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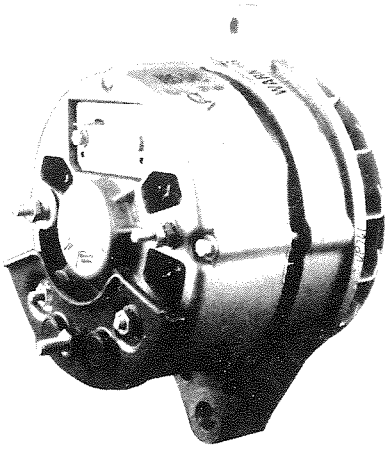
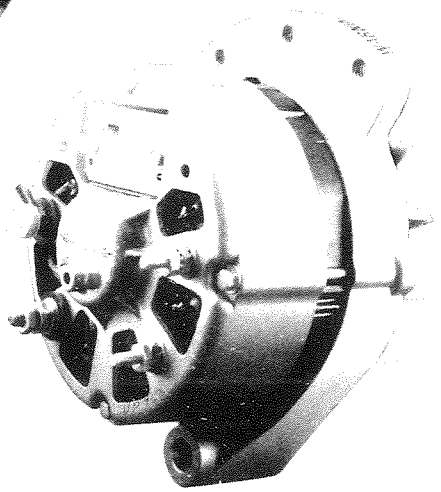
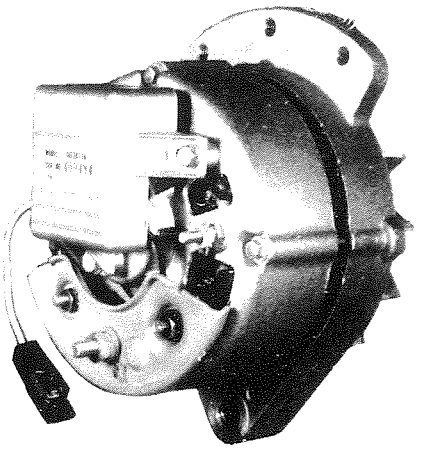
SERVICE MANUAL







A/8AL, HA/8HA & RA/8AR SERIES ALTERNATORS

PRESTOLITE ELECTRIC, INC.
125-183AB
10/88
400 MAIN STREET, ARCADE, NY 14009
PRINTED IN USA

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SECTION 1.

SYSTEM DESCRIPTION

1

INTRODUCTION

A/8AL ALTERNATOR SERIES

The A/8AL Series Alternators and Voltage Regulators covered in this manual are designed for Automotive, Truck, Aircraft, Agricultural, and Industrial Applications that demand normal or special charging requirements.

These compact and efficient charging systems are designed for 6, 12 and 24 volt applications, and for negative and positive system ground configurations, Figure 1-1.

Model variation is based upon the particular requirements of Original Equipment customers. Generally this difference involves mounting details, pulley and fan selection, and choice of associated voltage regulator.

The 35 and 37 amp, 12 and 24 volt systems are used in general positive/negative ground applications where normal vehicle loads are encountered.

The 40 amp 12 volt, positive/negative ground system provides a low RPM cut-in unit for vehicles operating at low speeds and requiring higher charge currents at idle speed.

Heavy duty 6 and 12 volt systems using the 55 and 62 amp, positive/negative ground units are designed for vehicles with additional electrical accessories such as two-way radio, air-conditioning, etc.

The four housing thru-bolts are spaced 90^{o}apart, thus allowing four possible positions for the rear housing (output stud) with respect to the mounting foot.

Brush replacement is a minor service operation with conventional hand tools.

The 6 and 12 volt regulator models incorporate ungrounded circuitry permitting their use with positive or negative ground charging systems.

The Regulators are all electronic, transistorized devices. No mechanical contacts or relays are used to perform the voltage regulation of the alternator system. The system is temperature compensated to permit the ideal charging rate at all temperatures.

HA/8HA ALTERNATOR SERIES

The HA/8HA alternator systems are designed for truck and industrial engine service where heavy duty front alternator bearings are required. This compact and easy to maintain alternator is available in several models for 12 volt and 24 volt electrical systems, negative and insulated ground, Figure No. 1-1.

The alternator rear housing (output stud) can be rotated to any one of four desired positions. Also, brush replacement does not require disassembly of the alternator.

The electronic voltage regulator assemblies for the 12 volt alternators are available in two types. 1) The "standard" (non-adjustable) models where epoxy encapsulation protects the regulator components from damage by vibration, dust and moisture, and 2) The "deluxe" (adjustable) models which permit adjustment to satisfy the requirements for specific charging voltage levels.

The 24 volt alternators utilize the 24 volt "deluxe" (adjustable) regulator as standard equipment.

RA/8AR ALTERNATOR SERIES

The RA/8AR Alternator assembly consists of an alternator and voltage regulator combined (integral) as a single unit, as shown in Fig. 1-1. This compact and easy to maintain charging system was developed to meet the requirements of the non-automotive market, where "open-hood" engines are used.

Units are available in 12 and 24 volt models for use in negative and insulated ground systems.

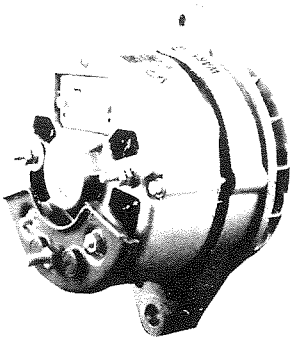
Specific applications are farm tractors and allied powered equipment, road maintenance machinery, construction equipment and stationary engines.

The components of the voltage regulator are encapsulated in epoxy for protection against vibration, dirt and moisture.

As in the other alternator series, it is not necessary to disassemble the alternator to replace brushes or voltage regulator. Such operations are usually accomplished with the alternator left intact on the engine.

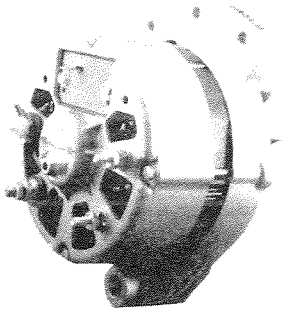
The stator and rear housing, as an assembly, may be positioned to place the positive output terminal at 3:00, 9:00 or 12:00 o'clock, with reference to the mounting foot.

6 VOLT, 55 AMP, A & 12 VOLT, 35–62 AMP A/8AL & HA/8HA ALTERNATORS WITH LARGE PLATE ISOLATION DIODE

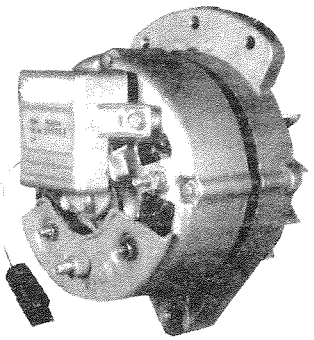


12 VOLT A/8AL & 24 VOLT HA/8HA 35 AMP ALTERNATORS WITH SMALL PLATE ISOLATION DIODE

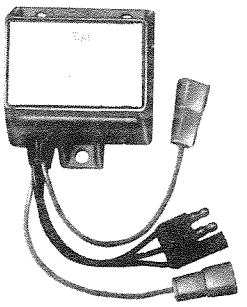
FIG. 1-1 TYPICAL CHARGING SYSTEM PRODUCTS (PARTIAL)



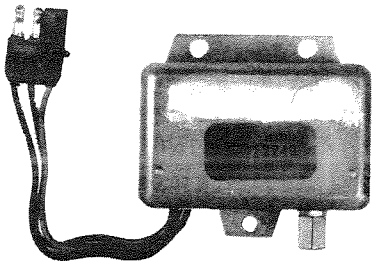
12 VOLT, 35–62 AMP, A/8AL ALTERNATORS WITH FIELD DIODE



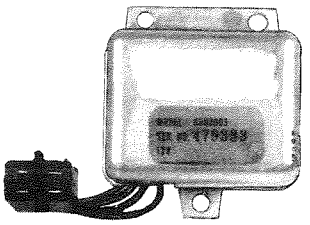
12/24 VOLT, 35–55 AMP, RA/8AR ALTERNATORS WITH LARGE PLATE ISOLATION DIODE & INTEGRAL REGULATOR



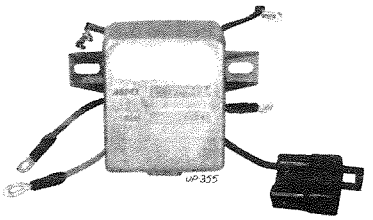
R2 SERIES REGULATOR



8RD SERIES REGULATOR



8RH SERIES REGULATOR



8RF SERIES REGULATOR

FIG. 1-1 TYPICAL CHARGING SYSTEM PRODUCTS (Continued)

GENERAL INFORMATION

The engine driven alternator is an electro-mechanical device, designed to charge storage batteries in fixed or mobile operations.

Alternators are compact, light weight and easy to maintain. Pulleys are secured to the threaded rotor shaft with a hex-nut and are easy to change. The rotor turns on sealed ball bearings that contain lubrication for the life of the bearing. Brush replacement is a minor service operation with conventional hand tools.

The operation of positive and negative ground alternators is identical. The basic difference in the two systems is that the rectifier diodes, and isolation diode polarities are reversed (See Figure 1-2) and the brush assembly of the positive ground alternator is insulated from the alternator housing.

The four housing thru-bolts are spaced 90^{o} apart, thus allowing four possible positions for the alternator rear housing with reference to the mounting foot, refer to installation section for details.

The alternator is cooled by an externally mounted fan. Correct air circulation requires air to be pulled into the rear of the alternator and expelled through the front housing. HA/8HA alternators may be driven in either direction (clockwise or counter-clockwise). If it is desired to drive the A/8AL or RA/8AR alternator counter-clockwise at the drive end, the fan must be changed to provide adequate cooling. Replace the original fan with fan kit, 107-9.

ALTERNATOR

The alternator converts mechanical and magnetic energy to A.C. (Alternating Current) and voltage by the rotation of an electromagnetic field (rotor) inside a three phase stator assembly. The alternating current and voltage are changed to direct current and voltage, by passing A.C. energy through a three phase, full wave rectifier system. Generally, six silicon rectifier diodes are used, see Figure 1-2.

Since diodes pass direct current in only one direction, their arrangement in the alternator eliminates the need for a cut-out relay in the voltage regulator. The individual rectifier diodes, three positive and three negative, are assembled in two temperature dissipating heat sinks. The heat sinks are placed in the alternator with threaded studs that also serve as circuit terminals, Figure 1-3.

Maximum charging current is limited by the design and connections in the stator assembly, eliminating the need for a current regulating relay in the voltage regulator.

The Isolation Diode, shown in Figure 1-4, is mechanically

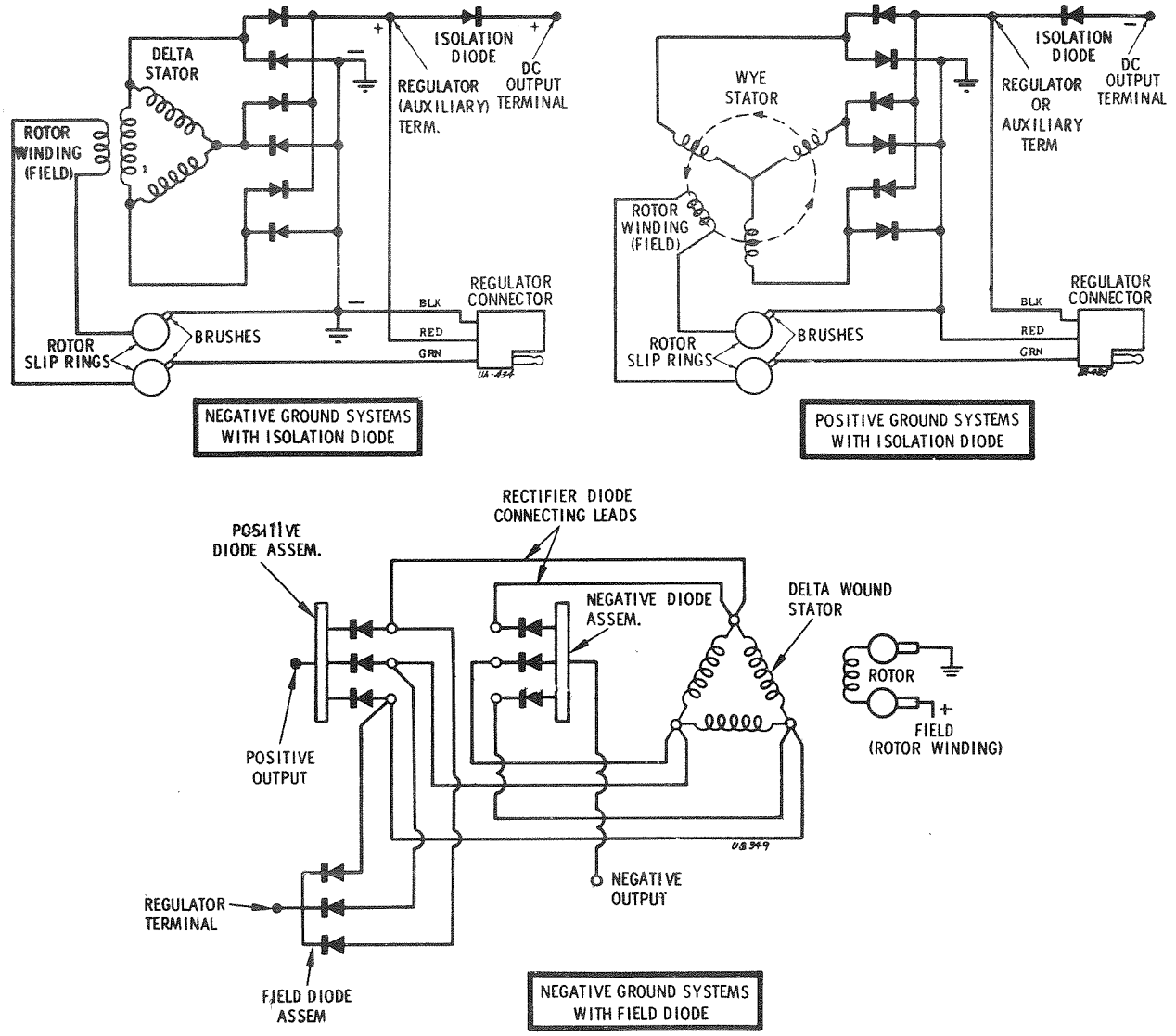


FIG. 1-2 TYPICAL ALTERNATOR CIRCUIT DIAGRAMS

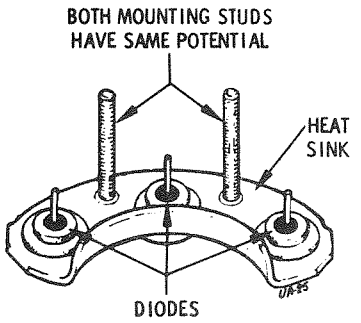


FIG. 1-3 RECTIFIER DIODE ASSEMBLY

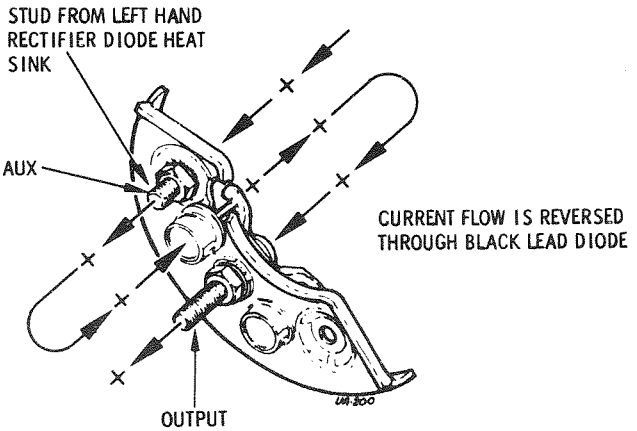


FIG. 1-4 ISOLATION DIODE ASSEMBLY

and electrically connected to one of the studs in the left rectifier diode heat sinks. This places the isolation diode in a series circuit between the rectifier diodes and the output terminal stud on the isolation diode. The junction formed by the rectifier stud and the isolation diode is the "Auxiliary" or "Regulator" terminal of alternators using the isolation diode, Figure 1-4.

The "Isolation Diode" consists of a single, or two, parallel connected diodes mounted in a heat sink (plate). The heat sink is factory-coated with a special corrosion resistant paint. The color of the paint assists in identifying the ground potential of the alternator.

The Isolation Diode provides the means for operating an alternator charge indicator lamp without using a mechanical relay. Electrically, the charge indicator lamp is connected in parallel with the isolation diode. When the alternator produces a normal charge the voltage differential across the isolation diode is so small that the charge lamp will not light.

Figure 1-2 shows a schematic diagram of a Delta wound stator alternator, using a separate field diode for alternator field current after initial excitation. The polarity of the field diode must be the same as the polarity of the "insulated" rectifier diodes; Figure 1-2 shows the field diode circuit used in a Negative Ground, 55 ampere alternator. The field diode provides the same regulator sense and operating power functions as the isolation diode system.

NOTE: FOR ADDITIONAL INFORMATION CONCERNING ALTERNATOR THEORY AND OPERATION, REFER TO SEPARATE "BASIC ALTERNATOR THEORY" MANUAL, 25-138.

VOLTAGE REGULATOR

The voltage regulator is an electronic switching device which senses the system voltage level & switches the voltage applied to the field in order to maintain proper system voltage, Figure 1-5. The circuit is a variable duty cycle switch which determines what the average field current in the alternator will be. A high ratio of "on" time to "off" time will result in a near full field condition while a low ratio will result in a low field current condition. Alternator RPM & system load conditions are the factors which determine what the field current must be.

Both regulator sense and operating power (including field power) are obtained from the "Regulator" terminal of the alternator.

ALTERNATOR EXCITATION

The steel pole fingers of the rotor are treated to resist residual or permanent magnetism. It becomes necessary to electrically magnetize the rotor winding to develop a charge. This circuit differs depending on whether the alternator has an isolation diode or field diode. The voltage regulator will **differ** too.

Figure 1-6, Diagram A, illustrates the circuit for 8RD Series Regulators with an external resistor. 1.5 to 2.0 volts at the auxiliary terminal was sufficient to magnetize the field. When the alternator is charging the resistor will not allow higher voltage feed back to the ignition switch.

Diagram B shows a 12 volt charge indicator lamp connected in parallel with the resistor. This combination provides higher excitation voltage. If the lamp or the resistor would open circuit, the remaining component could carry excitation current.

Diagram C is the excitation circuit through a 5 wire, R2 series voltage regulator. The resistor is incorporated in the regulator, with two connecting leads. The charge indicator lamp could be applied to this system too, between the ignition switch and auxiliary terminals.

Five Lead, R-2 regulators can be applied to positive and negative ground alternator systems. One excitation lead would connect to the ignition switch and the other to auxiliary, regardless of auxiliary polarity.

Four Lead 8RF and 8RH series regulator shown in Diagram D, has one excitation lead from the resistor, this must connect to positive at the ignition switch. The opposite end of the resistor connects to the regulator input lead within the regulator.

The excitation diode in Diagram E, can be applied to positive or negative ground alternators by reversing the diode. **Do not** use a charge indicator lamp with the excitation diode.

The diode provides the highest available excitation voltage and can be used on 6, 12 and 24 volt systems. Feedback from the auxiliary terminal to the ignition switch is zero.

If the excitation diode is used on a diesel engine with an electric solenoid fuel valve, a charge indicator lamp can not be used, Figure 1-7. When the control switch is turned off to secure the engine, the voltage at the auxiliary term-

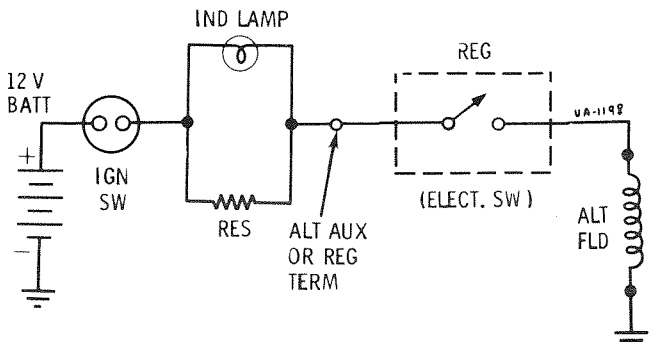


FIG. 1-5 SIMPLIFIED ELECTRONIC REGULATOR OPERATING DIAGRAM

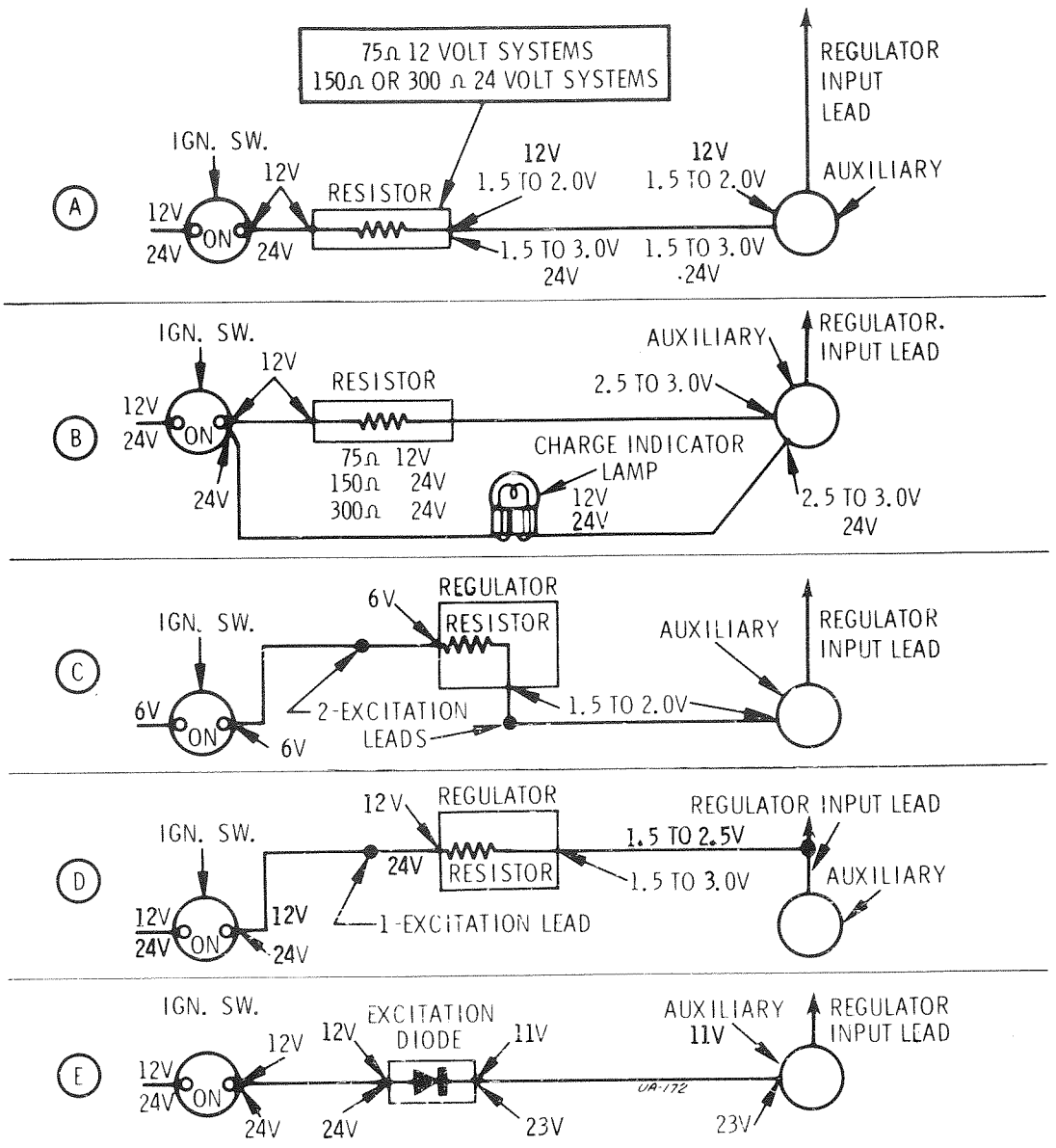


FIG. 1-6 TYPICAL EXCITATION METHODS

inal (15.0 to 15.5 on a 12 volt system), would pass through the charge indicator lamp and keep the fuel solenoid valve energized, as shown in Figure No. 1-8. It would be necessary to remove the lamp to break the circuit on every stop.

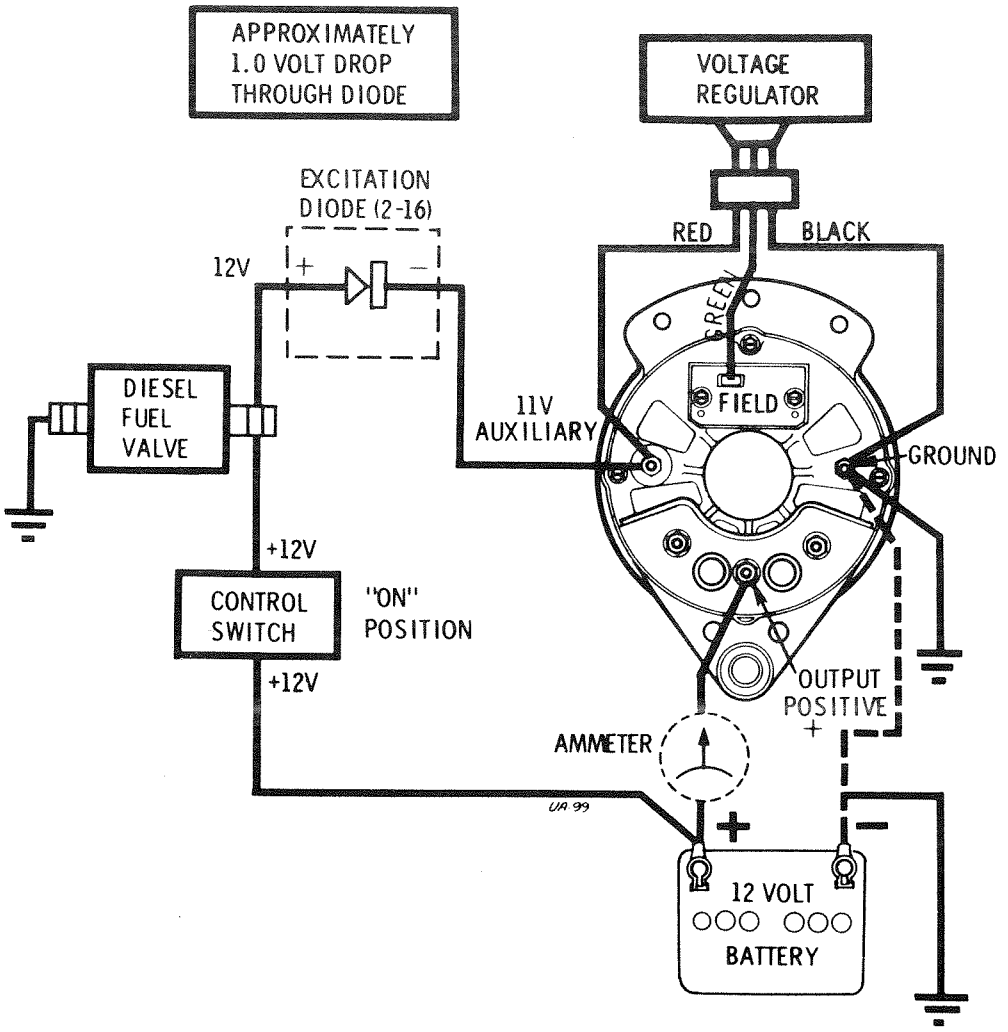


FIG. 1-7 ACCEPTABLE APPLICATION OF EXCITATION DIODE

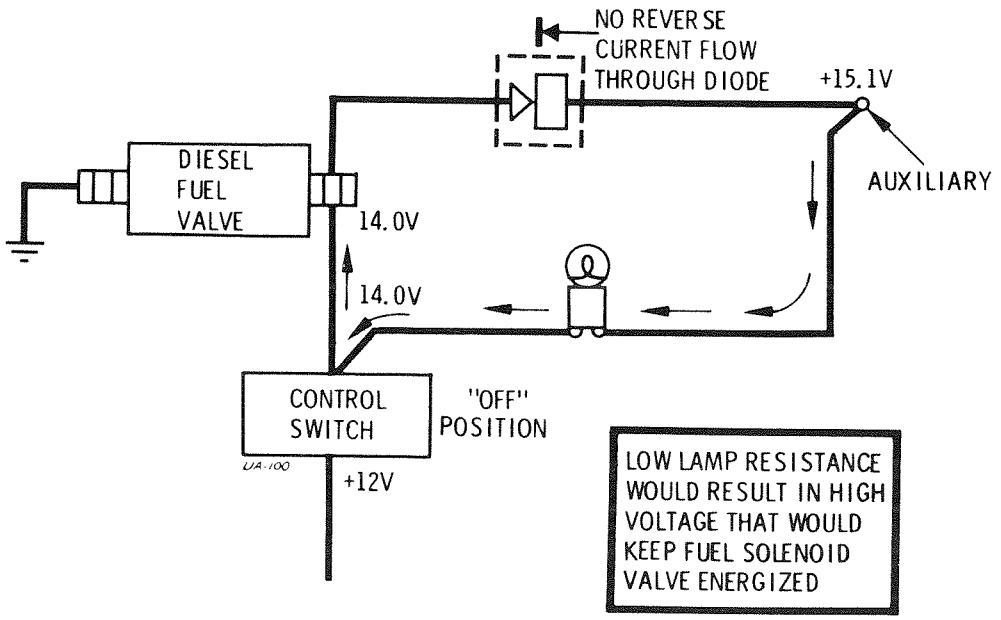


FIG. 1-8 IMPROPER USE OF CHARGE LAMP WITH EXCITATION DIODE

SECTION 2.

INSTALLATION PROCEDURE

GENERAL

CAUTION: OBSERVE PROPER POLARITY WHEN INSTALLING ALTERNATOR OR BATTERY. GROUND POLARITY OF BATTERY AND GROUND POLARITY OF ALTERNATOR MUST BE THE SAME. REVERSE POLARITY WILL DESTROY THE RECTIFIER DIODES IN ALTERNATOR.

AS A PRECAUTIONARY MEASURE, DISCONNECT UNGROUNDED (HOT) BATTERY TERMINAL WHEN CHARGING BATTERY IN CAR. CONNECTING CHARGER IN REVERSE WILL DESTROY THE RECTIFIER DIODES IN THE ALTERNATOR.

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 moutning bracket, (2) correct belt alignment, and (3) protection from road spray, and from engine exhaust system heat.

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.

ALTERNATOR PULLEY ALIGNMENT

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 true center, Figure 2-1.

Best results are obtained if the belts wrap the alternator pulley by at least 100°. Lesser wraps induce belt slipping, belt and pulley wear and overheating of the front alternator bearing, Figure 2-2.

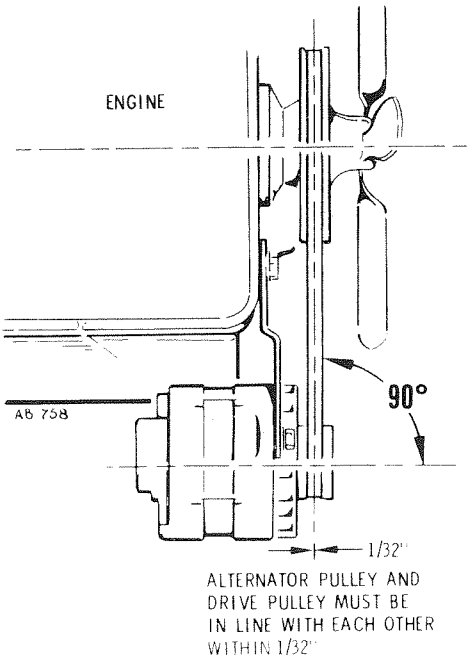


FIG. 2-1 ALTERNATOR BELT ALIGNMENT

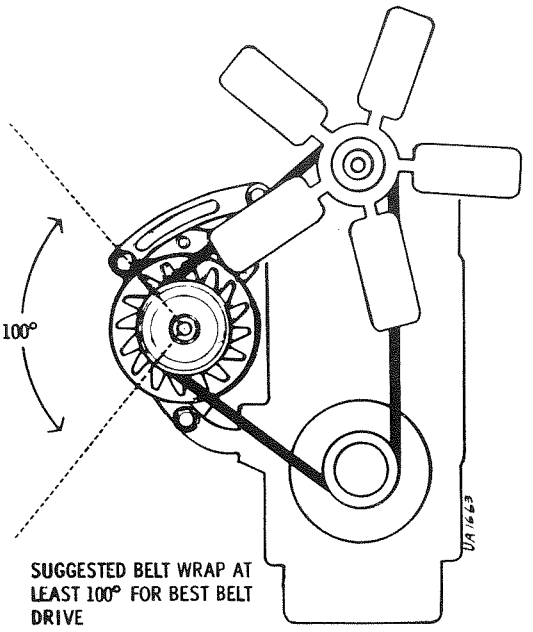


FIG. 2-2 ALTERNATOR BELT INSTALLATION

ALTERNATOR PULLEY RATIO

The diameter of the alternator 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 engine top operating RPM. Excess alternator speed over 8,000 RPM tends to shorten bearing life.

Figure 2-3 shows the dimensional detail for machining other pulleys to fit the rotor shaft. Consult your Distributor for information on pulleys and mounting brackets.

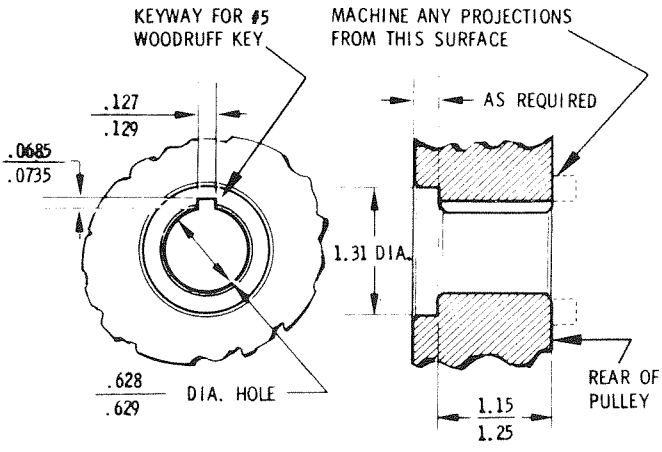


FIG. 2-3 PULLEY DIMENSIONAL DETAIL

Tighten pulley nut to 40 - 50 foot pounds. 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 engine manufacturer recommendations. If this information is not available, tighten belts to the point where the alternator fan cannot be turned by hand.

ROTATING ALTERNATOR REAR HOUSING

For special installation purposes, the alternator rear housing may be rotated to four different mounting positions spaced 90° apart, Figure 2-4. To rotate the housing, proceed as follows:

(1) Remove brush assembly and isolation diode (if used).
(2) Completely remove any three thru-bolts.
(3) Remove fourth bolt only enough to clear front housing (this bolt temporarily holds the rear housing and stator together while rotating them).
(4) Rotate the rear housing to the desired position.
(5) Install all thru-bolts.

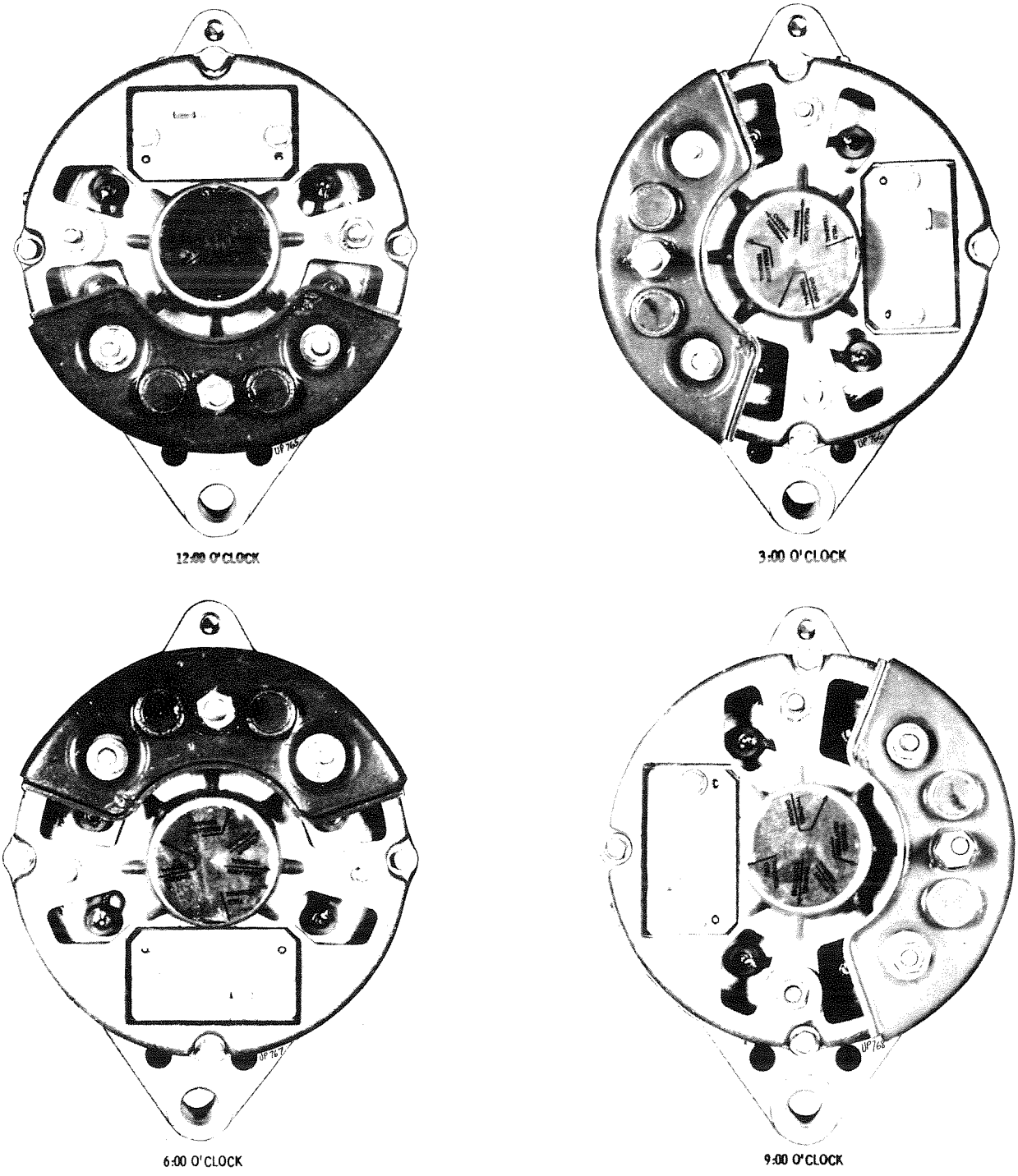


FIG. 2-4 TYPICAL ALTERNATOR MOUNTING POSITIONS

REGULATOR MOUNTING (REMOTE REGULATORS)

Locate the voltage regulator in the front of the engine compartment and if possible, below the level of the exhaust manifold; mount in a convenient place on metal fender well or radiator cowl. If a metal surface is not available for mounting the regulator, then it should be mounted on a metal plate at least 8" by 8" square. The metal plate can then, in turn, be mounted in a cool location. Shock mount the regulator if severe vibration is noted. Secure the regulator to the metal plate rigidly.

Mount the regulator with three number 10 self-tapping screws. Use the regulator as a template to locate holes; drill holes with a 5/32" or number 24 drill.

If severe vibration of the regulator is expected, use cable clamps to secure regulator wires to prevent their movement under vibration.

AMMETER

Ammeter requirements vary with application. An original equipment ammeter may be difficult to replace with a higher reading meter 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 2-5.

An accessory ammeter may be used if it provides 100-0-100 scale information. Such meters are available in two types: direct reading and separate shunt types. Figure 2-6 and 2-7 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.

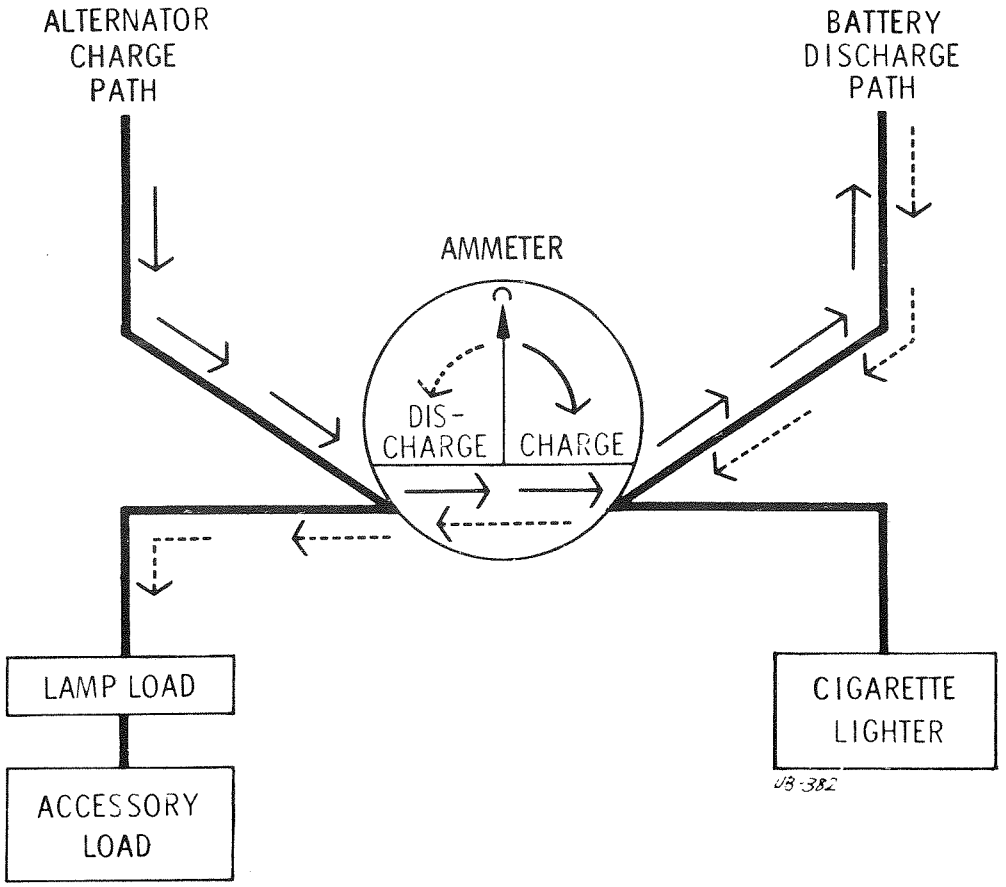


FIG. 2-5 AMMETER CHARGE & DISCHARGE CIRCUIT

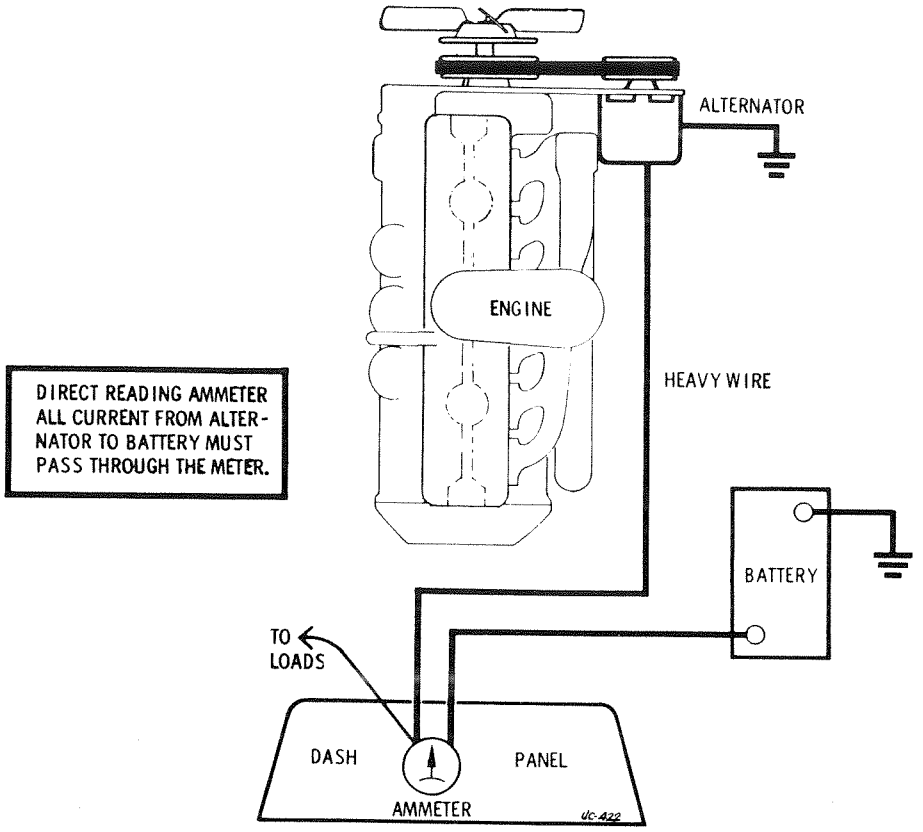


FIG. 2-6 ALTERNATOR AMMETER INTERWIRING DIAGRAM (DIRECT READING METER)

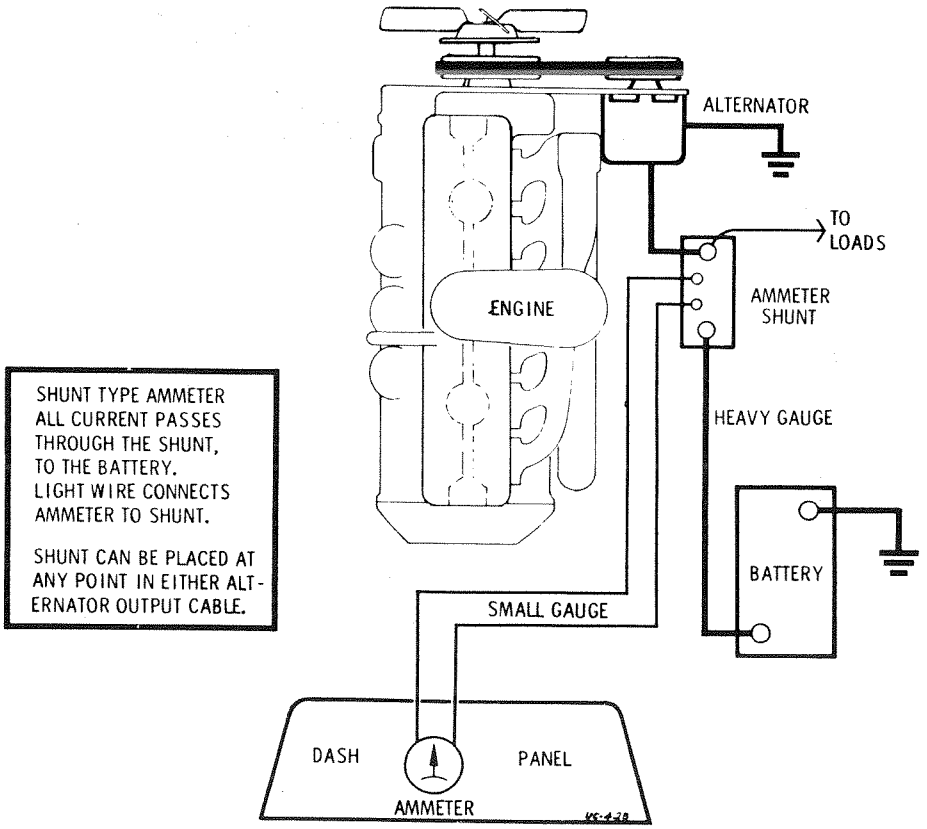


FIG. 2-7 ALTERNATOR AMMETER INTERWIRING DIAGRAM (SHUNT TYPE METER)

GENERAL

It is desirable to test the charging system (alternator & voltage regulator) in the vehicle using the vehicle wiring harness & electrical loads that are a permanent part of the system. In-vehicle testing will then provide the technician with an operational test of the charging system as well as the major components of the electrical system.

PRELIMINARY CHECKS & TESTS

Before starting the actual electrial test procedure, the charging system, battery & wiring should be checked to eliminate possible problem areas. The following procedure is recommended:

1. Check the condition & adjustment of belts.
   A. If the alternator fan can be moved by pushing on a fan blade with your finger, the belts should be adjusted.
   B. Replace any worn or glazed belts.

2. Check to see that all terminals, connectors & plugs are clean & tight.
   A. Loose broken or corroded connections cause high resistance and this could cause overcharging, undercharging or damage to the charging system.
   B. Badly corroded battery cables could prevent the battery from reaching a fully charged condition.

3. Check battery condition & charge if necessary. A low or discharged battery may cause false or misleading readings on the in-vehicle tests.

4. Testing Precautions
   DO NOT disconnect load (alternator output lead) from alternator while the alternator is operating.

   DO NOT remove alternator from car without first disconnecting the grounded battery cable. If battery must be removed, disconnect grounded cable first.

   DO NOT under any circumstances, short FIELD terminal of alternator to ground.

   DO NOT disconnect voltage regulator while alternator is operating.

TEST EQUIPMENT REQUIREMENTS

The Alternator and Regulator tests outlined require electrical test equipment to measure voltage. A good quality voltmeter with an appropriate scale which can be easily read should be used.

DC VOLTMETER: 0-50 Volt Scale

BATTERY TEST EQUIP: Any commercial type hydrometer with temperature correction scale, or Electronic Battery Tester NOTE: Many maintenance free batteries cannot be tested with a hydrometer.

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 or instruments.

The following rule applies to all alternator charging systems: CAUTION: IF A BATTERY IS BEING INSTALLED, MAKE CERTAIN THAT THE GROUND POLARITY OF THE BATTERY AND THE GROUND POLARITY OF THE ALTERNATOR ARE THE SAME. REVERSE POLARITY WILL DESTROY RECTIFIER DIODES IN THE ALTERNATOR.

BATTERY INSPECTION

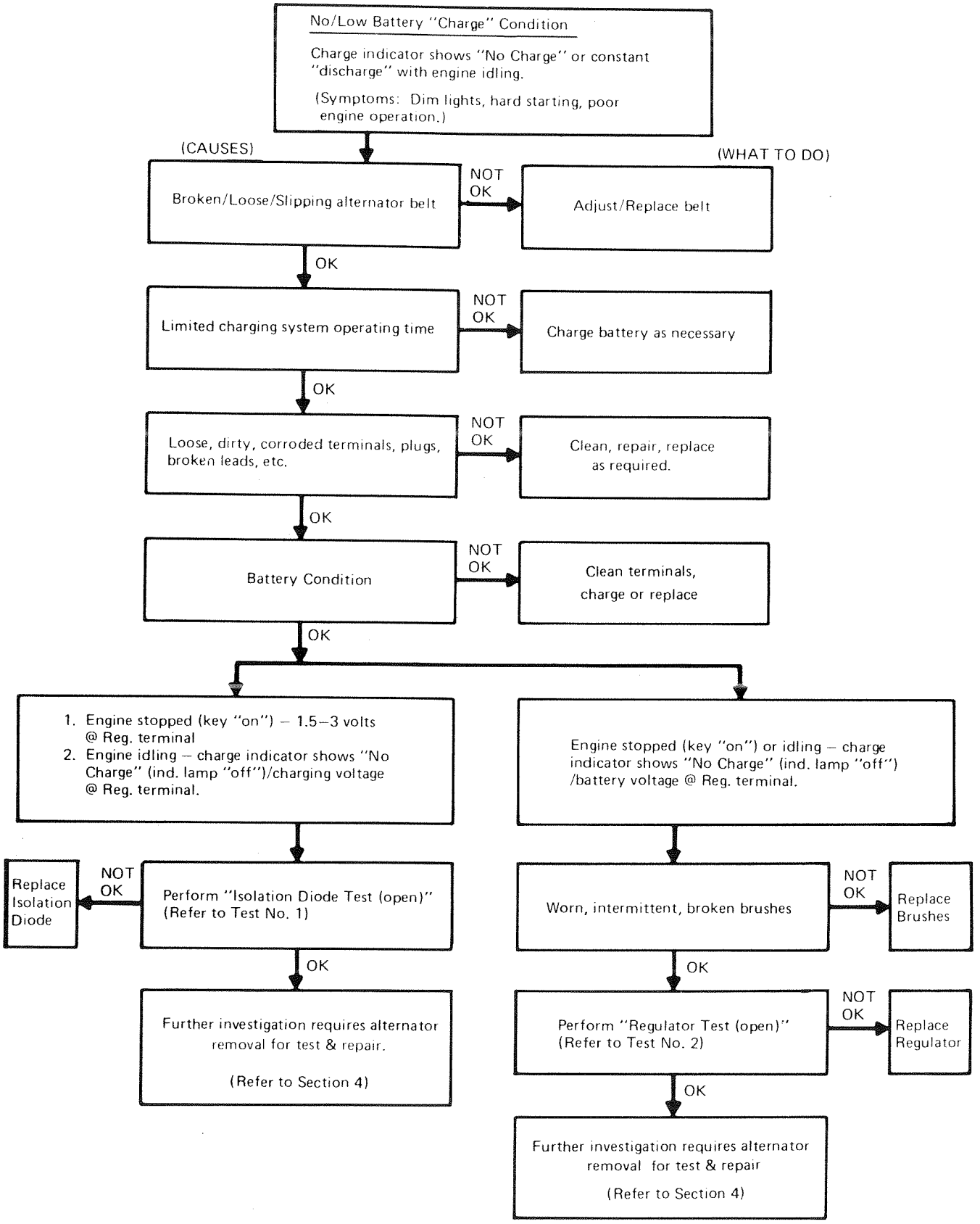
The following table illustrates typical ranges of specific gravity for a cell in various states of charge. THE BATTERY MUST BE AT LEAST 75% OF FULL CHARGE FOR EFFECTIVE ALTERNATOR TESTING.

1.260 SP. GR. BATTERY	1.280 SP. GR. BATTERY	CHARGE STATE
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 Cap.
1.110 Sp. Gr.	1.130 Sp. Gr.	Discharged

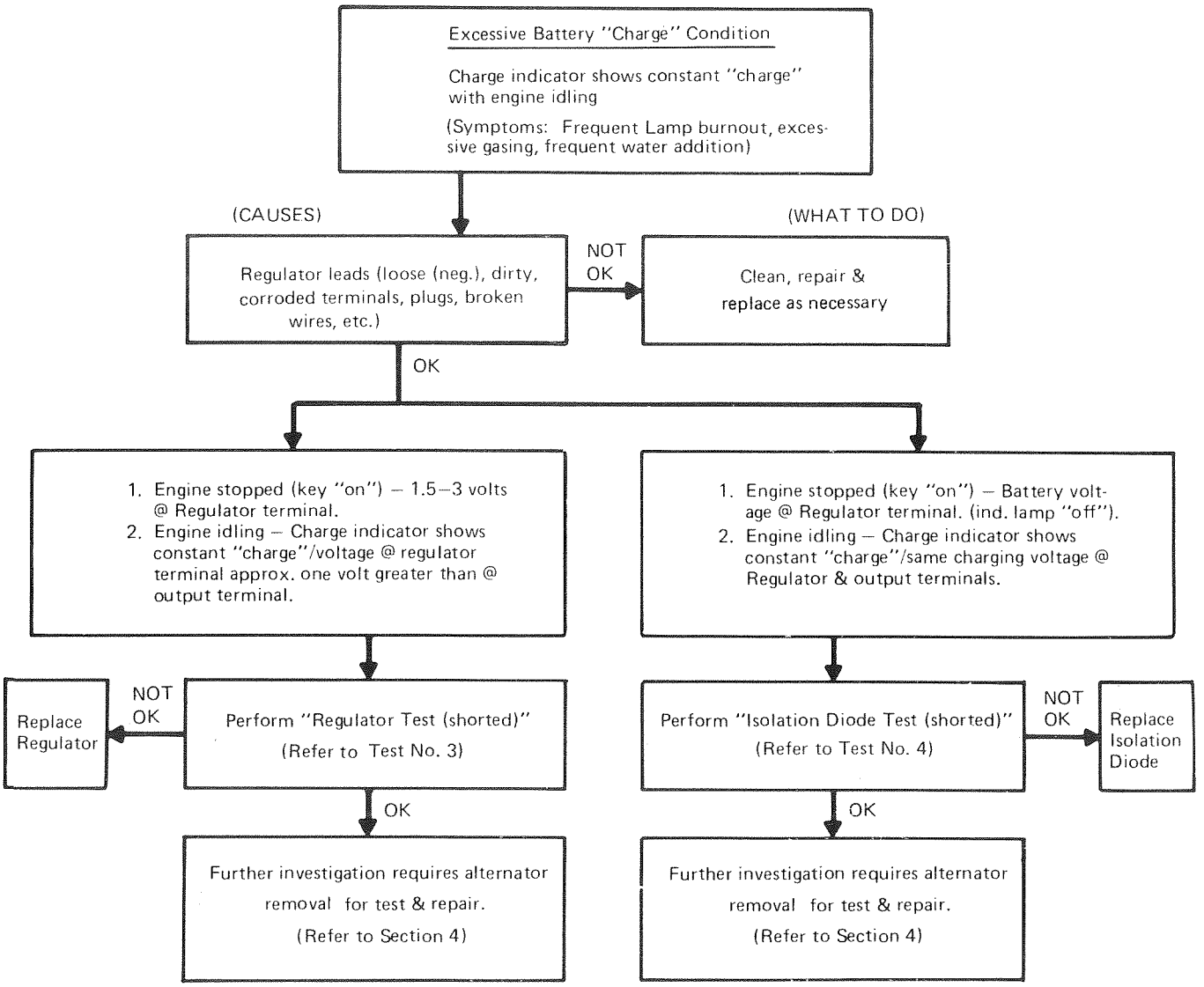
CAUTION: CARE SHOULD BE TAKEN WHEN WORKING AROUND THE BATTERY AS A SPARK COULD IGNITE THE GASES WHICH COLLECT ABOVE THE BATTERY WHEN CHARGING.

TEST PROCEDURE — Continued on next page.

IN-VEHICLE TEST PROCEDURE FOR: A; 6 VOLT, 55 AMP – A/8AL, HA/8HA, RA/8AR; 12/24 VOLT, 35 - 62 AMP ALTERNATORS – NEGATIVE GROUND SYSTEM WITH ISOLATION DIODE



CHARGING SYSTEM DIAGNOSTIC CHART NO. 1



CHARGING SYSTEM DIAGNOSTIC CHART NO. 2

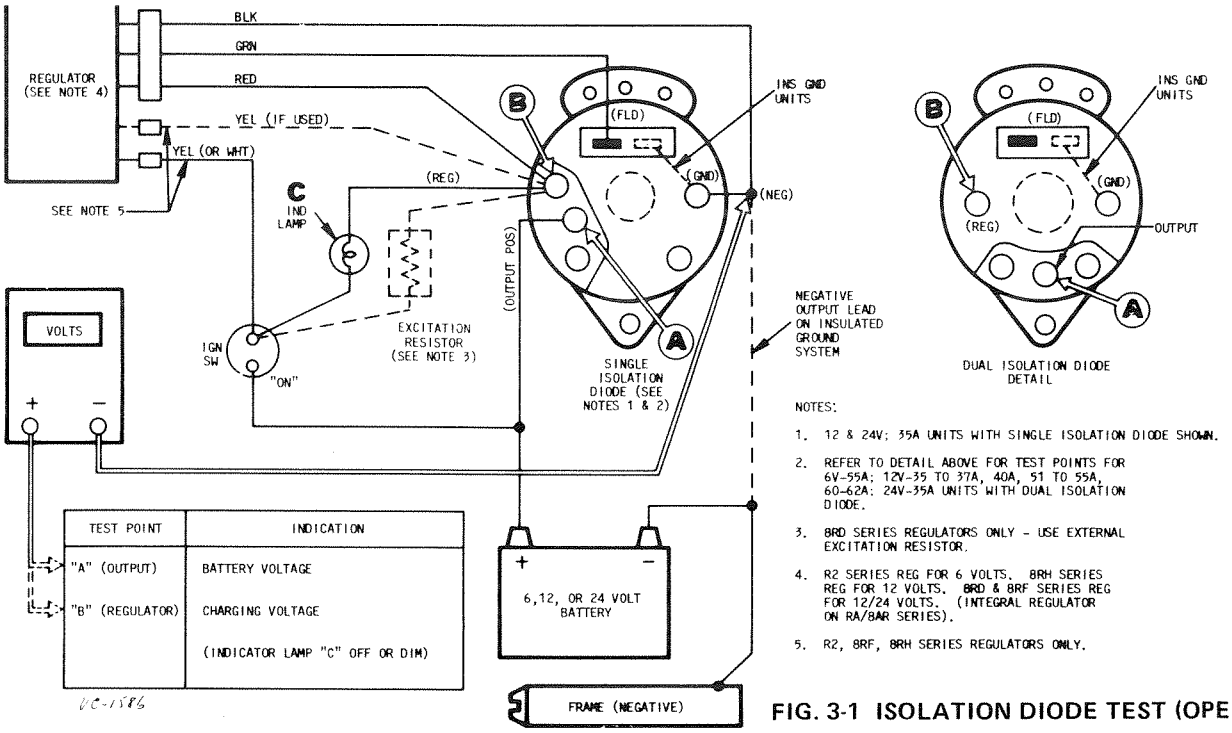


FIG. 3-1 ISOLATION DIODE TEST (OPEN)

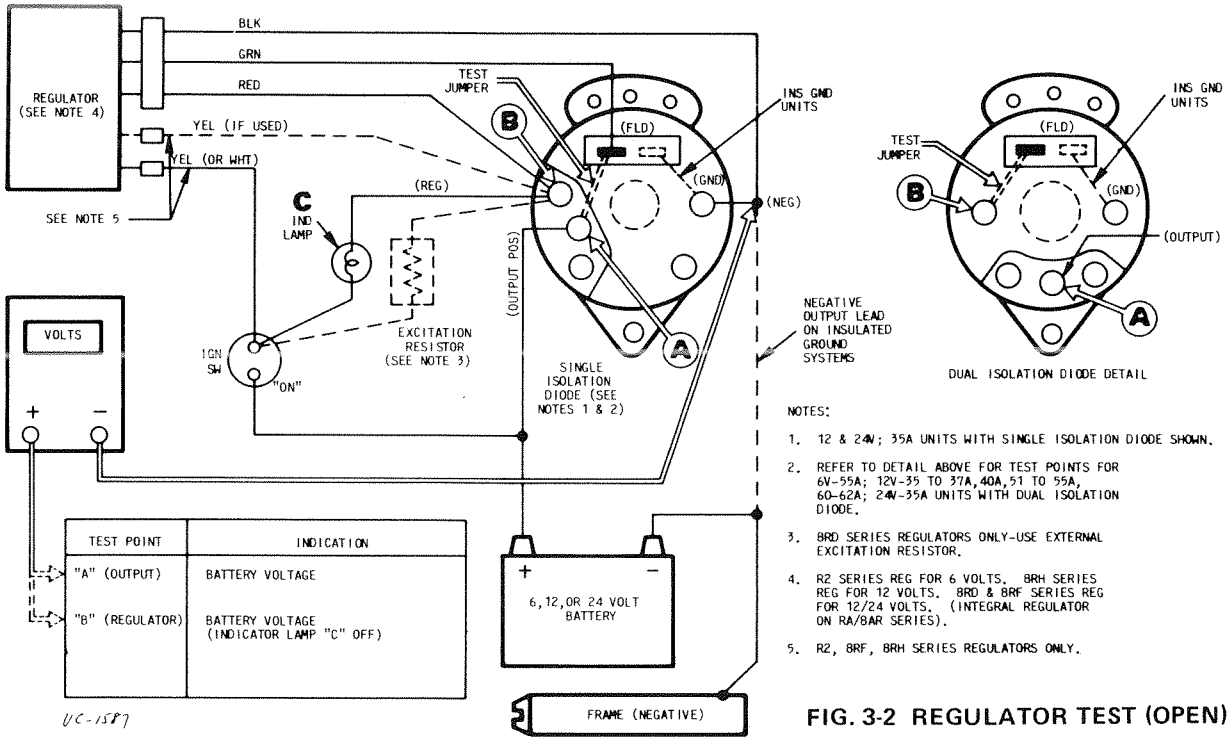


FIG. 3-2 REGULATOR TEST (OPEN)

ALTERNATOR/REGULATOR TESTS

Test No. 1 – Isolation Diode Test (open)

CONDITIONS: Engine operation (see text)(after proper hook-up is made & test leads connected), no electrical loads.

With voltmeter connected as shown in Figure 3-1, measure and note voltages at alternator terminals A and B with engine "off" (key "on"). Start engine and recheck voltages at terminals A and B. If voltmeter now indicates a voltage increase at B only, the isolation diode is open (defective) and must be replaced.

Test No. 2 – Regulator Test (open)

CONDITIONS: Engine stopped (key "on") or idling (after proper hook-up is made & test leads connected) and voltmeter set-up as shown in Figure 3-2.

Indicator lamp will be "off" and battery voltage will be measured at alternator terminal B. After jumper addition, the indicator lamp should now be "on" (and 1.5–3 volts should be present at terminal B of alternator), with key on and engine stopped, thus indicating an "open" (defective) regulator. If lamp is still not on, check bulb and harness. If lamp is still not on, an open field circuit (brushes, slip-rings, etc.) is indicated and alternator must be removed for repair.

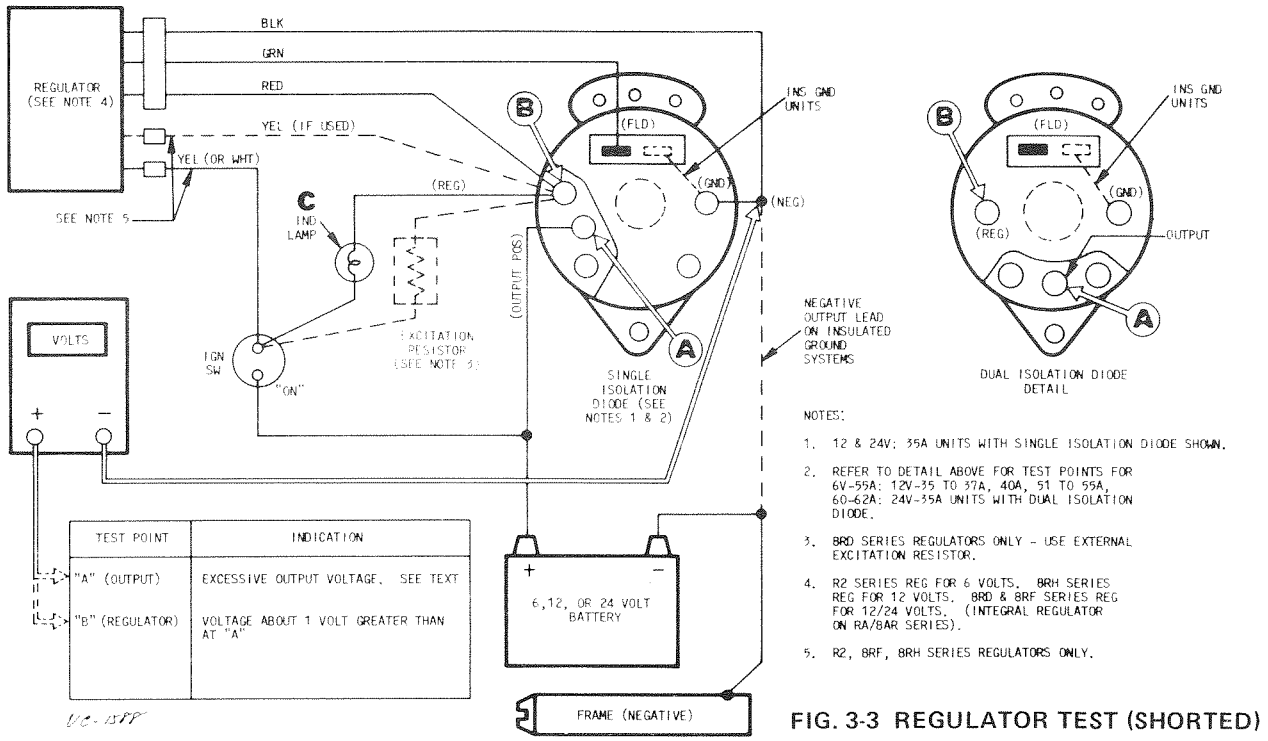


FIG. 3-3 REGULATOR TEST (SHORTED)

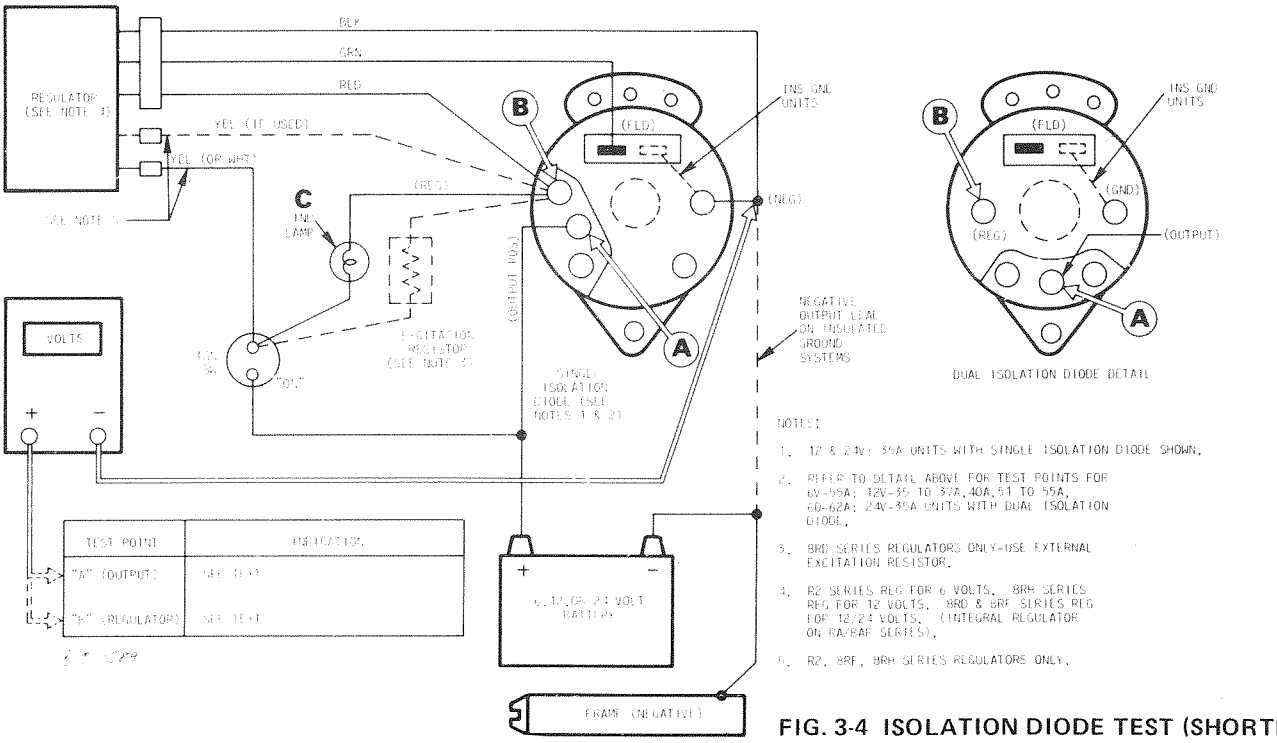


FIG. 3-4 ISOLATION DIODE TEST (SHORTED)

Test No. 3 — Regulator Test (shorted)

CONDITIONS: Engine idling (after connecting voltmeter as shown in Figure 3-3).

Start engine and run at fast idle (approx. 1,000 RPM) with no electrical loads. Continue running engine until voltmeter reading stabilizes at the regulator high end setting. This reading must not exceed the system voltage limits shown in the following chart.

SYSTEM VOLTAGE	OUTPUT VOLTAGE LIMIT
6	7.5
12	15.0
24	30.0
32	40.0

If excessive voltage readings are obtained, the regulator is probably shorted (defective) and should be replaced. However, be sure that a shorted isolation diode is not the cause of the problem (refer to Test No. 4 Isolation Diode Test (shorted).

Test No. 4 — Isolation Diode Test (shorted)

CONDITIONS: Engine idling (after voltmeter is connected as shown in Figure 3-4).

With ignition key "on"/"off" and engine not running, battery voltage will be measured at both the regulator and output terminals of the alternator. After starting and idling engine, the output voltage will be approximately one volt higher than normal due to the shorted isolation diode. If the same voltage can be measured at both the regulator and output terminals, the isolation diode is shorted (defective) and requires replacement. Also, a shorted diode will discharge the battery (engine not running) rather quickly since the field is connected directly to the battery at all times (regardless of key position).

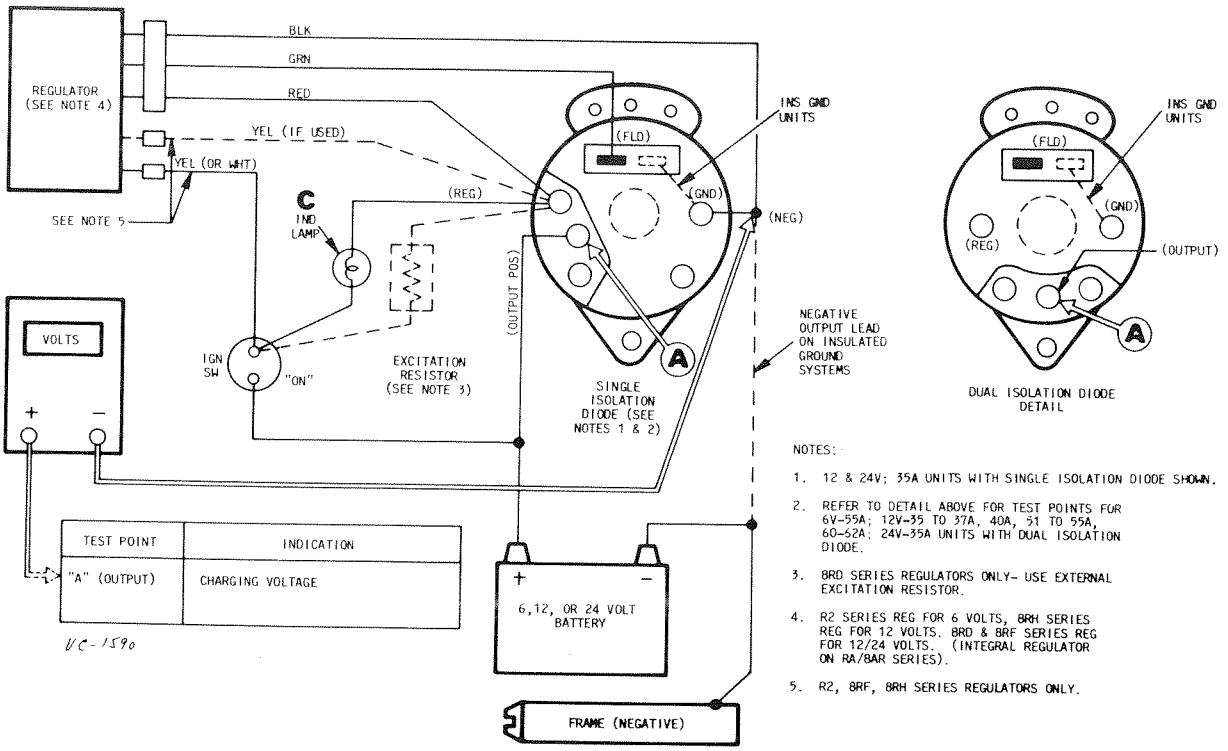


FIG. 3-5 ALTERNATOR OUTPUT TEST

Test No. 5 – Alternator Output Test

CONDITIONS: Engine running at fast idle (after voltmeter is connected as shown in Figure 3-5).

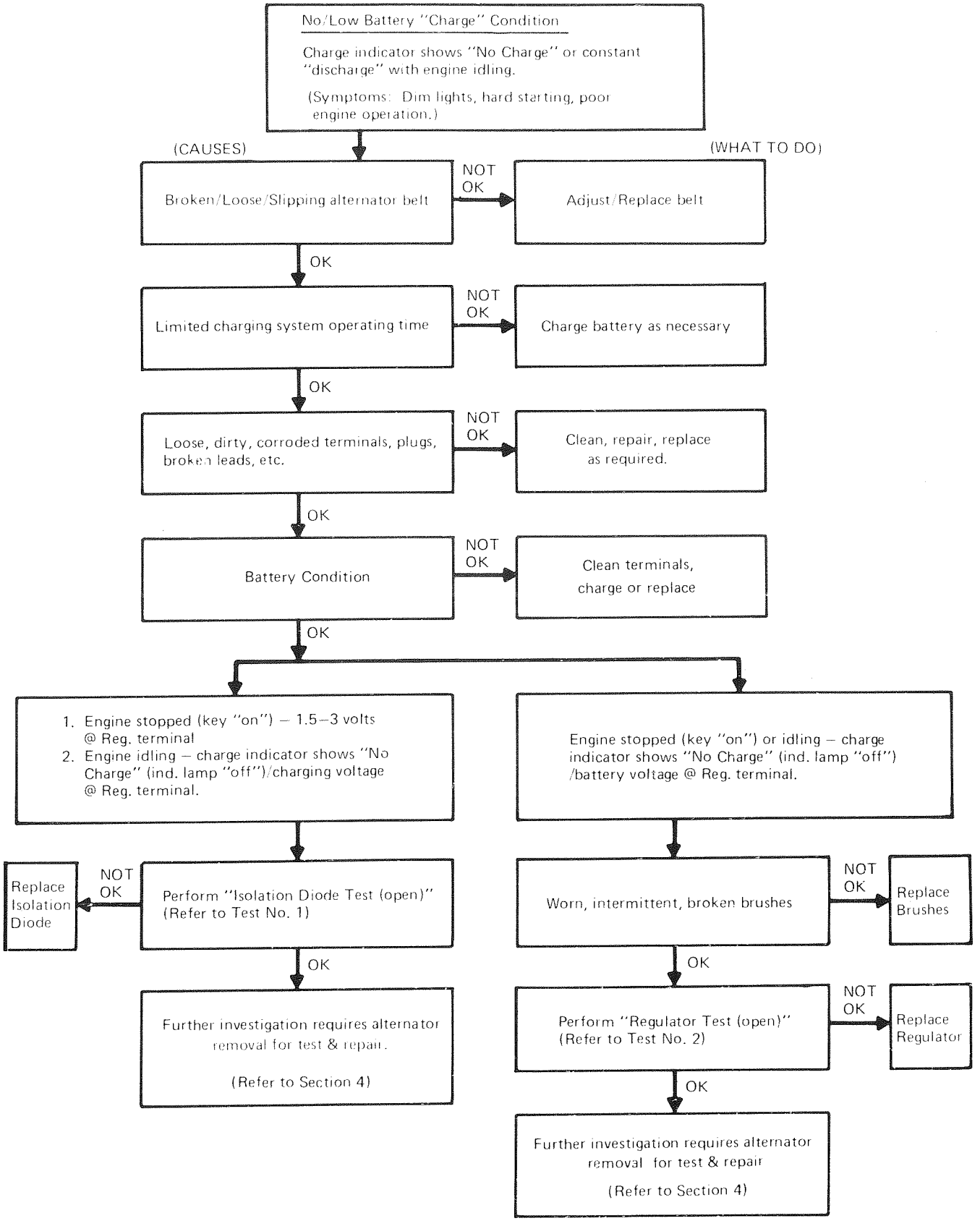
Start and run engine at a fast idle of approximately 1,000 RPM. Turn on vehicle headlights and blower fan (low speed). Check for nominal system output voltages as shown in the following chart.

SYSTEM VOLTAGE	*NOMINAL OUTPUT VOLTAGE
6	6.9–7.4
12	13.8–14.8
24	27.6–29.6
32	36.5–39.5

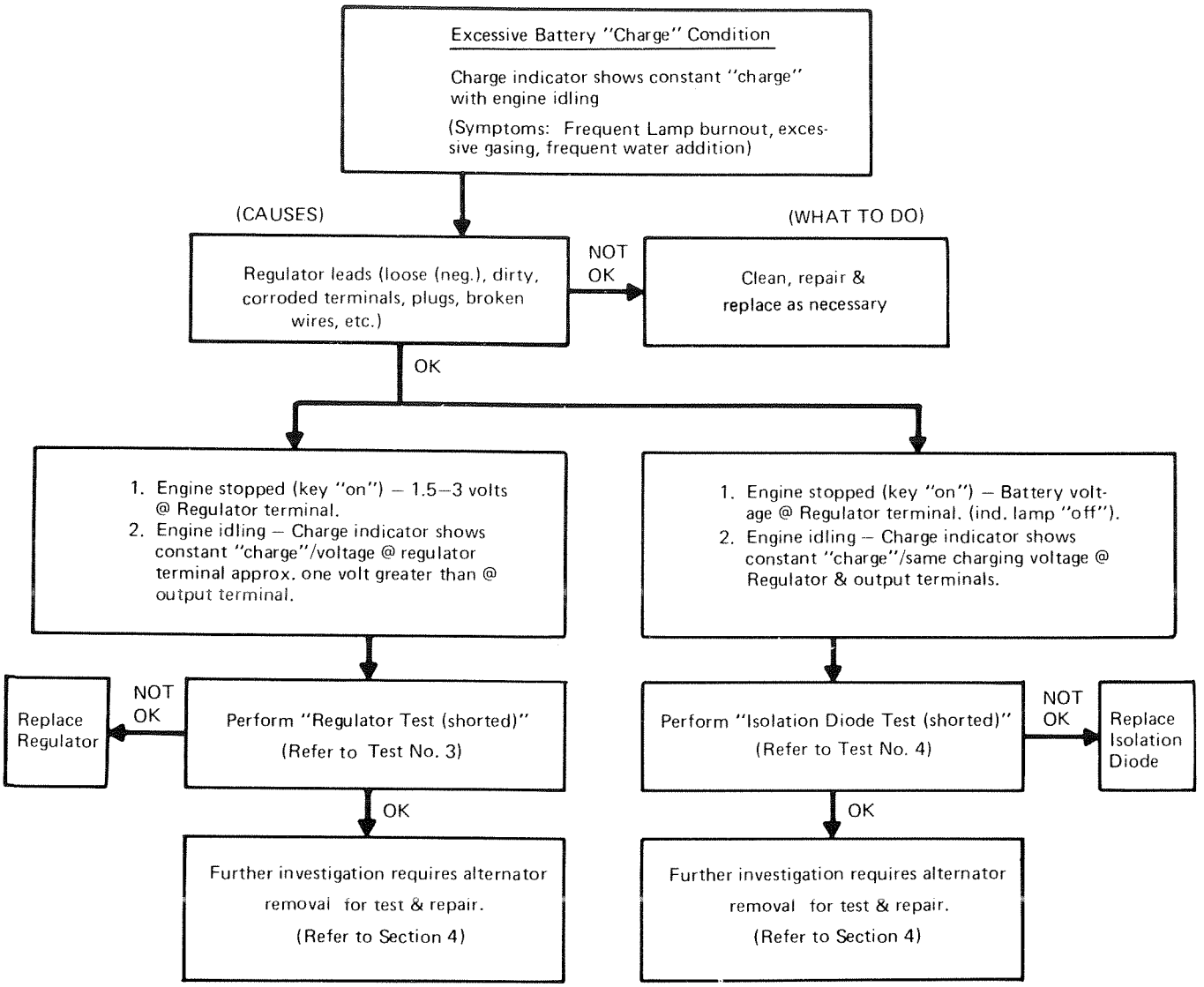
*VOLTAGES MAY VARY A FEW TENTHS OF A VOLT (HIGHER OR LOWER) DUE TO AMBIENT TEMPERATURE VARIATIONS.

If the alternator output voltage does not fall within the proper range, the alternator should be disassembled for further inspection and tests. Refer to Section 4 (overhaul/repair procedure) for additional information.

IN-VEHICLE TEST PROCEDURE FOR: A; 6 VOLT, 55 AMP – A/8AL, HA/8HA, RA/8AR; 12/24 VOLT, 35–62 AMP ALTERNATORS – POSITIVE GROUND SYSTEM WITH ISOLATION DIODE



CHARGING SYSTEM DIAGNOSTIC CHART NO. 1



CHARGING SYSTEM DIAGNOSTIC CHART NO. 2

ALTERNATOR/REGULATOR TEST

Test No. 1 – Isolation Diode Test (open)

CONDITIONS: Engine operation (see text) (after proper hook-up is made & test leads connected), no electrical loads.

With voltmeter connected as shown in Figure 3-6, measure and note voltages at alternator terminals A and B with engine "off" (key "on"). Start engine and recheck voltages at terminals A and B. If voltmeter now indicates a voltage increase at B only, the isolation diode is open (defective) and must be replaced.

Test No. 2 – Regulator Test (open)

CONDITIONS: Engine stopped (key "on") or idling (after proper hook-up is made, test leads connected) and voltmeter set-up as shown in Figure 3-7.

Indicator lamp will be "off" and battery voltage will be measured at alternator terminal B. After jumper addition, the indicator lamp should now be "on" (and 1.5–3 volts should be present at terminal B of alternator), with key on and engine stopped, thus indicating an "open" (defective) regulator. If lamp is still not on, check bulb and harness. If lamp is still not on, an open field circuit (brushes, slip-rings, etc.) is indicated and alternator must be removed for repair.

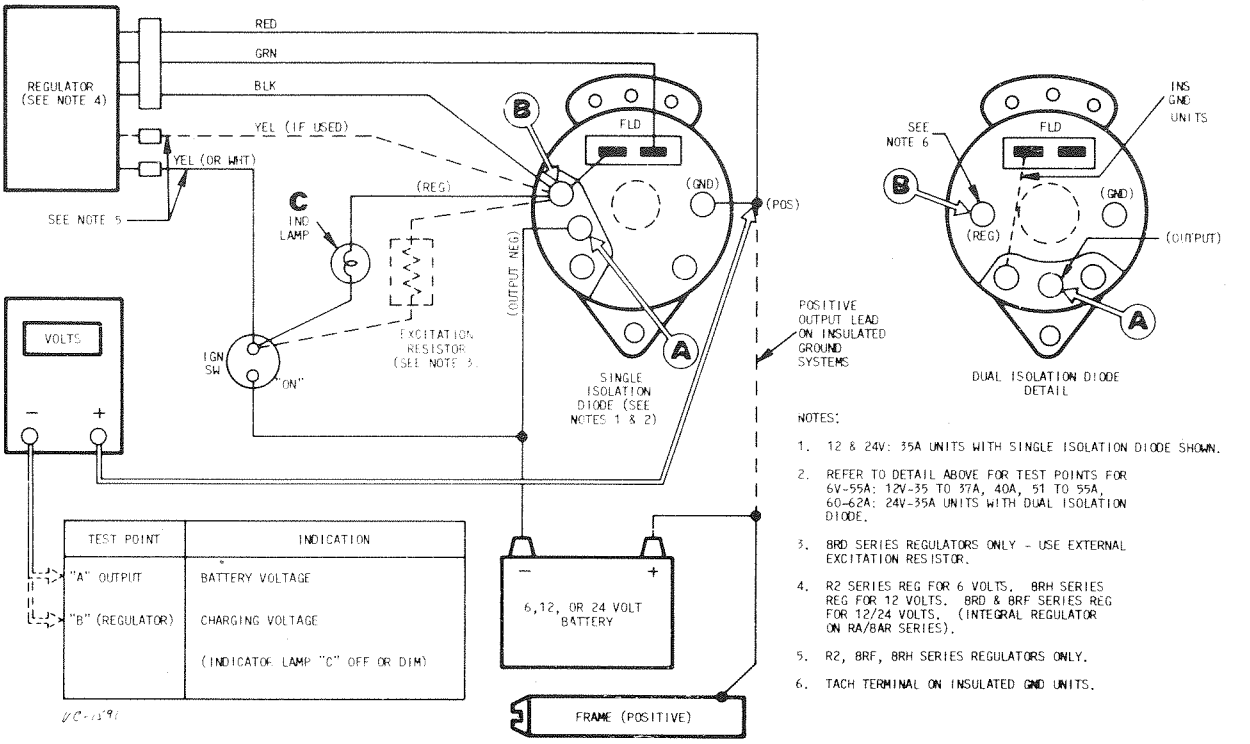


FIG. 3-6 ISOLATION DIODE TEST (OPEN)

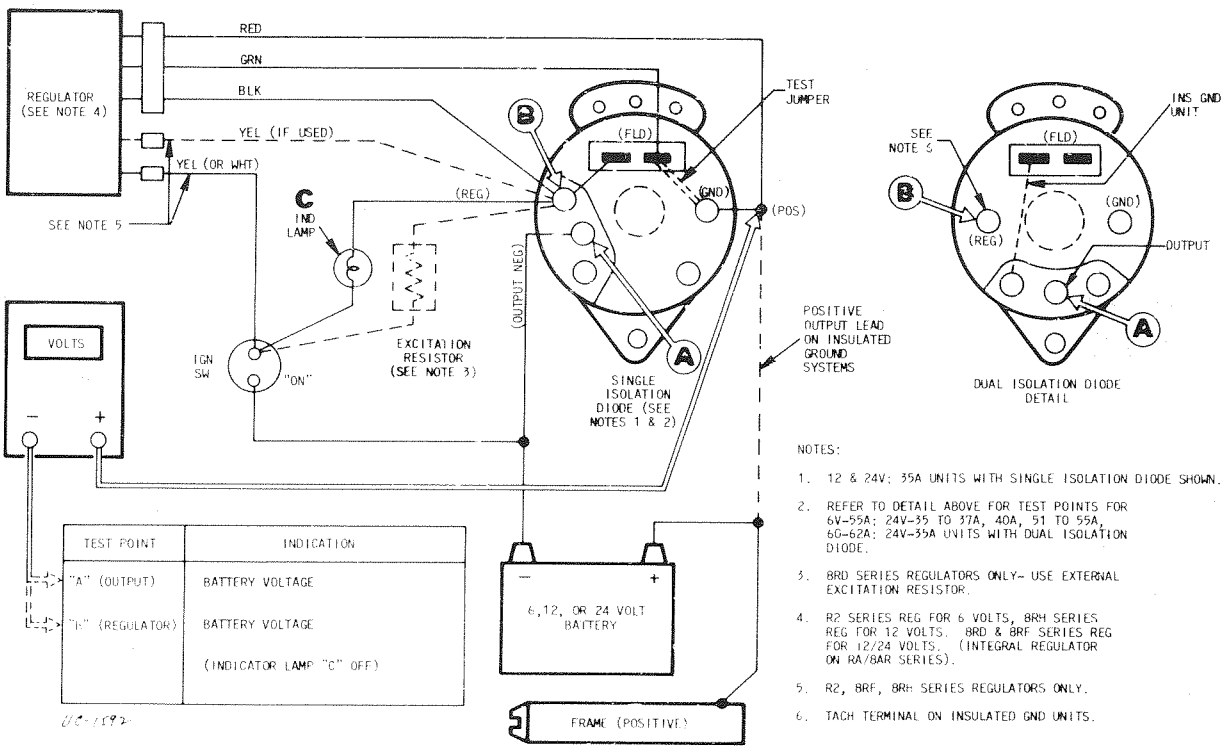


FIG. 3-7 REGULATOR TEST (OPEN)

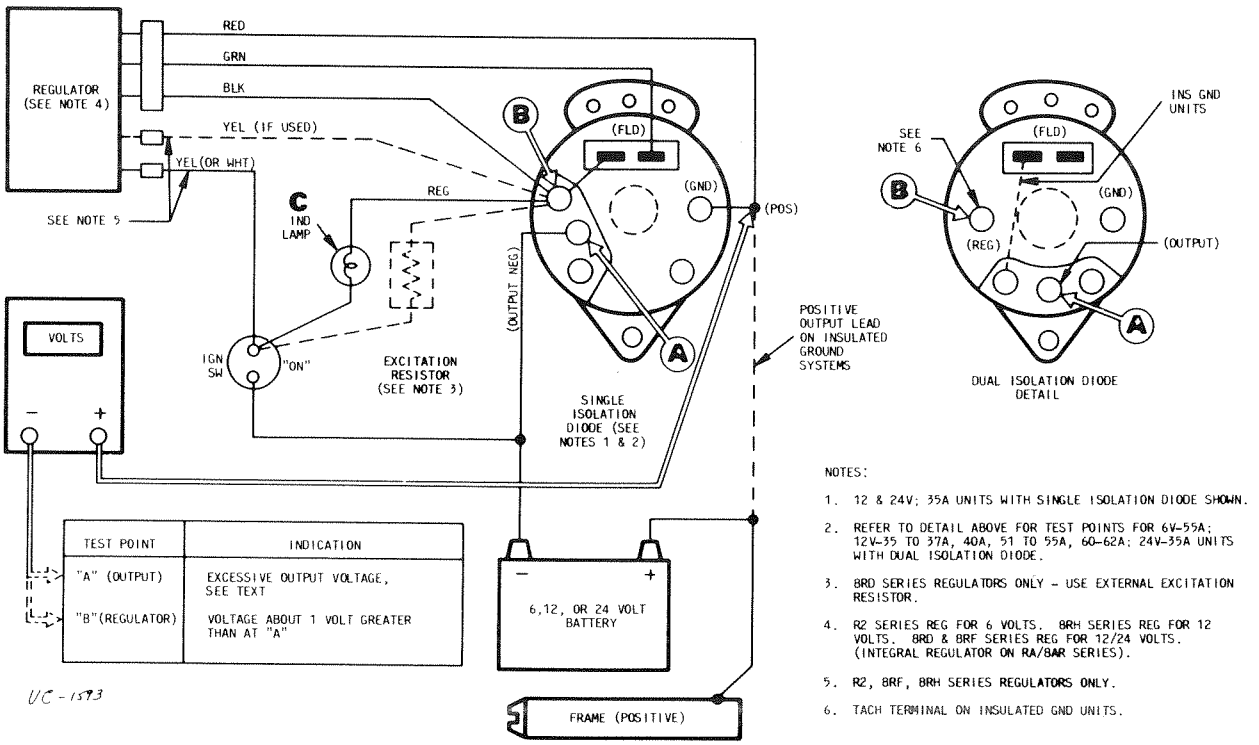


FIG. 3-8 REGULATOR TEST (SHORTED)

Test No. 3 – Regulator Test (shorted)

CONDITIONS: Engine idling (after connecting voltmeter as shown in Figure 3-8).

Start engine and run at fast idle (approx. 1,000 RPM) with no electrical loads. Continue running engine until voltmeter reading stabilizes at the regulator high end setting. This reading must not exceed the system voltage limits shown in the following chart.

SYSTEM VOLTAGE	OUTPUT VOLTAGE LIMIT
6	7.5
12	15.0
24	30.0
32	40.0

If excessive voltage readings are obtained, the regulator is probably shorted (defective) and should be replaced. However, be sure that a shorted isolation diode is not the cause of the problem (refer to Test No. 4 – Isolation Diode Test (shorted).

Test No. 4 – Isolation Diode Test (shorted)

CONDITIONS: Engine idling (after voltmeter is connected as shown in Figure 3-9).

With ignition key "on"/"off" and engine not running, battery voltage will be measured at both the regulator and output terminals of the alternator. After starting and idling engine, the output voltage will be approximately one volt higher than normal due to the shorted isolation diode. If the same voltage can be measured at both the regulator and output terminals, the isolation diode is shorted (defective) and requires replacement. Also, a shorted diode will discharge the battery (engine not running) rather quickly since the field is connected directly to the battery at all times (regardless of key position).

Test No. 5 – Alternator Output Test

CONDITIONS: Engine running at fast idle (after voltmeter is connected as shown in Figure 3-10).

Start and run engine at a fast idle of approximately 1,000 RPM. Turn on vehicle headlights and blower fan (low speed). Check for nominal system output voltages as shown in the following chart.

SYSTEM VOLTAGE	*NOMINAL OUTPUT VOLTAGE
6	6.9 – 7.4
12	13.8 – 14.8
24	27.6 – 29.6
32	36.5 – 39.5

*VOLTAGES MAY VARY A FEW TENTHS OF A VOLT (HIGHER OR LOWER) DUE TO AMBIENT TEMPERATURE VARIATIONS.

If the alternator output voltage does not fall within the proper range, the alternator should be disassembled for further inspection and tests. Refer to Section 4 (overhaul/repair procedure) for additional information.

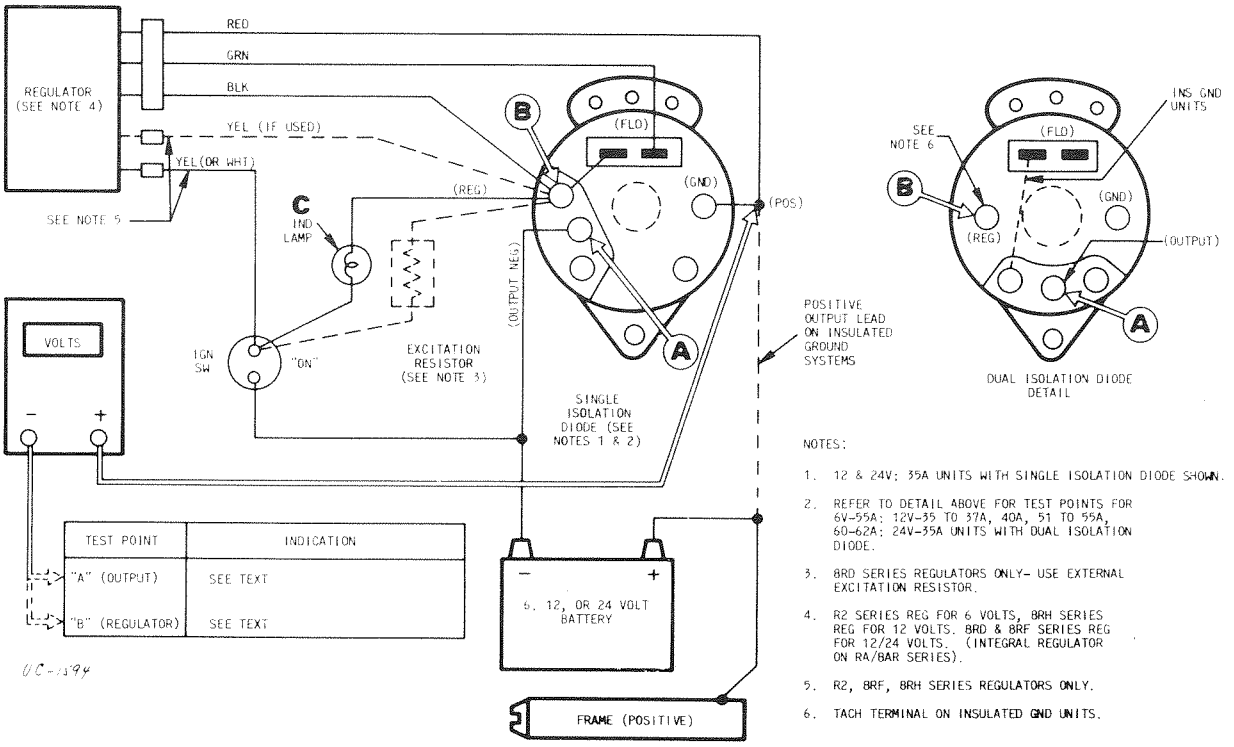


FIG. 3-9 ISOLATION DIODE TEST (SHORTED)

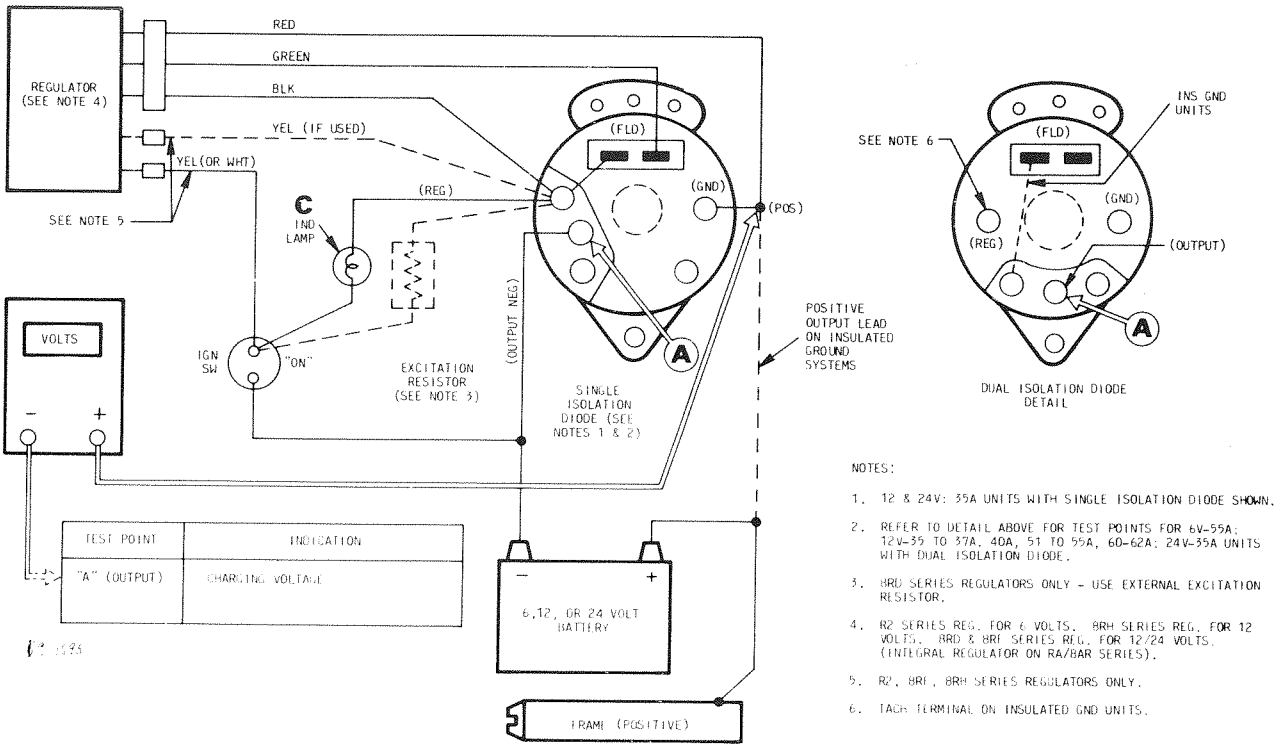
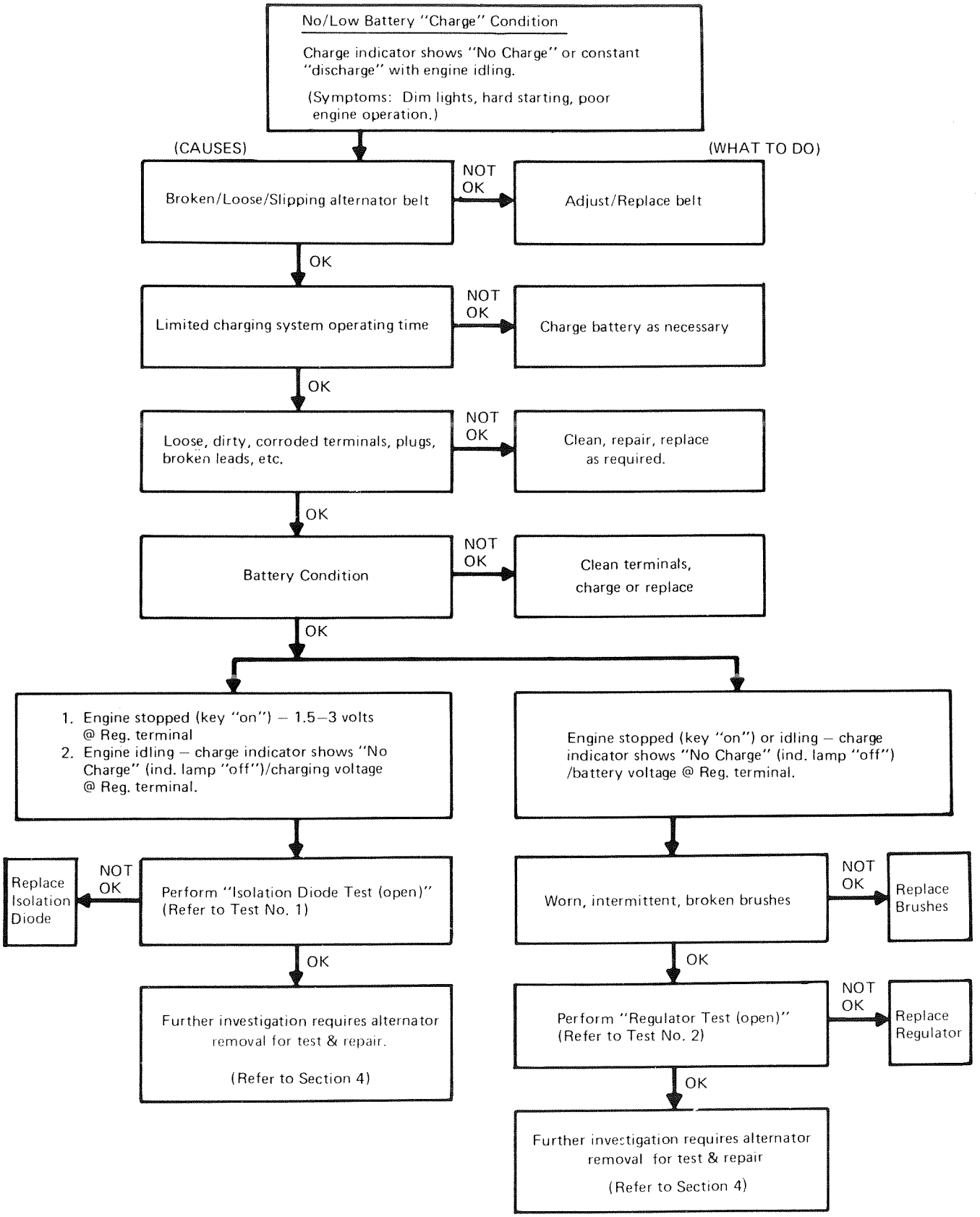
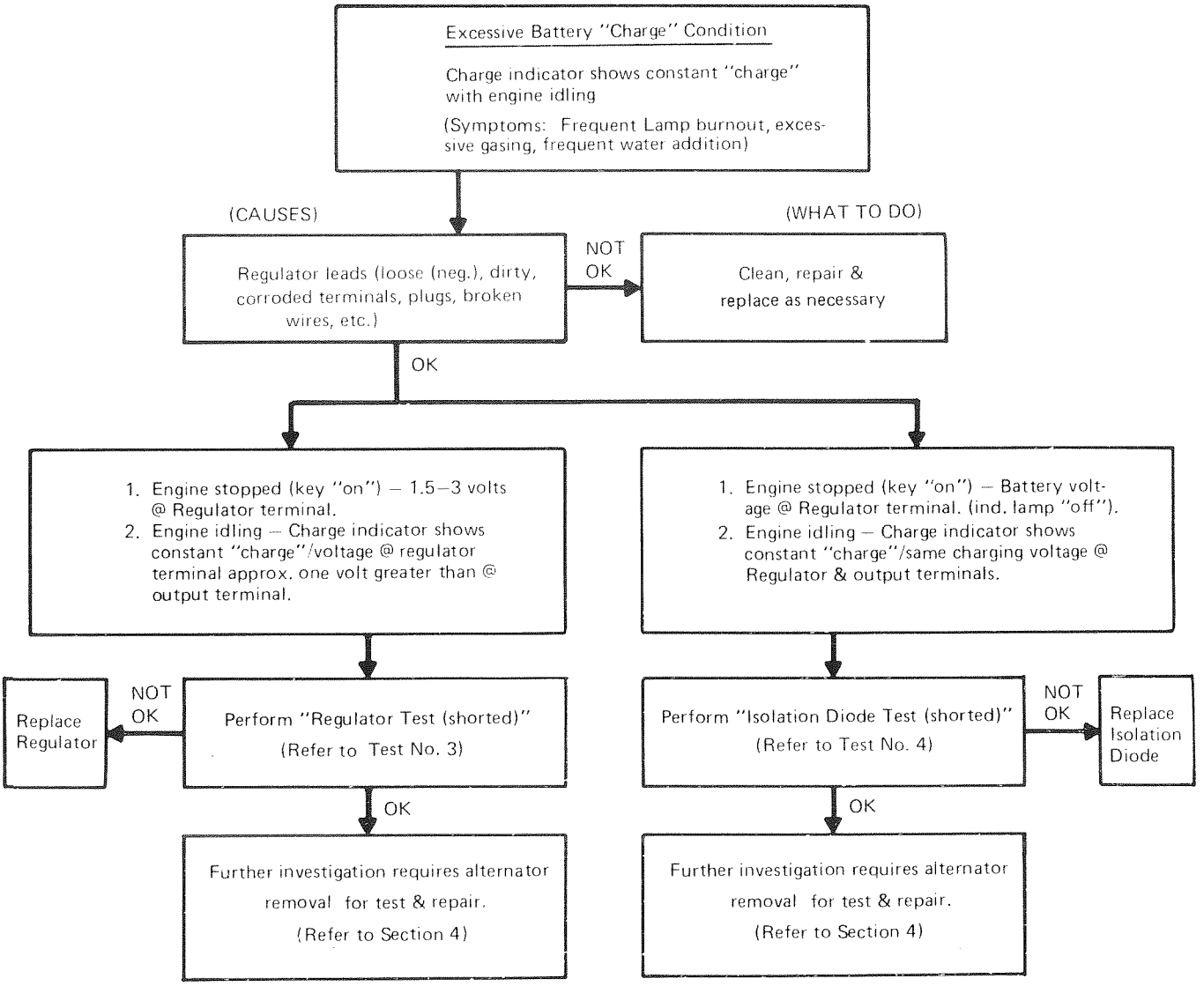


FIG. 3-10 ALTERNATOR OUTPUT TEST

IN-VEHICLE TEST PROCEDURE FOR: A/HA/RA; 12/24 VOLT, 35 & 60–62 AMP ALTERNATORS – POSITIVE GROUND (INS) SYSTEM WITH ISOLATION DIODE



CHARGING SYSTEM DIAGNOSTIC CHART NO. 1



CHARGING SYSTEM DIAGNOSTIC CHART NO. 2

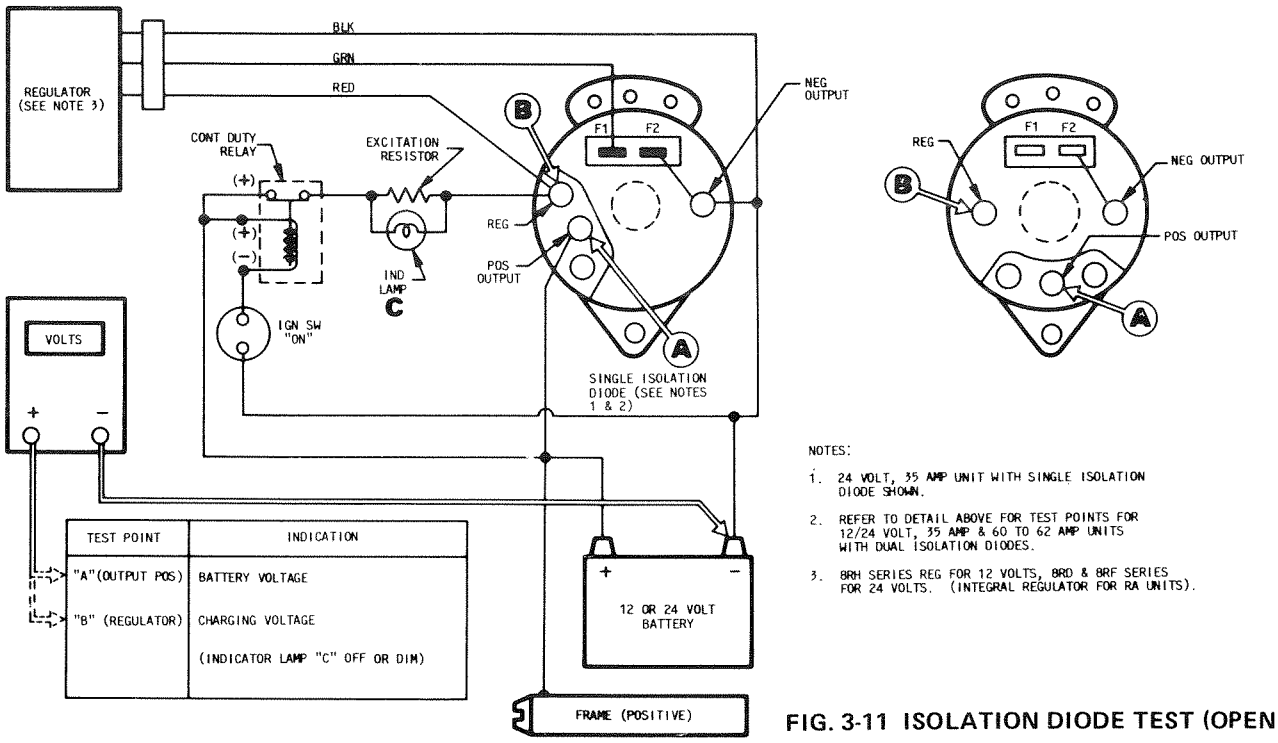


FIG. 3-11 ISOLATION DIODE TEST (OPEN)

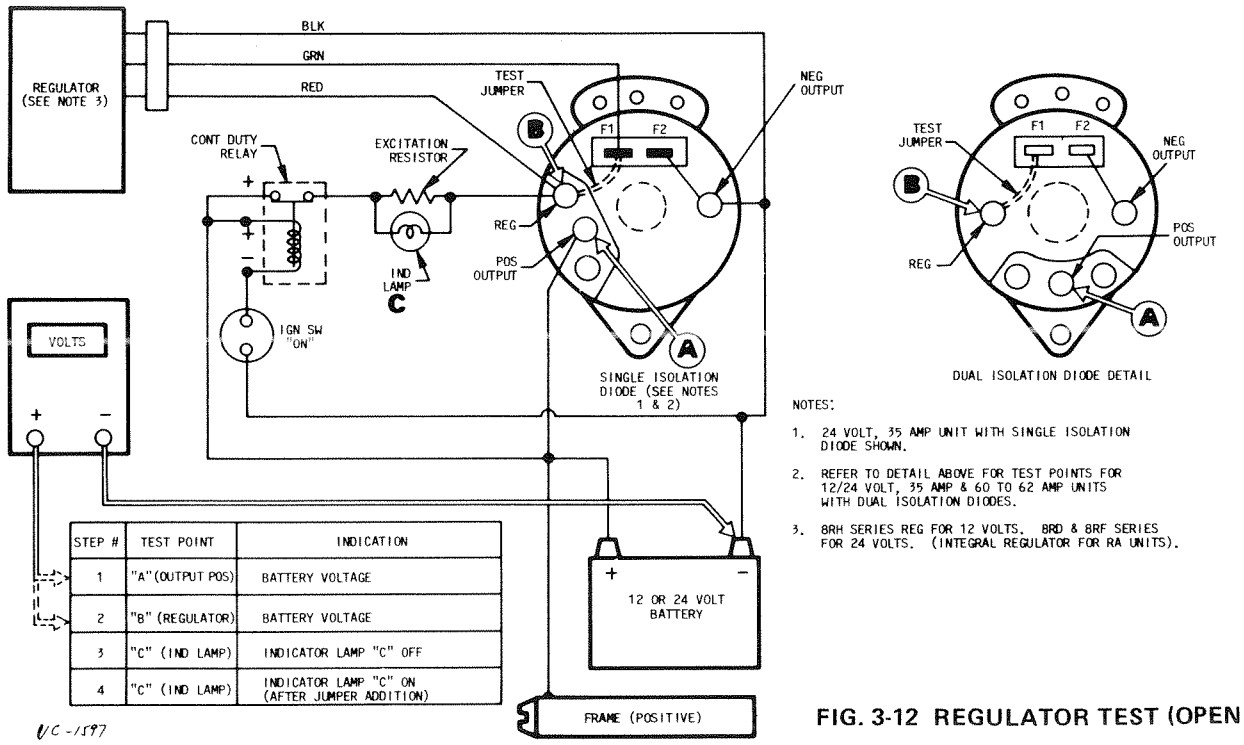


FIG. 3-12 REGULATOR TEST (OPEN)

ALTERNATOR/REGULATOR TESTS

Test No. 1 – Isolation Diode Test (open)

CONDITIONS: Engine operation (see text) (after test leads connected), no electrical loads.

With voltmeter connected as shown in Figure 3-11, measure and note voltages at alternator terminals A and B with engine "off" (key "on"). Start engine and recheck voltages at terminals A and B. If voltmeter now indicates a voltage increase at B only, the isolation diode is "open" (defective) and must be replaced.

Test No. 2 – Regulator Test (open)

CONDITIONS: Engine stopped (key "on") or idling (after proper hook-up is made & test leads connected) and voltmeter set-up as shown in Figure 3-12.

Indicator lamp will be "off" and battery voltage will be measured at alternator terminal B. After jumper addition, the indicator lamp should now be "on" (and 1.5–3 volts should be present at terminal B of alternator), with key on and engine stopped, thus indicating an "open" (defective) regulator. If lamp is still not on, check bulb and harness. If lamp is still not on, an open field circuit (brushes, slip-rings, etc.) is indicated and alternator must be removed for repair.

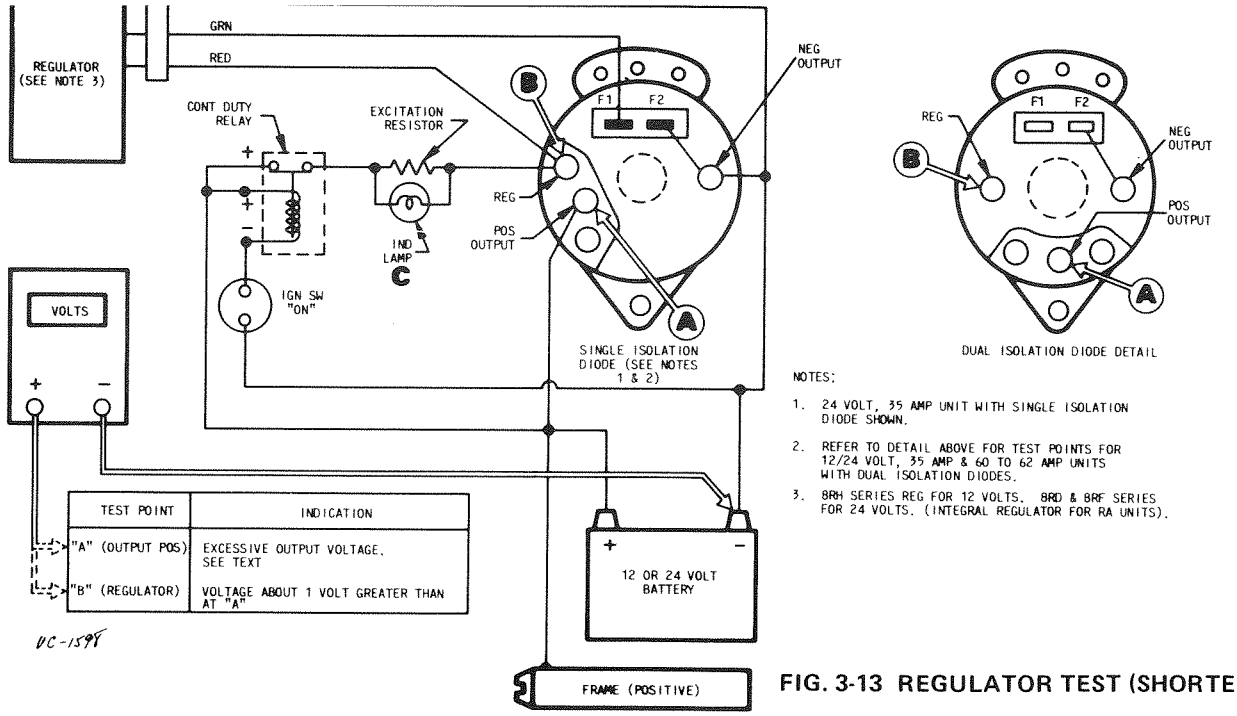


FIG. 3-13 REGULATOR TEST (SHORTED)

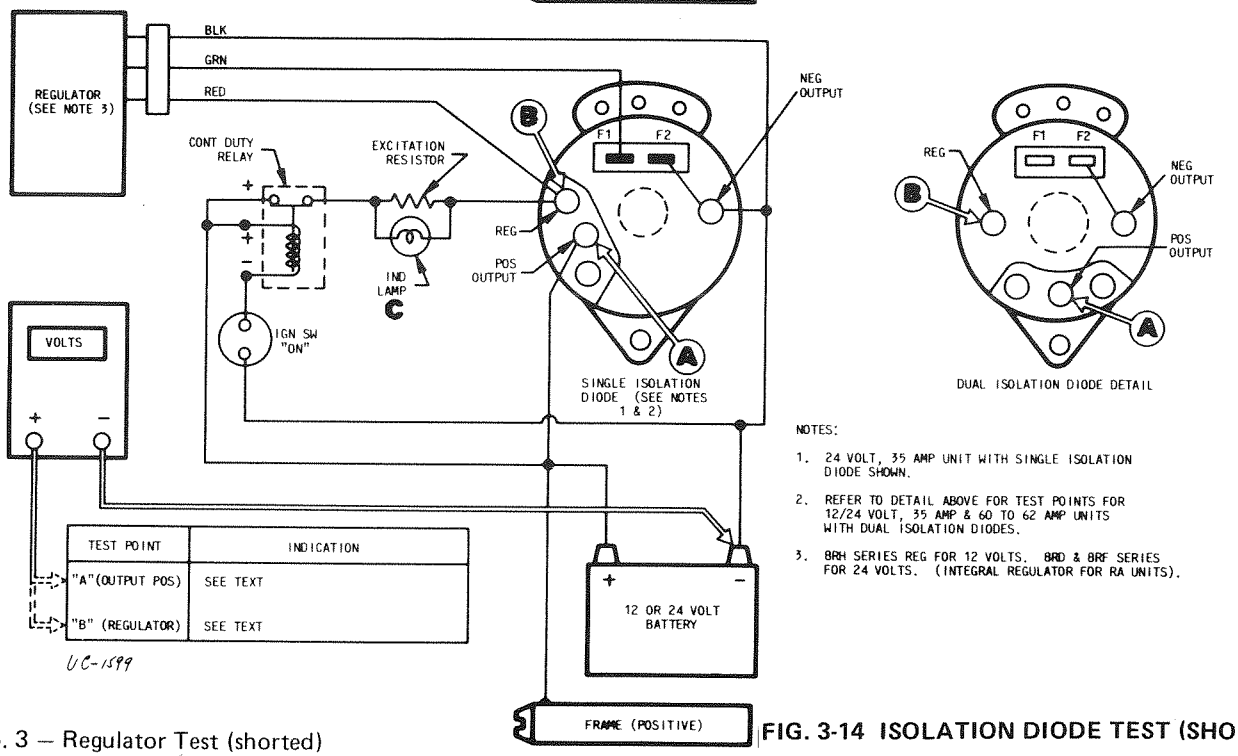


FIG. 3-14 ISOLATION DIODE TEST (SHORTED)

Test No. 3 – Regulator Test (shorted)

CONDITIONS: Engine idling (after connecting voltmeter as shown in Figure 3-13).

Start engine and run at fast idle (approx. 1,000 RPM) with no electrical loads. Continue running engine until voltmeter reading stabilizes at the regulator high end setting. This reading must not exceed the system voltage limits shown in the following chart.

SYSTEM VOLTAGE	OUTPUT VOLTAGE LIMIT
12	15.0
24	30.0

If excessive voltage readings are obtained, the regulator is probably shorted (defective) and should be replaced. However, be sure that a shorted isolation diode is not the cause of the problem (refer to Test No. 4 – Isolation Diode Test (shorted).

Test No. 4 – Isolation Diode Test (shorted)

CONDITIONS: Engine idling (after voltmeter is connected as shown in Figure 3-14).

With ignition key "on"/"off" and engine not running, battery voltage will be measured at both the regulator and output terminals of the alternator. After starting and idling engine, the output voltage will be approximately one volt higher than normal due to the shorted isolation diode. If the same voltage can be measured at both the regulator and output terminals, the isolation diode is shorted (defective) and requires replacement. Also, a shorted diode will discharge the battery (engine not running) rather quickly since the field is connected directly to the battery at all times (regardless of key position).

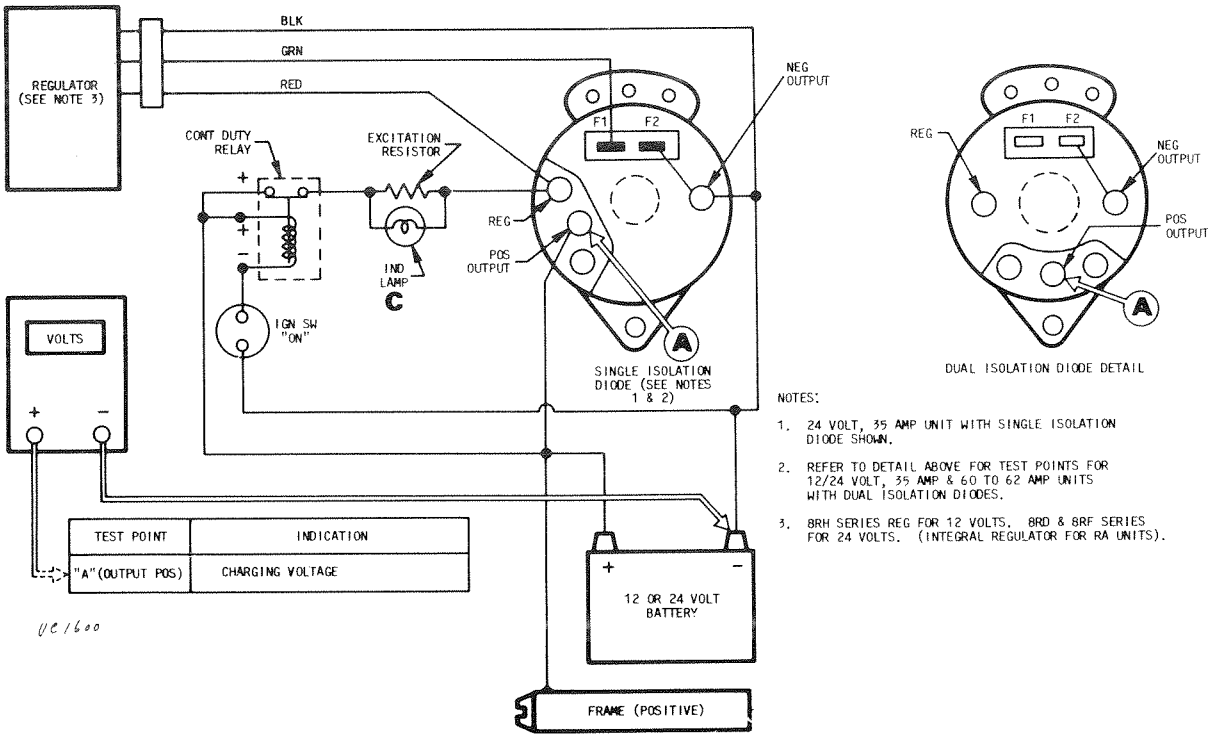


FIG. 3-15 ALTERNATOR OUTPUT TEST

Test No. 5 – Alternator Output Test

CONDITIONS: Engine running at fast idle (after voltmeter is connected as shown in Figure 3-15).

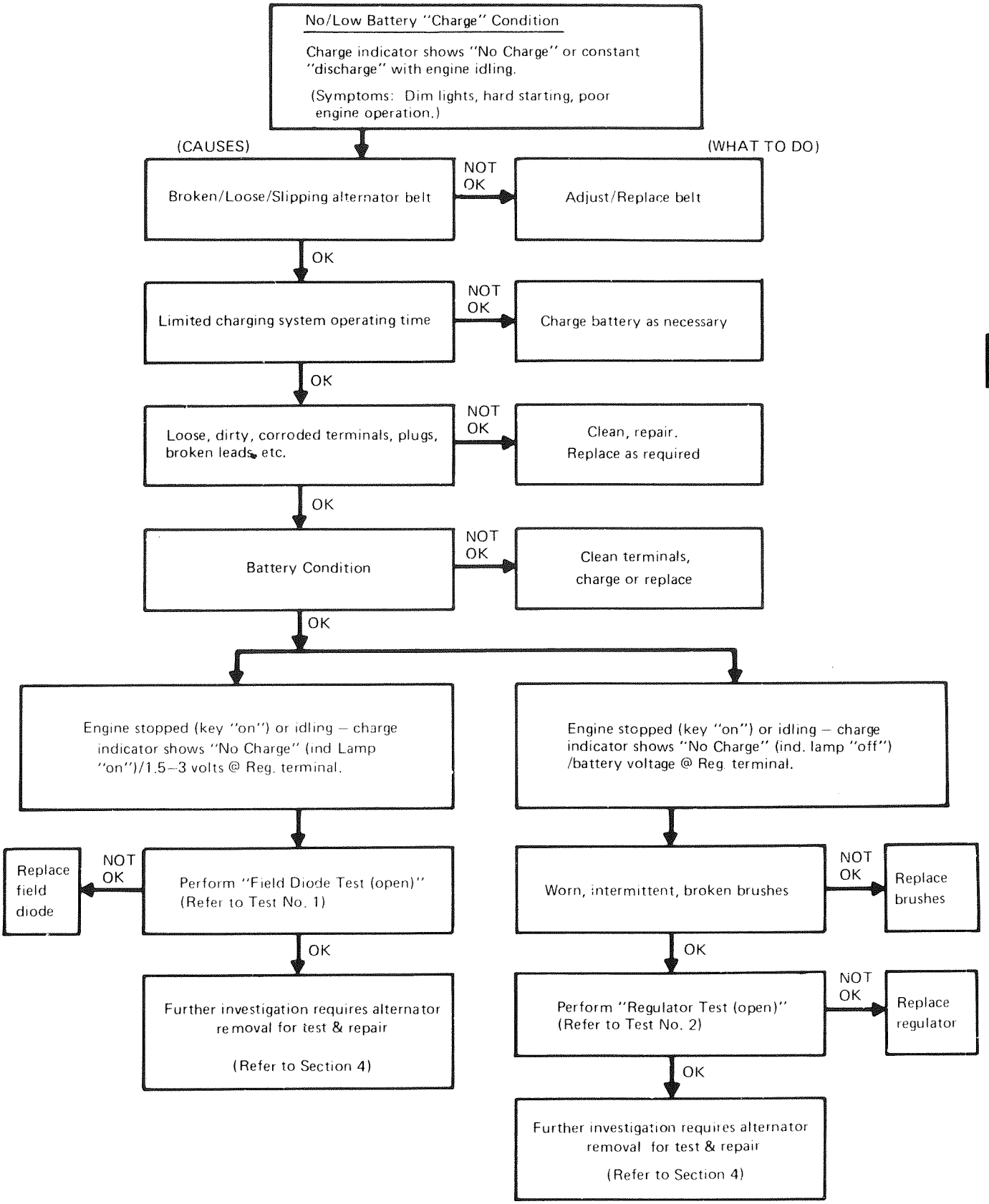
Start and run engine at a fast idle of approximately 1,000 RPM. Turn on vehicle headlights and blower fan (low speed). Check for nominal system output voltages as shown in the following chart.

SYSTEM VOLTAGE	*NOMINAL OUTPUT VOLTAGE
12	13.8 – 14.8
24	27.6 – 29.6

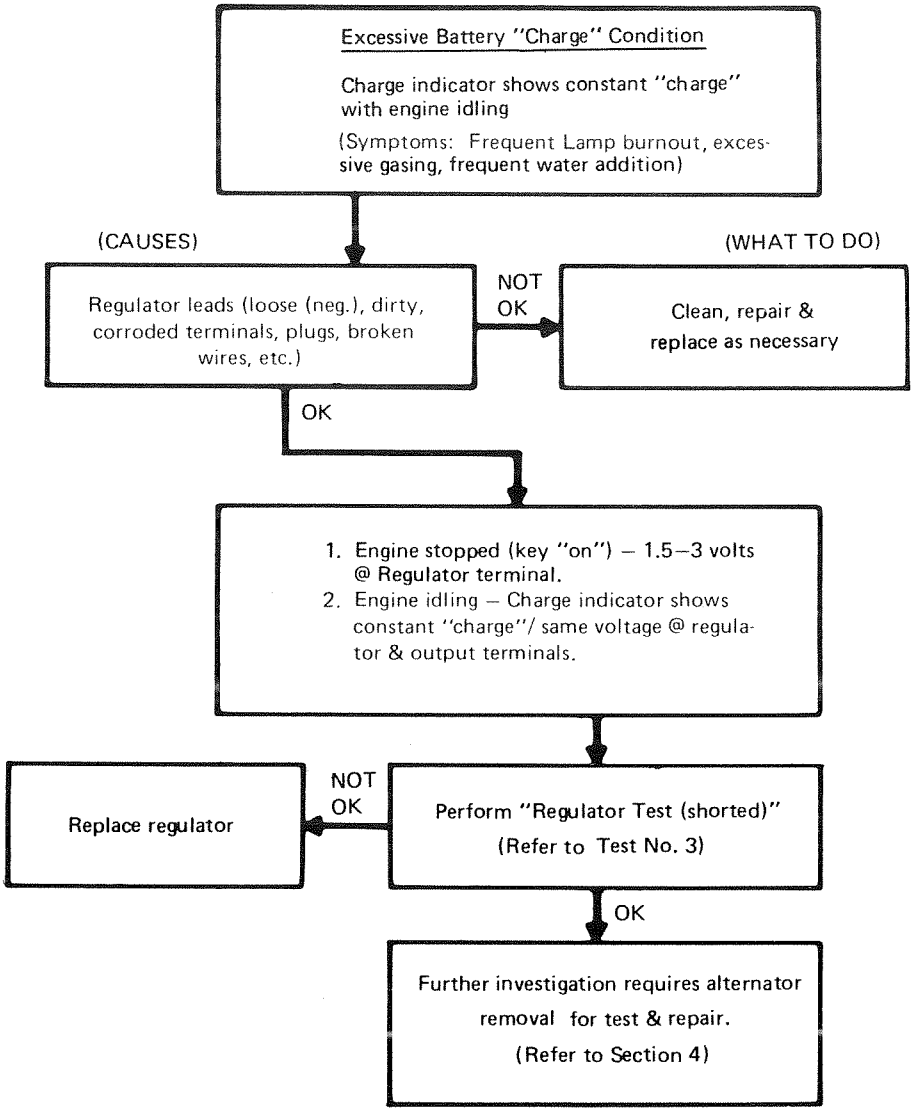
*VOLTAGES MAY VARY A FEW TENTHS OF A VOLT (HIGHER OR LOWER) DUE TO AMBIENT TEMPERATURE VARIATIONS.

If the alternator output voltage does not fall within the proper range, the alternator should be disassembled for further inspection and tests. Refer to Section 4 (overhaul/repair procedure) for additional information.

IN-VEHICLE TEST PROCEDURE FOR: 8AL/8AR; 12 VOLT, 35–37, 51–55 & 60–62 AMPERE ALTERNATORS – NEGATIVE GROUND SYSTEM WITH FIELD DIODE



CHARGING SYSTEM DIAGNOSTIC CHART NO. 1



CHARGING SYSTEM DIAGNOSTIC CHART NO. 2

ALTERNATOR/REGULATOR TESTS

Test No. 1 – Field Diode Test (open)

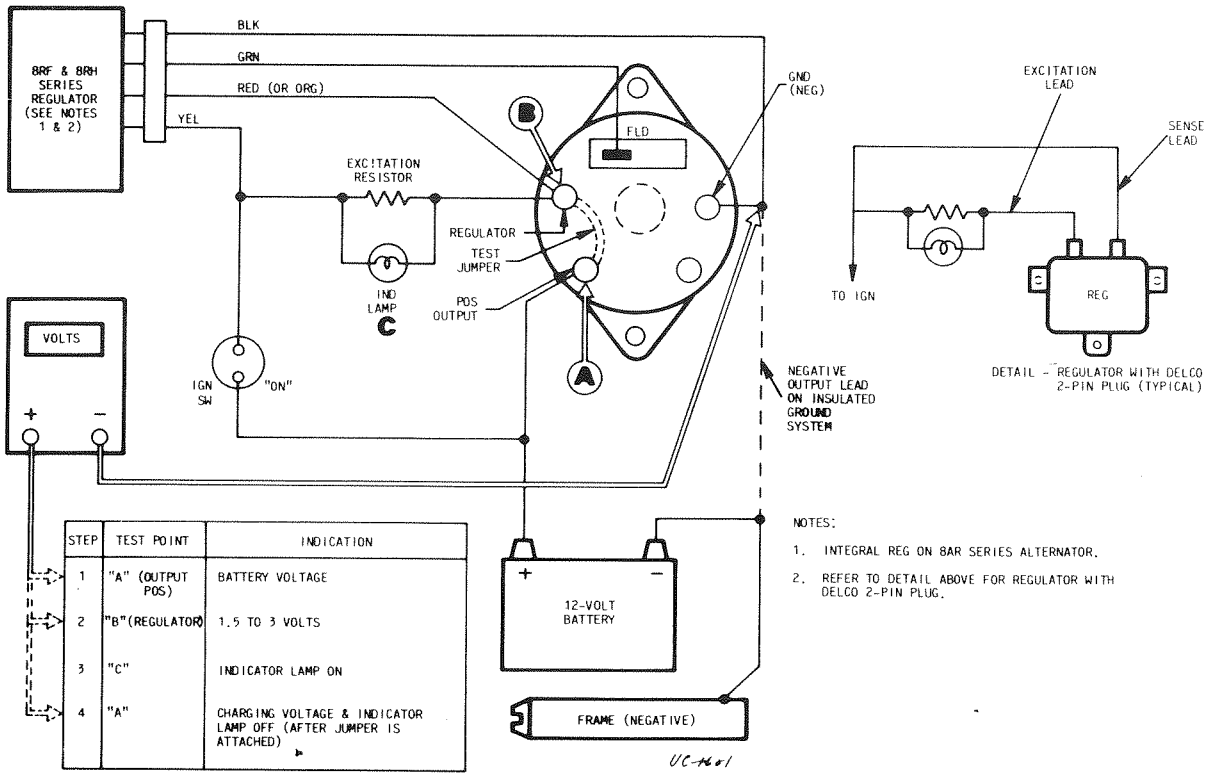
CONDITIONS: Engine stopped (key "on"/idling (after proper hook-up is made & test leads connected), no electrical loads.

Check for battery voltage at terminal A and for 1.5-3 volts at terminal B, Figure 3-16. Add jumper (JU1) between terminals A and B. If indicator lamp now goes "off" and charging voltage is present at terminal A, the field diode is probably "open" (defective) and alternator should be removed for repair.

Test No. 2 – Regulator Test (open)

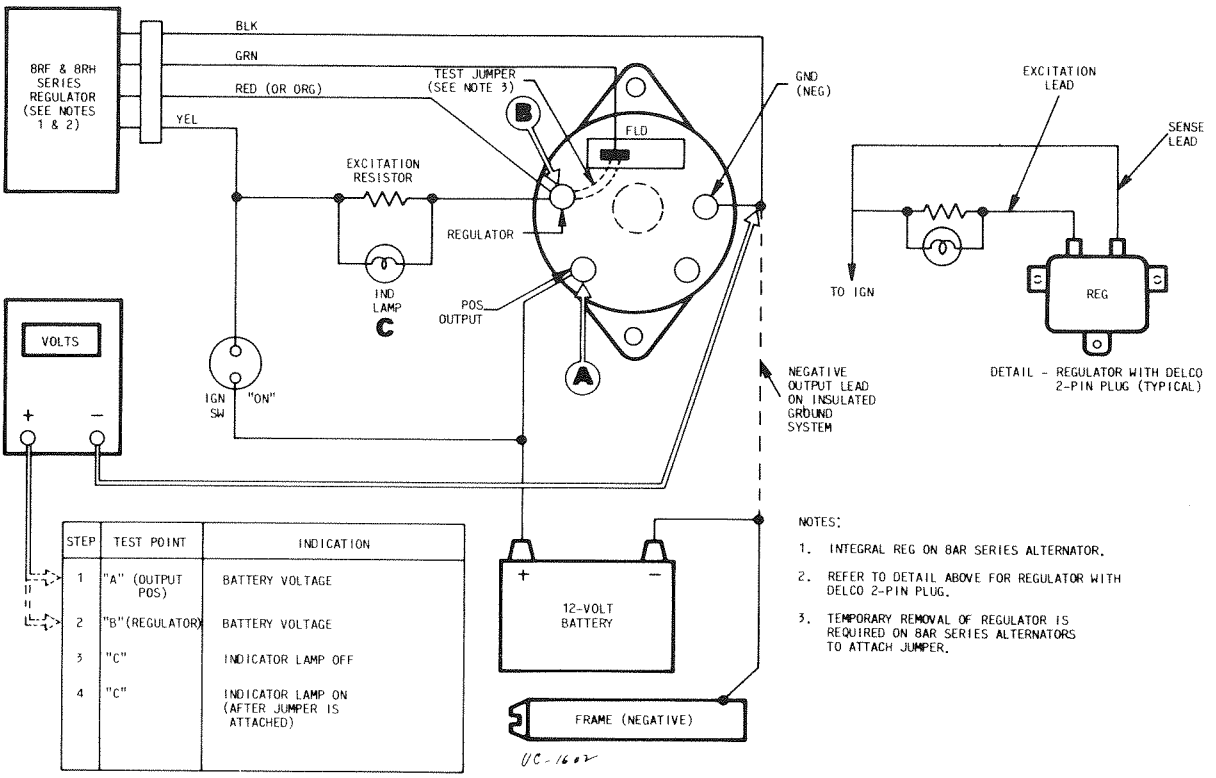
CONDITIONS: Engine stopped (key "on") or idling (after proper hook-up is made & test leads connected) and voltmeter set-up as shown in Figure 3-17.

The indicator lamp will be "off" and battery voltage will be present at alternator terminal B (reg). After jumper addition, the indicator lamp should now be "on" (and 1.5–3 volts should be present at terminal B of alternator), with key "on" and engine stopped, thus indicating an open (defective) regulator. If lamp is still not "on", an open field circuit (brushes, slip-rings, etc.) is indicated and alternator repair is required.



STEP	TEST POINT	INDICATION
1	"A" (OUTPUT POS)	BATTERY VOLTAGE
2	"B"(REGULATOR)	1.5 TO 3 VOLTS
3	"C"	INDICATOR LAMP ON
4	"A"	CHARGING VOLTAGE & INDICATOR LAMP OFF (AFTER JUMPER IS ATTACHED)

FIG. 3-16 FIELD DIODE TEST (OPEN)



STEP	TEST POINT	INDICATION
1	"A" (OUTPUT POS)	BATTERY VOLTAGE
2	"B"(REGULATOR)	BATTERY VOLTAGE
3	"C"	INDICATOR LAMP OFF
4	"C"	INDICATOR LAMP ON (AFTER JUMPER IS ATTACHED)

FIG. 3-17 REGULATOR TEST (OPEN)

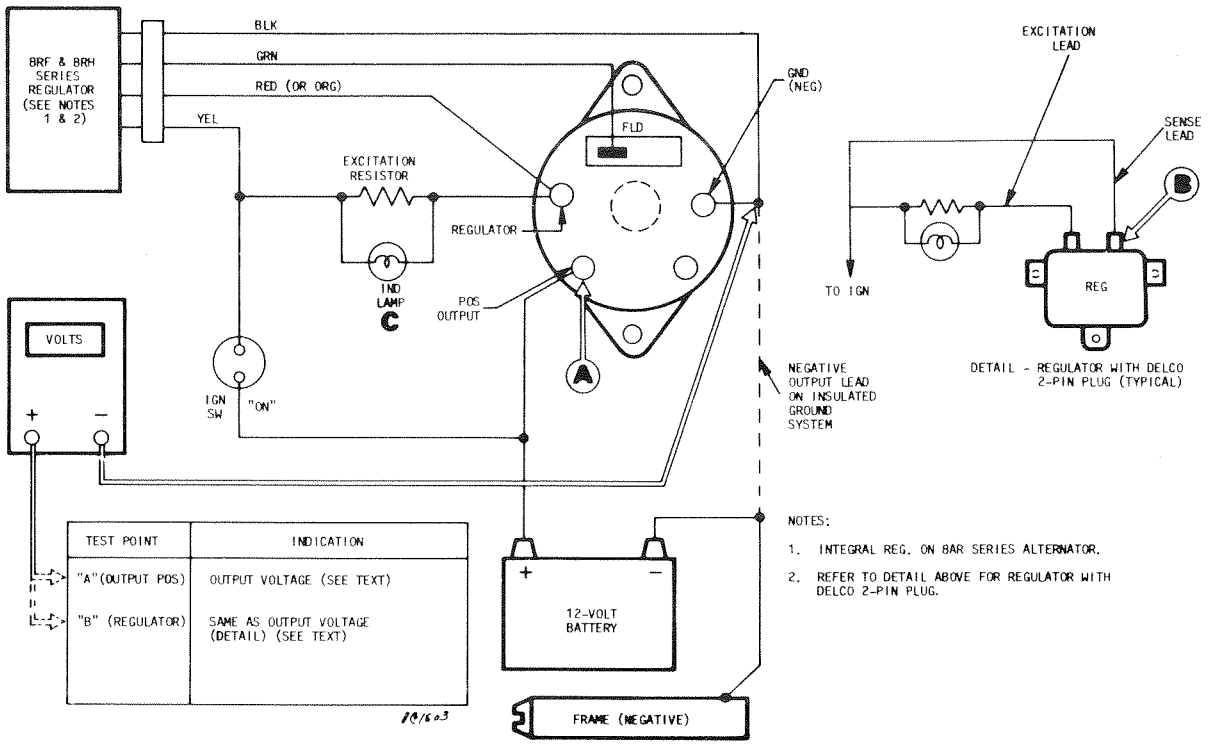


FIG. 3-18 REGULATOR TEST (SHORTED)

Test No. 3 – Regulator Test (shorted)

CONDITIONS: Engine idling (after connecting voltmeter as shown in Figure 3-18).

Start engine and run at fast idle (approx. 1,000 RPM) with no electrical loads. Continue running engine until voltmeter reading stabilizes at the regulator high end setting. This high end voltage reading must not exceed 15 volts for a correctly operating charging system.

If excessive voltage readings are obtained, the regulator is probably shorted (defective) and should be replaced. However, in charging systems with Delco 2-pin plug integral regulator – make sure "sense" voltage is approximately the same (not less) as output voltage or overcharging will result (even with a good regulator). For example, if the sense-to-output terminal voltage difference is greater than a few tenths of a volt, and the regulator is good, check for voltage drops in the wiring system.

Test No. 4 – Alternator Output Test

CONDITIONS: Engine running at fast idle (after voltmeter is connected as shown in Figure 3-19).

Start and run engine at a fast idle of approximately 1,000 RPM. Turn on vehicle headlights and blower fan (low speed). Check for nominal system output voltage of between 13.8–14.8 volts for a properly operating charging system. (Voltages may vary a few tenths of a volt (higher or lower) due to ambient temperature variations).

If the alternator output voltage does not fall within the proper range, the alternator should be disassembled for further inspection and tests. Refer to Section 4 (overhaul/repair procedure) for additional information.

VOLTAGE REGULATOR TEST & ADJUSTMENT

GENERAL

Several types of regulators are utilized in these Alternator Systems and are described as follows:

The R-2 series is used in 6 volt systems with isolation diode, and in positive and negative ground configurations.

The 8RH Series is employed in 12 volt systems with isolation diode, and also in positive and negative ground applications.

The 8RD and 8RF Series are used in 12 and 24 volt systems with isolation diode and in negative and positive ground applications.

8RB/8RH Series Regulators are used in 12 volt systems with field diode, and in negative ground arrangements.

The 8RD regulators are the only types that provide an adjustable pot or switch for setting system output voltage. All other Regulators are non-adjustable and must be properly selected for any given alternator system.

Alternators with isolation diodes employ regulators that sense a regulator terminal voltage approximately 1 volt greater than the output voltage. Regulators in field diode type alternator systems sense auxiliary terminal voltages equal to the output reference level. From this it can be seen that the proper regulator must be used in any system if optimum performance is to be realized.

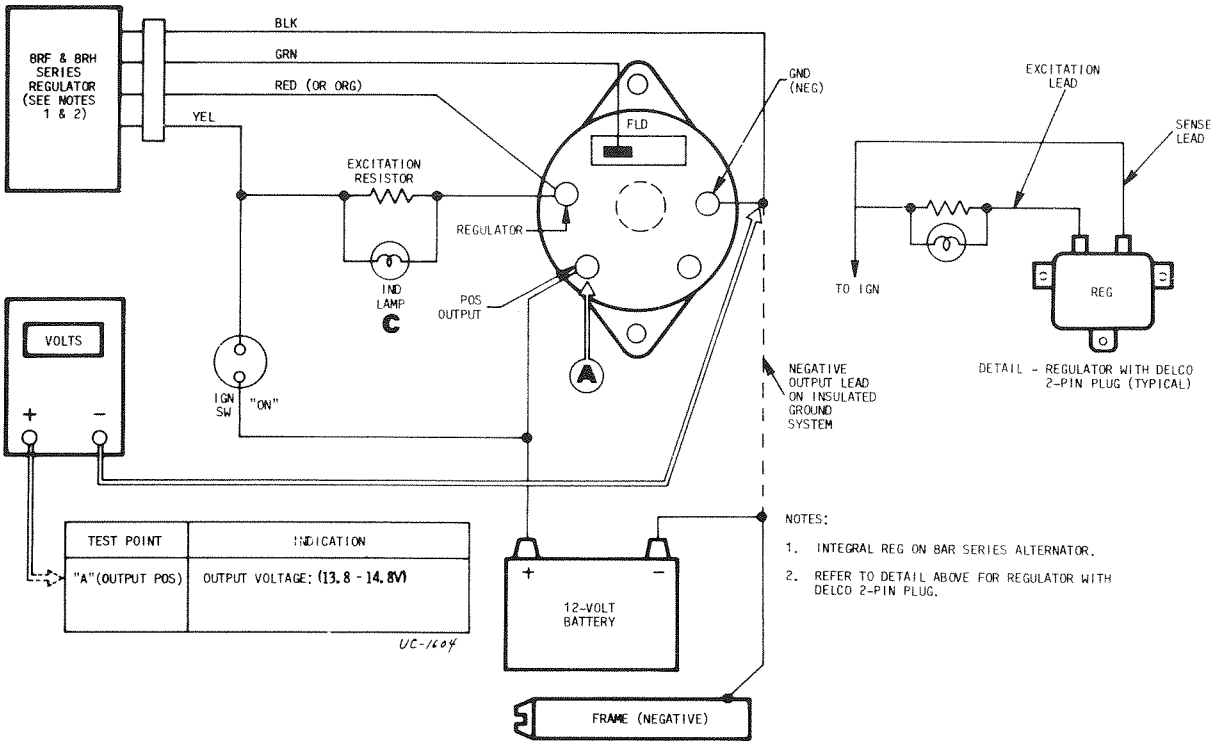


FIG. 3-19 ALTERNATOR OUTPUT TEST

The regulators are of all solid-state design and incorporate temperature compensation that automatically provides a slightly higher charging voltage in cold weather, and a lower voltage in hot weather.

VOLTAGE SETTING PROCEDURE FOR 8RD SERIES REGULATORS

The regulator voltage setting may be changed from the factory established value in order to accommodate a special operating situation. The most desirable setting is the one that allows the alternator to maintain a fully charged battery with minimum water usage. Carefully check all circuit connections to eliminate loose wires or higher resistance junctions prior to adjusting the regulator. Figure 3-21 shows a typical equipment set-up diagram for regulator test and adjusting purposes.

ADJUSTMENT PROCEDURE (FIG. 3-20)

1. With engine off, connect voltmeter across the alternator output and negative (or ground) terminals, and connect an ammeter in series with alternator output, Figure 3-21.

2. Vehicle should be set-up so that alternator RPM is 2000–4000 RPM (3000 RPM is optimum). Loads should be applied to achieve 20% of alternator output current rating. System should be stabilized in this condition for 5 minutes for optimum results.

3. Continue to operate engine until voltmeter pointer stops moving, indicating that the electrical system has stabilized (minimum of 5 minutes, maximum of 15 minutes).

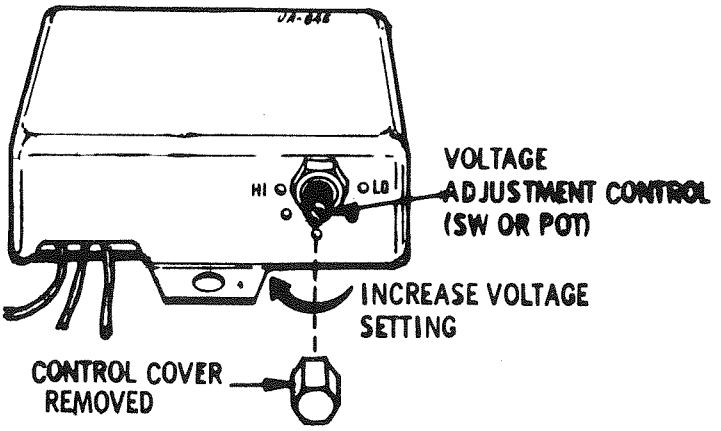


FIG. 3-20 TYPICAL REGULATOR CONTROL ADJUSTMENT DETAIL

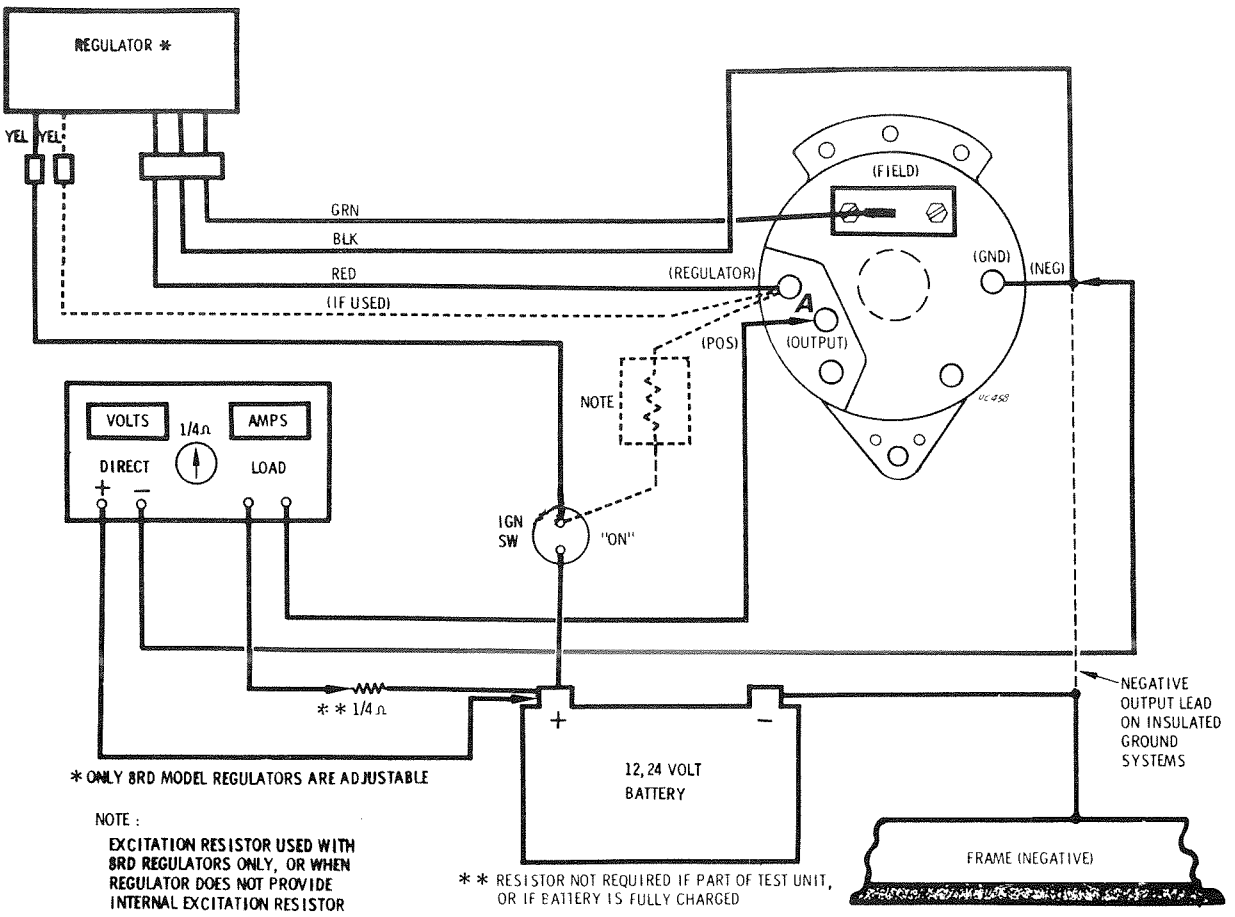


FIG. 3-21 TYPICAL REGULATOR TEST SET-UP DETAIL

4. Use a 3/8" nut-driver or socket wrench to remove the control cover.

5. Use a small (1/8" blade) screwdriver to rotate the control until the desired voltage is reached. Regulators with switch type controls have 5 discrete positions, each of which represents a voltage change of 0.3 volt (12V) or 0.6 volt (24V). Regulators with pot controls are continuously variable and adjustable over approx. the same voltage range. Regulators are shipped with controls in the center position. (DO NOT FORCE THE CONTROL PAST ITS END STOPS AS THIS WILL DAMAGE CONTROL.) Rotation of control in clockwise direction (toward "HI" position) increases voltage-rotation in opposite direction decreases voltage. When changing control positions, load may have to be readjusted to maintain the "20% of alternator rating" requirement.

6. Replace the control cover.

7. Turn engine off.

8. Disconnect the voltmeter from the alternator output terminals.

9. Disconnect the ammeter from the alternator output circuit and reconnect the OUTPUT lead to the alternator OUTPUT terminal.

SECTION 4.

REPAIR/OVERHAUL PROCEDURE

GENERAL

The following instructions are presented as a general overall procedure for complete disassembly of an alternator. However, it should be pointed out that following the complete procedure whenever a repair is necessary will seldom, if ever, be required. In cases where the causes of the malfunction are known, it is only necessary to follow that portion of the procedure directly related to resolving the problem. Similarly, when the reasons for the malfunction are uncertain, it will be necessary to follow the procedure in greater depth in order to isolate and correct the problem in a systematic and efficient manner.

In addition, referring to the following troubleshooting diagrams should help identify some of the more common problems to concentrate on during the overhaul/repair procedure.

REPAIR/OVERHAUL PROCEDURE

DISASSEMBLY

REMOVE VOLTAGE REGULATOR (RA/8AR Series) – Make certain that the regulator connector leads are disconnected from the studs of the rectifier diode plate. NOTE: Observe regulator lead colors and connections to facilitate reassembly. Remove three regulator mounting screws, hold regulator away from rear housing, detach regulator brush connecting lead.

REMOVE BRUSH ASSEMBLY – Mount the alternator in a vise, with the rear housing facing you. Remove Brush assembly. See Figure 4-4.

Remove the two (2) number 8-32 tapping screws, cover, and insulator (Figure 4-4). Pull brush assembly straight out, sufficient to clear the locating pins, then lift brush assembly out. (Procedure is the same for single and dual terminal brush assemblies).

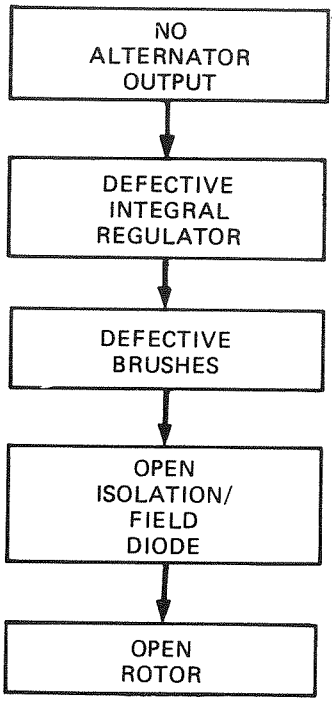


FIG. 4-1 ALTERNATOR TROUBLESHOOTING DIAGRAM (NO OUTPUT).

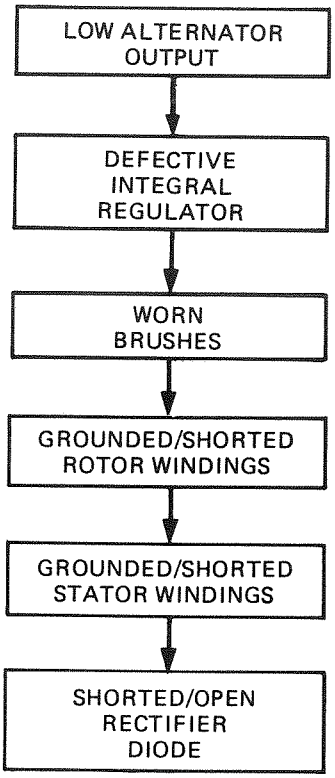


FIG. 4-2 ALTERNATOR TROUBLESHOOTING DIAGRAM (LOW OUTPUT)

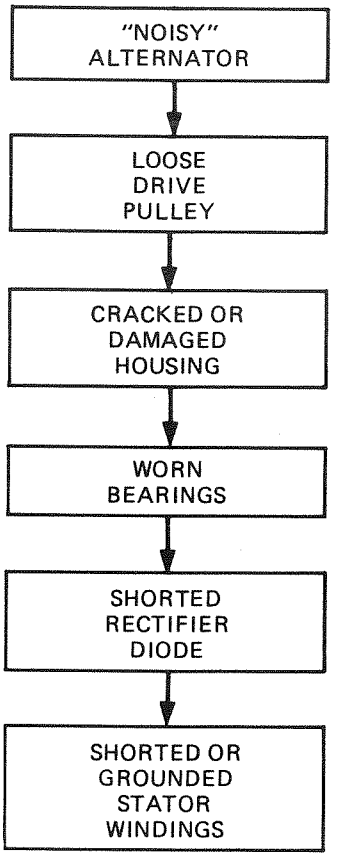


FIG. 4-3 ALTERNATOR TROUBLESHOOTING DIAGRAM (NOISY)

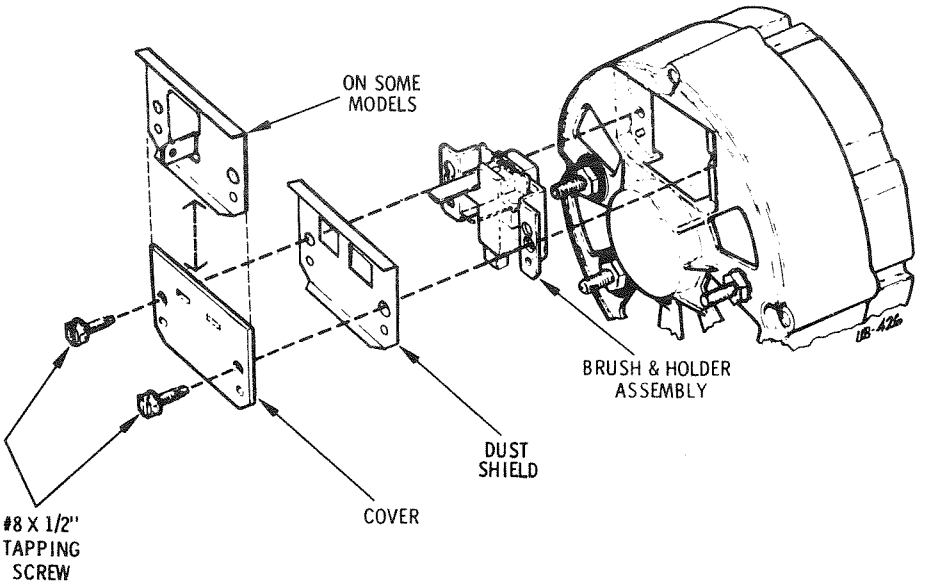
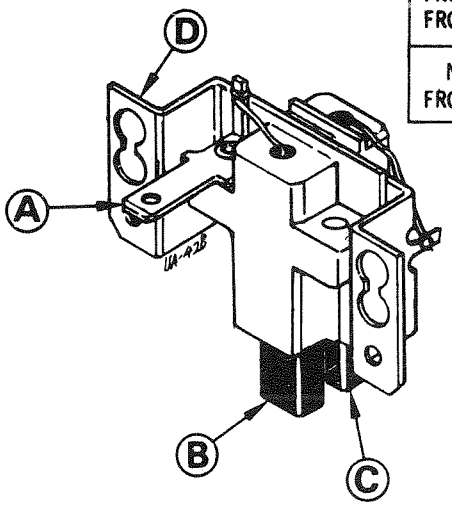


FIG. 4-4 BRUSH ASSEMBLY REMOVAL

BRUSH INSPECTION AND TESTING – Figure No. 4-5 shows terminal arrangement and testing procedure for single terminal brush assemblies. Figure No. 4-6 shows dual terminal arrangement and testing procedure. Brush material is carbon composition.

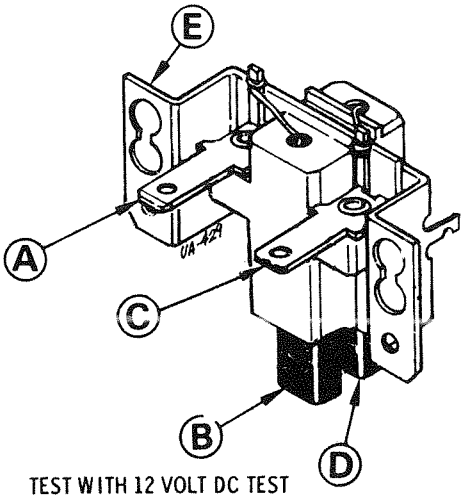
A IS INSULATED BRUSH
C IS GROUNDED BRUSH

TEST
CONTINUITY: FROM A TO B FROM C TO D
NO CIRCUIT: FROM D TO A OR B



TEST WITH 12 VOLT DC TEST LAMP OR OHMMETER.

FIG. 4-5 SINGLE TERMINAL BRUSH TEST



TEST WITH 12 VOLT DC TEST LAMP OR OHMMETER.

FIG. 4-6 DUAL TERMINAL BRUSH TEST

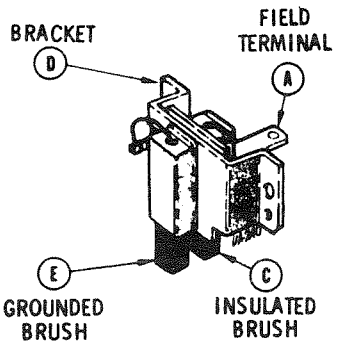


FIG. 4-7 BRUSH INSPECTION

The original brush set may be reused if the brushes are 3/16" or longer, and if brushes are not oil soaked or cracked. Compare spring tension to a new set, Figure No. 4-7.

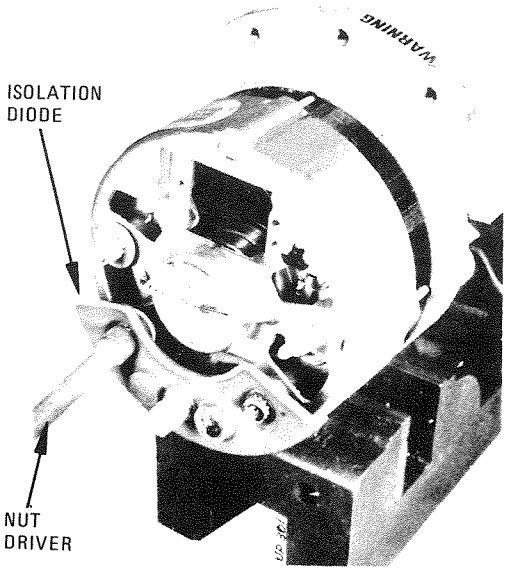
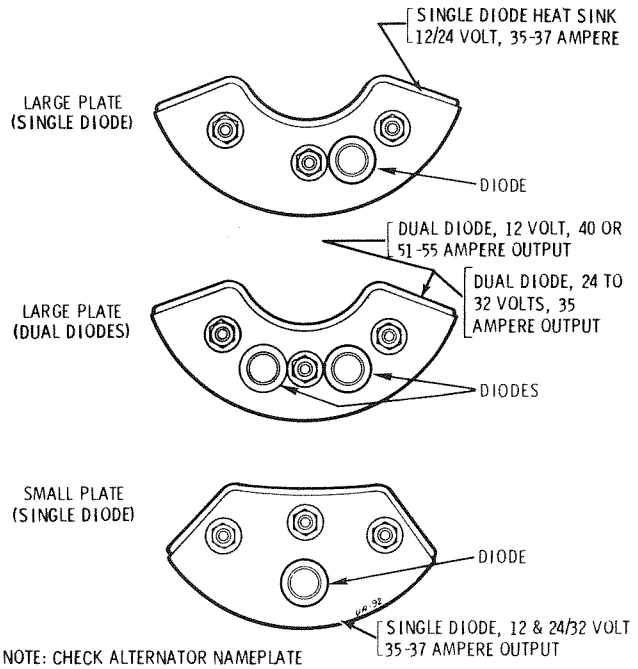


FIG. 4-8 ISOLATION DIODE REMOVAL

REMOVE ISOLATION DIODE (ISOLATION DIODE MODELS) – Remove hex nuts and insulators fastening the isolation diode assembly to the rectifier diode terminal studs, see Figure No. 4-8. Insulating washers and sleeve may be reused if in good condition. Figure 4-9 illustrates the different types of isolation diodes used with these alternator series.

Test the isolation diode to determine if the diode will pass direct current voltage and current in only one direction while rejecting the opposite polarity. A commercial diode tester, 12 volt D.C. Test Lamp or ohmmeter may be used for this test. **Do not** use an A.C. test lamp.



NOTE: CHECK ALTERNATOR NAMEPLATE FOR VOLTAGE AND GROUND POTENTIAL INFORMATION.

FIG. 4-9 ISOLATION DIODE IDENTIFICATION

Isolation diodes, used in 12 and 24 volt negative ground systems, should test alike. Positive potential should pass from the bare metal input areas through the heat sink and diode (s), to the output stud, as shown in Figure No. 4-10.

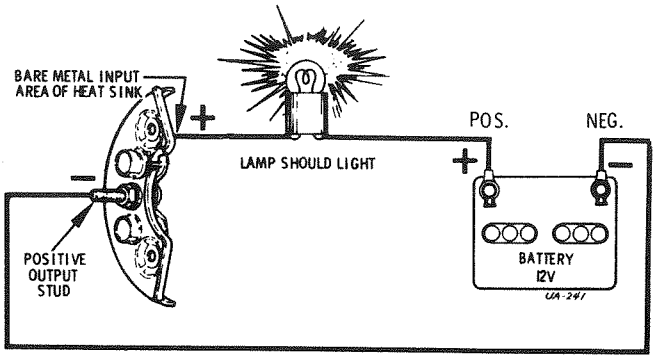


FIG. 4-10 ISOLATION DIODE (DUAL) TEST (NEG. GND. UNITS)

Reverse test leads and retest as shown in Figure No. 4-11, the test lamp should not light.

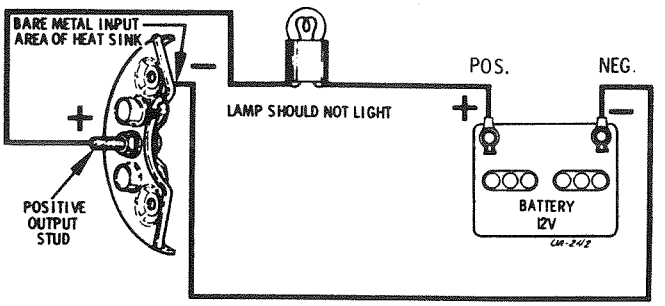


FIG. 4-11 ISOLATION DIODE (DUAL) TEST (NEG. GND. UNITS)

Positive Ground units use the isolation diode test shown in Figure No. 4-12. This is the foreward bias test that should light test lamp.

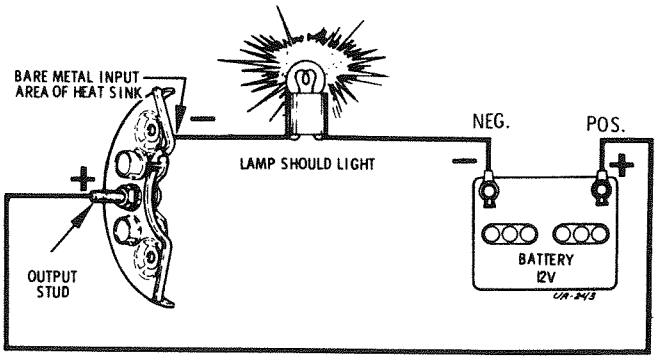


FIG. 4-12 ISOLATION DIODE (DUAL) TEST (POS. GND. UNITS)

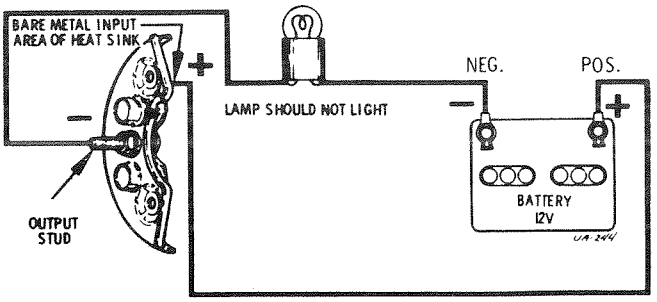


FIG. 4-13 ISOLATION DIODE (DUAL) TEST (POS. GND. UNITS)

Figure No. 4-13 is the reverse bias test, the test lamp should not light.

If test lamp lights regardless of how test leads are switched the isolation diode is shorted. If test lamp fails to light regardless of test lead switching, the isolation diode is open. Replace diode if necessary. NOTE: Single and dual isolation diodes are tested in the same manner.

NOTE: Some manufacturers may paint the alternator to match their engine color, concealing the identifying color of the isolation diode. Check ground polarity and system voltage information on alternator name plate to insure correct test procedures are followed.

Do not soak the isolation diode in any solvent that could remove the protective, corrosion resistant paint.

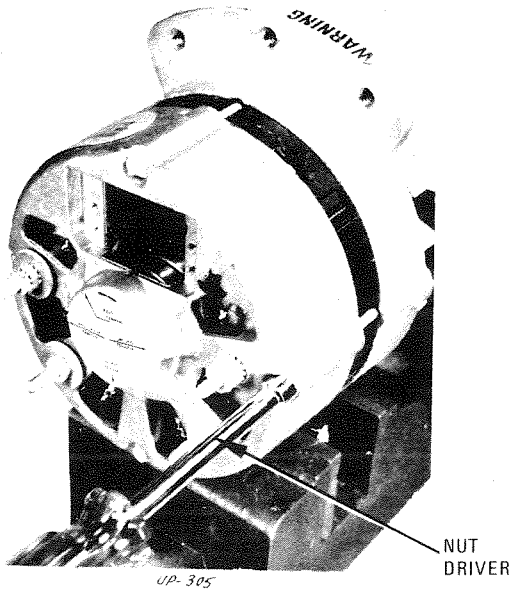


FIG. 4-14 THRU-BOLT REMOVAL

REMOVE THRU-BOLTS – See Figure No. 4-14 remove four thru-bolts, and associated square nuts located in recessed areas in front housing.

SEPARATE REAR HOUSING FROM FRONT HOUSING – Carefully insert two small bladed screwdrivers in the stator slots between stator and front housing (See Figure 4-15.

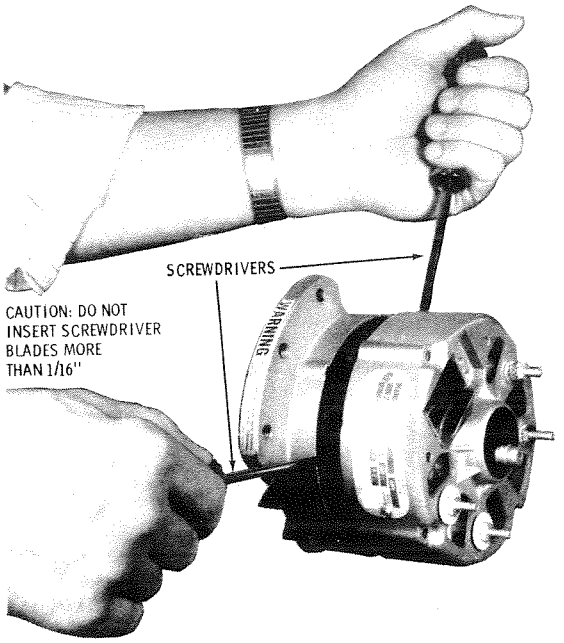


FIG. 4-15 FRONT & REAR HOUSING SEPARATION

CAUTION: **Do not** insert screwdriver blades deeper than 1/16" to avoid damaging stator winding.

Apply prying pressure at several points around the stator to extract rotor and front housing as an assembly. **Do not** burr the stator core which would make reassembly difficult.

At this time, the rear housing and stator are one assembly, the front housing and rotor are another assembly. Continue with disassembly of the stator and rear housing.

REMOVE REAR HOUSING – Place the open end of the stator on a clean work surface, free of metal chips that could damage the stator windings. Remove all hex nuts and insulators from the diode terminal studs, Figure No. 4-16.

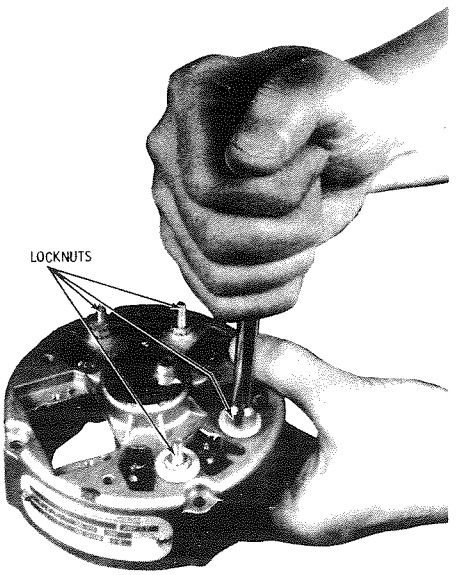


FIG. 4-16 LOCKNUT REMOVAL

SEPARATE REAR HOUSING FROM RECTIFIER DIODE TERMINALS – Carefully and evenly tap the rectifier diode terminal studs out of the rear housing, as shown in Figure No. 4-17. Lift rear housing off the studs. Remove any insulating sleeves remaining in terminal stud holes. The stator and diode sets are removed as an assembly.

NOTE: Models with stator tap must have lead disconnected from insulated stud before rear housing can be separated from stator & diode sets.

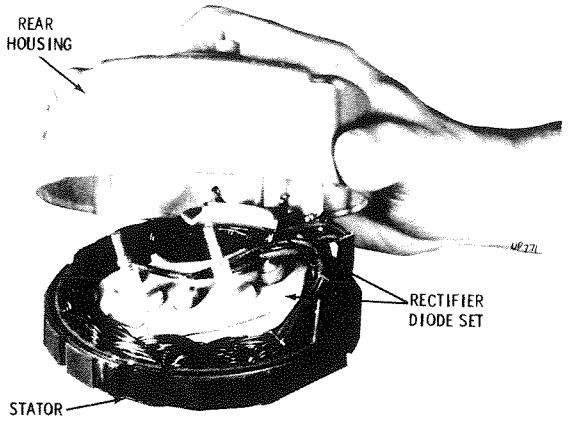


FIG. 4-17 REAR HOUSING & DIODE TERMINAL SEPARATION

INSPECTION OF REAR HOUSING – Inspect the rear housing for a cracked or broken casting, stripped threads or evidence of severe wear in the bearing bore due to a worn rear bearing, as shown in Figure No. 4-18.

If casting is to be reused, clean in solvent, dry with compressed air. Also, a new rear bearing retainer "O" ring should be installed as shown in Figure No. 4-52.

DISCONNECT RECTIFIER DIODES FROM STATOR – It is necessary to unsolder the stator leads from the rectifier diode terminals, in order to properly test each diode. Make note of the diode to stator connections for reassembly purposes later on.

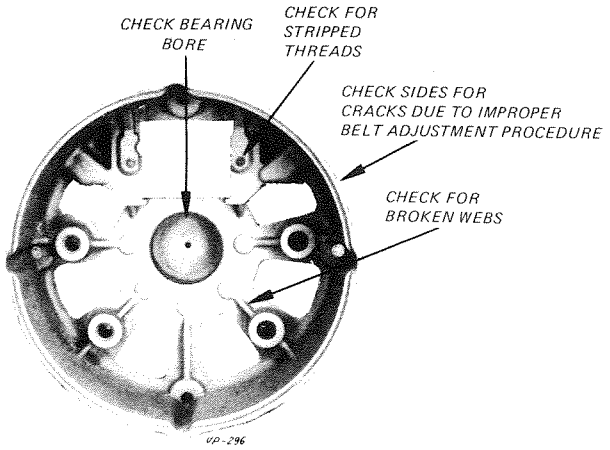


FIG. 4-18 REAR HOUSING INSPECTION

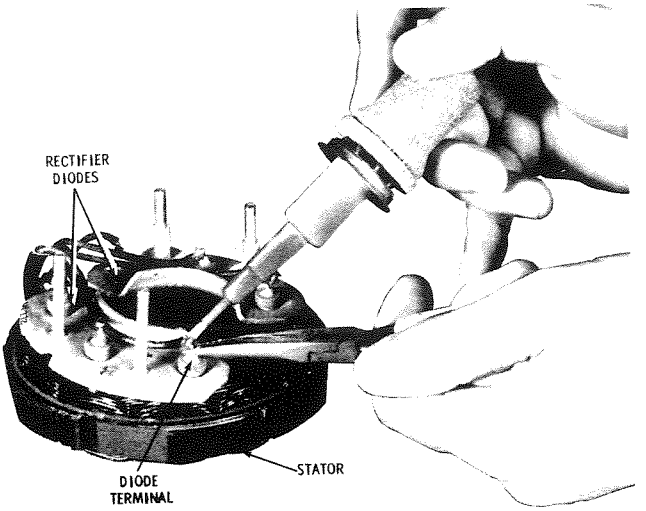


FIG. 4-19 UNSOLDERING RECTIFIER DIODE

Figure No. 4-19 shows a heat dam in place between the top of the diode and diode body, in order to protect the diode from damage in removing and replacing the stator leads. Allow solder joint to cool for a few seconds before removing heat dam. Avoid bending or twisting diode terminal. NOTE: Use only rosin core (electrical) solder for all alternator service operations.

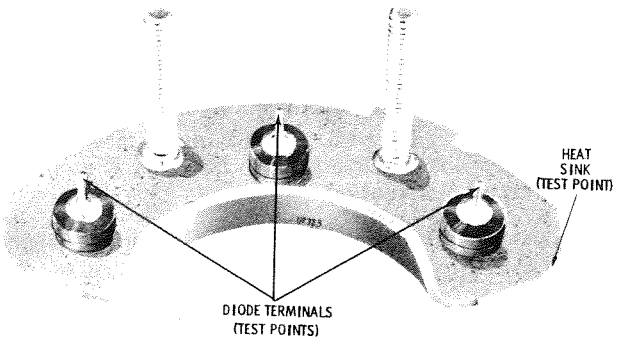


FIG. 4-20 RECTIFIER DIODE TEST POINTS

TESTING RECTIFIER DIODES – If a commercial diode tester is available, test the diodes according to the equipment manufacturers instructions, test points are shown in Figure No. 4-20. NOTE: In field diode models, remove the 3 leads to the field diode assembly before testing rectifier diodes.

When using a 12VDC test lamp or ohmmeter, the same test points are used. All diodes in the positive heat sink, where the part number is printed in RED, should test as indicated in Figure No. 4-21.

Figure No. 4-22, shows testing of the negative rectifier diode assembly, where the part number is printed in Black.

Replace the complete rectifying diode assembly if any diode in the assembly is open or shorted.

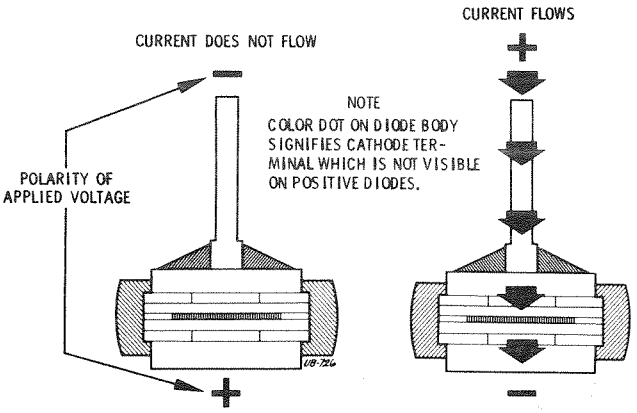


FIG. 4-21 POSITIVE DIODE TESTS

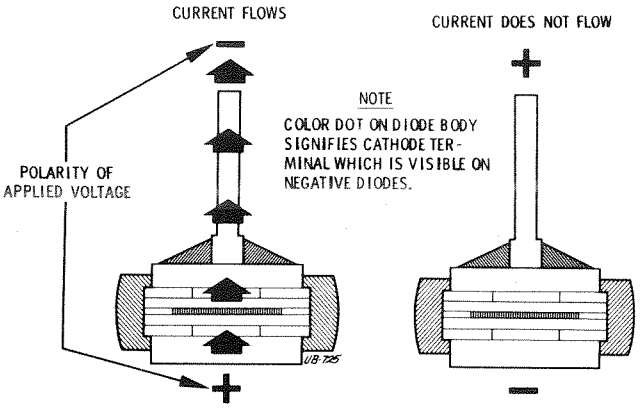


FIG. 4-22 NEGATIVE DIODE TESTS

NOTE: **Do not** connect test leads to the terminal studs, they may be loose. Loose studs are secured to the heat sink when the diode assembly is assembled to the rear housing.

REMOVE FIELD DIODE ASSEMBLY (FIELD DIODE MODELS) – Remove hex nut and washer securing the field diode assembly to the ungrounded rectifier diode heat sink, Figure 4-23. Unsolder the three leads at the rectifier diode terminals to free or test the field diode assembly. Use heat dams to protect the rectifier diodes in all soldering operations.

Using a commercial diode tester or 12 volt DC test lamp; check for continuity from each lead separately to the center metal contact stud; Continuity should be observed in one direction (polarity) only, and all diodes should check alike, Figure 4-24. If any diode is defective replace the entire field diode assembly; refer to Figure 4-25 for component layout details.

STATOR TESTING

The alternator stator assembly consists of three individual windings, wound on a common metal core or lamination. The lamination is epoxy coated to provide durable insulation, Figure No. 4-26.

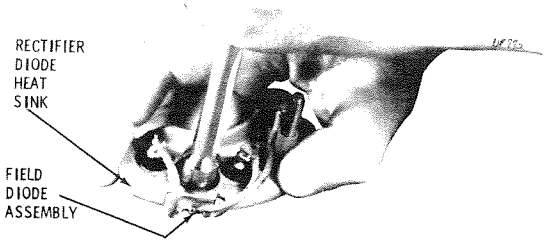


FIG. 4-23 REMOVING FIELD DIODE ASSEMBLY (FIELD DIODE MODELS)

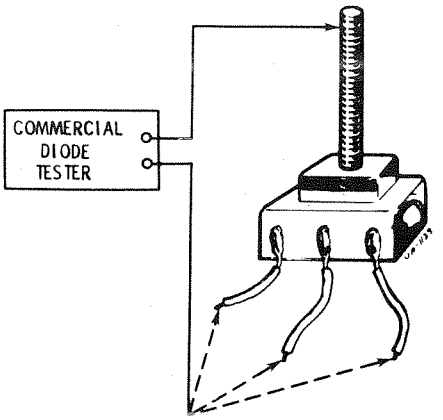


FIG. 4-24 TESTING FIELD DIODE ASSEMBLY

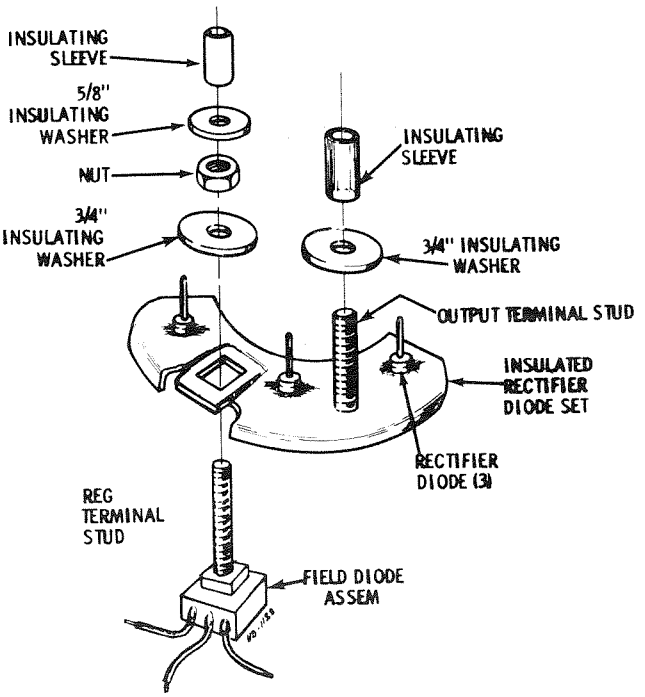


FIG. 4-25 FIELD DIODE ASSEMBLY DETAIL (FIELD DIODE MODELS)

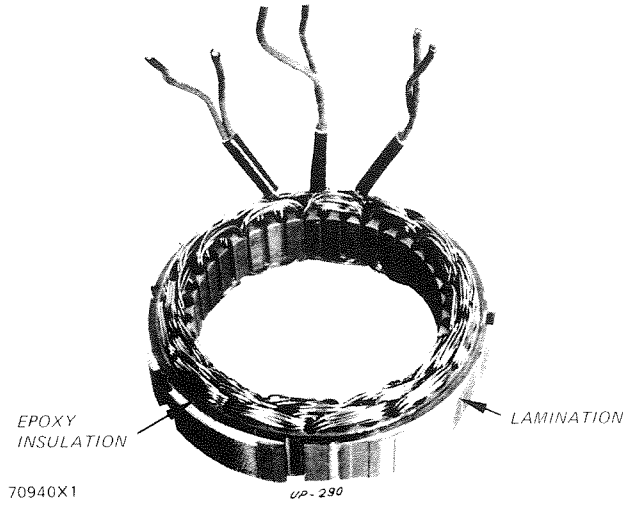


FIG. 4-26 STATOR ASSEMBLY

The usual reference to stators concerns the method of terminating the ends of the three windings. They may be connected in a Wye or a Delta circuit, as shown in Figure 4-27.

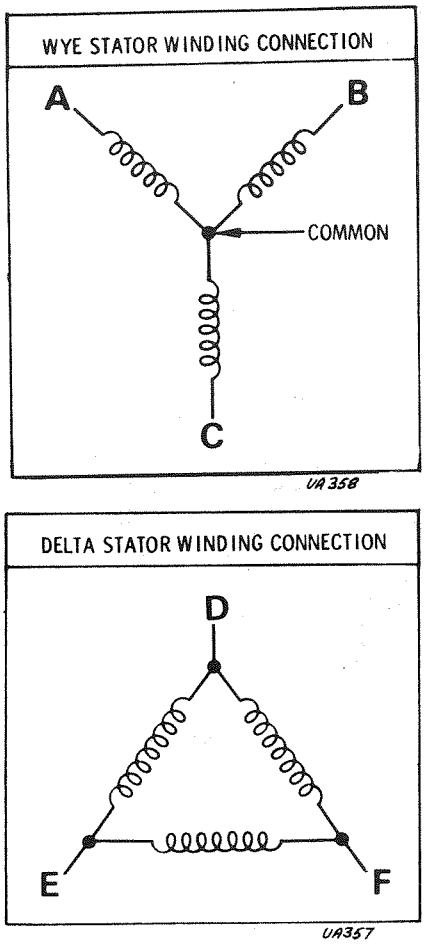


FIG. 4-27 TYPICAL STATOR WINDING CONNECTIONS

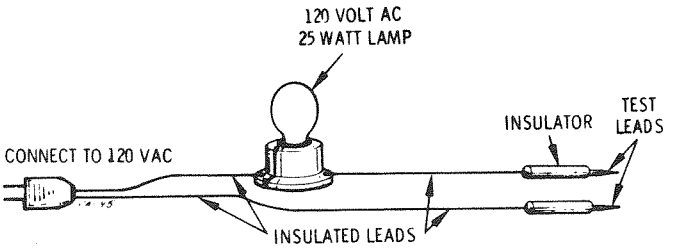


FIG. 4-28 STATOR TEST CIRCUIT

Visually inspect stator wingings for possible discoloration due to overheating. Some slight overall discoloration with age is an acceptable condition. However, discoloration in certain areas only ("hot spots") is probable evidence of shorted or grounded (defective) windings. Defective windings will result in lower output voltage and premature failure of the alternator. Testing the stator with a 110V AC Test Lamp, Figure No. 4-28 may be a general or a specific test.

GENERAL TESTS – With diodes separated from leads, but all connecting leads intact, check between each junction, and from each junction to the lamination, as shown in Figure No. 4-29. Replace the stator if test indicates open or grounded windings.

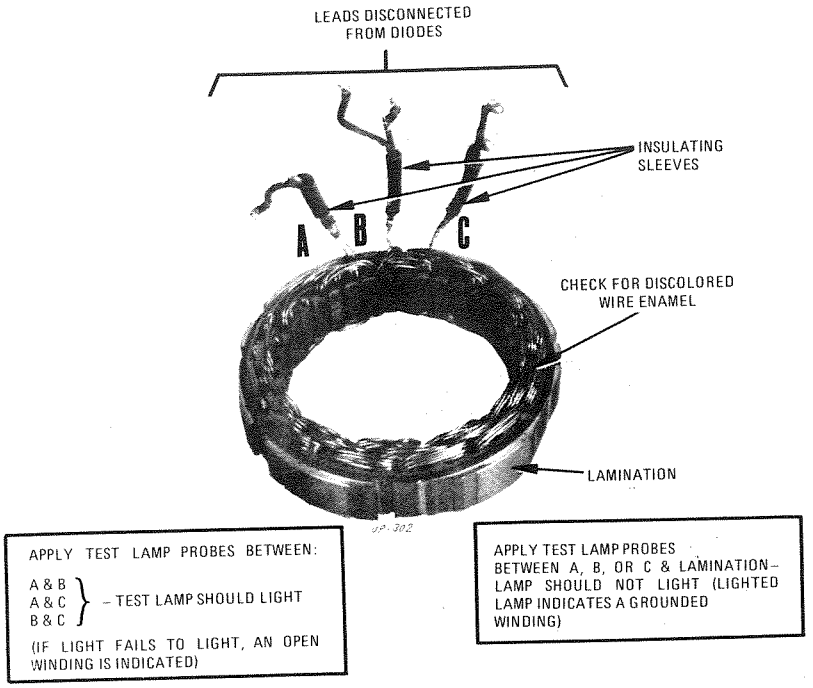


FIG. 4-29 STATOR TEST

SPECIFIC TESTING – Requires unsoldering the diode connecting leads from each junction. The common terminal on Wye type windings must be unsoldered and wire ends separated.

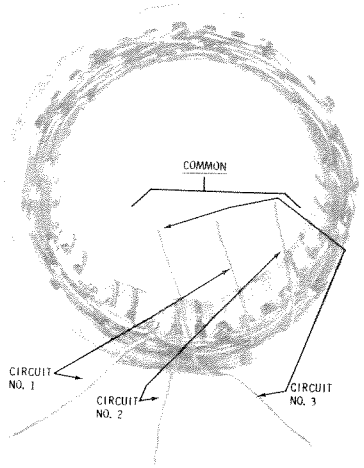


FIG. 4-30 WYE STATOR TEST POINTS

Figure No. 4-30 shows the three circuits of a Wye wound stator.

Test each winding for, (1) continuity, or complete circuit between the wire ends, (2) for a short circuit with either of the other windings and (3) for a ground between the winding and the metal lamination. Replace stator if any winding is open; shorted or grounded.

Replacement stators have diode conecting leads soldered to the windings.

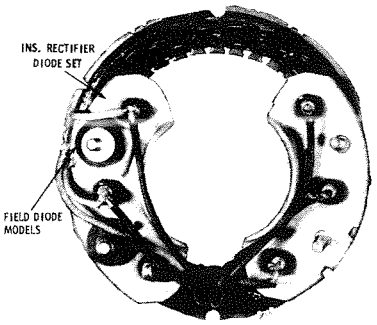


FIG. 4-31 RECTIFIER DIODES REASSEMBLED TO STATOR

Reassemble diode sets to the stator leads, be sure to use a heat dam to protect the diodes from heat damage, Figure 4-31. Be sure to replace any insulating sleeves over the winding junctions and properly dress leads prior to assembly. On Wye type units, a new piece of shrink tubing (Class A type for 150°C use) must be placed over the common lead junction. Usually, radiant heat from a small soldering iron is sufficient to properly shrink the tubing.

On field diode model alternators, assemble diode to rectifier diode heat sink and connect leads; see Figure 4-25.

REMOVE PULLEY, FAN AND SPACER – The pulley is a slip-fit on the rotor shaft, positioned with a Woodruff Key. Remove the nut and lockwasher from the shaft using an impact wrench or other suitable tool, Figure 4-32.

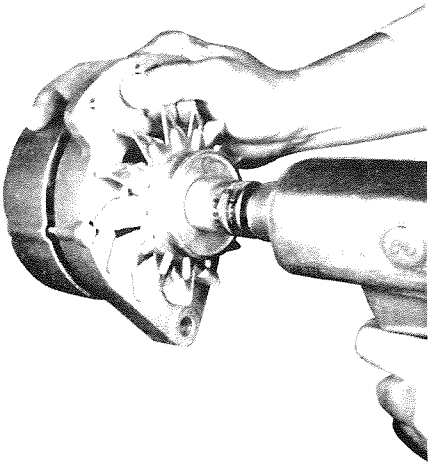


FIG. 4-32 PULLEY REMOVAL

After nut and lockwasher are removed the alternator may be separated from the pulley. Stubborn cases may require the use of special service tools.

The fan will slide over the key. The key may be removed with diagonal pliers, or with a screwdriver as shown in Figure No. 4-33.

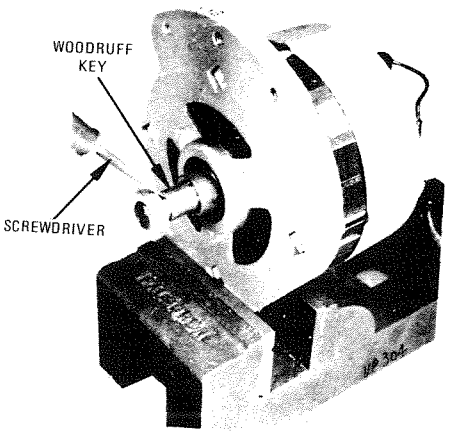
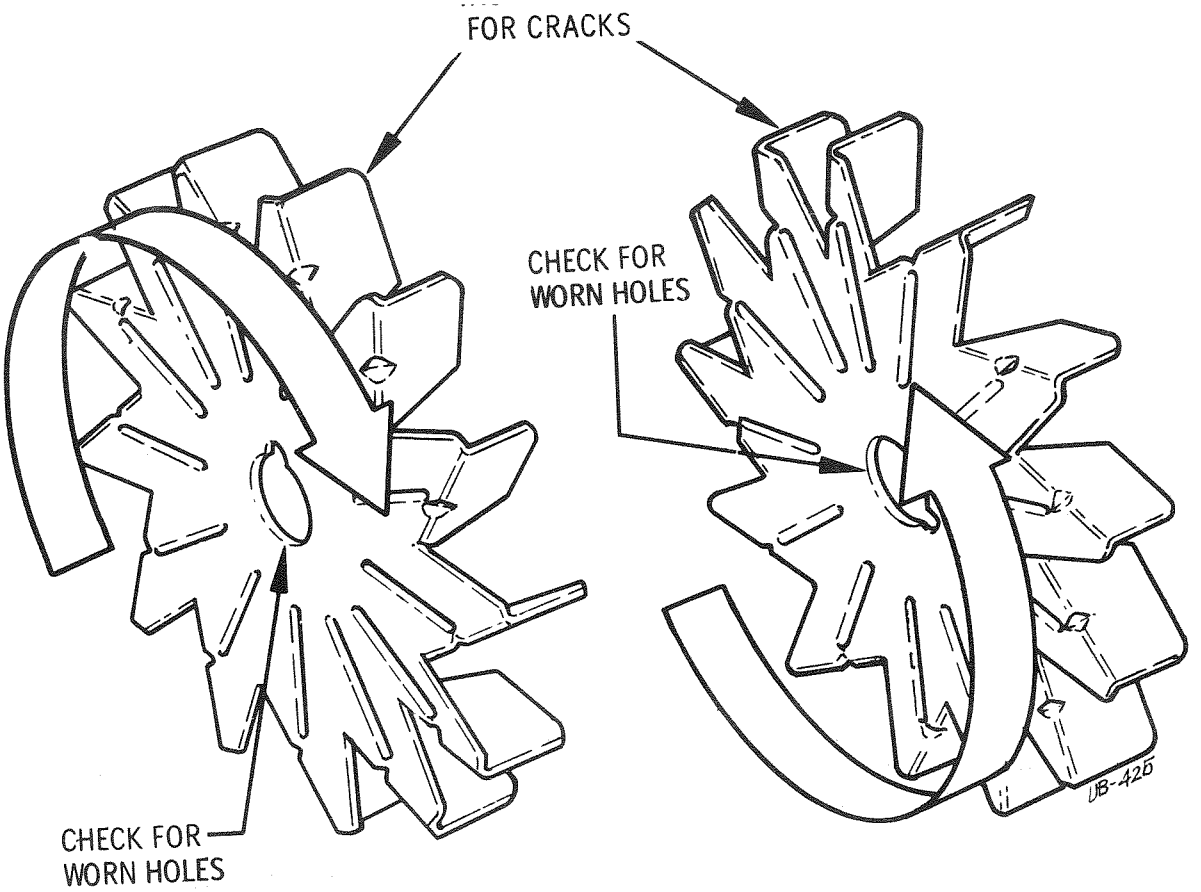


FIG. 4-33 WOODRUFF KEY REMOVAL

Figure No. 4-34 shows the fans that may be used with these alternator series.

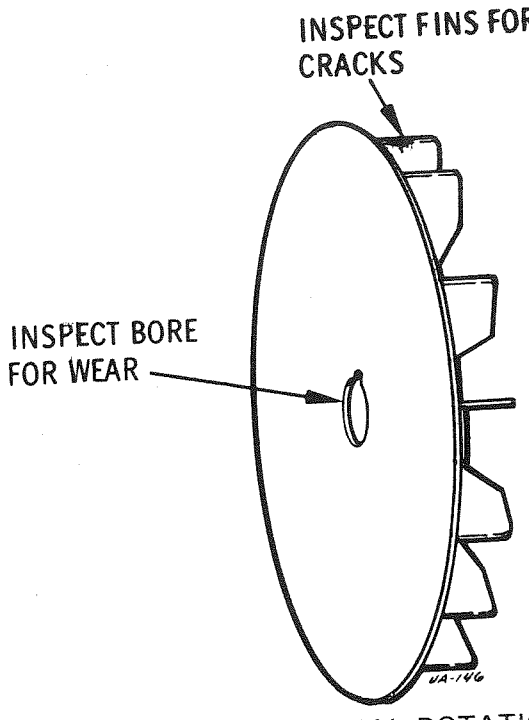
Inspect the fan for cracked or broken fins, note the condition of the mounting hole. If worn from running loose, replace the fan to insure balance.

Inspect pulley for possible faults as listed in Figure No. 4-35.



STD (CLOCKWISE) ROTATION

REVERSE (CCW) ROTATION



BI-DIRECTIONAL ROTATION

FIG. 4-34 TYPICAL FANS AND INSPECTION POINTS

REMOVE FRONT BEARING RETAINER A/8AL & RA/8AR Series – Use a pair of long nose pliers to compress the ears of the front bearing retainer, lift retainer free of recess, as shown in Figure No. 4-36.

HA/8HA SERIES – Remove three bearing retainer screws, Figure 4-36.

SEPARATE FRONT HOUSING FROM ROTOR – Tap the shaft on a wooden block, as shown in Figure No. 4-37, to separate front housing from the front bearing. If special pullers are needed for this operation, check for any damage to the front housing after such use.

Inspect front housing for possible faults as shown in Figure No. 4-38.

If original housing is reused, clean with solvent, dry with compressed air.

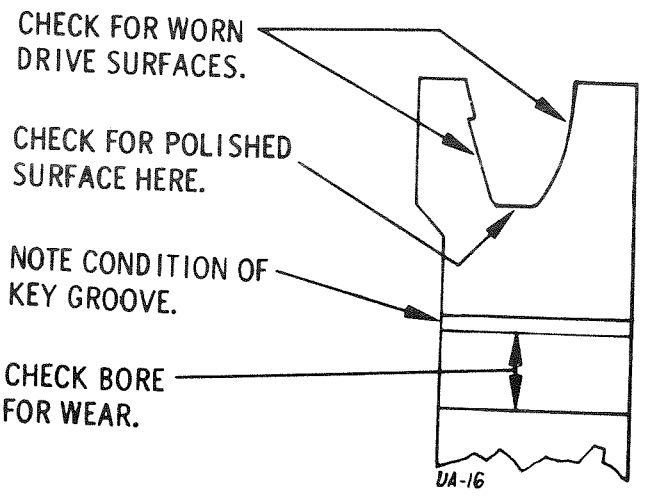
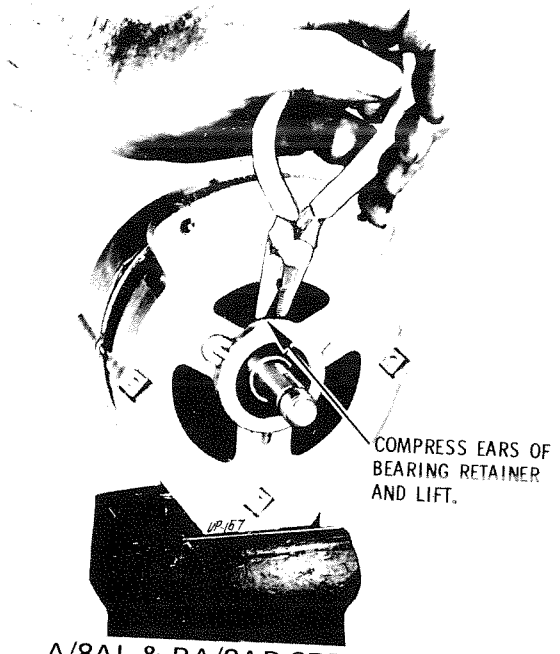
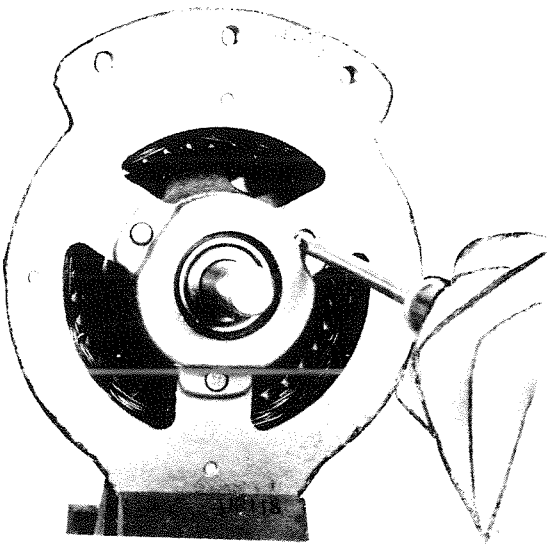


FIG. 4-35 PULLEY INSPECTION POINTS



A/8AL & RA/8AR SERIES



HA/8HA SERIES

FIG. 4-36 REMOVE FRONT BEARING RETAINER

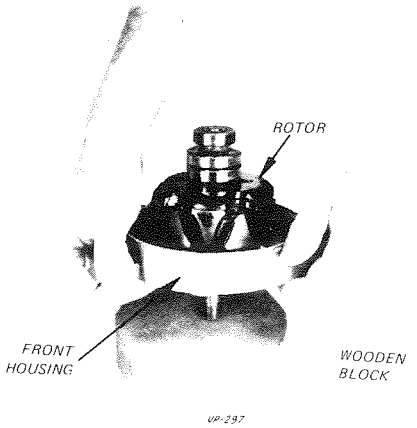


FIG. 4-37 SEPARATE FRONT HOUSING FROM ROTOR

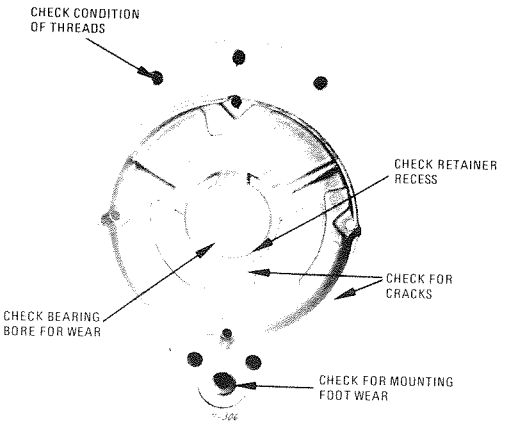


FIG. 4-38 FRONT HOUSING INSPECTION

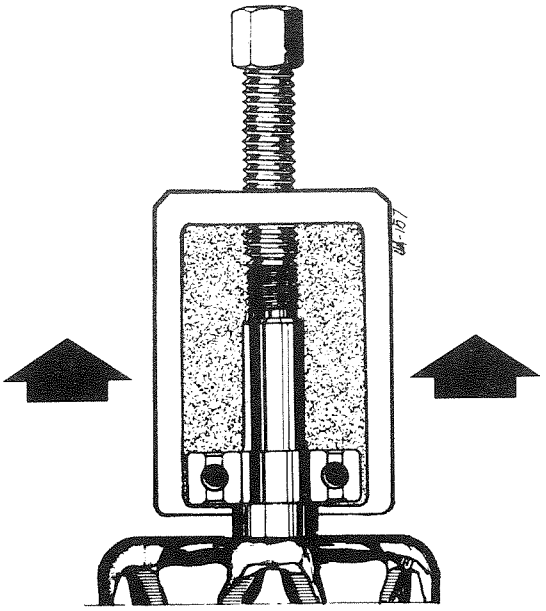


FIG. 4-39 REMOVING FRONT BEARING

REMOVE FRONT BEARING FROM ROTOR – Use bearing puller to pull bearing off shaft. If bearing is to be re-used, puller must contact inner race only, Figure 4-39. Remove front bearing retainer from shaft, inspect for distortion, replace if unsatisfactory.

HA/8HA SERIES – Separate sleeve from bearing on units with 5/8" shaft diameter. Re-use sleeve with new bearing, Figure No. 4-40.

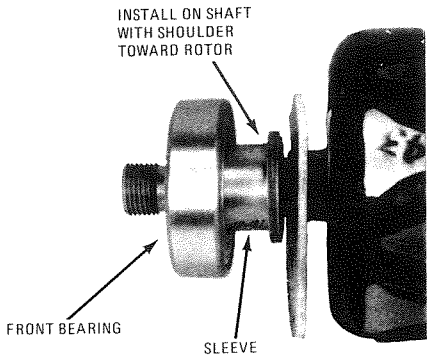


FIG. 4-40 FRONT BEARING & SLEEVE ASSEMBLY (HA/8HA SERIES)

REMOVE REAR BEARING FROM ROTOR – Figure 4-41 illustrates removal of rear bearing from rotor shaft.

ROTOR INSPECTION AND ELECTRICAL TESTING – Check the rotor assembly for the following electrical properties, see Figure No. 4-42.

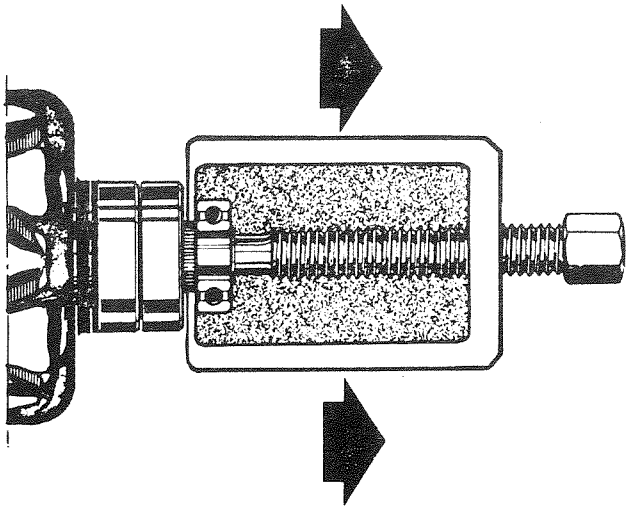


FIG. 4-41 REMOVE REAR BEARING

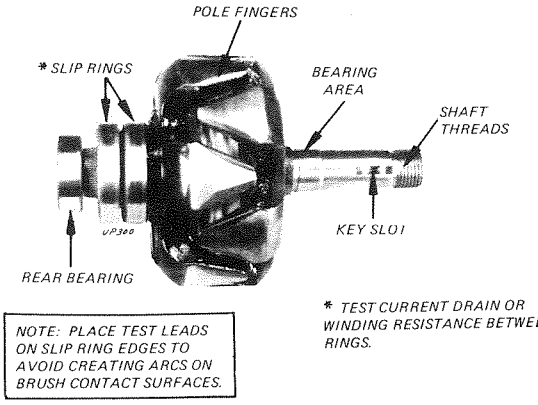


FIG. 4-42 ROTOR INSPECTION & ELECTRICAL TESTS

4

A. Current Draw or Resistance of the Winding

CAUTION: Turn off DC power source before removing test leads to avoid arc damage to slip ring surfaces.

1. CURRENT DRAW IN AMPERES, @ 70° to 80°F.

6 VOLT MODELS, RATED AT:	CORRECT CURRENT DRAW @ 5.0V
55 AMPERES	1.65 to 2.25 AMPERES
12 VOLT MODELS, RATED AT:	**CORRECT CURRENT DRAW @ 10.0V**
35 & 37 AMPERES	1.95 to 2.55 AMPERES
40 AMPERES	1.65 to 2.25 AMPERES
51-55 AMPERES	1.65 to 2.25 AMPERES
60-62 AMPERES	1.95 to 2.55 AMPERES
24 VOLT MODELS, RATED AT:	**CORRECT CURRENT DRAW @ 20.0V**
35 AMPERES	1.28 to 1.88 AMPERES

2. RESISTANCE OF WINDING IN OHMS, @ 70° to 80°F. (ALTERNATE WINDING TEST)

NOTE: Rotor winding resistance is measured directly across the slip rings.

6 VOLT MODELS, RATED AT:	CORRECT WINDING RESISTANCE
55 AMPERES	2.2 to 3.0 OHM

12 VOLT MODELS, RATED AT:	CORRECT WINDING RESISTANCE
35 & 37 AMPERES	4.2 to 5.5 OHM
40 AMPERES	4.0 to 5.2 OHM
51-55 AMPERES	4.0 to 5.2 OHM
60-62 AMPERES	4.2 to 5.5 OHM

24 VOLT MODELS, RATED AT:	CORRECT WINDING RESISTANCE
35 AMPERES	11.0 to 14.0 OHM

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.

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 entire rotor assembly.

D. Rotor Shaft and Pole Pieces

(1) Stripped threads on shaft
(2) Worn key slot
(3) Worn bearing surface
(4) Scuffed pole fingers
(5) Worn or dry rear bearing

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

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

If rear bearing requires replacement, follow instructions for this operation.

REASSEMBLY

INSTALL NEW FRONT BEARING AND RETAINER – Remove any burrs or foreign material from bearing cavity in housing. Press new bearing using driver tool that exerts pressure on the outer race only, as shown in Figure No. 4-43.

Place bearing retainer in recess, make certain retainer ears line up with opening in the housing. Use wooden dowel to exert pressure on the retainer while locking edge of retainer in recess, as shown in Figure No. 4-44. On HA/8HA Series, install front bearing retainer and secure with three screws.

HA/8HA SERIES – Assemble sleeve and front bearing on the units with 5/8" rotor shaft. Place bearing sleeve

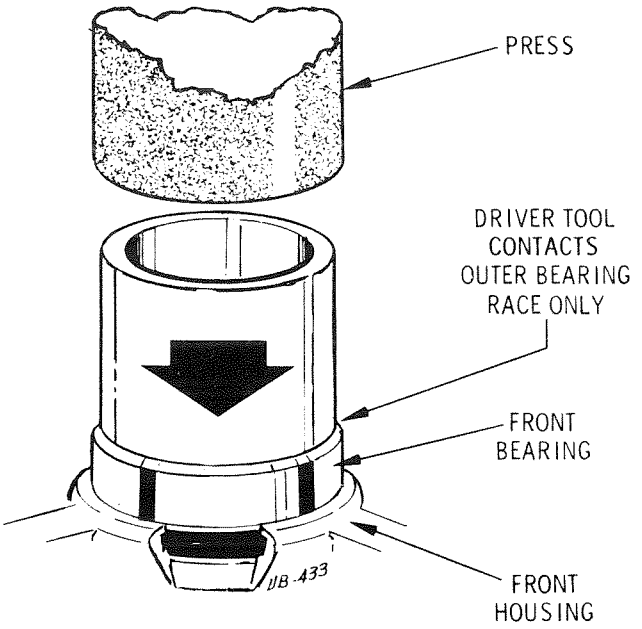


FIG. 4-43 INSTALLING FRONT BEARING

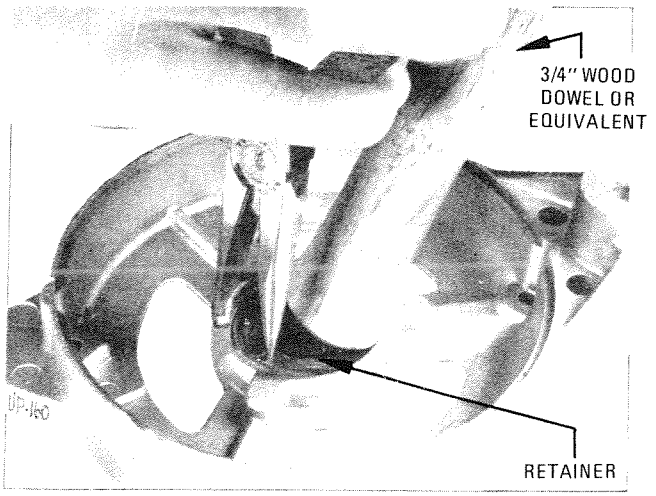


FIG. 4-44 INSTALLING FRONT BEARING RETAINER

combination in cavity, with sleeve shoulder toward rotor body, Figure No. 4-40. Bearing for 7/8" shaft models is placed in cavity without special positioning. Press on outer bearing race only, Figure No. 4-43.

INSTALL NEW REAR BEARING ON ROTOR – Support the pulley end of the rotor on an arbor press. Place the new bearing over the end of the shaft. Select a bearing driver that contacts only the inner bearing race, press bearing on the shaft until inner race contacts the shoulder, see Figure No. 4-45.

ASSEMBLE ROTOR AND FRONT HOUSING – Place the rotor on the bed of an arbor press, using two steel blocks for support, as shown in Figure No. 4-46. Place front housing over shaft. Using driver sleeve that contacts inner bearing race only, press front housing down until inner bearing race contacts shoulder on the shaft.

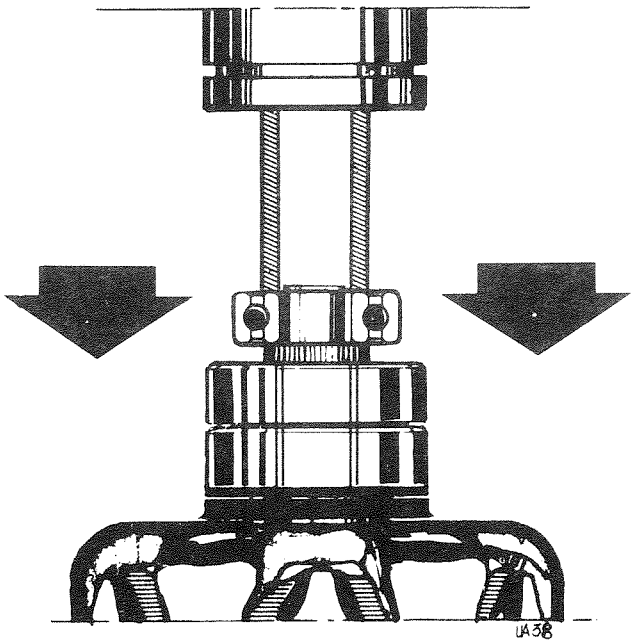


FIG. 4-45 INSTALLING REAR BEARING

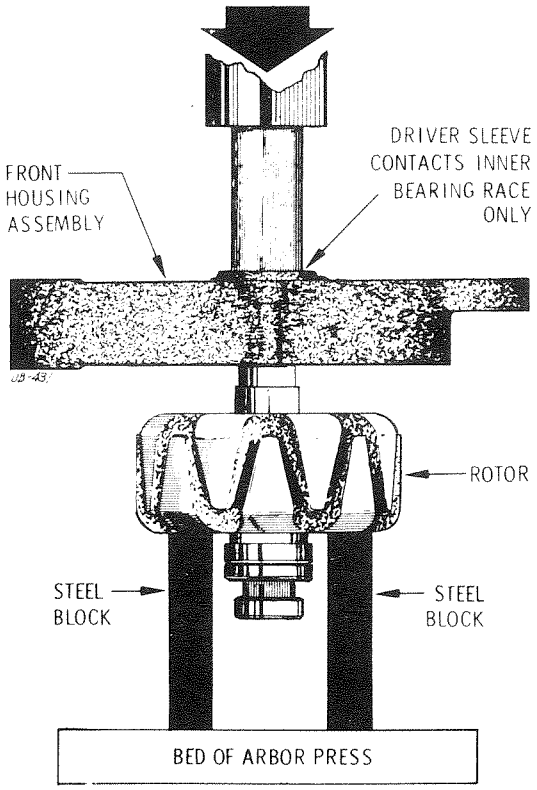


FIG. 4-46 ASSEMBLE FRONT HOUSING TO ROTOR

ASSEMBLE SPACER, FAN, AND PULLEY – Place pulley spacer over shaft. Install Woodruff Key and then fan. Install pulley, lockwasher and nut, tighten to 40 to 50 ft. lbs., Figure 4-32. **FAILURE TO REGULATE TORQUE ON IMPACT WRENCH MAY RESULT IN DAMAGED SHAFT.**

Spin rotor by hand to test freedom of bearing and seals.

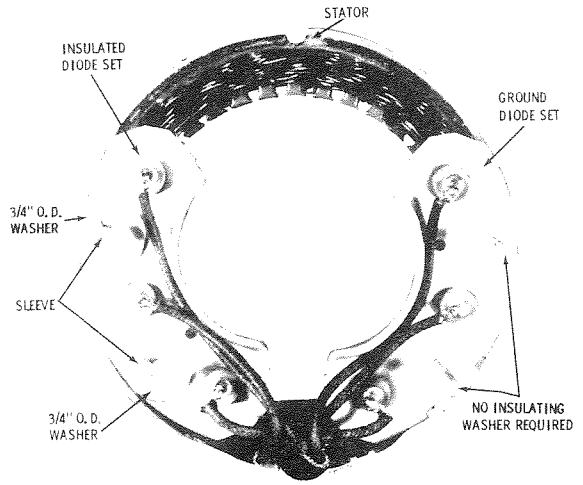


FIG. 4-47 PLACEMENT OF INTERNAL INSULATORS FOR POS. & NEG. GND. UNITS WITH ISOLATION DIODE

ASSEMBLE INSULATORS TO RECTIFIER DIODE STUDS – See Figure No. 4-47 for the placement of the internal insulating washers and sleeves for alternators equipped with isolation diode and having one diode set grounded to the alternator rear housing.

Figure 4-48 shows the placement of insulating washers and sleeves for alternators containing a field diode with one rectifier diode set grounded to the rear housing.

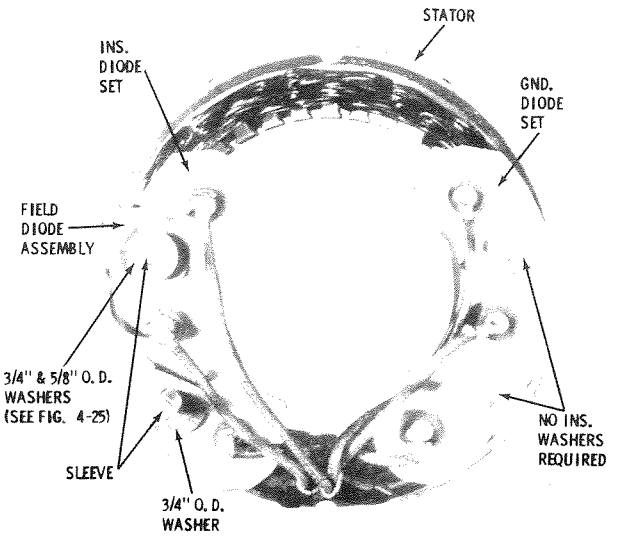


FIG. 4-48 PLACEMENT OF INTERNAL INSULATORS FOR NEG. GND. UNITS WITH FIELD DIODE

Placement of insulating washers and sleeves for insulated ground units is shown in Figure 4-49. On alternators with a phase tap, assemble phase tap screw and insulators to rectifier diode plate as shown in Figure 4-50. The AC phase tap can be added to an alternator not so equipped by installing Kit No. 102-17.

Carefully insert rectifier diode terminal studs through the rear housing.

On all models, install external insulating washers and lock-nuts as indicated in Figure 4-51.

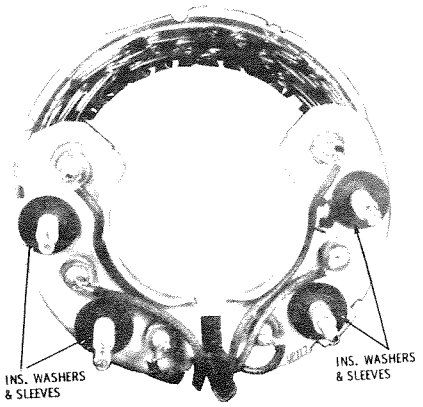


FIG. 4-49 PLACEMENT OF INTERNAL WASHERS AND INSULATORS FOR INSULATED GROUND UNITS WITH ISOLATION DIODE

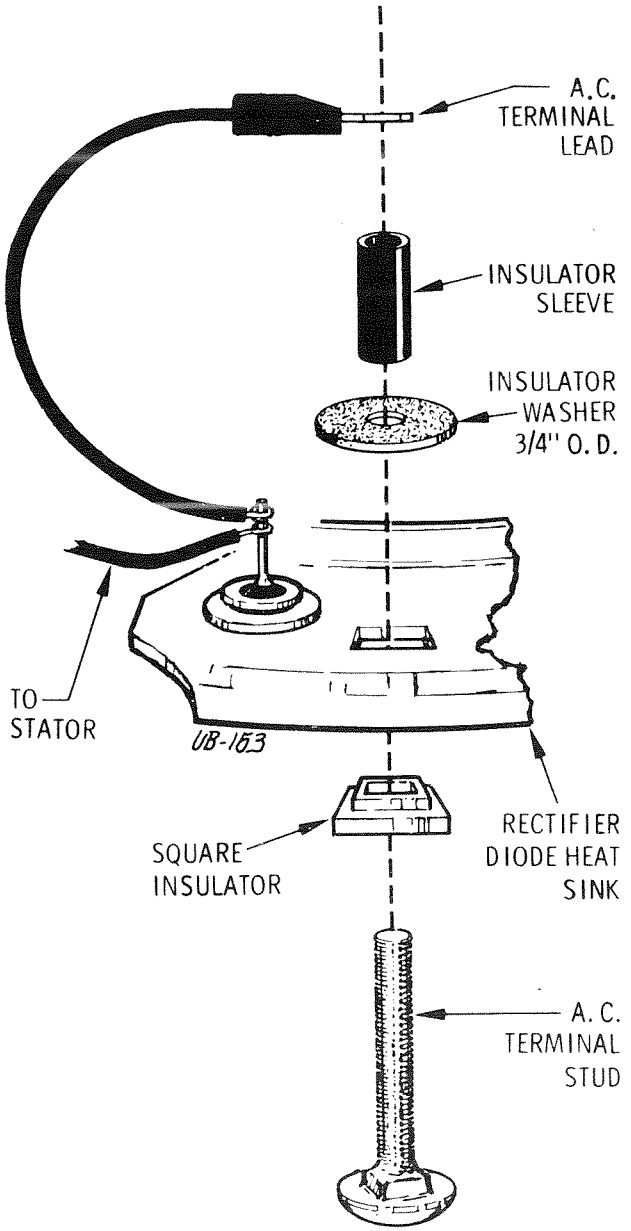
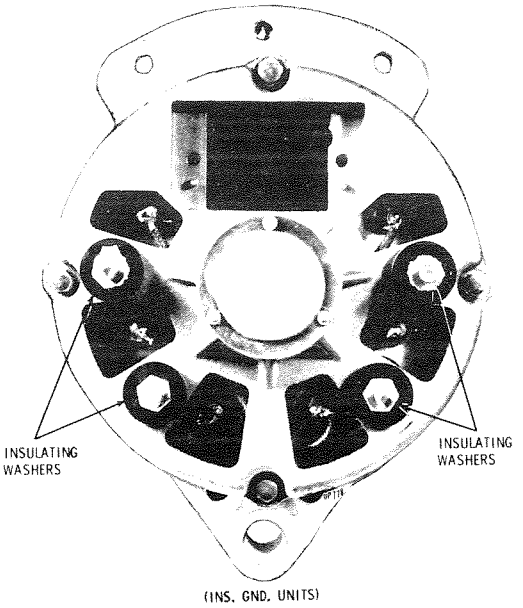


FIG. 4-50 PHASE TAP TERMINAL ASSEMBLY



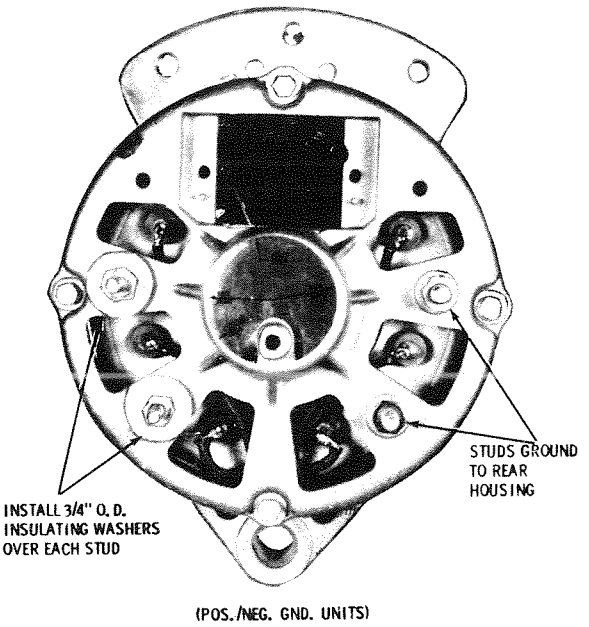


FIG. 4-51 PLACEMENT OF EXTERNAL INSULATORS

INSTALL REAR BEARING RETAINER IN REAR HOUSING – Place new synthetic "O" Ring bearing retainer in the recess in the rear bearing bore, Figure No. 4-52. Lubricate the exposed surface of the ring with minimum amount of hydraulic brake fluid to ease assembly over the rear bearing. **Do not use oil.**

ASSEMBLE FRONT AND REAR HOUSING – Determine correct position of the rear housing with reference to the alternator mounting foot, Figure 2-4. Make certain that internal wiring is properly dressed to avoid damage by spinning rotor.

Place rear housing over the slip ring end of the rotor and hand press housings together. Install thru bolts, and secure

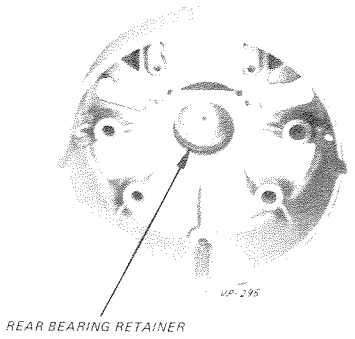


FIG. 4-52 REAR BEARING RETAINER INSTALLATION

nuts if used, tighten evenly, 30 to 35 inch pounds. Spin rotor by hand to test freedom of bearings.

INSTALL BRUSH ASSEMBLY – Install brush assembly in reverse order to that given under Disassembly, refer to Figure 4-4. On RA/8AR alternators, secure regulator with three mounting screws after attaching leads.

INSTALL ISOLATION DIODE – Refer to Figure No. 4-53 for correct placement of hardware and insulators for the isolation diode assembly. Tighten diode mounting nuts to 20 to 30 inch pounds.

NOTE: Alternators with small isolation diode plates do not require any insulating washers.

Connect any brush lead jumper required as shown in Figure No. 4-54. Place hex-locknuts over terminals, tighten 20 to 30 inch pounds.

NOTE: On RA/8AR series, perform Alternator Performance Test before installing regulator.

This completes the reassembly of the overhauled alternator unit.

Refer to subsequent Alternator Performance Test for instructions for bench testing repaired alternators.

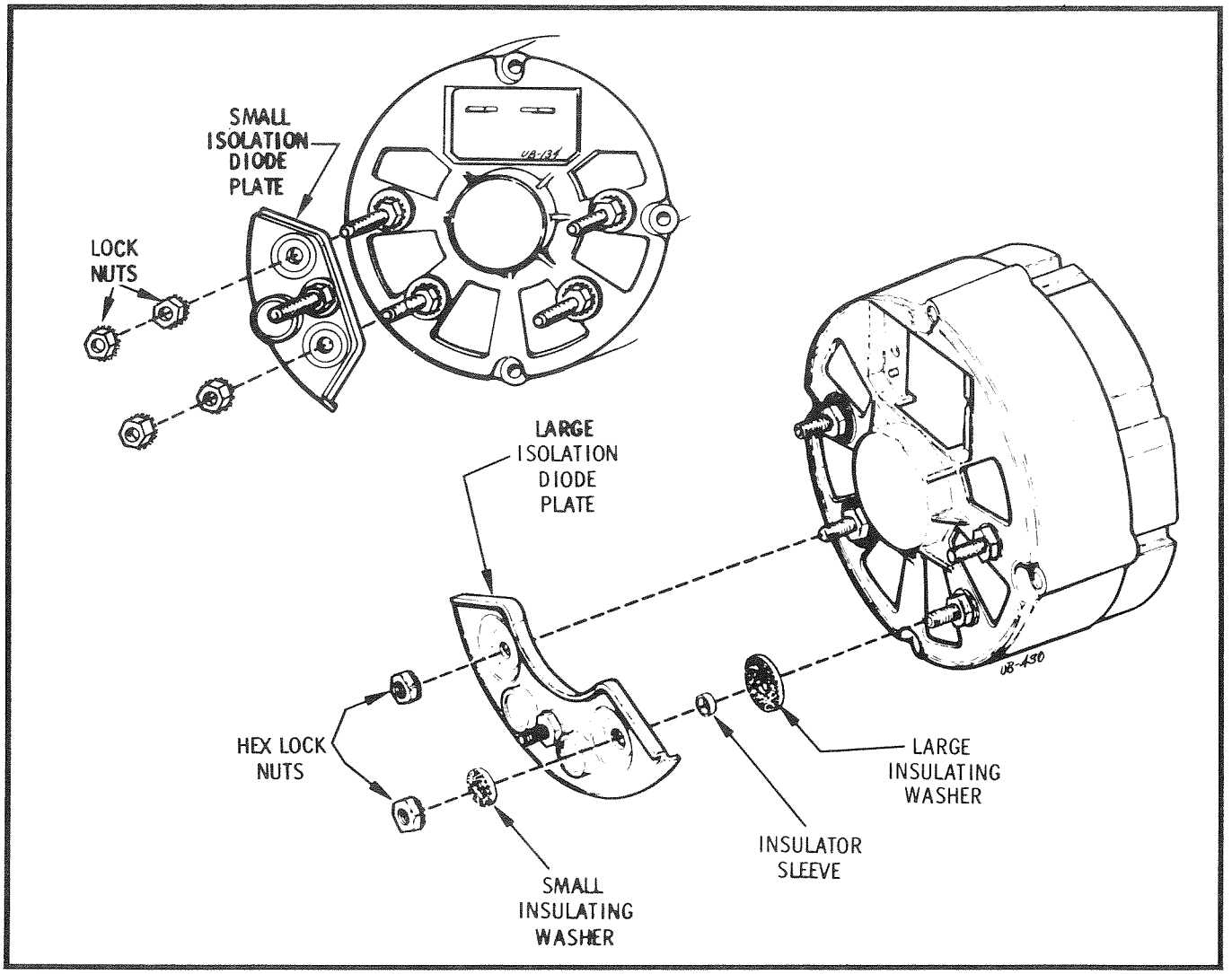


FIG. 4-53 ISOLATION DIODE REPLACEMENT DETAIL

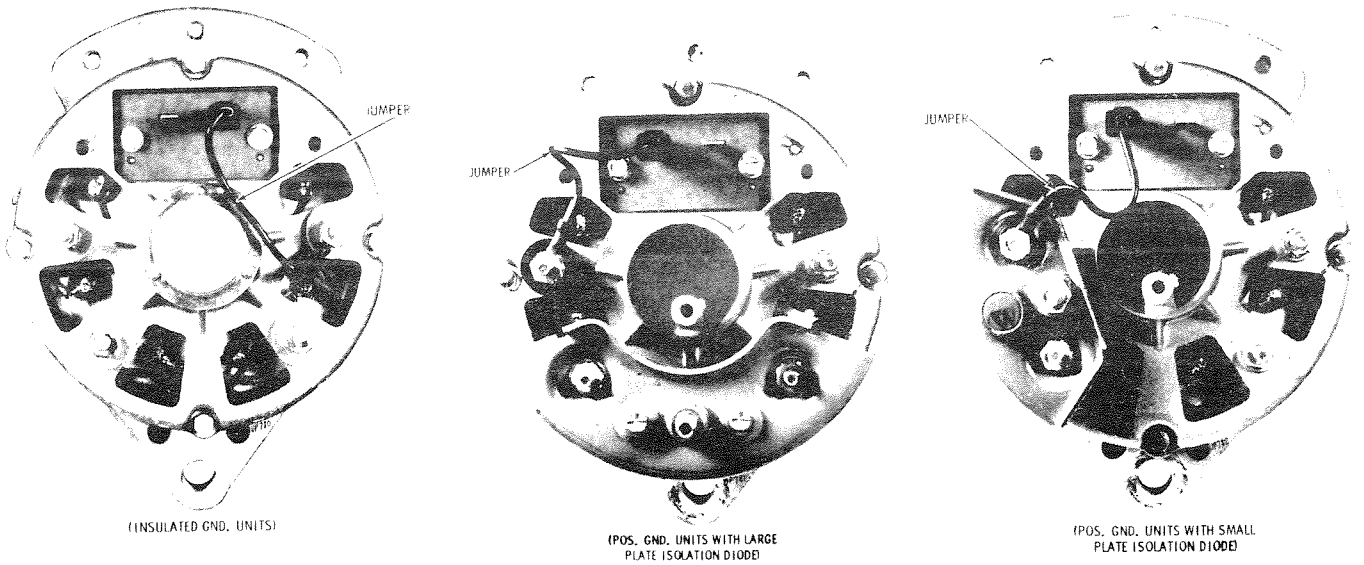


FIG. 4-54 FIELD CIRCUIT JUMPER APPLICATION

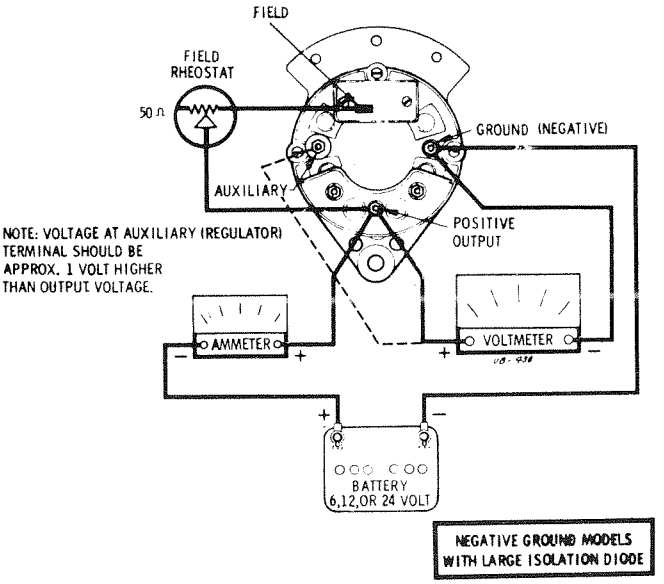
ALTERNATOR PERFORMANCE TEST

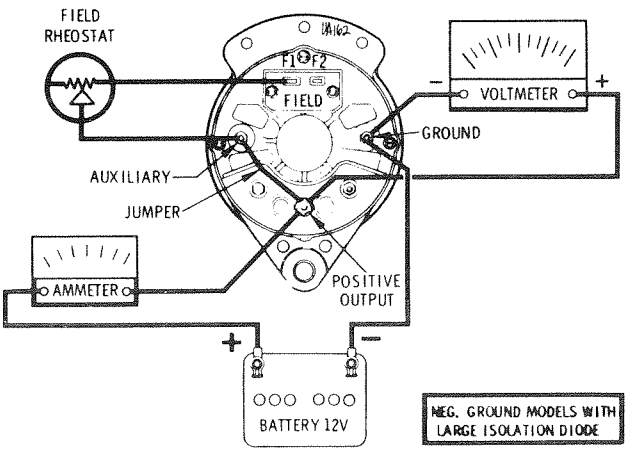
The following test will determine the current producing capability of the repaired alternator. In these tests, the alternator output is manually controlled with a field rheostat.

Mount the alternator in a test fixture capable of providing 3000 to 4000 alternator RPM. Select required battery voltage and circuit polarity. Connect fixture circuit leads and instruments to the alternator terminals as shown in Figure No. 4-55, depending on the alternator model being tested. Place field rheostat in maximum resistance position.

Turn drive motor on, adjust to obtain 3000 to 4000 alternator RPM. Slowly reduce field rheostat resistance, alternator should develop a charge. Continue to reduce resistance until alternator reaches rated current output in amperes. **DO NOT** operate the alternator for more than a few minutes in this manner, due to the lack of voltage control. If the alternator will deliver its rated output, terminate the test.

After successful completion of these tests, the alternator is ready for installation; refer to Installation Section 2 for procedure and additional information.





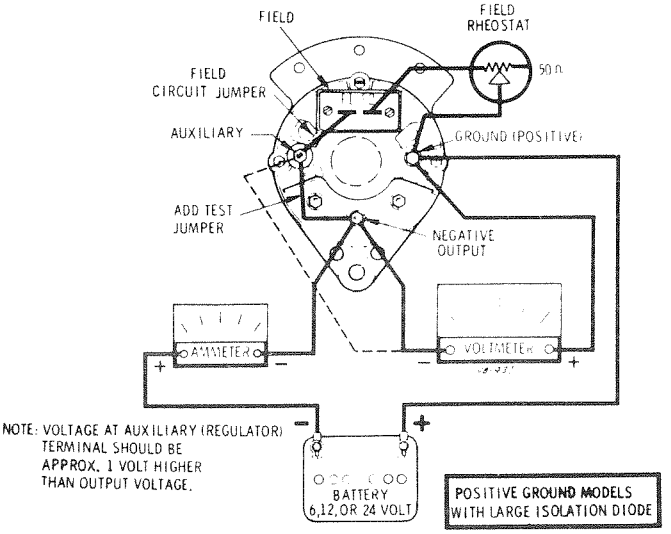
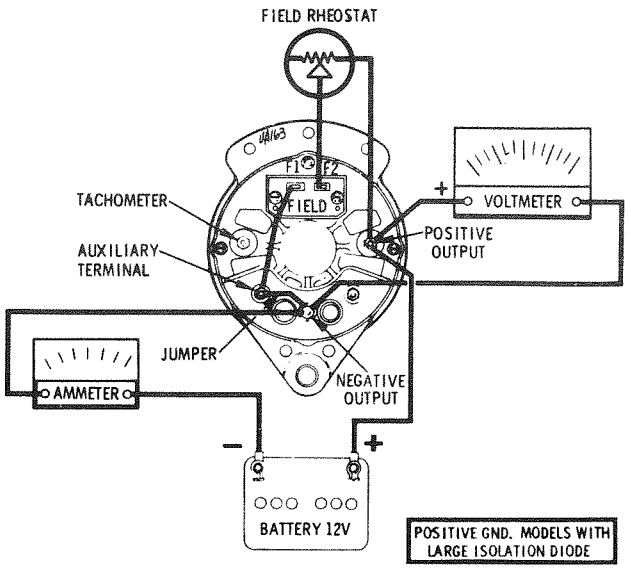
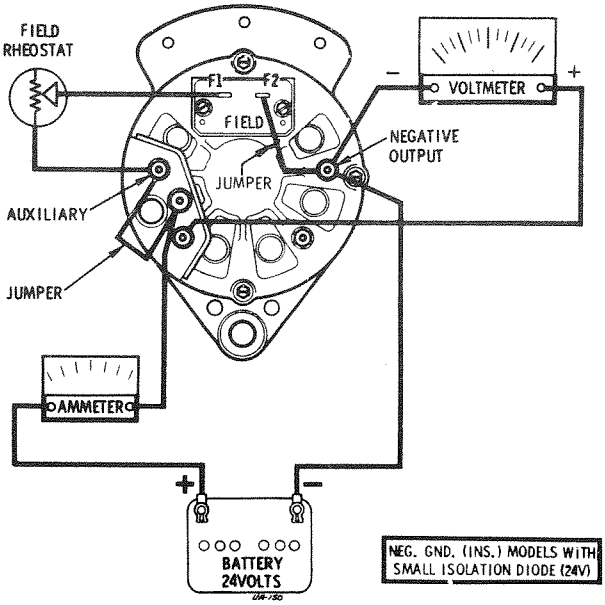


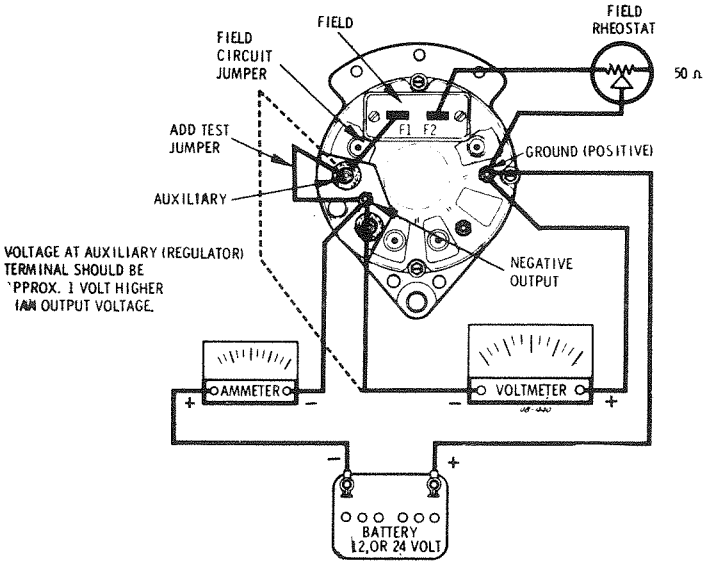
FIG. 4-55 ALTERNATOR PERFORMANCE TEST



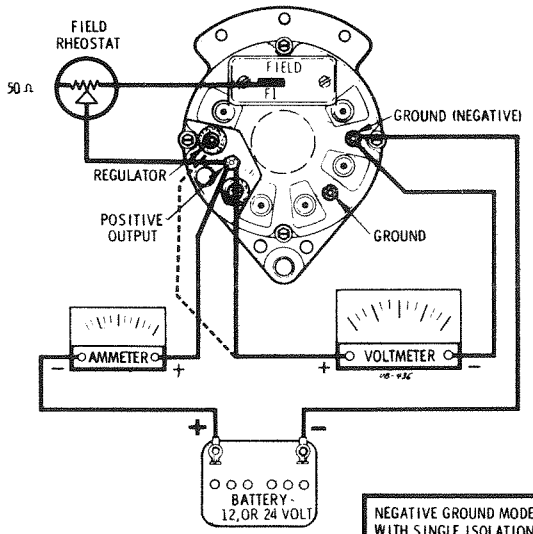
POSITIVE GND. MODELS WITH LARGE ISOLATION DIODE



NEG. GND. (INS.) MODELS WITH SMALL ISOLATION DIODE (24V)

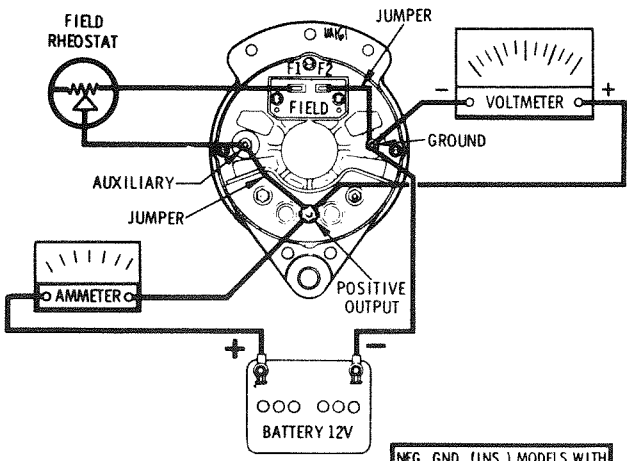


POSITIVE GROUND MODELS WITH SMALL ISOLATION DIODE

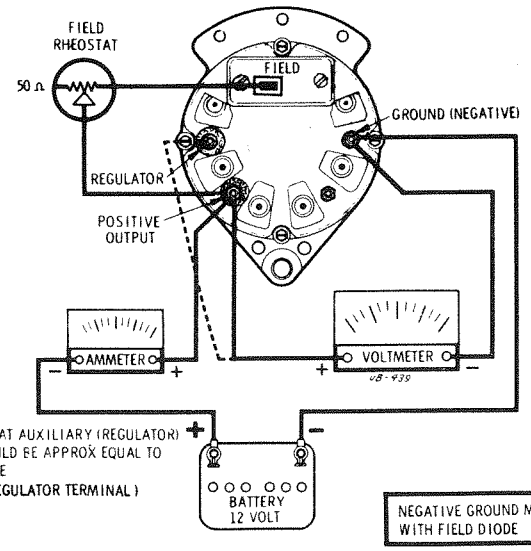


NOTE: VOLTAGE AT AUXILIARY (REGULATOR) TERMINAL SHOULD BE APPROX. 1 VOLT HIGHER THAN OUTPUT VOLTAGE.

NEGATIVE GROUND MODELS WITH SINGLE ISOLATION DIODE



NEG. GND. (INS.) MODELS WITH LARGE ISOLATION DIODE (12V)



NOTE: VOLTAGE AT AUXILIARY (REGULATOR) TERMINAL SHOULD BE APPROX EQUAL TO OUTPUT VOLTAGE (NO LOAD ON REGULATOR TERMINAL)

NEGATIVE GROUND MODELS WITH FIELD DIODE

4

FIG. 4-55 ALTERNATOR PERFORMANCE TEST (CONT'D.)

NOTES

NOTES