Neg. to	5	Pos. to	6	Los (80)
POSITIVE POTENTIOMETER RESISTOR (68 OHMS)	A	Pos. to	4	Neg. to	6	Low (60)
	B	Neg. to	4	Pos. to	6	Low 68 Max.
NEGATIVE POTENTIOMETER RESISTOR (120 OHMS)	A	Pos. to	2	Neg. to	8	Actual (120)
	B	Neg. to	2	Pos. to	8	Low (75)
POTENTIOMETER (30 OHMS)	A	Pos. to	2	Neg. to	4	Actual (30)
	B	Pos. to	2	Neg. to	3	0 - 30
The 0-30 reading is obtained by a full turn of the potentiometer slotted knob.						
TANTALUM CAPACITOR	A	Pos. to	3	Neg. to	8	120-150
	B	Neg. to	3	Pos. to	8	60-75
The variation in readings here is caused by turning the potentiometer slotted knob.						
FEEDBACK CAPACITOR	A	Pos. to	3	Neg. to	9	Infinity
	B	Neg. to	3	Pos. to	9	130-160
LOW RESISTANCE LEAD	A	Pos. to	7	Neg. to	8	0 Ohms
PARALLEL RESISTORS AND DRIVER TRANSISTOR	A	Pos. to	1	Neg. to	7	Low (30)
	B	Neg. to	1	Pos. to	7	Low (82)
	C	Pos. to	1	Neg. to	8	Low (30)
	D	Neg. to	1	Pos. to	8	Low (80)

The following test can only be performed on the early units. Refer to "Internal Wiring Diagram (Schematic)" and Fig.4-10 for a method to distinguish between units

LOW RESISTANCE LEAD	A	Pos. to	7	Neg. to	10	0 Ohms

4.10.2 Remember many of the resistance readings shown in the table include a transistor or a diode and cannot be given a definite value for all types of ohmmeters. Thus the term "LOW", "HIGH", etc. has been used. All resistance values shown are approximate. Values over 200 ohms will be marked "HIGH, and values less than 10 ohms will be marked "LOW".

4.11 REPAIRS TO THE CIRCUIT PANEL

4.11.1 If it has been determined that one or more components of the printed circuit assembly are faulty, a new circuit panel assembly should be used to replace the defective panel assembly. For regulator type 5030RA, circuit panel part number 75119 must be used.

4.12 INTERNAL WIRING DIAGRAMS (Schematic)

4.12.1 Figure 4-11 is the internal schematic wiring diagram for the 5030RA regulator. In some regulators the electrolytic capacitor is approximately 3/4" in diameter and 1 7/8" long, while in other regulators the capacitor is approximately 3/8" in diameter and 2 1/4" long. Figure 4-11 is the internal wiring diagram for regulators using 3/4" capacitor.

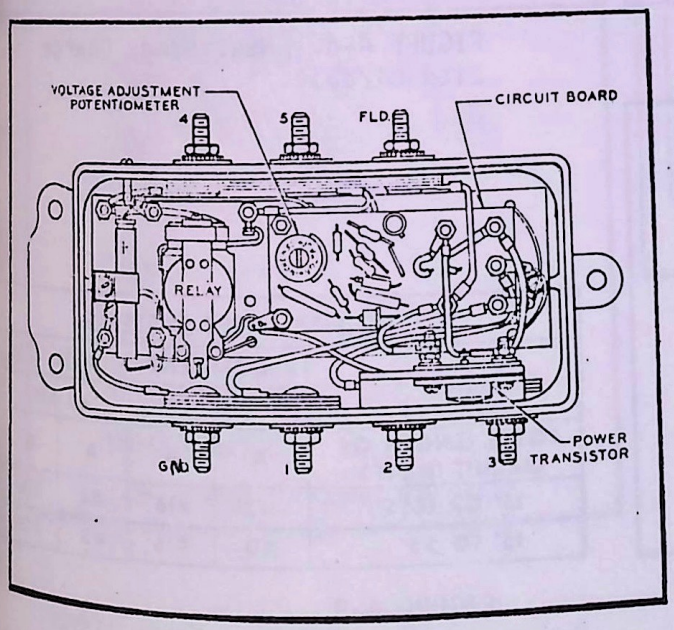


FIGURE 4-1
5030RA

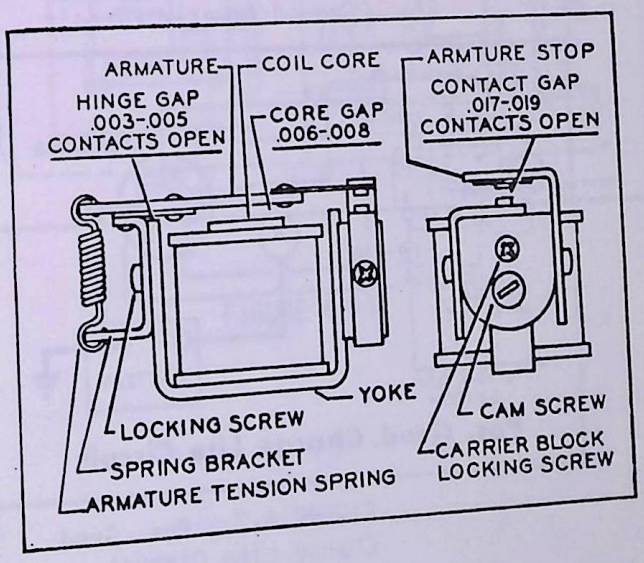


FIGURE 4-2

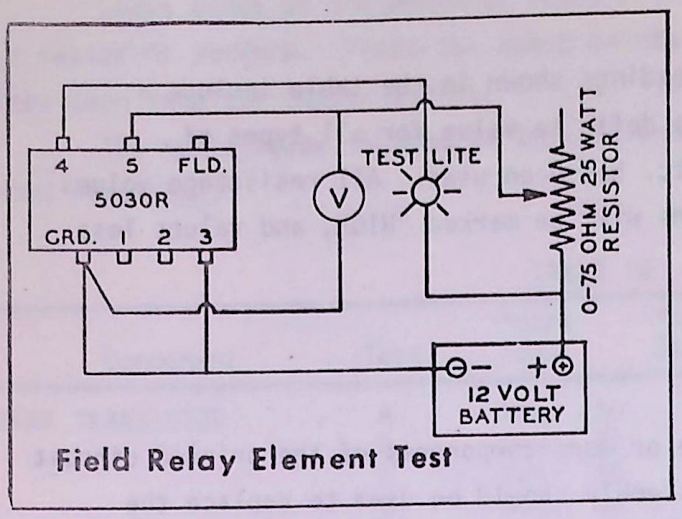


FIGURE 4-3. Field Relay Element Test

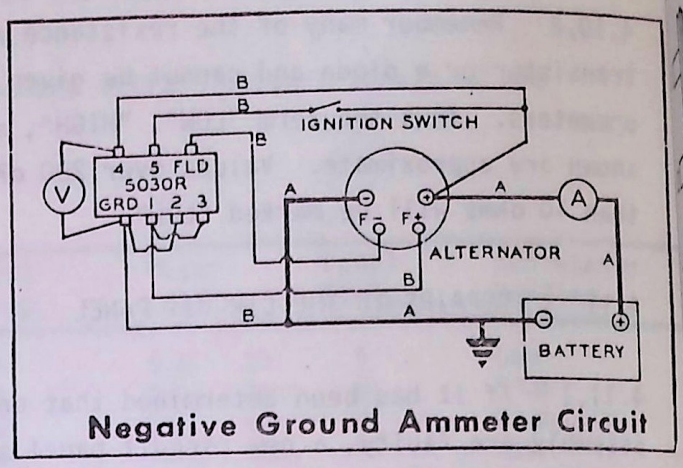


FIGURE 4-4. Negative Ground Ammeter Circuit

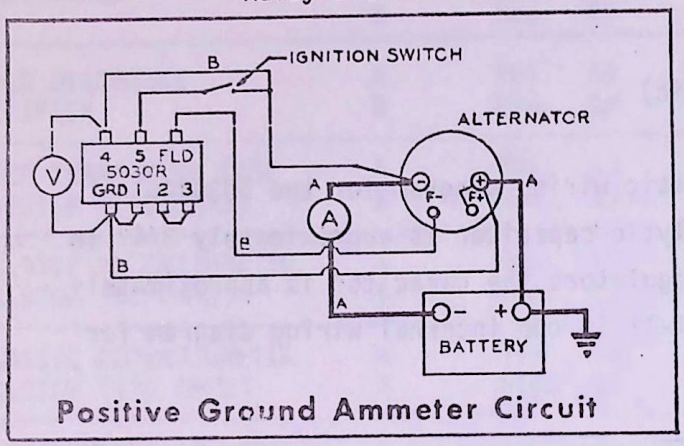


FIGURE 4-5. Positive Ground Ammeter Circuit

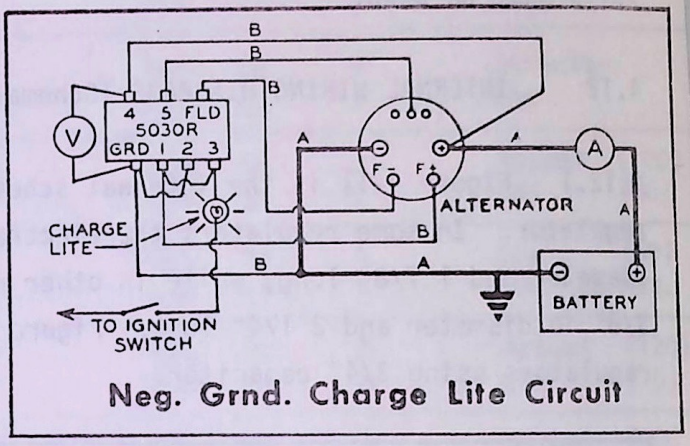


FIGURE 4-6. Neg. Grnd. Charge Lite Circuit.

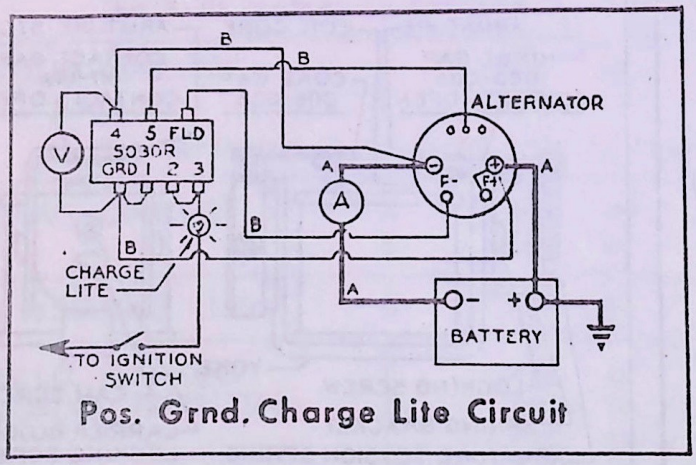


FIGURE 4-7. Pos. Grnd. Charge Lite Circuit.

FOR 14 VOLT SYSTEMS				
	RECOMMENDED CABLE SIZES			
	205 AMP		140 AMP	
TOTAL LENGTH OF CIRCUIT IN FEET	A	B	A	B
15' OR LESS	#2	#16	#4	#16
15' TO 25'	#0	#16	#2	#16

FIGURE 4-8.

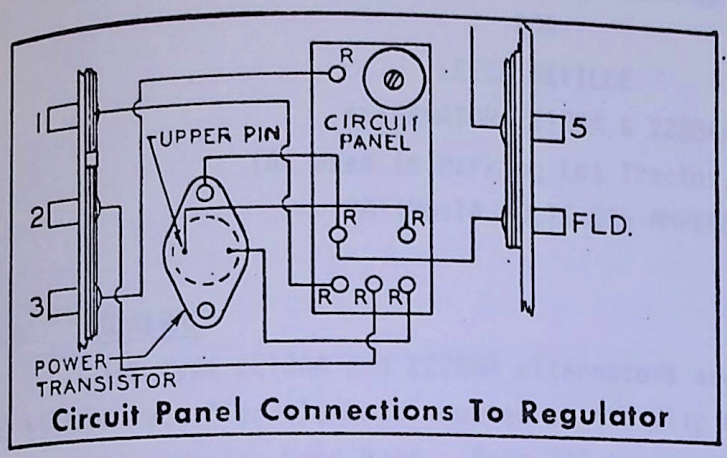


FIGURE 4-9. Circuit Panel Connections to Regulator

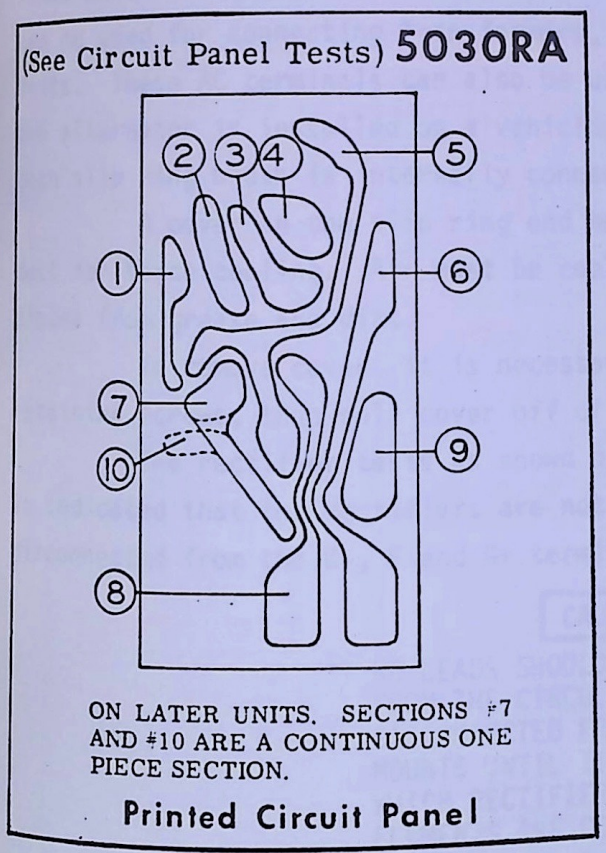


FIGURE 4-10. Printed Circuit Panel

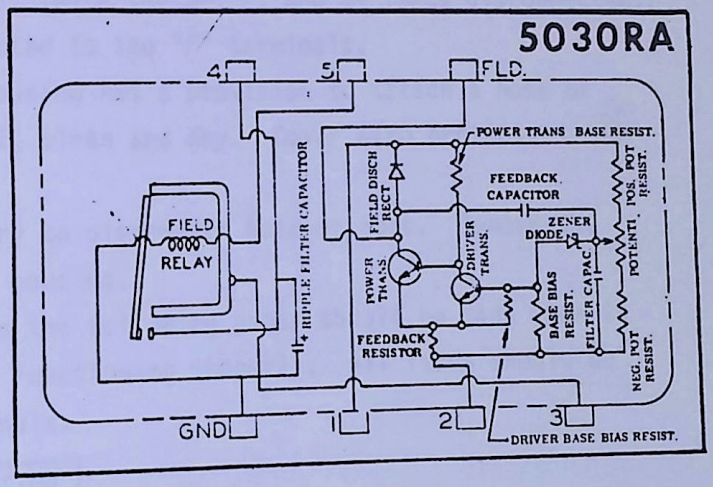


FIGURE 4-11.

MAINTENANCE INSTRUCTIONS
FOR
LEECE NEVILLE
ALTERNATOR 2218AA & 2228AA
(As Used in Parking Lot Tractor - WDW)
RATING:14 VOLTS 205 AMPERE

10.0 GENERAL

The type 2218AA and 2228AA alternators are extra heavy duty units with six (6) silicon rectifier elements mounted on the slip ring end housing and internally connected to circular buss bars. Four (4) terminals (G-, F, F, G+) provide for connections to the electrical system of vehicle or engine.

The three (3) AC terminals are Internally connected to the rectifier heat sinks which in turn are connected to the stator windings. The three AC terminals can be used for connecting Transformers, Field Relay Rectifiers or Mobile Power Units. These AC terminals can also be used to test the silicon rectifiers when the alternator is installed on a vehiclde, (with the G-, F, and G+ leads disconnected). Each slip ring brush is internally connected to the "F" terminals.

A cover on the slip ring end housing has a provision to attach a hose or duct for force cooling. Air must be cool, clean and dry. Cover also protects diodes from grease and dirt.

To remove cover, it is necessary to disconnect hose or duct. Remove the retaining screws, then pull cover off of housing.

The rectifier tests as shown on the following pages should be made when it is indicated that the rectifiers are not functioning properly. All leads should be disconnected from the G-, F and G+ terminals.

CAUTION

NO LEADS SHOULD BE DISCONNECTED FROM THE CIRCULAR BUSS BARS OR DISCONNECTED FROM THE RECTIFIER MOUNTS UNTIL IT IS DETERMINED WHICH RECTIFIER ELEMENT OR ELEMENTS ARE DEFECTIVE.

10.1 RECTIFIER TESTS (COVER REMOVED)

NOTE

Any two of the three stator winding leads must be disconnected from the heat sinks before the following tests are made. Do not [illegible] volt tests on diodes or A.C.

10.1.1 Rectifier tests should be performed with a diode tester such as the Leece-Neville Auto Diode Tester Type 134AA.

10.2 L-N DIODE TESTER

10.2.1 The Leece-Neville Auto Diode Tester utilizes a 30 volt battery to insure more accurate tests. By applying a higher voltage to the diodes, weak or borderline units are more easily detected. A conventional ohmmeter or test light will often show a diode to be OK when actually it is not.

10.2.2 The diode tester battery should always be checked before using the instrument by connecting the two test leads together. The pointer should swing to the right and remain in the "battery OK" section of the scale. If the pointer fails to register in the "battery OK" section, the battery should be replaced.

10.2.3 Diodes are tested for their ability to pass current in one direction and block it in the opposite direction. Connect the diode tester across the diode with the positive (red) lead of the tester to the positive terminal of diode. The diode should block the current flow and the pointer should remain at the left end of the scale in the "diode OK" section. Repeat the above test with the diode tester leads reversed. The diode should now pass current and the pointer should swing to the right into the "battery OK" section of the scale. If the pointer remains at the left side of the scale with the leads connected in both directions, the diode is open. If the pointer swings to the right with the leads connected in both directions, the diode is shorted.

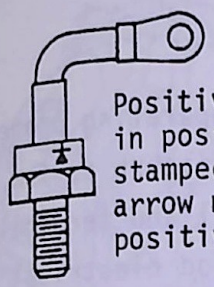
NOTE

Some alternator checks show the diode tester connected between one output terminal and an AC terminal which checks 3 diodes at one time. Occasionally the diode tester will not remain all the way in the "diode OK" section due to 3 diodes being parallel. This does not necessarily indicate a failure and if such a reading is obtained each diode should be tested individually.

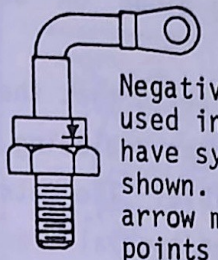
RECTIFIER CELL POLARITY MARKINGS

CAUTION

DO NOT USE COLOR CODING TO DETERMINE POLARITY.



Positive terminal post cells used in positions 1-3-5 have symbol stamped as shown. The symbol or arrow marking always points to the positive side of the rectifier.



Negative post cells used in positions 2-4-6 have symbol stamped as shown. The symbol or arrow marking always points to the positive side of the rectifier.

10.3 TEST 1 (POSITIVE TERMINAL POST CELLS)

10.3.1 With the negative (-) clip of the diode tester on terminal post of cell No. 1 and positive (+) clip on the corresponding heat sink, the pointer should swing to the extreme right end of the scale.

10.3.2 With the positive (+) clip of the diode tester on the terminal post of cell No. 1 and the negative (-) clip on the corresponding heat sink, the pointer should remain at the left end of scale marked diode "OK". Each of the Positive Terminal Post Cells (Nos. 1, 3, 5) should be checked in the above manner.

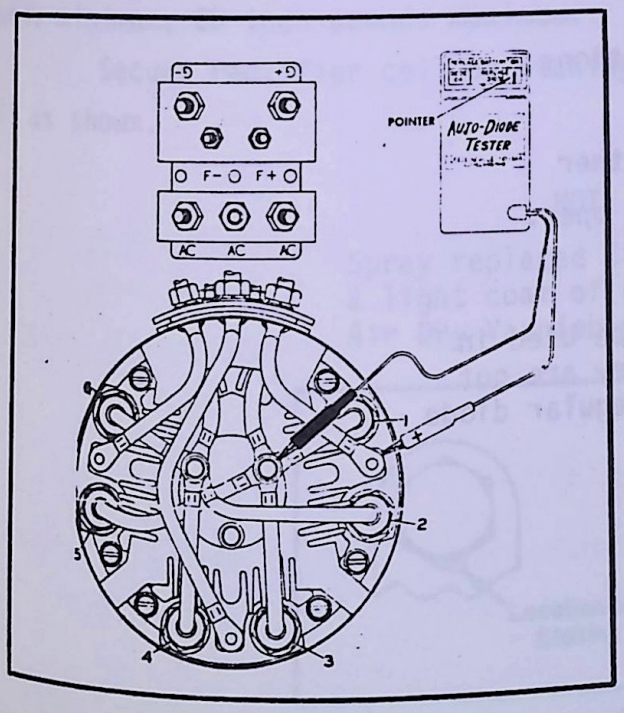


FIGURE 10-1

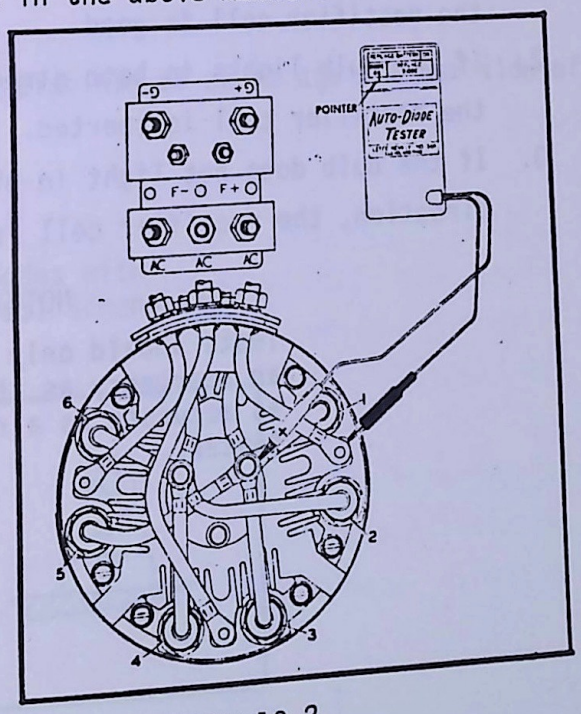


FIGURE 10-2

10.4 TEST 2 (NEGATIVE TERMINAL POST CELLS)

10.4.1 All three cells (Nos. 2, 4, 6) should be tested in a similar manner. With the positive (+) clip of the tester on the terminal post of the cell and the negative clip on the corresponding heat sink, the pointer should swing to the extreme right end of the scale. When the clips are reversed, the indicator should remain on the left end of scale, in the diode "OK" section.

10.4.2 Any cell or cells that the above tests indicate as not operating properly must be replaced. When replacing cells, care must be taken to disturb as few connections as possible. The metal to metal surfaces of the cell and terminal connections are given special treatment in assembly to insure good electrical contact and to prevent electolysis and the formation of oxides. This same treatment must be applied when a new or replacement cell is installed.

10.5 RECTIFIER TESTS (ALTERNATE)

10.5.1 If a diode tester is not available, these tests may be made with 24 volts of battery and a 24 volt bulb. See Figure 10-3. This test is basically the same as Rectifier Tests (Cover Removed) with the bulb and battery replacing the diode tester as shown in Test 1.

10.5.2 The results of the above tests are as follows:

1. If the bulb lights in one direction only, the rectifier cell is good.
2. If the bulb lights in both directions, the rectifier cell is shorted.
3. If the bulb does not light in either direction, the rectifier cell is open.

NOTE

Tests should only be used in an emergency as they are not as accurate as a regular diode tester.

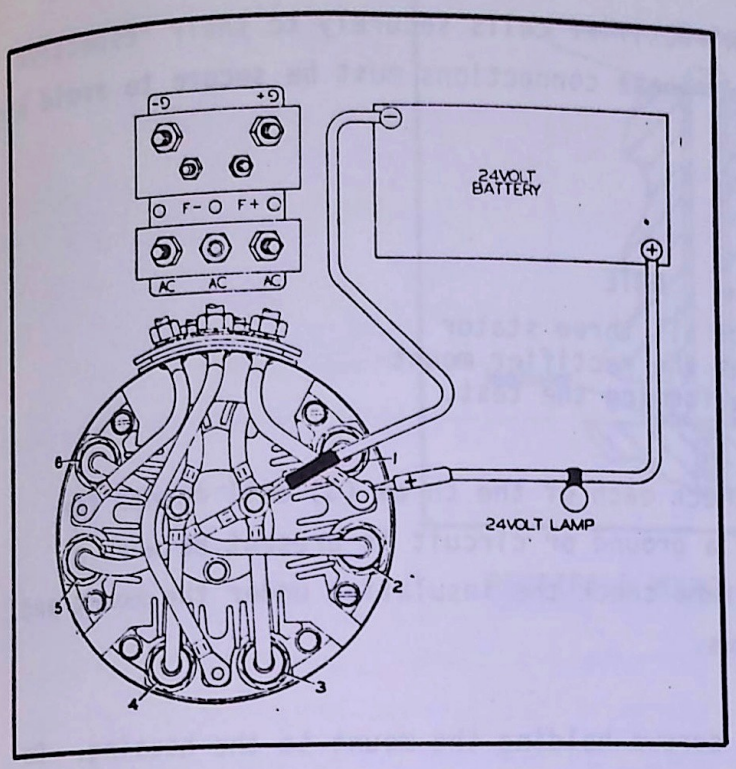


FIGURE 10-3

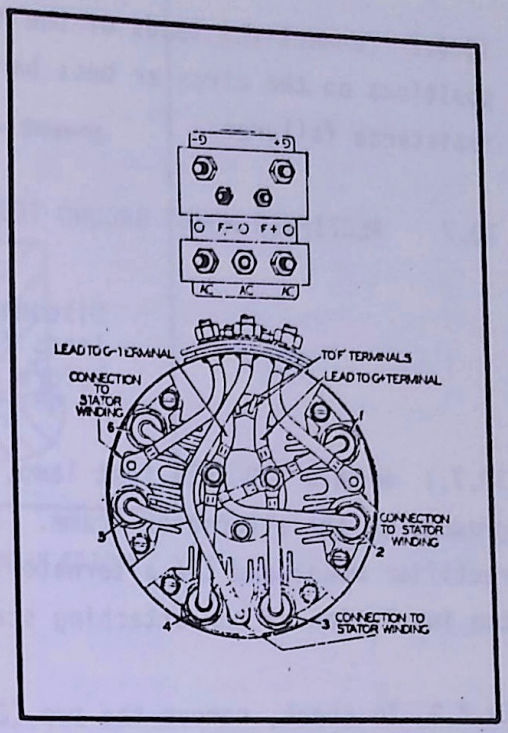


FIGURE 10-4

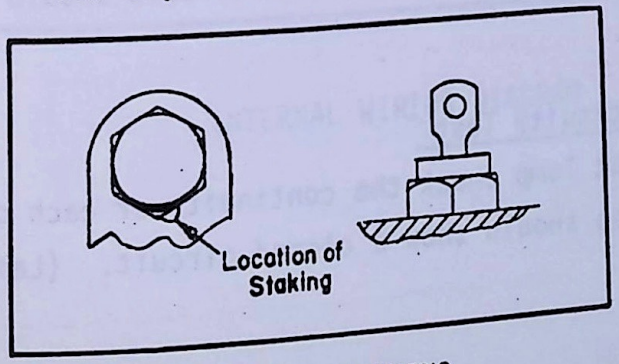
10.6 RECTIFIER CELL REPLACEMENT

10.6.1 Disconnect the lead of the cell to be replaced from the circular buss bar and with a wrench remove the cell from the tapped hole in the mount. With a wire brush and Leece-Neville compound No. 56624 clean the area around the cell mounting hole. Immediately after cleaning apply a thin coating of the No. 56624 compound to the clean surface and install the new cell. Tighten cell in mount with a torque of 20 inch pounds minimum, 25 inch pounds maximum.

Secure rectifier cell by staking aluminum of mount against hex side of cell as shown.

NOTE

Spray replaced diodes with
a light coat of #651 Schenectady
Air Dry Varnish.



LOCATION OF STAKING

10.6.2 Connect the leads of the new rectifier cells securely to their respective positions on the circular buss bars. These connections must be secure to avoid high resistance failures.

10.7 RECTIFIER MOUNT GROUND TEST

NOTE

Disconnect all three stator leads from the rectifier mount before performing the test.

10.7.1 With a 110 volt test lamp, check each of the three (3) cell mounts for grounds to the alternator frame. If a ground or circuit is present between a rectifier mount and the alternator frame check the insulation under the mount and the insulation of the attaching screws.

10.7.2 To check, remove the two (2) screws holding the mount to the housing. Do not remove the leads from the buss bars. The flexible leads will permit the mount to be lifted slightly so that the insulator underneath may be pulled out. Check the insulting sleeving and washer on the screws. Replace cracked or broken insulators, sleeving or insulation washers. When replacing the screws, holding the mount to the housing, make sure the insulation washer is between the guard washer and cell mount.

10.8 UNIT CHECK

10.8.1 Stator Ground Test

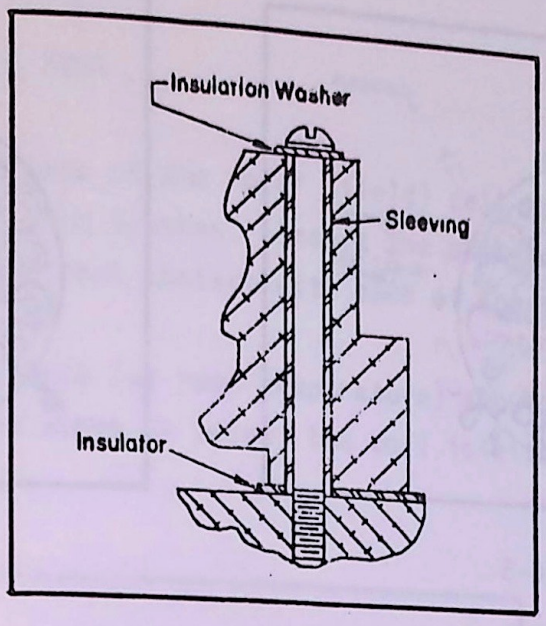
Check each stator phase for grounds to the alternator frame as shown. See Figure 10-5. A 110 or 220 volt test lamp is used for this test. No circuit shoul be present. (Lamp should not light)

10.8.2 Stator Ground Test (Stator Winding Leads Disconnected From Rectifier Mounts)

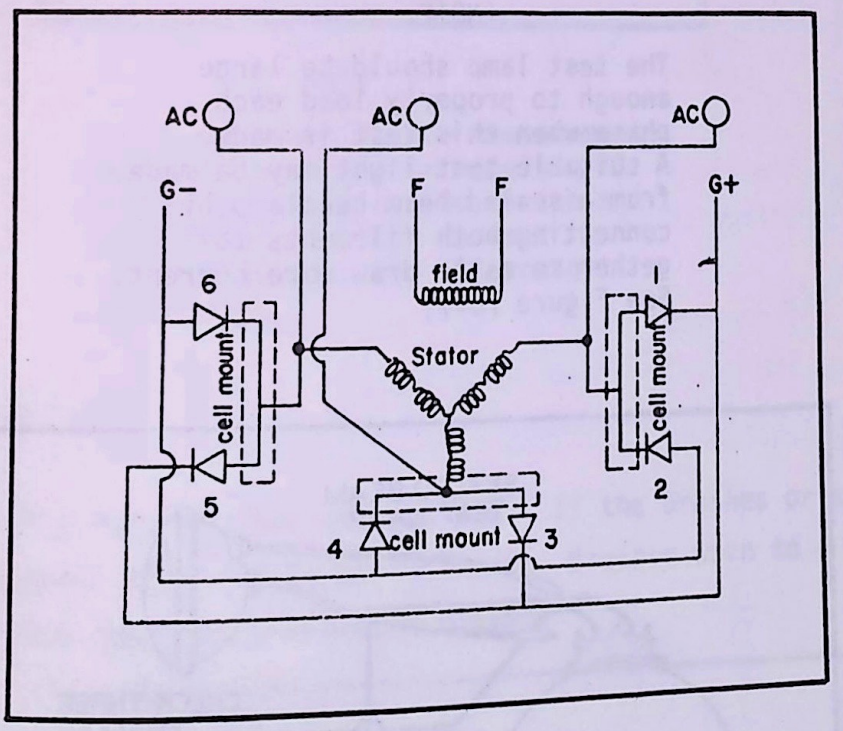
Check each stator phase for grounds to the alternator frame as shown. A 110 or 220 volt test lamp is used for this test. No circuit should be present. (Lamp should not light)

10.8.3 Stator Winding Continuity Test

With a 110 volt test lamp check the continuity of each of the three stator phases as shown. Each phase should show a closed circuit. (Lamp should light)



RECTIFIER MOUNT INSULATION



INTERNAL WIRING DIAGRAM

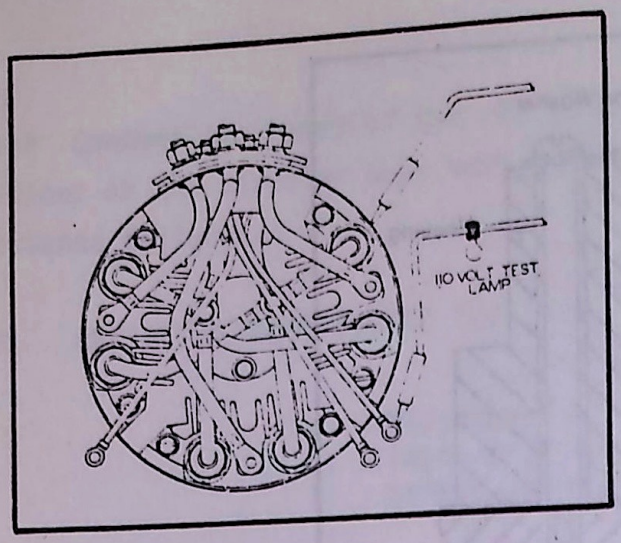


FIGURE 10-5

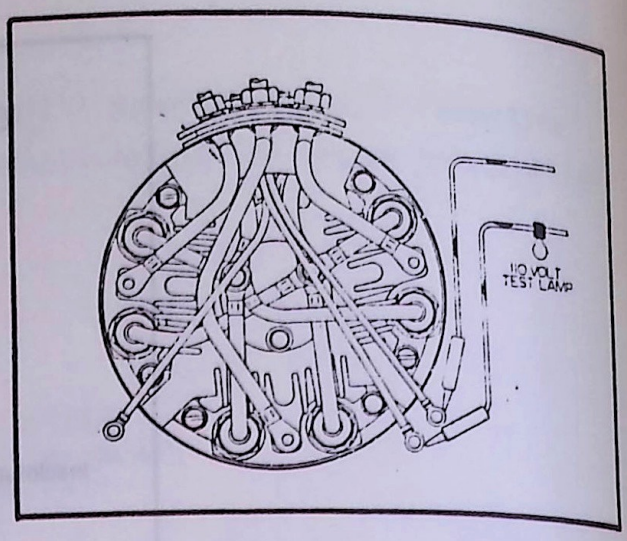


FIGURE 10-6

10.8.4 Stator Phase Test

With the alternator on the test block connect a 12 volt battery to the field circuit and run the alternator at approximately 800 RPM. Connect an AC voltmeter, or test lamp of the same voltage rating as the system, across the three AC terminals in turn. Voltage or lamp brilliancy should be the same across phases 1-2, 2-3, and 1-3. A pronounced difference in voltmeter reading or lamp brilliancy indicates shorted or grounded stator winding.

NOTE

The test lamp should be large enough to properly load each phase when this test is made. A suitable test light may be made from a sealed beam headlamp by connecting both filaments together so as to draw more current. See Figure 10-7.

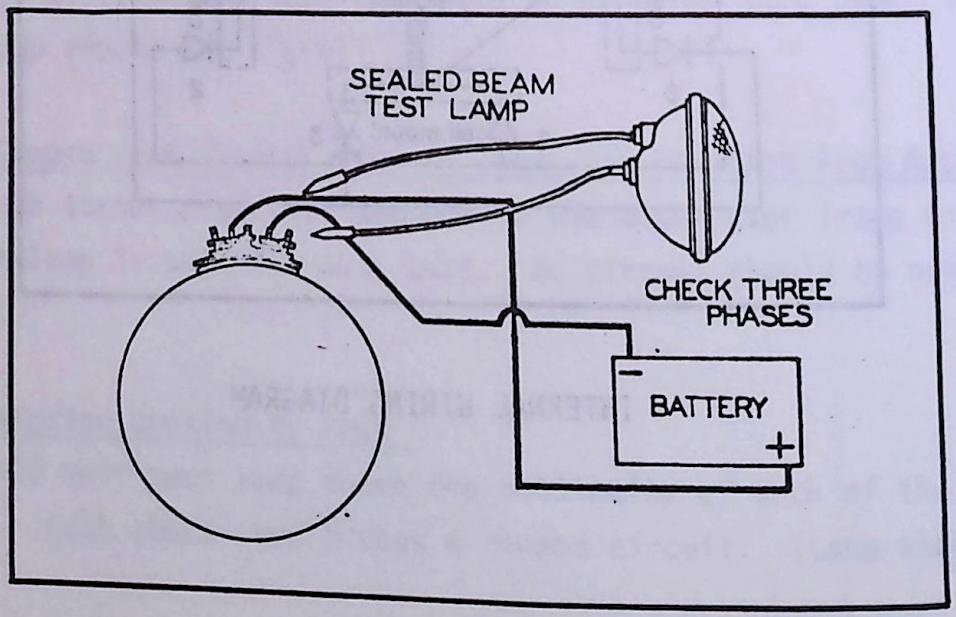
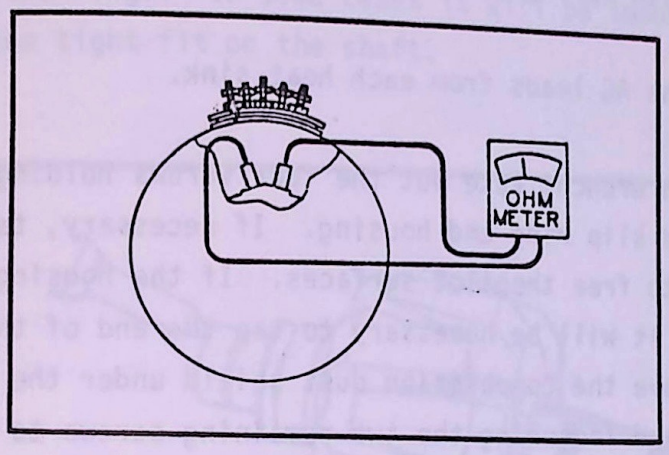


FIGURE 10-7

10.9 ROTOR COIL RESISTANCE TEST

10.9.1 To measure the resistance of the rotor (field) coil winding, remove the two brush holders and the slip ring brushes. Insert the ohmmeter test prods into the brush holder openings and make direct contact with each of the two slip rings.

10.9.2 The rotor coil resistance (at room temperature) should read between 2.2 to 2.6. If the resistance is read above or below, the coil is either shorted or has a loose or poor solder connection.

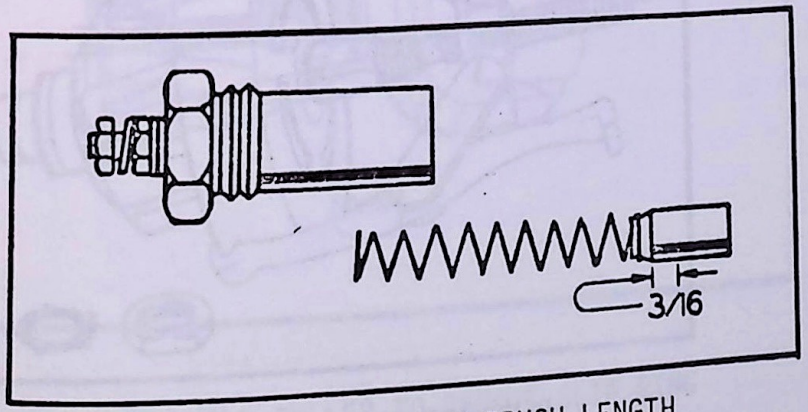


NOTE

Rotor coil resistance measurement made at the field terminals will not be accurate due to variable slip ring and brush contact resistance when the alternator is at rest.

10.10 SLIP RING BRUSHES

10.10.1 Check the slip ring brushes and springs. If the brushes or springs are cracked, broken or burned, they should be replaced. Brushes worn to a length less than 3/16 inches are too short and must be replaced.



MINIMUM SERVICABLE BRUSH LENGTH

10.10.2 Should any of these tests indicate that the alternator is not operating properly, it should be removed from the engine and completely overhauled.

10.11 DISASSEMBLY

10.11.1 Remove rotor shaft nut, washer and pull fan and pulley assembly from shaft. Remove shaft key.

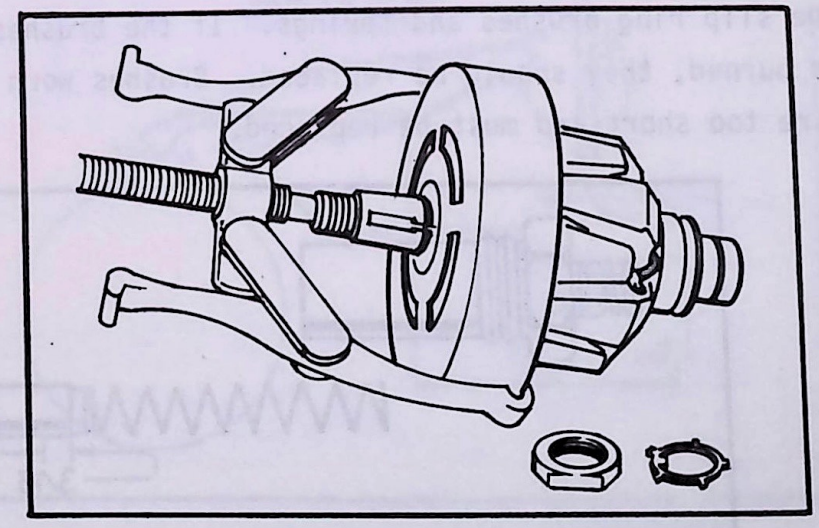
10.11.2 Remove "F" leads from brush holder assemblies and take out the two brush holders and brushes (with springs).

10.11.3 Disconnect the AC leads from each heat sink.

10.11.4 With an Allen wrench, take out the four screws holding the housings and stator and pull off the slip ring end housing. If necessary, tap around the housing with a rawhide mallet to free thepilot surfaces. If the housing cannot be removed with a rawhide mallet, it will be necessary to tap the end of the rotor shaft with a soft brass bar. Remove the composition dust shield under the circular buss bars by removing one screw and loosening the two remaining screws to reveal the rotor shaft.

10.11.5 Remove the stator from the drive end housing and rotor. Again it may be necessary to use a rawhide mallet to free the pilot surfaces.

10.11.6 Take off the shaft locknut and tabbed washer. Remove the four 10-32 hex head screws from the bearing inner retainer plate to prevent damage when housing is pulled or pressed from rotor assembly.

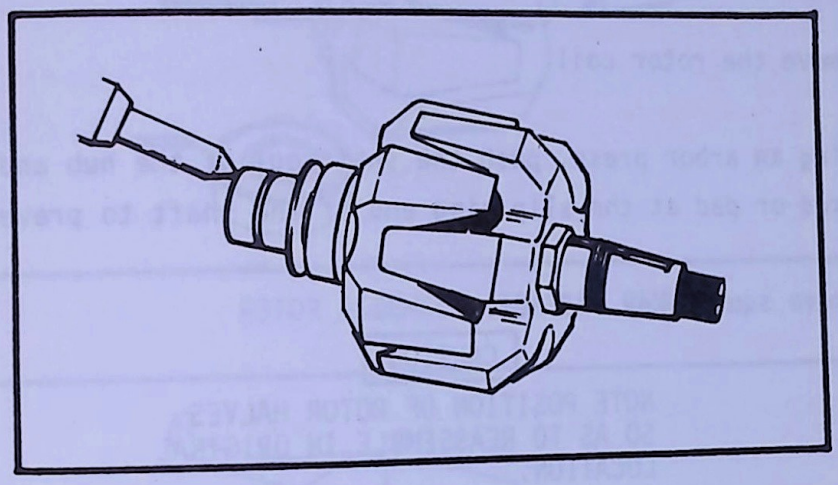


REMOVING DRIVE END HOUSING

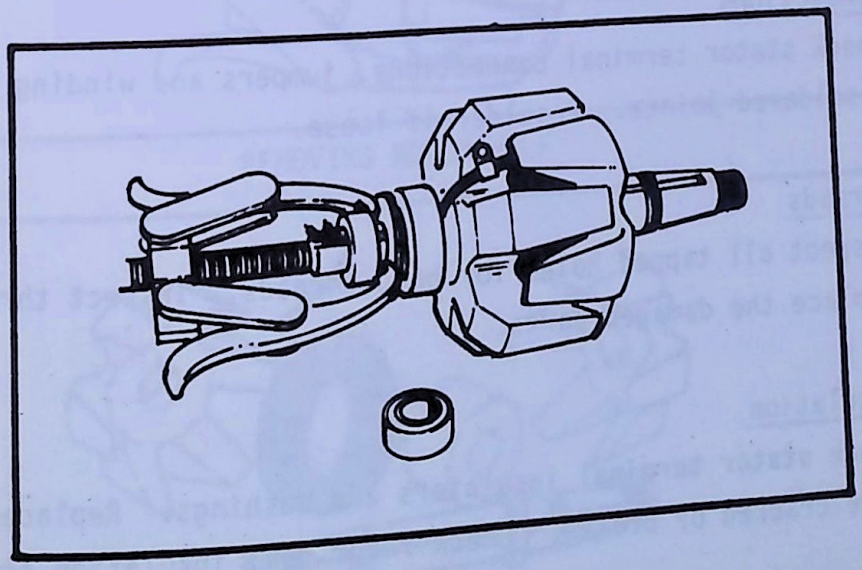
10.11.7 Bearing can then be pulled off of the rotor shaft. If the rotor bearings, slip rings and coil are in good condition, further disassembly is unnecessary. If the field coil is open circuited, grounded, does not have the correct resistance, or is loose in the rotor halves, the rotor assembly must be disassembled and the field coil replaced.

10.12 ROTOR DISASSEMBLY

10.12.1 Unsolder both field coil leads from the slip rings and using a small puller, carefully pull off the rings. In some cases it will be impossible to save the old slip rings due to the tight fit on the shaft.



UNSOLDERING FIELD LEAD



USING SMALL PULLER TO REMOVE SLIP RING

10.12.2 Take off the insulation washer and snap ring in front of the bearing and pull the bearing from the shaft. Save the small wedge removed from the lead slot under the bearing.

10.12.3 Loosen field coil lead clip and free the coil lead.

10.12.4 Holding the rotor in a vise, remove the shaft nut at the slip ring end, (DO NOT disturb the nut at D.E.) and tap off the slip ring end rotor half. Remove the square key.

NOTE

Rotor coil may be damaged in disassembly due to the adhesive epoxy securing the coil to the rotor halves.

10.12.5 Remove the rotor coil.

10.12.6 Using an arbor press, push the shaft out of the hub and remaining rotor half. Use a brass rod or pad at the slip ring end of the shaft to prevent nicks or burrs.

10.12.7 Remove square key and nut.

CAUTION

NOTE POSITION OF ROTOR HALVES, SO AS TO REASSEMBLE IN ORIGINAL LOCATION.

10.13 INSPECTION AND CLEANING

10.13.1 Connections

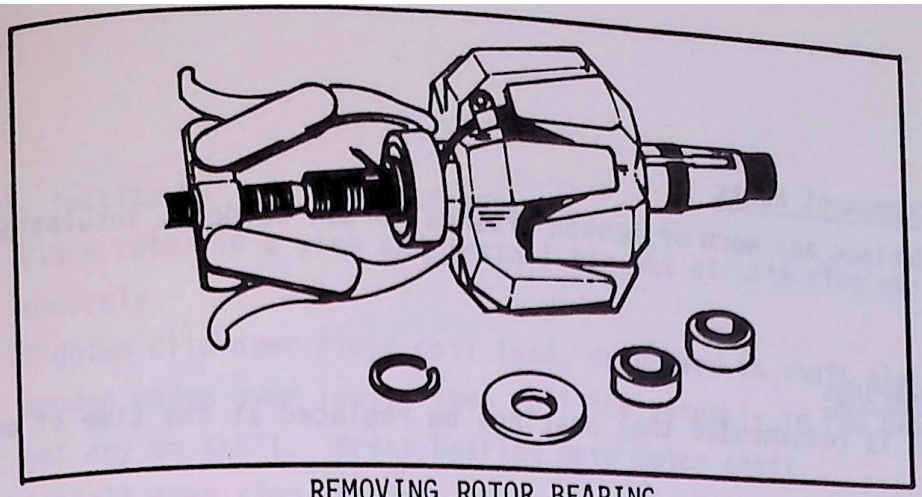
Check stator terminal connections, jumpers and winding connections for security of soldered joints. Resolder if loose.

10.13.2 Threads

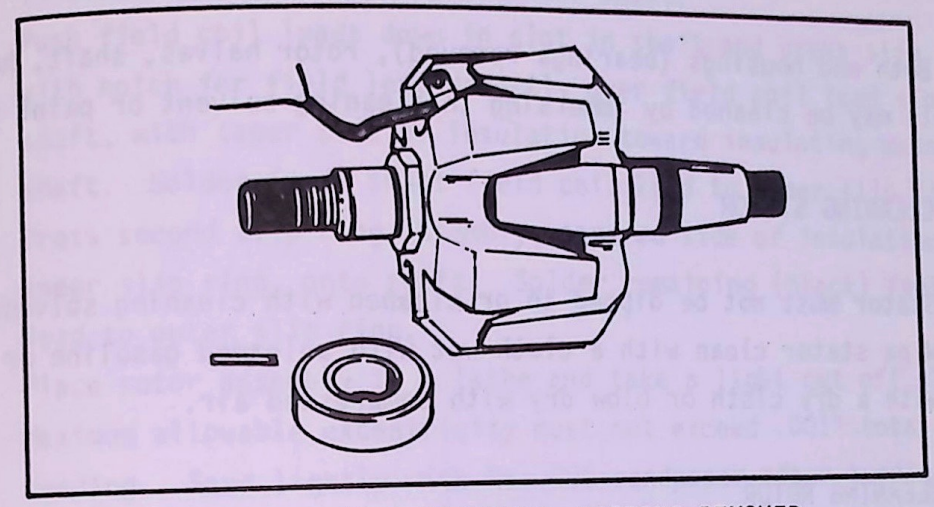
Inspect all tapped holes for good threads. Inspect threads on rotor shaft. Repair or replace the damaged parts.

10.13.3 Insulation

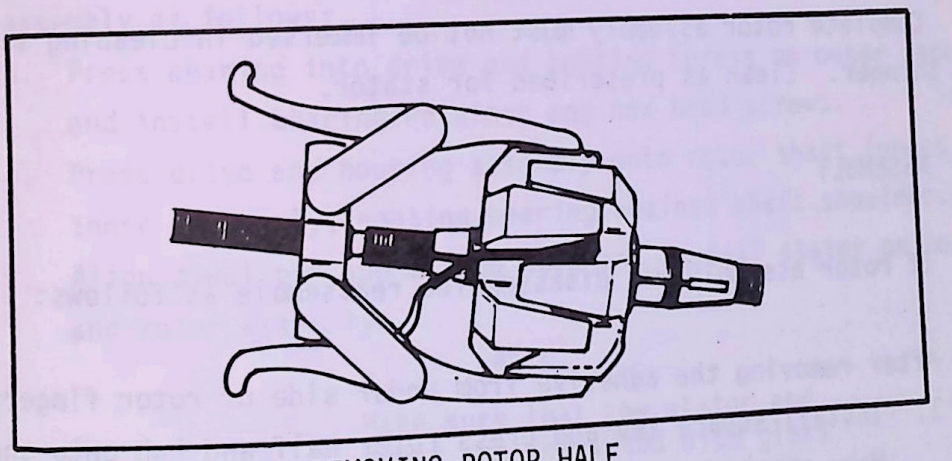
Check stator terminal insulators and bushings. Replace slip rings if insulators are cracked or broken. Check rotor coil insulation and leads for cuts or breaks.



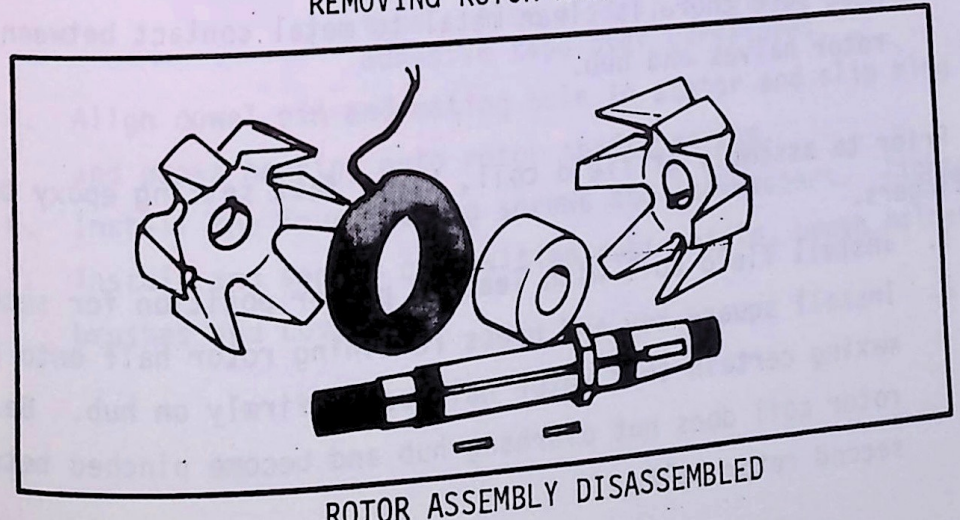
REMOVING ROTOR BEARING



ROTOR ASSEMBLY, BEARING REMOVED



REMOVING ROTOR HALF



ROTOR ASSEMBLY DISASSEMBLED

10.13.4 Component Parts

Replace any worn or broken brushes, brush holders, insulation washers, or snap rings.

10.13.5 Bearings

It is recommended that bearings be replaced at the time of overhaul.

10.14 CLEANING COMPONENTS

10.14.1 Both end housings (bearings removed), rotor halves, shaft, hub, hardware and brackets may be cleaned by immersing in cleaning solvent or paint thinner.

10.15 CLEANING STATOR

10.15.1 Stator must not be dipped in or cleaned with cleaning solvent or paint thinner. Wipe stator clean with a cloth wet with unleaded gasoline or kerosene and then wipe with a dry cloth or blow dry with compressed air.

10.16 CLEANING ROTOR

10.16.1 Complete rotor assembly must not be immersed in cleaning solvent or paint thinner. Clean as prescribed for stator.

10.17 ASSEMBLY

10.17.1 If rotor assembly was disassembled reassemble as follows:

10.17.2 After removing the adhesive from under side of rotor fingers:

1. Install square key and press rotor half and hub onto shaft. Make sure there is clean metal to metal contact between rotor halves and hub.

10.17.3 Prior to assembly of field coil, apply fast setting epoxy to under side of rotor fingers.

1. Install field coil with lead in proper position for securing under clip.
2. Install square key and press remaining rotor half onto rotor shaft, making certain that rotor half seats firmly on hub. Be sure that rotor coil does not overhang hub and become pinched between hub and second rotor half.

10.17.4. Apply loctite "A" to shaft threads.

1. Place rotor in a vise and install hex nut at slip ring end. Tighten securely.
2. Tighten clip over field coil lead, drop lead in shaft slot, install wooden wedge over lead. Then roll the assembly in red oxide. Do not get any on shaft. Press bearing onto rotor shaft.
3. Install snap ring and insulation washer. Be sure opening in snap ring is directly over lead slot in rotor shaft.
4. Push field coil leads down in slot in shaft and press slip ring assembly, with notch for field lead directly over field coil lead slot in rotor shaft, with taper side of insulation toward insulating washer, onto shaft. Solder (red) short field coil lead to inner slip ring.
5. Press second slip ring assembly, tapered side of insulation toward inner slip ring, onto shaft. Solder remaining (black) field coil lead to outer slip ring.
6. Place rotor assembly in a lathe and take a light cut off slip ring. Maximum allowable excentricity must not exceed .001" total indicator reading. Sand lightly with No. 000 sandpaper after turning while still chucked in lathe. With rotor completely assembled, complete assembly as follows:
   a. Press bearing into drive end housing (press on outer race only) and install bearing retainer and hex head screws.
   b. Press drive end housing assembly onto rotor shaft (press on inner race only) seating bearing against shaft shoulder.
   c. Align dowel pin and mating hole and install stator on housing and rotor assembly.

NOTE

Make sure that the stator end turns are insulated with glass tape. Also a strip of glass adhesive tape over curvatures.

   d. Align dowel pin and mating hole in stator and slip ring end housing and press housing onto rotor shaft bearing.
   e. Install the four housing screws and lockwashers. Tighten securely.
   f. Install and secure composition dust shield, brush holders, new brushes and cover.

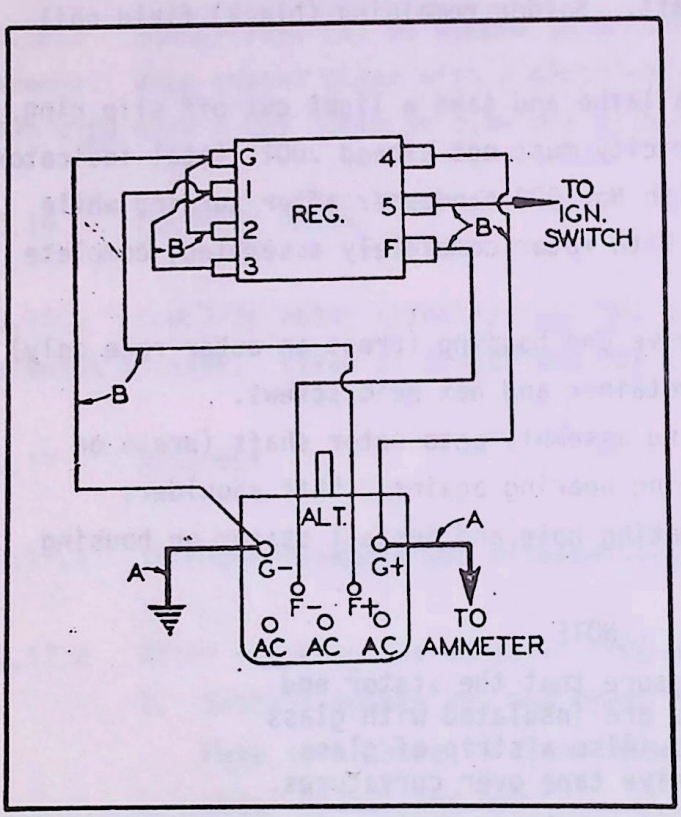
g. Install spacing washers, key, fan and pulley assembly and secure with washer and nut.

h. Check for free rotor rotation.

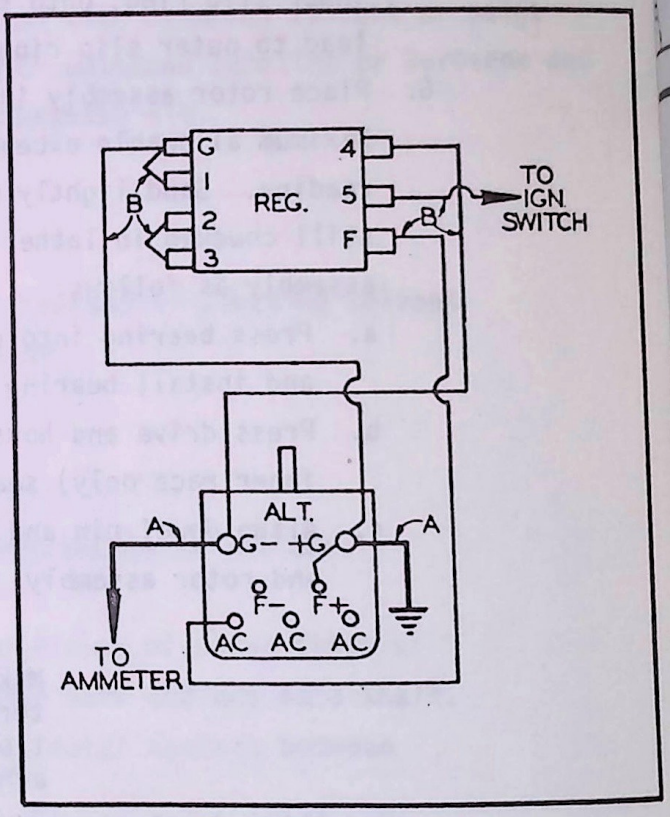
i. Bench test for proper operation.

NOTE

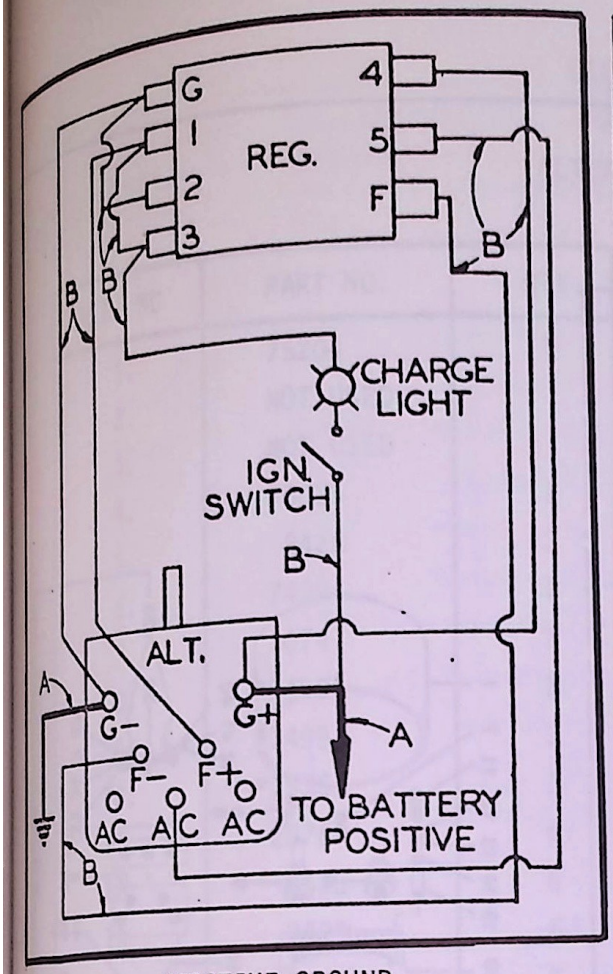
Bearings are lubricated with R.P.M. Automotive Medium Grease.



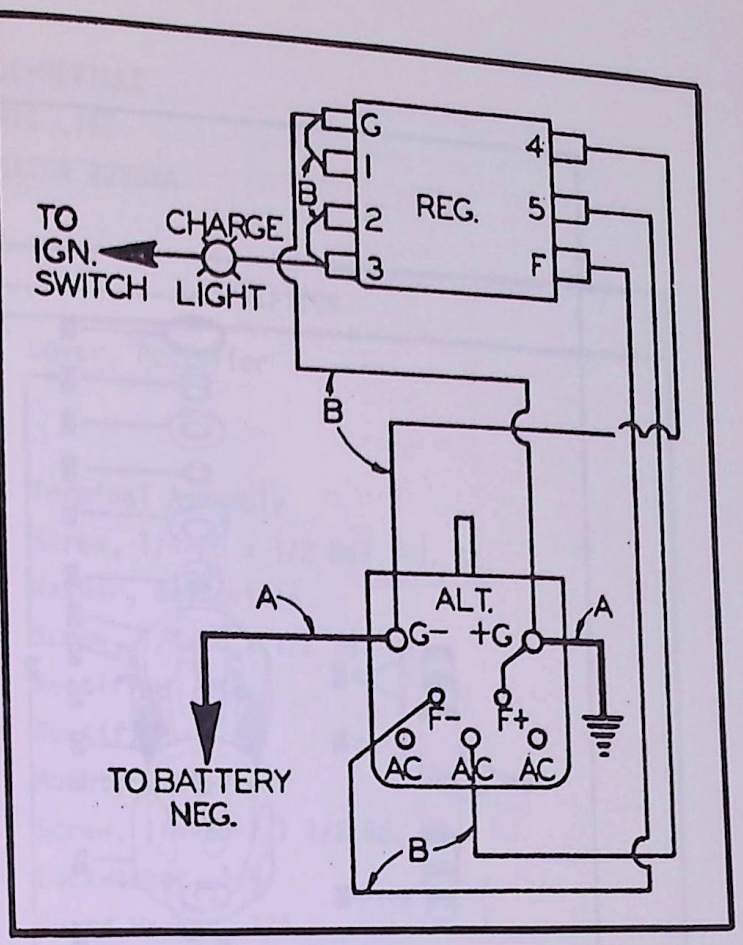
NEGATIVE GROUND AMMETER CIRCUIT



POSITIVE GROUND AMMETER CIRCUIT

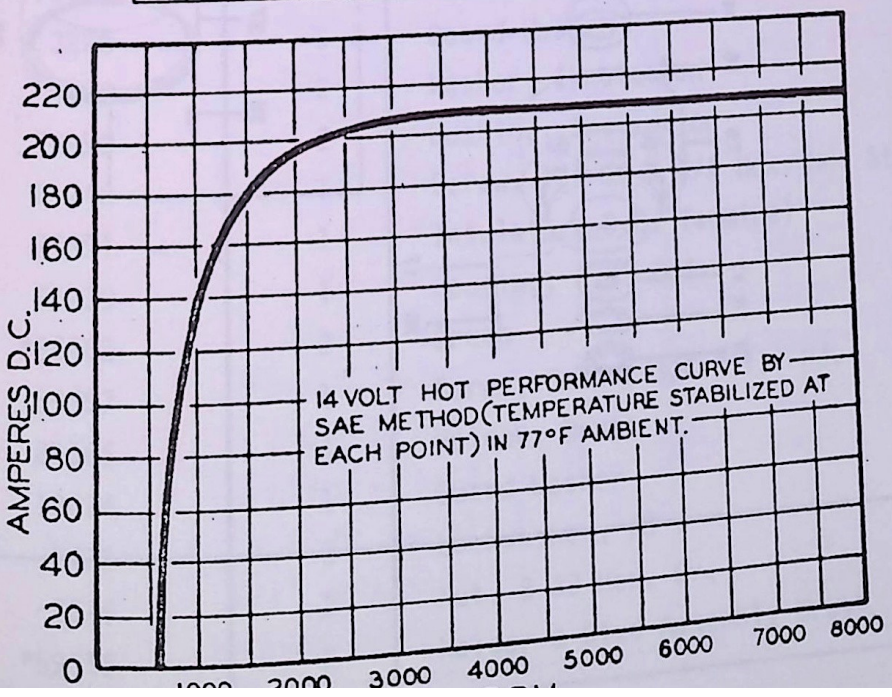


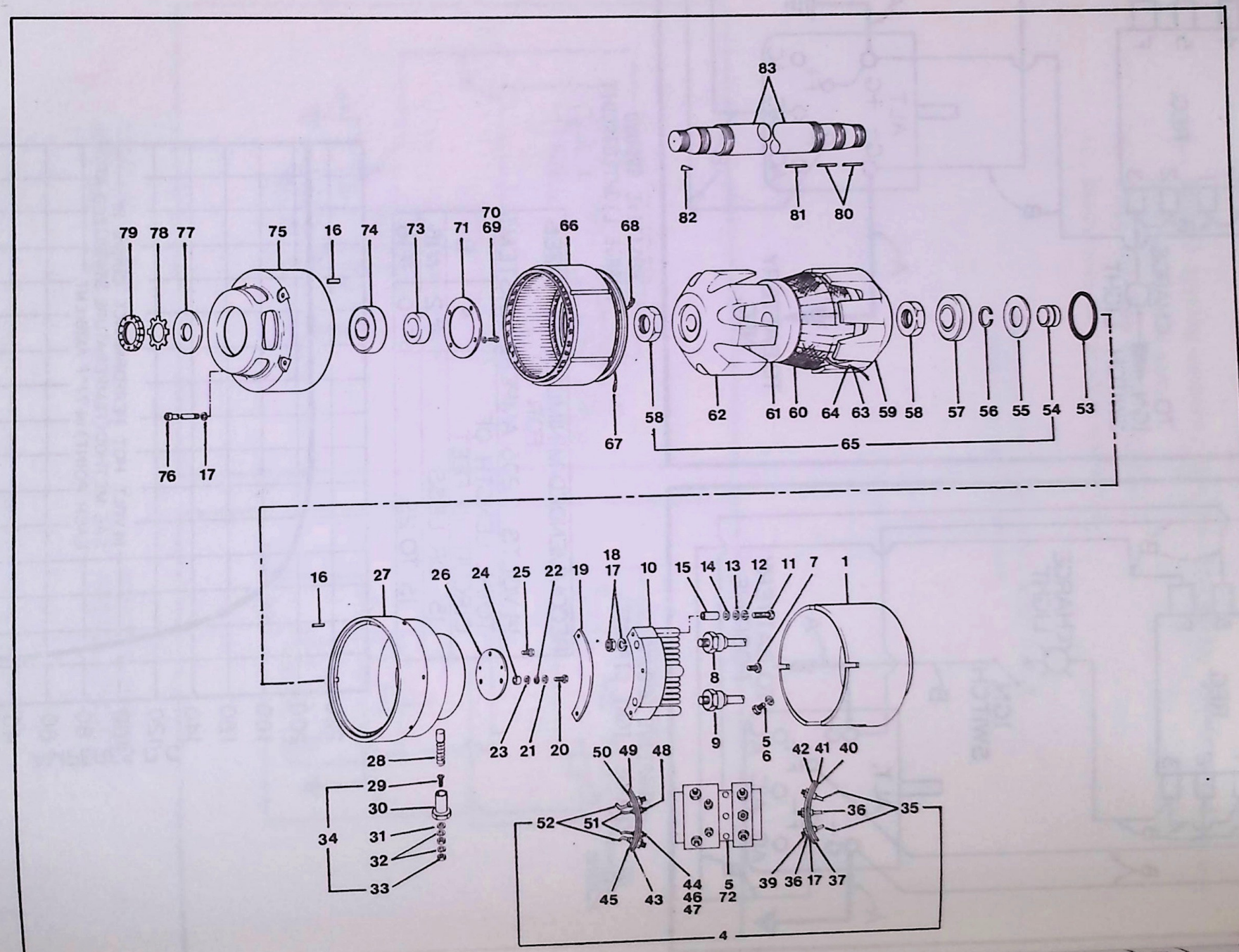
NEGATIVE GROUND
CHARGE LIGHT CIRCUIT



POSITIVE GROUND
CHARGE LIGHT CIRCUIT

RECOMMENDED MINIMUM WIRE SIZES FOR 14 VOLTS 205 AMPERE SYSTEMS		
TOTAL LENGTH OF CIRCUIT IN FEET	A	B
15 OR LESS	# 2	#16
15 TO 25	# 0	#16




83
82
81
80
79
78
77
75
16
74
73
71
70
69
66
68
76
17
67
58
62
61
60
64
63
59
58
57
56
55
54
53
65
16
27
26
24
25
22
19
18
17
10
15
14
13
12
11
7
1
8
9
5
6
23
21
20
28
29
30
31
32
33
34
50
49
48
52
51
45
43
44
46
47
5
72
42
41
40
36
35
39
36
17
37
4

LEECE-NEVILLE

PARTS LIST

ALTERNATOR 2228AA

REF. NO	PART NO.	QTY.	DESCRIPTION
1.	75204	1	Cover, Rectifier
2.	NOT USED		
3.	NOT USED		
4.	75025	1	Terminal Assembly
5.	8428	3	Screw, 1/4-20 x 1/2 Hex. Hd. St.
6.	74994	11	Washer, Belleville
7.	30747	3	Screw, 1/4-28 x 1/2 Rd. Hd.
8.	*74992	3	Rectifier
9.	*74993	3	Rectifier
10.	*75353	3	Mount, Rectifier
11.	28789	6	Screw, 1/4-20 x 1 1/2 Rd. Hd.
12.	2523	6	Lockwasher, 1/4
13.	2425	6	Guard Washer, 1/4
14.	5157	6	Washer, Insulation
15.	74412	6	Sleeving
16.	16333	2	Pin
17.	2433	11	Lockwasher, 3/8
18.	2787	6	Nut, 3/8-24 Hex. St.
19.	*58495	3	Insulator, Mount
20.	22078	2	Screw, 1/4-20 x 1 1/8 Hex. Hd. St.
21.	74994	3	Washer
22.	3226	3	Guard Washer
23.	4470	2	Washer, Insulation
24.	74990	2	Bushing, Insulation
25.	21740	1	Screw, 1/4-20 x 3/4 Hex. Hd. St.
26.	74991	1	Insulator, D.C. Terminal
27.	75229	1	Housing, S.R. End
28.	*28462	2	Brush
29.	59357	1	Screw, 8-32 x 3/4 Fill. Hd.
30.	29586	1	Holder, Brush
31.	13624	1	Guard Washer
32.	2435	2	Lockwasher, #8
33.	2525	2	Nut, 8-32 Hex. Br.
34.	*59356	2	Holder & Stud Assembly Brush

REF. NO	PART NO.	QTY.	DESCRIPTION
35.	75021	2	Lead Assembly (AC)
36.	75020	1	Lead Assembly (AC)
37.	3852	5	Guard Washer
38.	4661	5	Nut, 3/8-16 Hex.
39.	58492	5	Screw, Terminal
40.	*58488	1	Insulator, Inner
41.	58491	1	Plate, Terminal
42.	*58489	1	Insulator, Outer
43.	*58490	1	Insulator, Outer
44.	56623	2	Screw, Terminal
45.	*31419	2	Bushing, Insulation
46.	2771	2	Nut, 1/4-20 Hex.
47.	2523	2	Lockwasher, 1/4
48.	2524	2	Guard Washer
49.	*31557	5	Bushing, Insulation
50.	*58499	1	Insulator, Inner
51.	75019	2	Lead Assembly
52.	75022	2	Lead Assembly
53.	*58468	1	"O" Ring
54.	*33261	2	Ring Assembly
55.	*30257	1	Washer, Insulation
56.	*29658	1	Ring, Snap
57.	*29717	1	Bearing 206
58.	*29875	2	Nut, 1 3/8-12 Hex.
59.	29714	1	Rotor, (See Note)
60.	*75001	1	Coil Assembly
61.	29716	1	Hut, Rotor
62.	29715	1	Rotor (See Note)
63.	30295	1	Clip
64.	28334	1	Screw, #8
65.	*75227	1	Rotor Assembly
66.	*75002	1	Stator Assembly
67.	75003	1	Lead Assembly
68.	75004	2	Lead Assembly
69.	75348	4	Screw, 10-32 x 1/2 Hex. Hd. St.
70.	2434	4	Lockwasher, #10
71.	29663	1	Retainer Bearing

REF. NO.	PART NO.	QTY.	DESCRIPTION
72.	4495	3	Screw, 1/4-20 x 5/8 Hex. Hd. St.
73.	*29732	1	Collar, Thrust
74.	29662	1	Bearing, 306
75.	75231	1	Housing, D.E.
76.	58469	4	Screw, 3/8-16 x 5 1/4 Soc. Hd.
77.	30472	1	Collar, Spacing
78.	31097	1	Lockwasher, Shaft
79.	18930	1	Nut, Bearing Retainer
80.	*11826	2	Key, 5/32 Sq. x 7/8 Lg.
81.	*30470	1	Wedge, Slot
82.	* 3109	1	Key, #15 Woodruff
83.	34363	1	Shaft

ASSEMBLY & INSTALLATION INSTRUCTIONS FOR AMERICAN BOSCH WWC "20-20" UNITIZED ELECTRIC WINDSHIELD WIPER KIT (12 VOLT - TWO SPEED)

5.0 INSTRUCTIONS

5.1 ASSEMBLY

5.1.1 Assemble the various parts in the following order:

1. Pin "D" (Figure 5-1) to hole "B" in arm of wiper arm shaft assembly to obtain the desired wiping angle (85^{o}).
2. Wiper arm shaft assembly to mounting bracket (Figure 5-2) and secure it in place with the screws provided.
3. Spring washer, drive arm (See Note) and nut (Figure 5-2) to motor shaft. Hold drive arm in a vise or some other suitable fixture (to prevent damage to gear teeth) and tighten nut to a torque of 50-70 lbs. in.

NOTE

When facing the motor drive shaft and with the gear housing to the right, assemble the drive arm as follows:

5.2 HEADER MOUNTING

5.2.1 To the right to park arm and blade to the right side of windshield as viewed from drivers seat.

5.2.2 To the left to park arm and blade to the left side of windshield as viewed from driver seat.

5.3 COWL MOUNTING

5.3.1 To the right to park arm and blade to the left side of windshield as viewed from driver seat.

5.3.2 To the left to park arm and blade to the right side of windshield as viewed from driver seat.

5.3.3 All parking positions are reversed if windshield wiper assembly is mounted in the inverted position (wiper arm shaft assembly down).

5.3.4 Motor to mounting bracket and secure it in place with the screws provided.

5.3.5 Connecting link (Figure 5-2) to wiper arm shaft assembly and drive arm pins and secure it in place with the spacing washers and spring clips. The link must be assembled so that the bushing nearest the cut-out in the link is attached to the wiper arm shaft assembly with the cut-out section facing down.

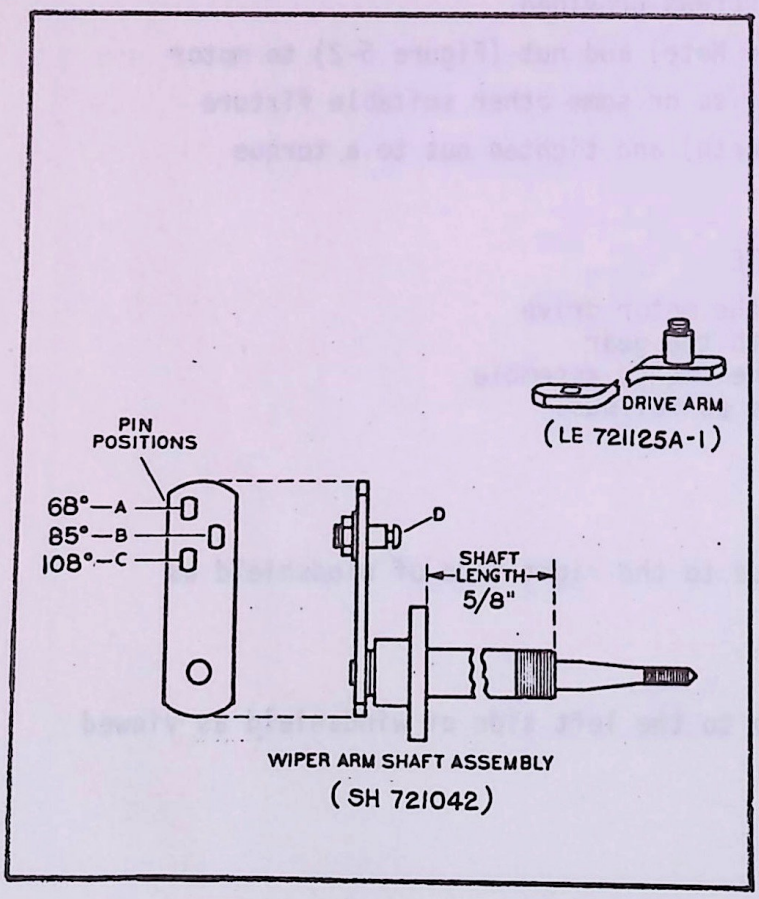


FIGURE 5-1

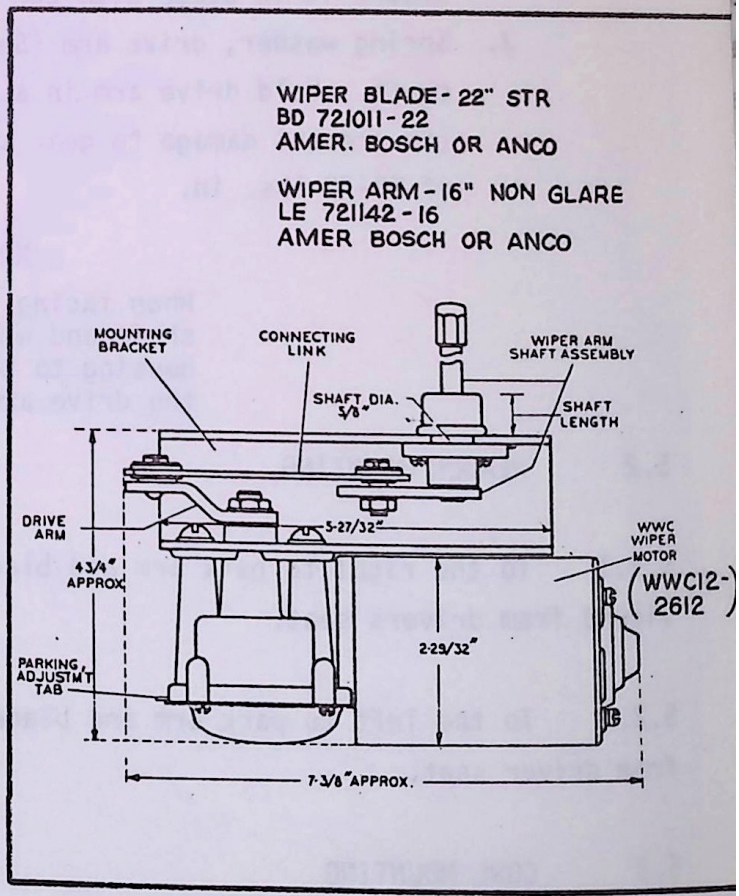


FIGURE 5-2

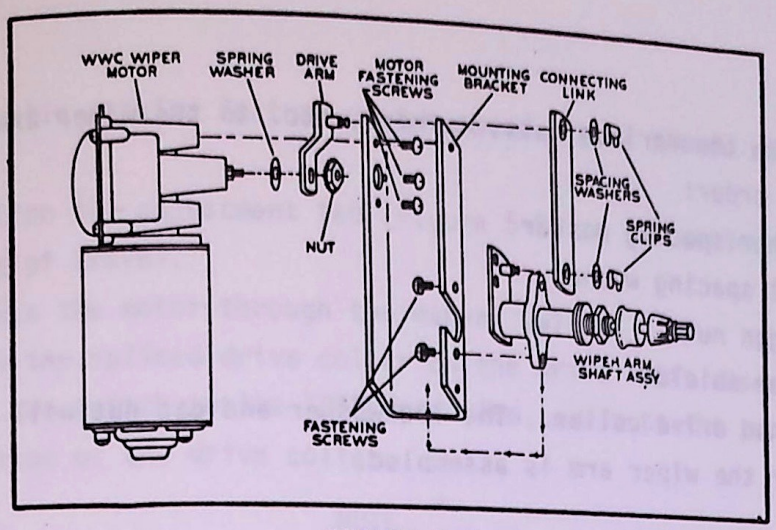


FIGURE 5-3

5.4 INSTALLATION INSTRUCTIONS

5.4.1 Determine whether adequate space is available in the mounting position desired (refer to Figure 5-2 for windshield wiper dimensions).

5.4.2 Locate the approximate wiper arm shaft assembly position on the cowl or header and, with the use of the attached protractor scale, determine whether or not the desired windshield area will be wiped. If not, it will be necessary to relocate the windshield wiper mounting position. Should a change of wiping angle be required refer to Figure 5-1.

5.4.3 With the use of the template on the protractor scale, locate the position of the holes required for the mounting screws and wiper arm shaft assembly; then center punch the "X" marks.

5.4.4 Drill the mounting screw holes to accommodate 1/4"-28 UNF screws. A 9/32 inch drill should provide adequate thread clearance.

5.4.5 When drilling the wiper arm shaft assembly hole, it is suggested that a small pilot hole be drilled and that this hole be progressively enlarged until the 5/8" diameter required is obtained. A slight reaming of this hole may be necessary to facilitate easy installation of the unit.

5.4.6 Remove the nut, washers, drive collar and rubber cap from the wiper arm shaft assembly and mount the windshield wiper assembly on the vehicle.

5.4.7 Reassemble the various nuts, washers, etc. to the wiper arm shaft assembly in the following order:

1. Leather spacing washer
2. Steel spacing washer.
3. Hexagon nut.
4. Rubber shield.
5. Splined drive collar. The lockwasher and cap nut will be assembled after the wiper arm is assembled.

5.4.8 The windshield wiper should now be wired according to Figure 5-4. Input le should be #14 stranded cable or larger.

NOTE

Should the portion of the vehicle to which the windshield wiper is mounted be insulated from the battery ground, it will be necesssary to install a separate motor ground wire. The ground wire should be #14 stranded cable.

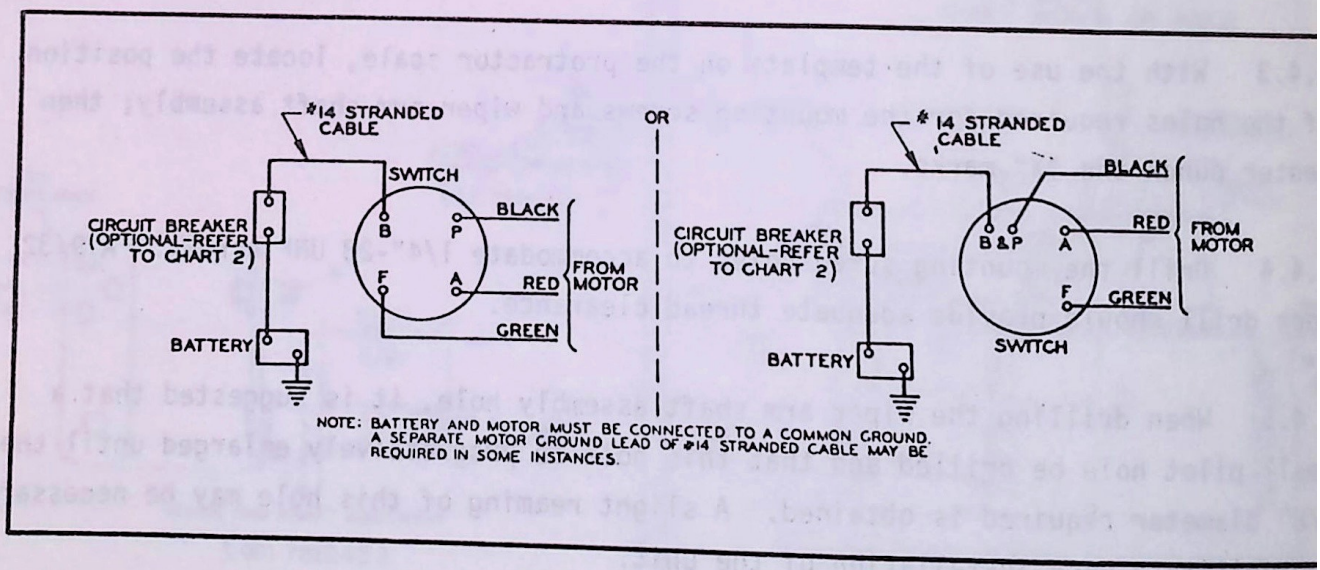


FIGURE 5-4

5.4.9 The automatic parking feature of two speed wipers should now be adjusted as follows:

1. Position the adjustment tab (Figure 5-2) at the center of its range of travel.
2. Operate the motor through the manual switch.
3. Watch the splined drive collar on the drive shaft assembly, turn the switch to the "OFF" position, and note the parking position of the drive collar.

NOTE

The parking position of the drive collar MUST be at the end of a complete oscillation.

4. If adjustment is necessary, proceed as follows:
   a. If the drive collar parks BEFORE reaching the end of an oscillation, move the adjustment tab in the "RET" direction.
   b. If the drive collar parks AFTER it has completed an oscillation and has started the return swing, move the parking tab in the "ADV" direction.
5. Assemble the wiper arm and blade so that the blade is in the desired parking position.
6. Operate the wiper and note the automatic parking position of the blade when the unit is turned off.
7. If the blade does not now park in the desired position, readjust by moving the parking tabe (Figure 5-2). NEVER adjust the blade to park closer than 1 1/2-2" from the windshield molding.

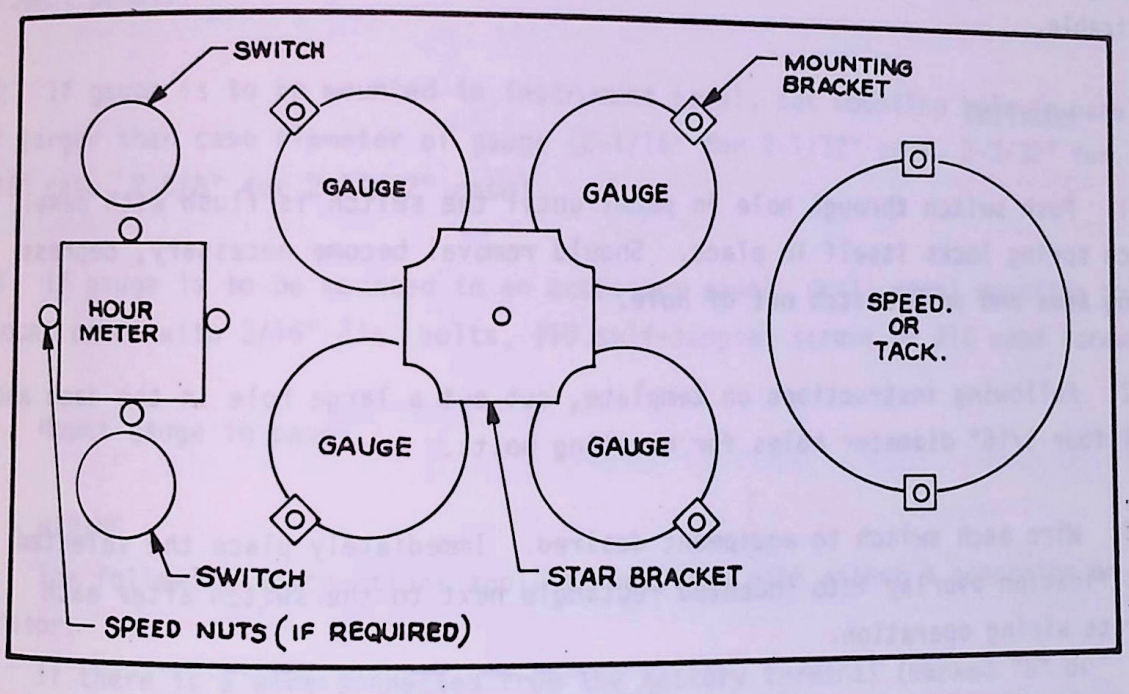
5.4.10 Lockwasher and cap nut to wiper arm shaft assembly.

INSTALLATION INSTRUCTIONS
FOR
271-A MARINE PANEL
271-E MARINE SWITCH PANEL

6.0 INSTALLATION

6.1 271-A MARINE PANEL

6.1.1 This panel is for the mounting of independently purchased instruments. All instruments must be mounted from the rear using the black bezels provided except the switches and hourmeter which require no bezel.



MOUNTING ILLUSTRATION

6.2 MOUNTING

6.2.1 Select a location where instruments can be easily read from a normal driving position.

1. Following the instructions on the template, cut a hole in dash at selected location and drill four 3/16" diameter holes for mounting.
2. Install all instruments into panel using brackets, starbracket and speednuts provided. See illustration above. Mounting hardware for switches is provided with switches.

NOTE

If hourmeter is not desired, a cover and overlay are provided in its place. Speednuts will be required to install cover.

3. Route wires through hole in dash.
4. Secure panel using bolts, washers, lockwashers and nuts provided. Self-adhesive woodgrain overlays are available in teakwood (822292-1), rosewood (822292-2) and walnut (822292-3).

6.3 271-E MARINE SWITCH PANEL

6.3.1 This panel has provisions for six switches only. Twelve identification overlays are provided to identify the function of the switches. Use six that are applicable.

6.4 MOUNTING

6.4.1 Push switch through hole in panel until the switch is flush with panel. Switch spring locks itself in place. Should removal become necessary, depress spring arms and push switch out of hole.

6.4.2 Following instructions on template, cut out a large hole in the dash and drill four 3/16" diameter holes for mounting bolts.

6.4.3 Wire each switch to equipment desired. Immediately place the selected identification overlay into indented rectangle next to the switch after each separate wiring operation.

NOTE

It is recommended that all switches are so installed that they may be depressed in the same position for "ON".

6.4.4 Mount panel using bolts, washers, lockwashers and nuts provided.

INSTALLATION INSTRUCTIONS
INDEPENDENT MOUNTING AMMETERS

7.0 INSTALLATION

7.1 MOUNTING

7.1.1 Select location for mounting gauge in which it will be easy to read from a normal driving position.

Independent mounting gauges are supplied with one "U" Bracket or two "L" Brackets for panel mounting. The most popular locations for mounting these gauges are in the instrument panel, or in an accessory panel which is mounted under the instrument panel.

7.1.2 If gauge is to be mounted in instrument panel, cut mounting hole in panel 1/32" larger than case diameter of gauge (2-1/16" for 2-1/32" case, 2-3/32" for 2-1/16" case, 2-5/8" for 2-19/32" case).

7.1.3 If gauge is to be mounted in an accessory panel, drill panel mounting holes and mount panel with 3/16" dia. bolts, #10 self-tapping screws or #10 wood screws.

7.1.4 Mount gauge in panel.

7.2 WIRING

The following instructions apply to vehicles with either a generator or alternator.

If there is a wire connected from the battery terminal (marked "B" or "BAT") of the voltage regulator directly to the battery, wire ammeter as outlined under Wiring Procedure 1. If no wire is connected in this manner, or if voltage regulator has no battery terminal, wire ammeter as outlined under Wiring Procedure 2.

7.3 WIRING PROCEDURE 1

7.3.1 Disconnect ground cable from battery.

7.3.2 Disconnect wire which is connected to battery terminal of voltage regulator from battery (Figure 7-1).

7.3.3 Disconnect all wires except battery cable from battery terminal of starter solenoid (terminal which is connected to battery by a heavy cable).

NOTE

If there are no wires connected to battery terminal of starter solenoid; (a) connect wire which was disconnected from battery directly to one post of ammeter with a length of #10 stranded automotive wire, (b) connect other post of ammeter to battery with another length of #10 stranded automative wire, (c) proceed to Step 7.3.6.

7.3.4 Splice wire which was disconnected from battery to wire or wires which were disconnected from starter solenoid. Connect these spliced wires to one post of ammeter with a length of #10 stranded automotive wire.

7.3.5 Connect other post of ammeter to battery terminal of starter solenoid with a length of #10 stranded automotive wire.

7.3.6 Connect ground cable to battery. Switch headlights on. Ammeter should indicate a definite discharge. If ammeter indicates a charge, reverse wires on ammeter posts.

7.4 WIRING PROCEDURE 2

7.4.1 Disconnect ground cable from battery.

7.4.1 If vehicle has a junction block as in Figure 7-2, disconnect all wires except battery cable from battery terminal of this block (terminal which is connected to battery by a heavy cable).

7.4.2 If vehicle does not have a junction block (Figure 7-2) disconnect all wires except battery cable from battery terminal of starter solenoid (terminal which is connected to battery by a heavy cable).

7.4.3 Splice disconnected wire or wires to a length of #10 automotive wire and connect to one post of ammeter.

7.4.4 Connect another length of #10 automotive wire from other post of ammeter to battery terminal of either junction block or starter solenoid, whichever is convenient.

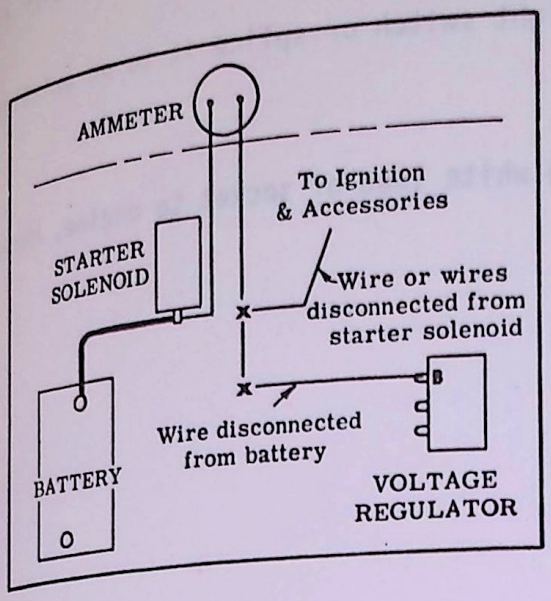


FIGURE 7-1

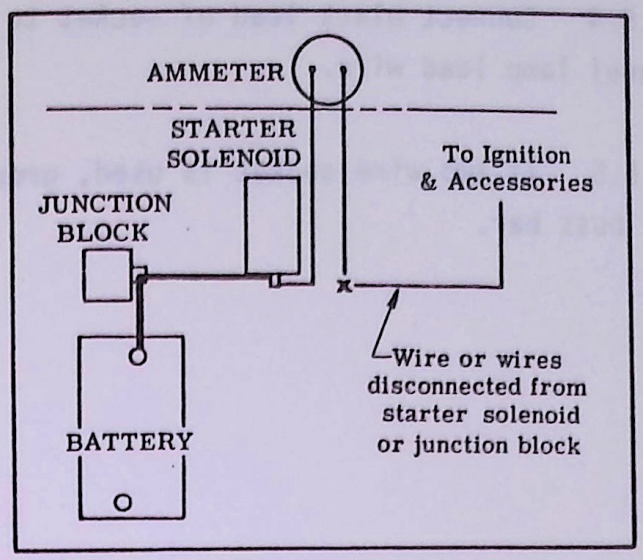


FIGURE 7-2

7.4.5 Connect ground cable to battery. Switch headlights on. Ammeter should indicate a definite discharge. If ammeter indicates charge, reverse wires on ammeter posts.

7.5 LIGHTING

7.5.1 Select necessary lighting components.

1. If gauge is to be mounted to a metal surface which is grounded to the battery, use one wire socket SOW Part No. 427157. If gauge is to be mounted to a non-conductive surface (wood, plastic, etc.), or to a metal surface which is not grounded to the battery, use two wire socket S-W Part No. 811053.
2. For 6-Volt electrical systems use lamp S-W Part No. 92149 (Trade No. 55). For 12-Volt systems use SOW Part No. 96196 (Trade No. 57).
3. Gauges with 2-19/32" dia. cases have a 5/8" dia. hole in rear of case to accommodate lamp socket. Gauges with 2-1/16" dia. cases have windows around side of gauge for indirect lighting and require an external lamp bracket S-W Part No. 42931 to accommodate lamp socket.

7.5.2 If gauge is of 2-1/16" dia. case size, install lamp bracket (Figure 7-3).

7.5.3 Insert lamp and lamp socket into hole in case or lamp bracket. (Figure 7-3)

7.5.4 Connect black lead of socket to light switch or splice it to an existing panel lamp lead wire.

7.5.5 If two wire socket is used, ground white lead of socket to engine, chassis or buss bar.

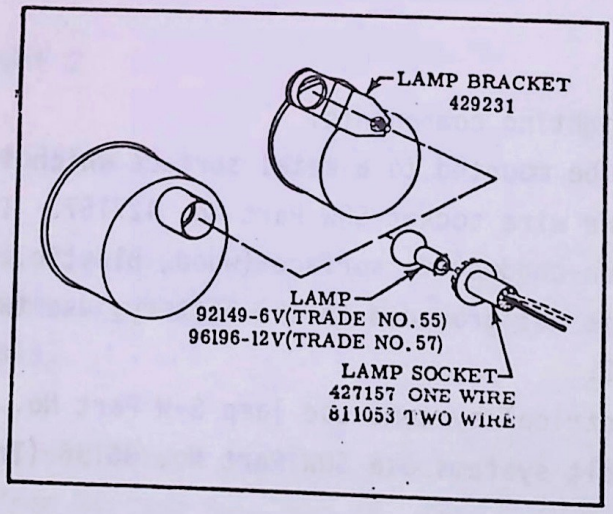


FIGURE 7-3
Lighting Components