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BOOK

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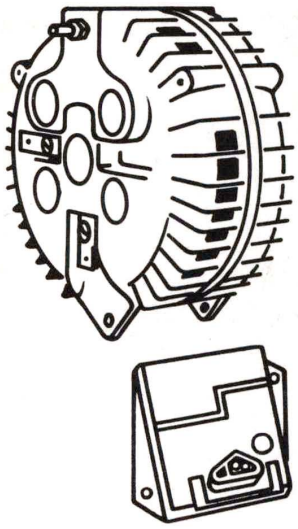

THE 1970 ALTERNATOR AND REGULATOR

CHRYSLER
MOTORS CORPORATION

PLYMOUTH • DODGE • CHRYSLER
IMPERIAL • DODGE TRUCK

Many Master Technicians will remember when the Chrysler Corporation opened a new era by pioneering the alternator charging system on its passenger cars back in 1960. As you know, this charging system has been highly successful and continues to prove the merit of its advanced engineering even today.

But, as new materials and processes are developed, even good things can be made better. As a result, we now have the advantages of electronic voltage regulation which makes voltage control more precise and consistent than ever before.

The direct benefits of this new equipment are improved electrical system operation and longer battery life. More important to Master Technicians, the new voltage regulator has no moving parts or adjustments. It is serviced by replacement and can be checked in minutes with the new Regulator Tester.

In the pages that follow, you'll find both the new and the familiar, so read on and bring your know-how up to date with the latest.

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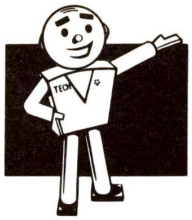


ALTERNATOR IDENTIFICATION

With the introduction of the 1970 Isolated-Field Alternator and Electronic Voltage Regulator, there are now three different types of Chrysler-built alternators in use. They all fit the same mounting brackets on the engine, but you can't interchange them because they are different electrically.

OLD RELIABLE COMES FIRST

The long-familiar grounded-brush alternator with its electro-mechanical voltage regulator is the first type used on Chrysler Corporation cars. As you know, this alternator has one brush connected to the single field terminal, and the other grounded to the alternator housing. In this system, the field circuit is grounded at the alternator through the ground brush.

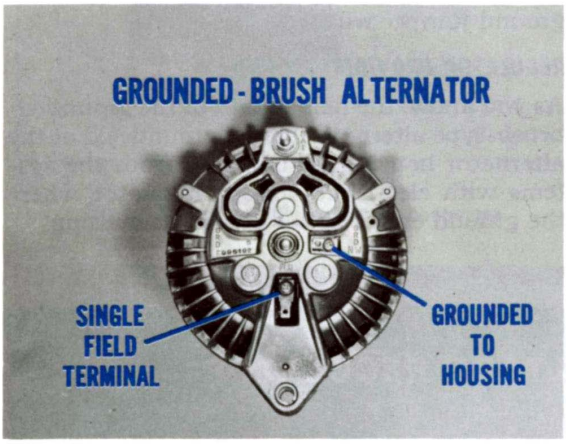


Fig. 1—Used with electro-mechanical regulator

THE FIRST BIG CHANGE

Next comes the insulated-brush-type alternator which is used on the '69 Imperials and some special applications. Here, both field brushes are insulated from the alternator housing. One brush connects to the single field terminal, but unlike the earlier type, the other brush connects to the heat sink instead of ground.

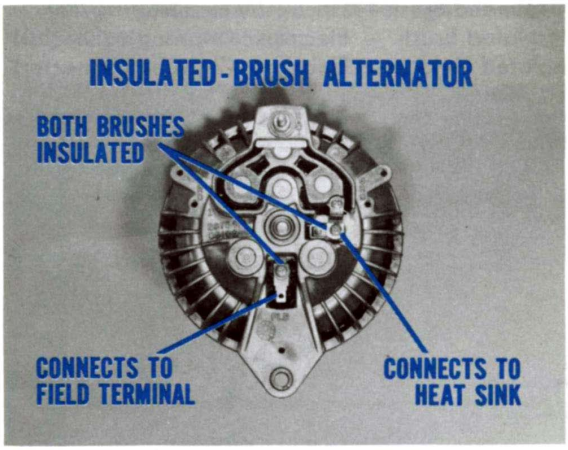


Fig. 2—Introduced in 1969

THE PRESENT MODEL

Finally we come to the new isolated-field type alternator which is used in all of our 1970 models. Like the insulated-brush type, this alternator also has two insulated brushes, but each has a separate field terminal. Since neither brush has a direct ground or heat sink connection, the internal field circuit is isolated.

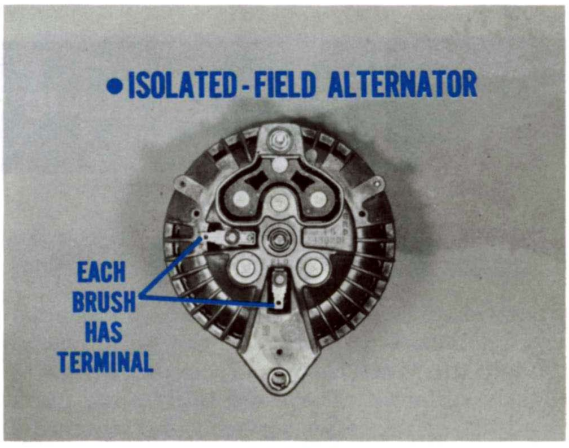


Fig. 3—Used on all 1970 Chrysler-built cars

THE REGULATORS ARE DIFFERENT

As you might expect, the voltage regulators used with these different alternators also have electrical differences. This means that each type of passenger car alternator must be used with its matching type of voltage regulator. Here's the lineup:

ALTERNATOR	REGULATOR
Grounded Brush —	Electro-Mechanical
Insulated Brush —	Electronic (3-prong connector)
Isolated Field —	Electronic (2-prong connector)

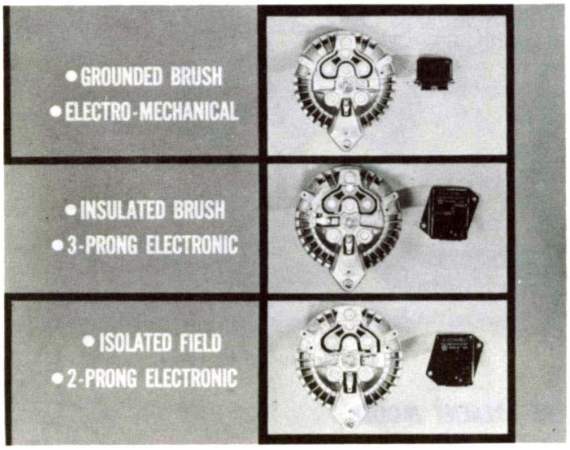


Fig. 4—Alternator and regulator must match

AN EXCEPTION TO THE RULE

The alternator-regulator matching requirement has an exception in the alternators used on some Dodge light-duty trucks made late in 1969. These are isolated-field alternators which are modified to use the electro-mechanical voltage regulator.

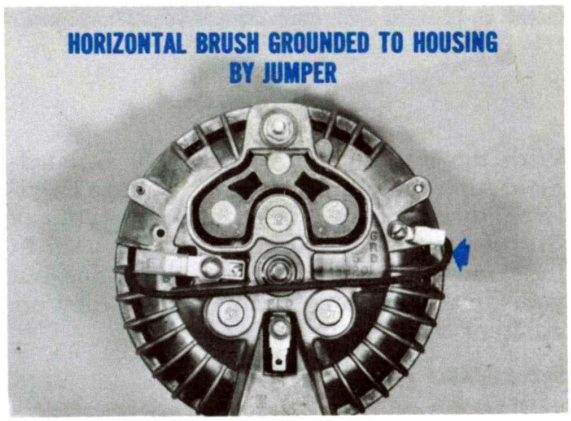


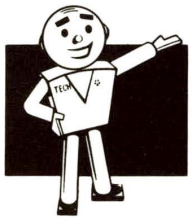
Fig. 5—Modification for light-duty trucks

DON'T FORGET THE JUMPER

In this case, the horizontal field brush is grounded to the alternator housing by a permanent jumper wire. If you replace one of these isolated-field alternators, use another of the same type and be sure to reinstall the ground jumper wire.

REGULATOR PROVIDES GROUND

As you know, the field circuit of the grounded-brush-type alternator has its ground end at the alternator housing. This differs from the systems with electronic voltage regulator where the ground end is at the regulator housing.



THE ELECTRONIC VOLTAGE REGULATOR

ELECTRONIC REGULATOR OPERATION

Operation of the two- and the three-prong voltage regulators is basically the same, even though their external field circuit wiring is slightly different. There are no moving parts or adjustments, so we service these regulators by replacement.

INTRODUCING THE ZENER

The heart of our electronic voltage regulator is a solid-state device called a Zener Diode. This special-type diode conducts current only when the electrical system line voltage rises above a certain level. In other words, a Zener Diode is a voltage-operated, electronic on-off switch.

Fig. 6—Regulator with three-prong connector

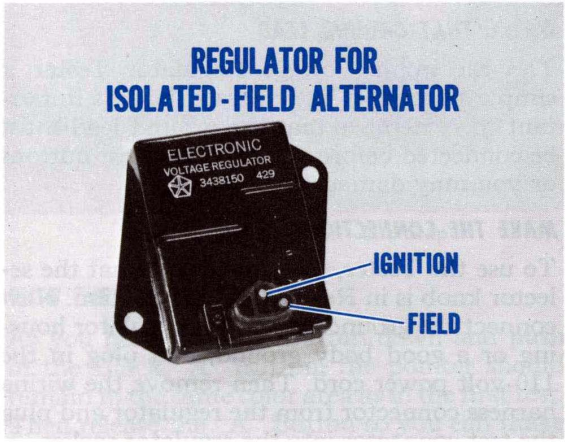


Fig. 7—Regulator with two-prong connector

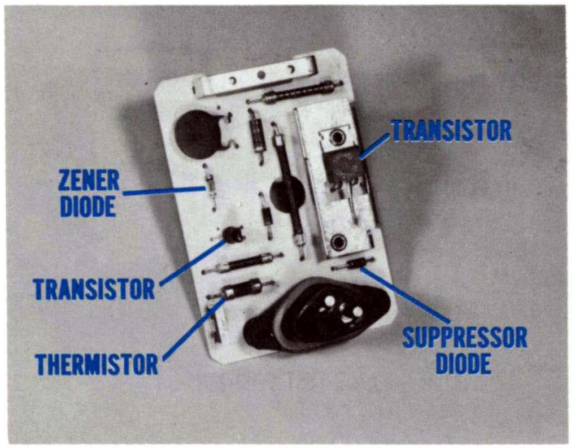


Fig. 8—Electronic regulator components

VOLTAGE SHUTS IT OFF...

When line voltage drops below the specified level, the Zener Diode shuts off the current which controls the field circuit transistors. These transistors also act as on-off switches but are not voltage-sensitive in the same sense as the Zener Diode. An important point to remember here is that the diode switching action is continuous and very rapid to regulate charging voltage accurately.

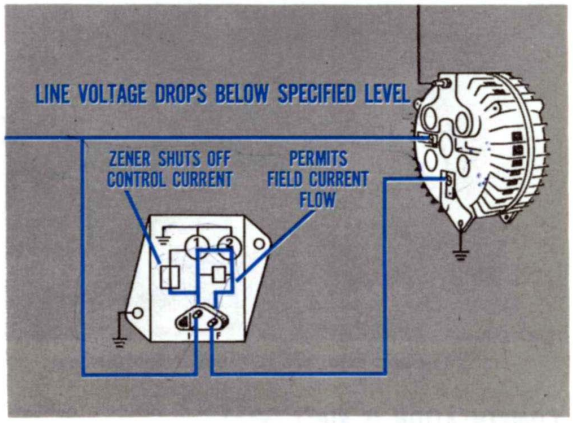


Fig. 9—Zener does not conduct

...OR TURNS IT ON

In operation, when system line voltage increases to the Zener turn-on level, the diode conducts current. This control current turns on one of the transistors which, in turn, shuts off the second transistor, blocking the direct flow of field current.

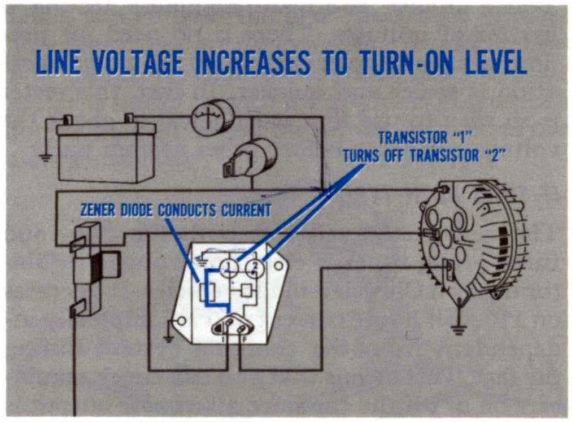


Fig. 10—Voltage "triggers" Zener diode

SUPPRESSOR DIODE LIMITS CURRENT

When the second transistor turns off, the field current then passes through the field suppressor diode which limits the current flow to reduce alternator output. Put more simply, the transistors control the field current and the Zener Diode controls the transistors.

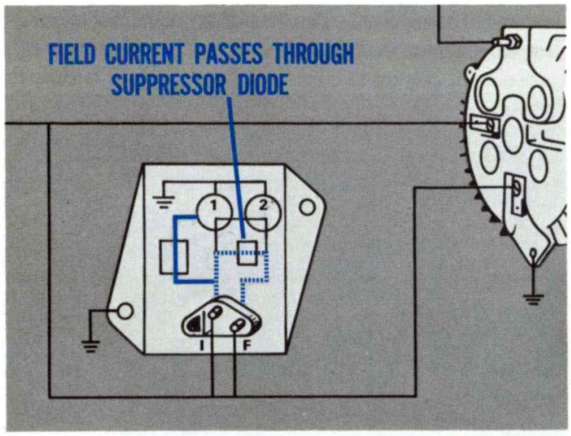


Fig. 11—Suppressor diode reduces field current

COMPENSATION IS BUILT IN

There are also other parts in the regulator which compensate for temperature change and other variables. However, these parts are not directly involved in our description of basic regulator operation.

VOLTAGE REGULATOR TESTS

The new C-4133 Electronic Voltage Regulator Tester makes complete regulator testing a matter of minutes. There is no need for preliminary warmup or cycling, so the whole operation is easier and quicker. In fact, this tester is so easy to use that it is logical to check the voltage regulator before other system parts.

IT TESTS BOTH TYPES

The new tester will test both the two- and three-prong types of electronic voltage regulator used on Chrysler-made vehicles. It operates on 110-volt house current and is completely independent from the charging system during the test. This means that you can check regulators on or off the car since alternator output is not required.

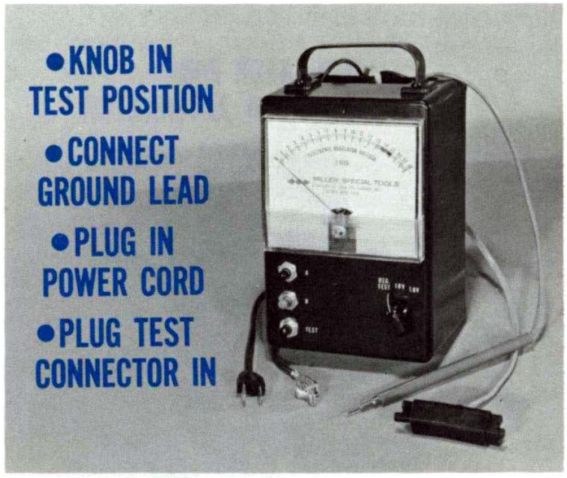


Fig. 12—Voltage regulator tester connections

WATCH THAT GROUND LEAD

The Electronic Voltage Regulator Tester is simple to connect and operate, but it's important to remember that the ground lead must be connected before you push any test buttons or you may damage the tester.

MAKE THE CONNECTIONS

To use the Tester, first make sure that the selector knob is in Regulator Test position. Next connect the ground lead to the regulator housing or a good body ground, and plug in the 110-volt power cord. Then remove the wiring harness connector from the regulator and plug the test connector into the regulator socket.

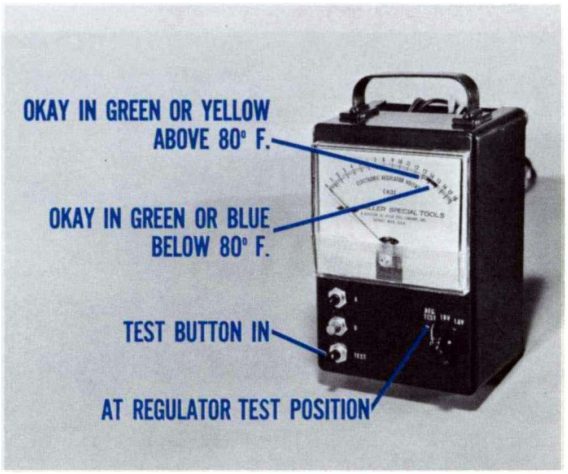


Fig. 13—Regulator Test—1st Step

THE FIRST TEST

With the selector knob at Regulator Test position, press the Test Button in. If the regulator is in good condition, the pointer should move to the green or yellow range on the dial when the regulator temperature is above 80°F. If regulator temperature is below 80° F., the pointer should be in the green or blue range.

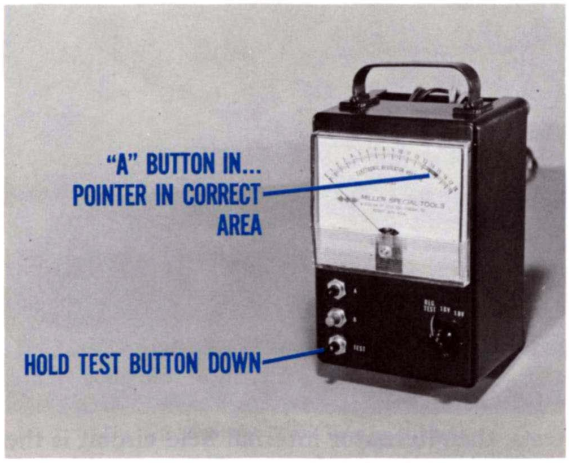


Fig. 14—Regulator Test—2nd Step

PUSH THE "A" BUTTON

As you hold the Test Button down and push in the Black "A" Button, the pointer should remain in the same color area as in the first test. Then release the "A" Button so you can make the final regulator test.

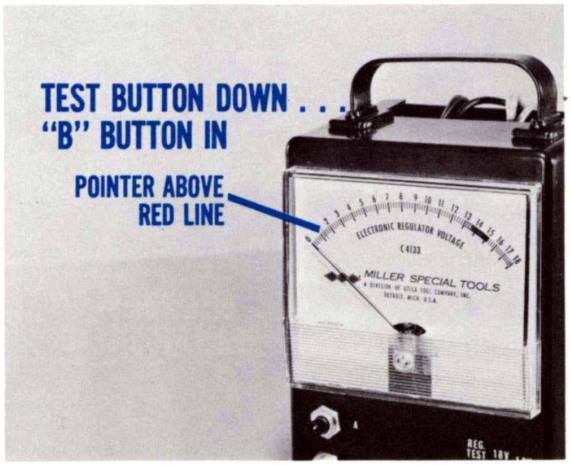


Fig. 15—Regulator Test—3rd Step

STAY OUT OF THE RED

Keep the Test Button down and push in the Red "B" Button. The pointer should now read above the Red Line on the dial. When you finish testing, remove the test connector and power cord plugs but leave the ground clip in place so you can use the tester as a voltmeter.

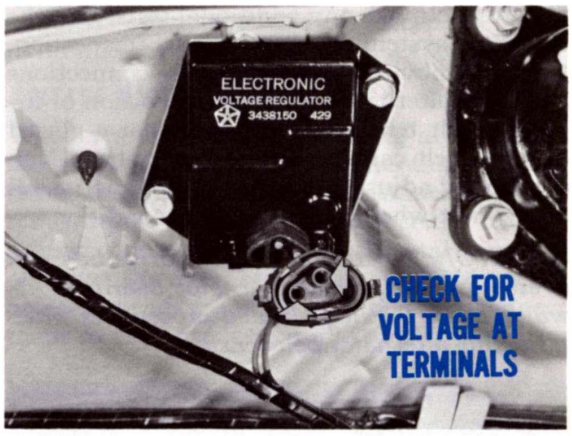


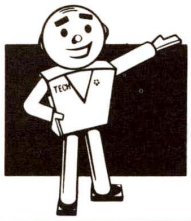
Fig. 16—Check voltage with tester prod

TESTER CHECKS VOLTAGE

If the regulator checks out okay on a car that's in for "no-charge" trouble, you next use the tester prod to check for voltage at the regulator wiring connector terminals. Move the test selector knob to the 18-volt position and turn on the car ignition switch for the test. No voltage at the terminals usually means an open in the field circuit or in the alternator rotor.

SERVICE MANUAL TELLS HOW

Once you've used the new Electronic Voltage Regulator Tester, checking the regulator first will probably become routine. But, if your tester is out of service for any reason, you can follow the regular testing sequence given in the Service Manual.



ALTERNATOR & CIRCUIT TESTS

INTERNAL FIELD TEST

Before you make any additional tests, give the charging system a quick visual inspection. Check for obvious things like loose connections and poor alternator drive belt condition or incorrect belt tension. Remember that a glazed or worn belt can slip and reduce output even if properly adjusted, so play it safe and install a new belt when you find these conditions.

CAUTION: Overtightening the drive belt can overload and damage alternator bearings. Always follow Service Manual procedures when adjusting alternator belt tension.

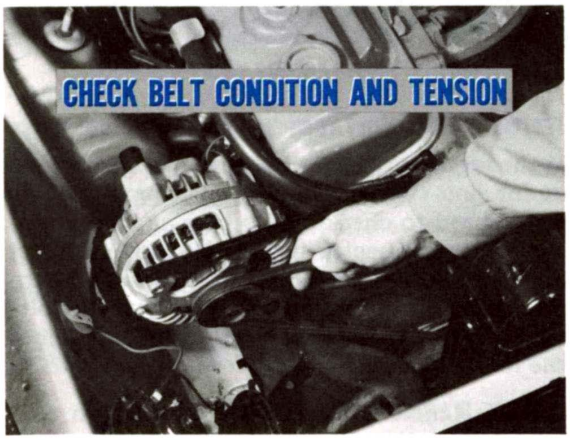


Fig. 17—Belt slippage lowers output

CHECK THE BATTERY CABLES

Your pre-testing inspection should also include the battery and its cables. It's easy to eliminate possible high resistance at the battery connections by simply cleaning the cable clamps and battery posts as a routine service operation. Resistance at these points can make the whole electrical system act up, so don't be fooled by a clean-looking cable clamp that may actually hide a layer of high-resistance lead oxide.

DISCONNECT THE FIELD LEAD

After the voltage regulator and field wiring

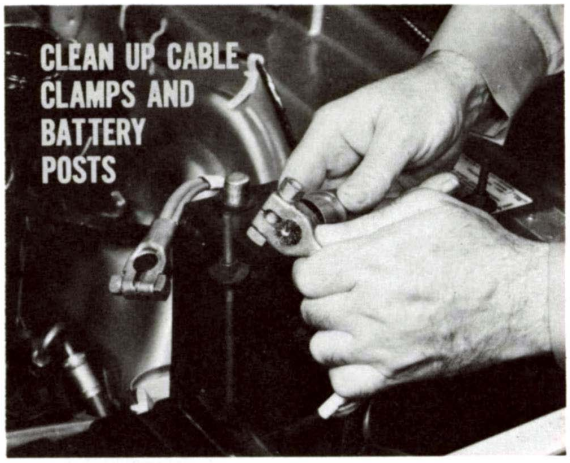


Fig. 18—Eliminate possibility of resistance

tests, the alternator internal field circuit is the easiest item to check next. To make this test on the car, first loosen the alternator drive belt temporarily so you can turn the pulley. Then disconnect the green field lead which comes from the voltage regulator, but leave any other field lead in place. On trucks, the color of the regulator field lead varies with different models, so check their wiring diagrams to get the right one.

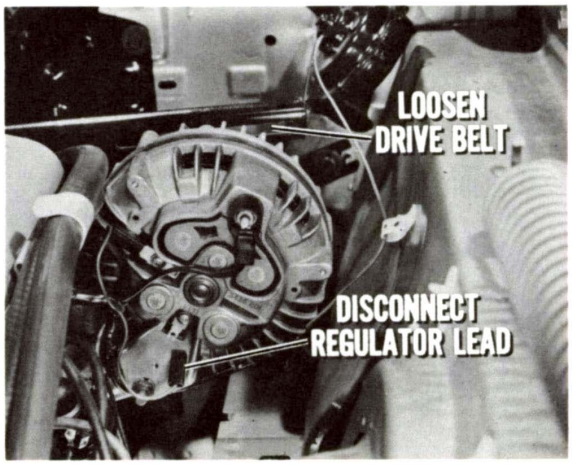


Fig. 19—Prepare for Current-Draw Test

THE AMMETER IS IN SERIES

With the field lead off, connect a test ammeter between the alternator field lead and its terminal so you can check the internal field current draw. Switch on the ignition to supply field current and slowly turn the rotor by hand as you watch the test ammeter indication.

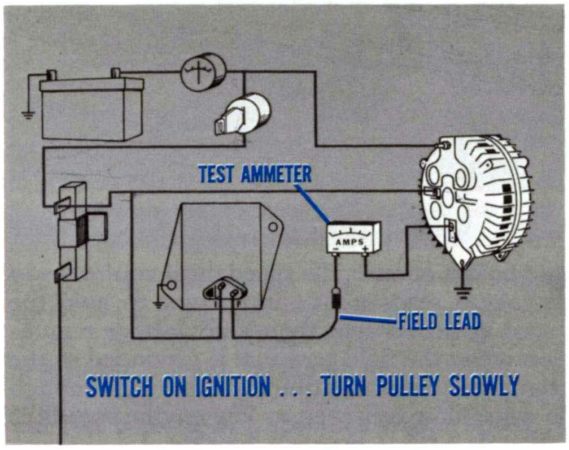


Fig. 20—Current-Draw Test conditions

CURRENT DRAW TELLS THE STORY

An internal field current draw of 2.3 to 2.7 amps is acceptable. A low reading can be caused by high rotor coil resistance or brushes and slip rings in poor condition. A high current reading usually means a short circuit or ground . . . no reading, an open in the rotor coil or the regulator field lead.

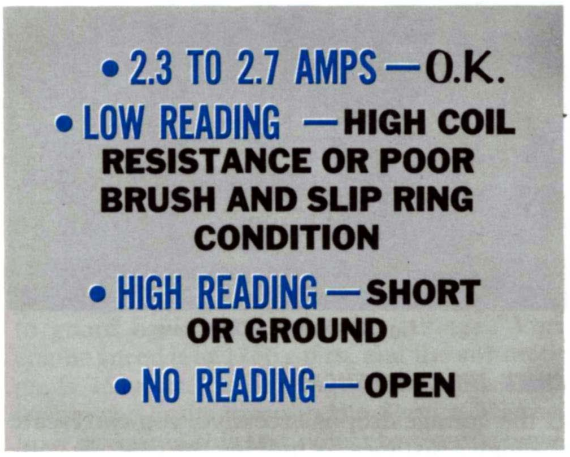


Fig. 21—Field Coil Current-Draw Test results

CHARGING CIRCUIT RESISTANCE TEST

If the rotor passes the current draw test, the next checkpoint is at the alternator output terminal. This terminal is normally hot when the battery is connected, so you can check it for voltage without running the engine. No voltage at the terminal tells you that the charging circuit is open somewhere between the alternator and the battery.

VOLTAGE MEANS GO

When you get a voltage reading at the alternator output terminal, it means that you can check the charging circuit resistance and current output. First you disconnect the battery ground cable to prevent accidental grounds, and then the alternator output lead. Move the ammeter leads from the field test and connect them to the output terminal and its lead.

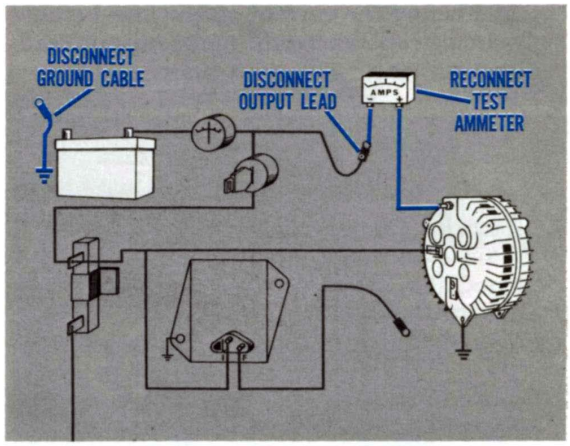


Fig. 22—Charging Circuit Resistance Test connections

THE JUMPER GOES TO GROUND

When the test ammeter is connected, reconnect the battery ground cable. Leave the green voltage regulator field lead off and connect a jumper between the alternator field terminal and a good ground. On isolated-field alternators, the other field lead remains connected for all tests.

CONNECT THE VOLTMETER

With the ammeter and field ground jumper connected, you then connect a test voltmeter. The positive lead goes to the alternator output lead and the negative to the positive battery

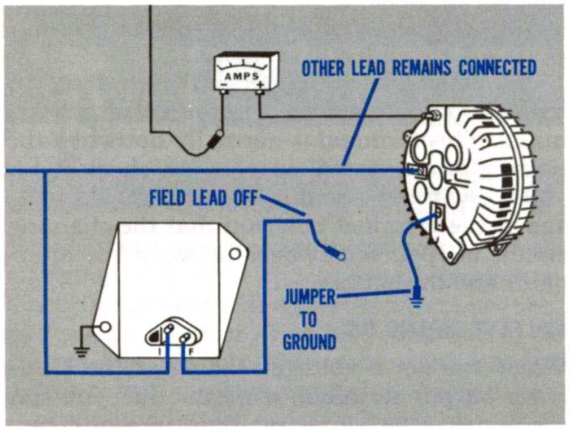


Fig. 23—Charging Circuit Resistance Test connections

post. By connecting the voltmeter in this manner you can check the total voltage drop in the charging circuit to tell whether the circuit resistance is excessive. The voltage drop is checked before the current output test because high circuit resistance will make output readings inaccurate.

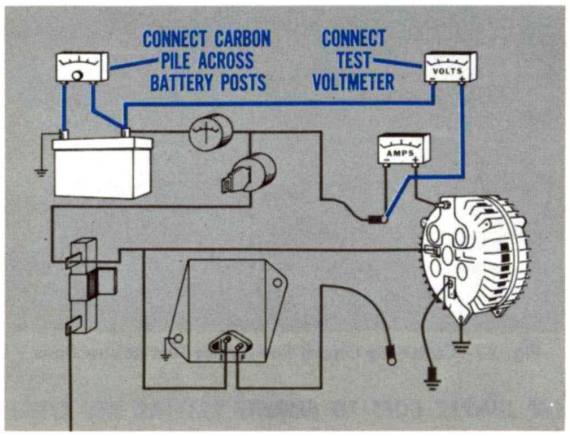


Fig. 24—Voltmeter and Load connections

LOAD REGULATES OUTPUT

To get an accurate voltage drop indication, with the ground jumper in the alternator field circuit, you next connect a carbon pile across the battery to provide a variable load. Be sure to turn the carbon pile control to "Off" position before you connect the leads.

KEEP ENGINE SPEED DOWN

For the circuit resistance test, start the engine

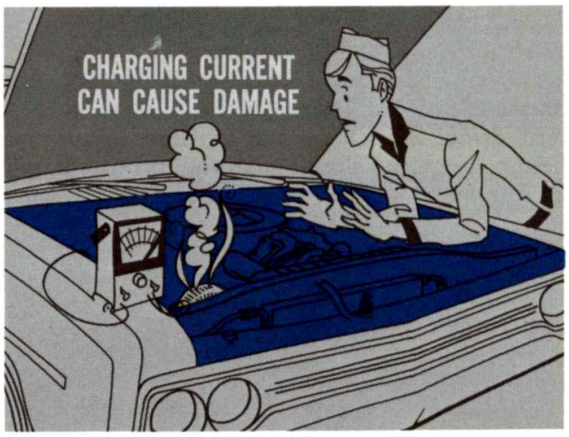


Fig. 25—Keep engine speed low

and hold it at curb idle speed until you're ready to take a reading. It's important to hold the speed down because there's no voltage regulation when the field terminal is grounded so the charging current can quickly climb high enough to cause damage, even at low engine speeds.

READ THE DROP

To make the resistance test, adjust the engine speed and carbon pile slowly to get 20 amperes on the meter. At this point, the voltage drop reading should not be over 0.7 of a volt if the charging circuit resistance is within limits.

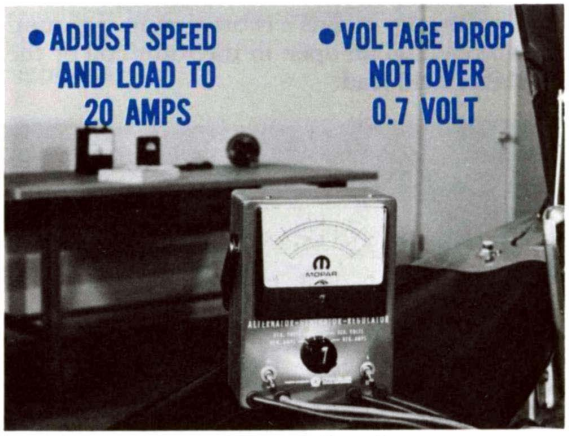


Fig. 26—Voltage-Drop Test

CHECK THE CONNECTIONS

If the voltage drop is excessive, you can locate the high resistance by moving the positive voltmeter clip to each connection in the charging

circuit while keeping the output at 20 amps. You'll find the high resistance between the connection which shows the high voltage drop and the point where it disappears.

WIGGLE THE WIRES

In some cases you can find the high resistance without moving the positive voltmeter lead if you wiggle the charging circuit wires and connections while you watch the meter for pointer movement. And while you're at it, make sure the body ground connection is in good condition. Obviously, the cause of excessive charging circuit resistance must be corrected before you move on to other tests.

CURRENT OUTPUT TEST

For the current output test, drop the engine speed to curb idle and back off the carbon pile. Then move the positive voltmeter lead to the alternator output terminal and connect the negative lead to a good body ground. The output test is made at a specified engine speed, so you'll also need a tachometer.

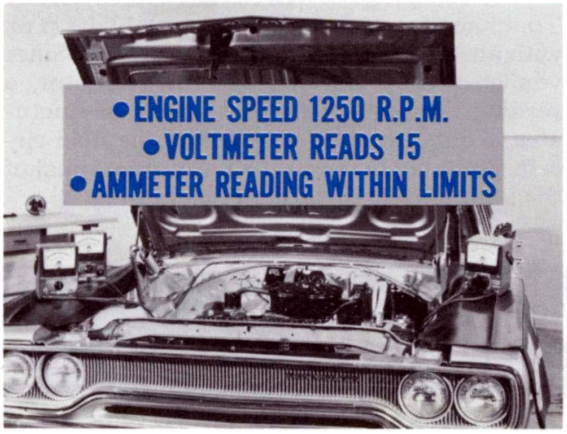


Fig. 27—Current-Output Test

CONTROL SPEED AND LOAD

After the voltmeter is reconnected, again adjust engine speed and the carbon pile slowly to guard against high output damage. When engine speed is at 1250 r.p.m. and the voltmeter reads 15 volts, the ammeter reading must be within the limits given in the Service Manual. Low output in this test points to trouble inside the alternator.

CHARGING VOLTAGE TEST

If the alternator current output checks out okay, you're ready for the charging voltage test. This is essentially the same as the voltage regulator test described in the Service Manual but here, since the regulator has already been tested, you are checking the condition of the complete field circuit.

Fig. 28—Regulator must have a good ground

REGULATOR NEEDS GOOD GROUND

Before you do any testing, make sure that the voltage regulator mounting screws are tight and the housing has a good ground. Don't forget that the ground side of the circuit is just as important to good operation as the regulator wiring and connectors.

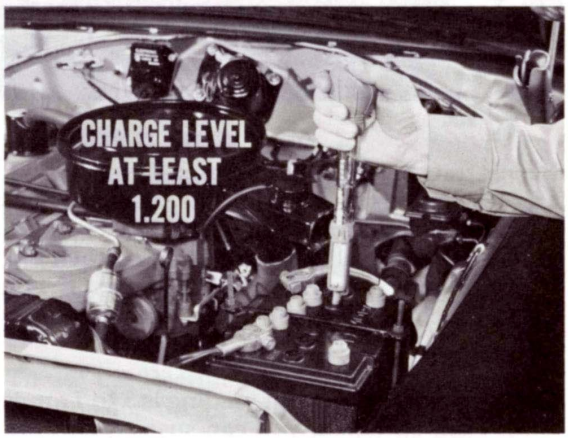


Fig. 29—Recharge battery if necessary

CHECK BATTERY GRAVITY

To get a prompt charging voltage test, the battery charge level must be at least 1.200. If the gravity level is below this point, recharge or substitute a charged battery for the test. You can use a charged booster battery as a substitute if you disconnect the low battery. If the booster is simply clipped on, it will discharge into the low or defective battery and drop the voltage. This will cause the voltage regulator to keep the alternator output higher than we want for proper testing as it tries to charge the low battery.

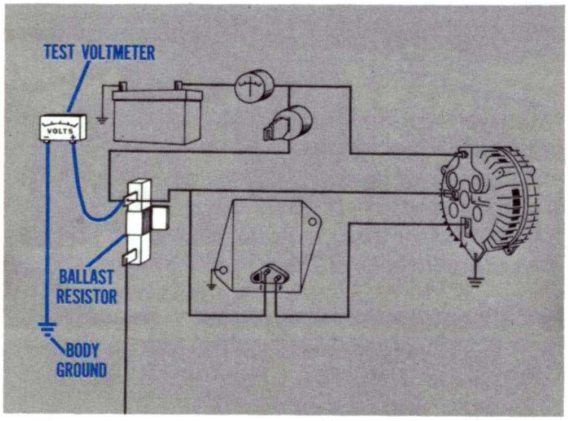


Fig. 30—Charging Voltage Test connections

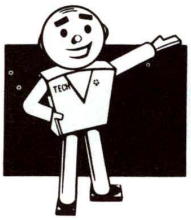
RECONNECT ALL LEADS

For the charging voltage test, you reconnect all the alternator leads and plug in the regulator wiring harness connector. Then connect the test voltmeter positive lead to the ignition ballast resistor at the end with one or two blue wires. The negative meter lead goes to a good body ground.

Fig. 31—Charging Voltage Test

SHUT OFF THE LIGHTS AND RADIO

To make the test, run the engine at 1250 r.p.m. with all lights and accessories turned off. Since you've already checked out the regulator, a reading that is slightly above specs or fluctuates, points to high resistance in the field circuit, probably between the battery terminal of the ignition switch and the regulator.



ALTERNATOR BENCH TESTS

Bench tests for the new isolated-field alternator are generally similar to the previous grounded-brush type. In general, it's common practice to make all the bench tests on each job, but you can pinpoint trouble causes if you watch for clues when you make tests on the car.

TROUBLE-SHOOTING CLUES

If the current output test reading is 5 to 7 amps lower than specified, you can suspect an open rectifier as a possible cause. Much lower output can point to a shorted rectifier. Refer to the Diagnosis Section of the Service Manual for other trouble-shooting hints which will help you save time.

IS THE ROTOR GROUNDED?

If the alternator passed the Field Coil Current Draw Test on the car, you can skip it here and go on to the field ground test. We check the alternator internal field circuit for grounds with a 110-volt test lamp. This relatively high volt-

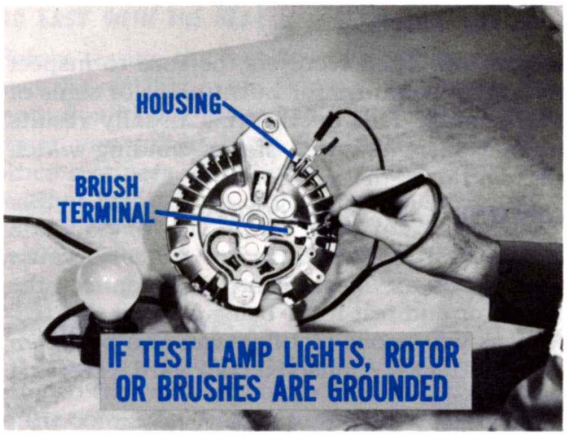


Fig. 32—Internal Field Circuit Ground Test

Fig. 34—Make sure washer is in place

age is used for testing because it shows up potential weak points more distinctly.

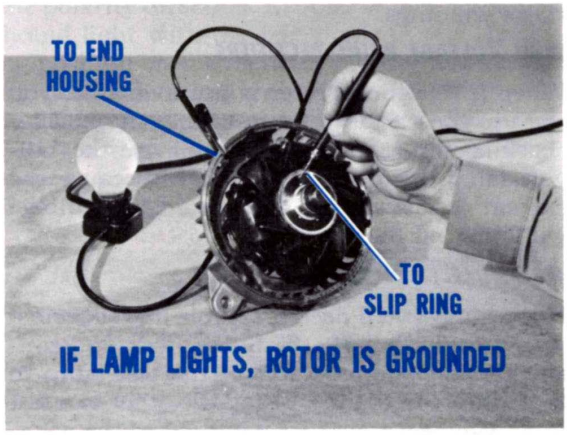


Fig. 33—Rotor Ground Test

CHECK BRUSHES AND ROTOR

The field ground test is simple. First touch one test prod to either field brush terminal and the other to the end housing. If the test lamp lights, the rotor or brushes are grounded. To locate the ground, first remove the brush holders and the end housing. Then clip one test lead to the remaining end housing and touch the test prod to either slip ring. If the lamp still lights, it means that the brushes are okay but the rotor is grounded.

WASHERS PREVENT GROUNDING

When you install brush holders, make sure a nylon washer is in place under the head of each brush holder attaching screw or you'll get a direct ground to the end housing. This is a special size screw, so don't try any substitutes. Also be careful that you don't jam or strip the threads in the housing and cause a loose brush holder.

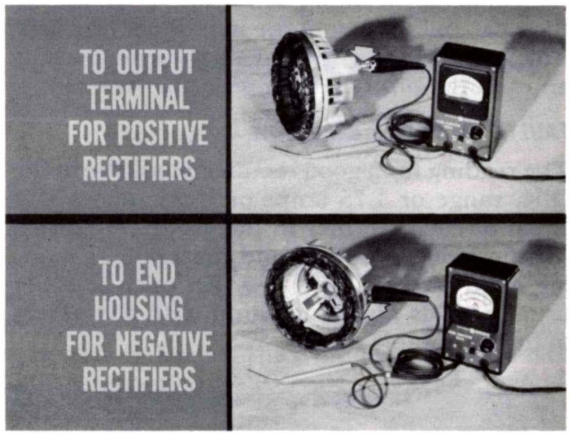


Fig. 35—Rectifier Tester connections

THE TESTER IS FASTER

When the alternator is apart, you can get at the rectifiers for checking. The 1-360 or C-3829 Rectifier Tester is preferred for this job because it eliminates the need to disconnect the rectifiers for testing.

NOT ON METAL BENCH TOP

To use the Rectifier Tester, put the stator and end housing on an insulated surface, and plug in the tester line cord. Connect the clip lead to the alternator output terminal when you check

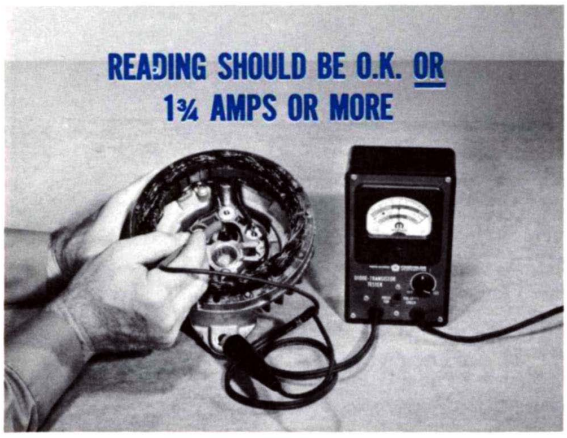


Fig. 36—Rectifier Test

the positive rectifiers, and move the clip lead to the end housing for the negative rectifiers.

POSITIVE THEN NEGATIVE

To make the test, first touch the tester prod to the connector lead of each positive rectifier in the heat sink and note the individual readings. Then, move the clip lead to the end housing and use the prod on each negative rectifier.

FAULTY RECTIFIERS READ LOW

The reading for a good rectifier should be in the O.K. range or 1.75 amps or more, and about equal at each rectifier in the group. A shorted rectifier reads near zero and causes the remaining good ones to read low. An open rectifier usually reads about one amp with the others in the acceptable range.

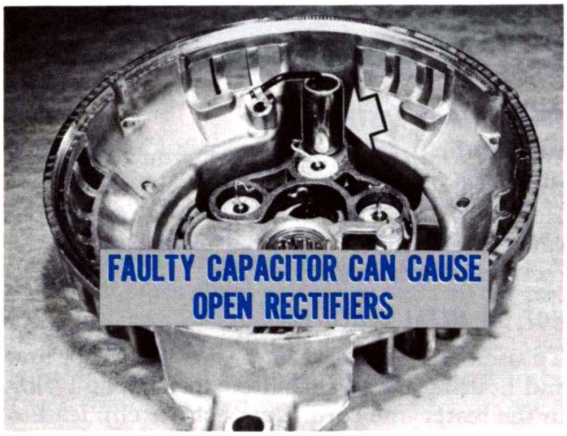


Fig. 37—Disconnect and test capacitor

LOOK FOR SHORTS

If you find open rectifiers, be sure to inspect the stator windings for burnt areas or signs of overheating. This overheating usually results from a short-circuited stator winding which also overloads the rectifiers.

CAPACITOR CAN BLOW RECTIFIERS

A faulty alternator capacitor can also cause open rectifiers, so be sure to disconnect the capacitor and test it for being open or shorted. And, as you know, rectifiers can also be blown if the battery is connected backward, reversing the polarity.

DOUBLE-CHECK WHEN IN DOUBT

If the rectifier tests are borderline or doubtful in any way, insulate the stator frame from the end housing and re-run the tests. If the rectifiers now check out okay, look for grounded stator windings.

HIGH VOLTAGE RUINS RECTIFIERS

When a Rectifier Tester is not available, you can use the battery and test lamp method for checking the rectifiers. We can't use the 110-volt lamp setup for testing here because the current is alternating and the higher voltage will blow out the rectifiers.

TEST LAMP IS IN SERIES

For testing you'll need a 12-volt battery and a test lamp with a No. 67 bulb, prods and connectors. Connect one side of the test lamp to the positive battery post and the other to a test prod. Connect the other test prod to the negative battery post.

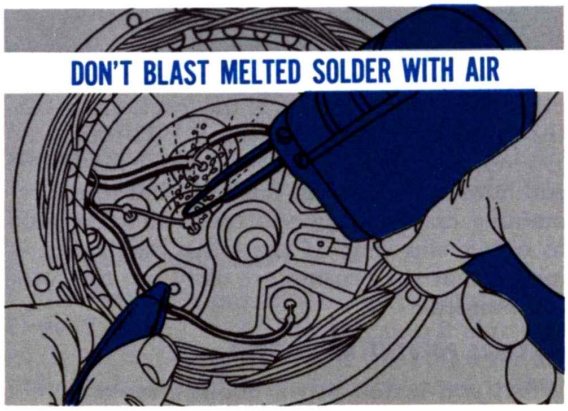


Fig. 38—Prevent accidental short circuits

GO EASY WITH THE HEAT

Before testing the rectifiers, you must disconnect the rectifier leads. When you unsolder the leads don't blast melted solder off with air because you might blow fine particles on the other rectifiers and short them out. Grip the rectifier lead with a clip-on heat sink or long-nose pliers to soak up the heat from the soldering iron. Always remember that too much heat can ruin a good rectifier, so take it easy.

TEST AND THEN REVERSE

To check a rectifier, first touch one test-lamp prod to the rectifier's outer case and the other to the connector lead in the center of the rectifier. Then switch the prods to reverse the test-current polarity.

ONE WAY ONLY

A good rectifier lets the test lamp light only in one polarity direction. In other words, the lamp should light with the test prods in one checking position on the rectifier, but not when they are reversed. When you get a light with the prods reversed, that rectifier is shorted, or if there's no light in either direction, the rectifier is open. In either case, the rectifier is defective and must be replaced.

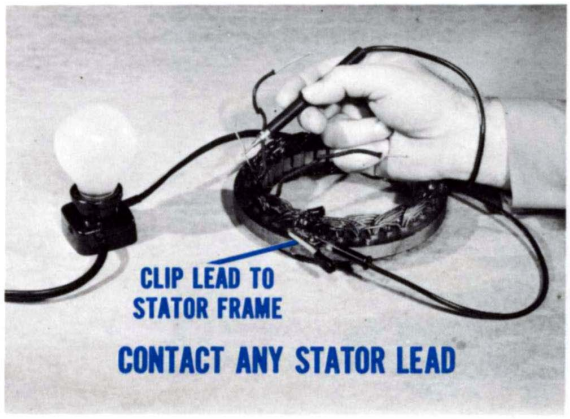


Fig. 39—Stator Ground Test

DISCONNECT FOR STATOR TESTS

At this point, the condition of the alternator internal field circuit and the rectifiers has been checked so the final tests are concerned with stator winding grounds and continuity. If the stator leads have not been disturbed, they will have to be disconnected from the rectifiers for the stator tests. Here again, be careful that you do not damage or ground the rectifiers when you disconnect the leads.

SEPARATE STATOR FROM HOUSING

When the stator leads are disconnected, remove the stator from the end housing and check it for grounds. With the stator on an insulated surface, clip one lead of the 110-volt test lamp to the stator frame and contact the other to any stator lead end. If you get a light, one or all of the windings are grounded.

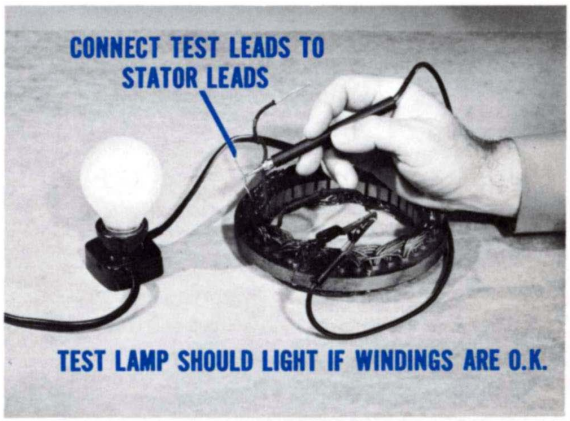


Fig. 40—Stator Continuity Test

LIGHT MEANS OKAY

The final stator test is for continuity. All you do is connect a test lead to any of the three stator leads and touch the test prod to the two remaining leads in turn. The test lamp should light at both leads if the windings are okay. No light at either or both remaining leads means an open winding.

REPLACE FAULTY STATOR

In either case, if you find the stator grounded or open, you'll have to install a new assembly. If the stator checks okay or you're installing a new part, carefully resolder the stator leads at the rectifier ends and the job is done.

GUARD AGAINST CORROSION

When soldering rectifier leads or in any other electrical job, stay away from acid-core solder or soldering paste, because these fluxes will cause corrosion to form. And play it safe by using a heat sink and low-melting-point solder so you won't overheat the rectifiers.

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