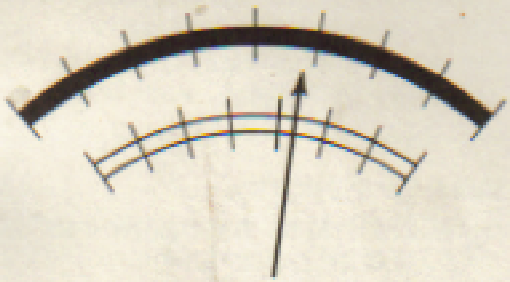
MASTER
TECHNICIANS
SERVICE
CONFERENCE

REFERENCE BOOK 69-3

CHARGING SYSTEM DIAGNOSIS



PLYMOUTH
DODGE
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CHARGING SYSTEM OPERATION CHECKING

The charging system tests given in the Service Manuals provide the step-by-step procedure needed to check out the whole system. The complete testing sequence is most useful in troubleshooting, especially when there is a possibility of trouble at more than one point in the system.

WATCH FOR SYMPTOMS

When there are signs of over- or under-charging, a complete system check-out is called for. To do less is courting a comeback, or, if you diagnose trouble by replacing parts, you can end up with a spectacular bill and a very unhappy customer.

CHECK TO MAKE SURE

There are some jobs, however, where there are no symptoms of charging system trouble, and we simply want to be sure that the system is operating properly. For example, when doing a tune-up, it's good practice to make sure that the battery and charging voltage are within specs. Low system voltage can hold engine performance down, even after the best possible tune-up. Besides, if the charging voltage is too high, distributor points and other electrical parts can be damaged.

LOOK FOR THE OBVIOUS

For a quick check of system operation, visual inspection and a charging voltage reading will usually do the trick. Begin checking with the obvious, like alternator drive belt condition and tension. Glazed, worn, or loose belts will slip and reduce alternator output, especially at high speeds or when the electrical system load is heavy.

DON'T MISS THE BATTERY

Remove the battery filler caps and add water if necessary. Look for signs of trouble, like low water level in all or any one cell. Water level below the tops of the plates may indicate high charging voltage or a damaged cell, and is your cue to check farther because either condition can upset proper charging system operation.

CHECK CABLE CONDITION

If the battery appears to be in good general condition, check both battery cables and the body ground cable between the engine and body bulkhead. Be sure the ground cable attaching screws are tight, especially at the body terminal. If this screw cannot be tightened because of stripped threads, you can have an intermittent contact or a high-resistance connection at this point.

CONNECTIONS ARE IMPORTANT

Wrap up your visual inspection by checking the charging system wiring for condition and tight connections. Don't forget to make sure the bulkhead wiring connector is pushed in all the way and held secure by its locking tabs.

OPEN-CIRCUIT VOLTAGE IS FIRST

To set up the charging voltage check, you simply connect a test voltmeter across the battery terminals and disconnect an ignition coil primary lead so the engine will not start. The voltmeter now indicates the open-circuit voltage of the battery.

LOAD THE BATTERY

Watch the voltmeter as you turn the engine over with the starter. If the pointer does not drop below 9.5 volts with the starter turning, the battery charge level is high enough to allow a dependable charging voltage check. If the battery charge is lower than specified, the charging voltage indication can be misleading.

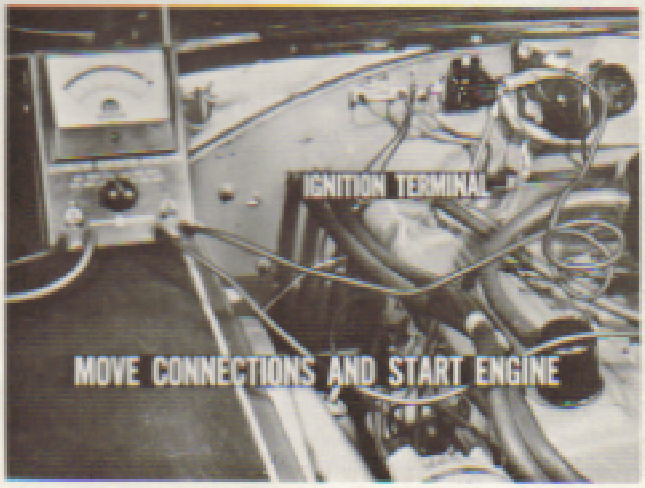


Fig. 1—Check voltage at ignition terminal

CHANGE THE CONNECTIONS

For the charging voltage check, first move the positive voltmeter lead from the battery terminal to the ignition terminal of the voltage regulator so the check is made at the point of control. Then hook up the disconnected ignition coil primary lead; start the engine and run it long enough to warm up the complete charging system.

CHARGE OR NO-CHARGE

With the engine running near fast-idle speed, charging voltage should be within the specifications shown in the Service Manual. If the meter indication does not rise, and only shows battery voltage with the engine running at fast-idle speed, the system is not charging. When this happens, you can narrow down the cause of the no-charge condition by making a few quick tests with the same voltmeter used in the system operation check. Just remember that these are only rough preliminary tests which will tell you whether or not the parts of the charging system are working. They are not intended as substitutes for the regular tests given in the Service Manuals.

NO-CHARGE QUICK CHECK

Usually, when the system stops charging, the driver notices it on the instrument panel ammeter. Quite often, however, the battery runs down before the no-charge condition is noticed and must be recharged before the regular tests can be made.

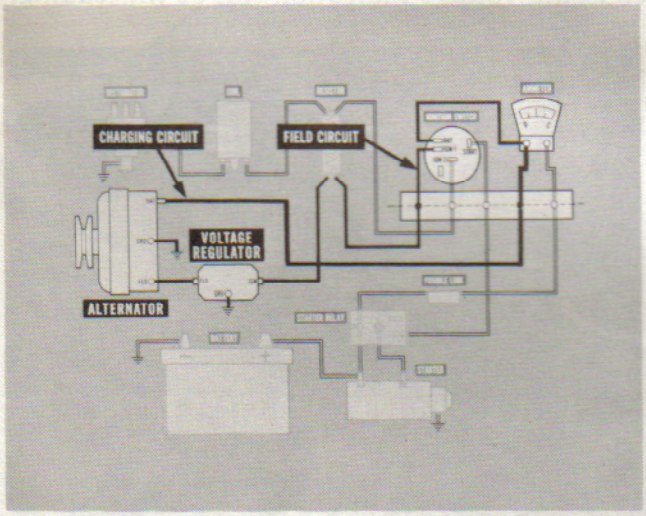


Fig. 2—Charging system components

Since the charging system can be divided into four main sections for testing, we can use a simple jumper wire and the process of elimination to tell which parts of the system are not operating.

SYSTEM HAS FOUR MAIN SECTIONS

Included in the charging system, we have a charging or alternator output circuit, a field or rotor supply circuit, an alternator, and a voltage regulator. Now, starting with the charging circuit, we should get a voltage indication at the alternator output terminal, even with the engine stopped, because this circuit is normally hot at all times.

LOW READING MEANS RESISTANCE

If the reading at the output terminal is lower than battery voltage, there's high resistance somewhere in the circuit. No voltage at the terminal indicates that the charging circuit has an open.

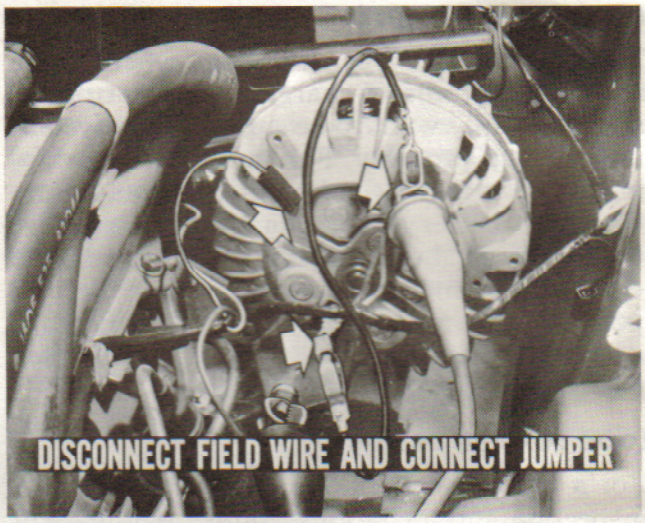


Fig. 3—Jumper feeds current to rotor

ELIMINATE REGULATOR

If there's battery voltage at the output terminal, disconnect the field wire from its terminal at the alternator to take the voltage regulator out of the field circuit. Next, connect a jumper wire between the output terminal and the field terminal to supply current direct to the rotor.

CAUTION: Make sure the field terminal end of the jumper does not touch ground. A short circuit here can seriously damage the charging circuit.

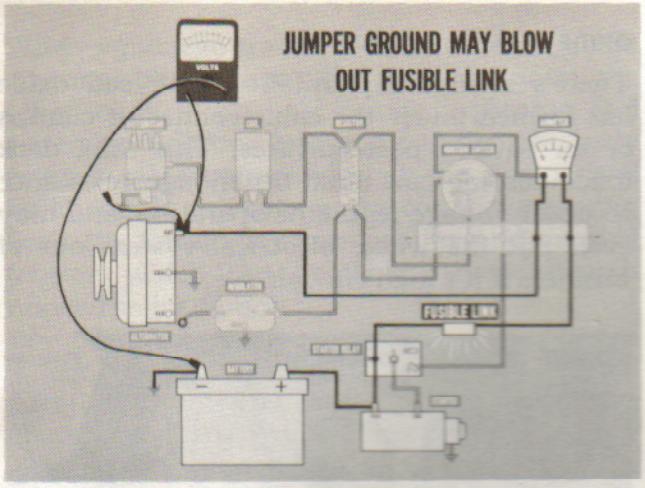


Fig. 4—Guard against accidental grounding

WATCH FOR SHORTS

Another thing to remember when you connect the jumper to the field terminal is the possibility of a shorted rotor winding. Normal field current is only about 2½ amperes, so a hot spark between the jumper and the field terminal probably means that the rotor circuit in the alternator is shorted.

ROTOR CAN BE OPEN

There's also a possibility that the rotor circuit is open, so you may as well check it before going any further. Simply connect a 12-volt continuity test light in series between the jumper and the field terminal, or directly between the output and field terminals. If the test light does not burn, the circuit is open.

FIELD CIRCUIT OR ALTERNATOR?

Assuming the rotor circuit is okay, and the jumper is in place, run the engine at moderate speed and check the voltmeter. A voltage increase indicates that the alternator is putting out, and the trouble is probably somewhere in the field circuit. No output indication points to trouble in the alternator. When making this test, remember that there's no voltage control when the regulator is out of the circuit, so don't risk high output damage by overspeeding the engine.

BYPASS THE REGULATOR

If the alternator seems to be okay, disconnect the field circuit wire from the ignition terminal of the voltage regulator to isolate the field

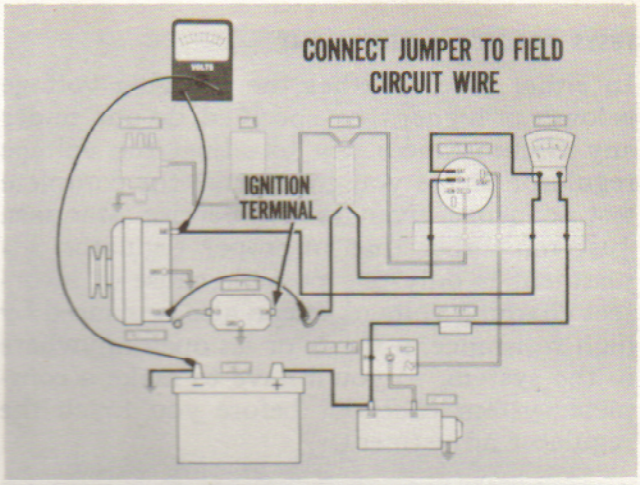


Fig. 5—Field wire feeds current directly

circuit. Then, disconnect the jumper from the output terminal and connect the free end directly to the field circuit wire.

REGULATOR CHECK NEEDED

Again, run the engine and check the voltmeter. If you now get a charge indication, it means that the field circuit itself is probably okay, and you'll have to check out the voltage regulator. Once again, remember that these are only rough operation checks to help you isolate trouble, and are no substitute for the regular Service Manual tests.

CHARGING SYSTEM TESTS—CONVENTIONAL

If the charging system operates but charges too much or too little, the resulting symptoms are usually the tipoff. As we mentioned earlier, low charging voltage can affect engine performance and, of course, it usually means a low state of charge and the possibility that the battery is sulphated.

In the opposite direction, charging voltage that's too high may show up in headlamp flare, burnt-out bulbs, blued ignition points, excessive use of battery water, or battery overcharge breakdown.

TESTS PRECEDE ADJUSTMENT

In either case, whether the charging voltage is lower or higher than specified, do not, under any circumstances, try to adjust the voltage regulator unless you go through the complete test sequence given in the Service Manuals. Just remember that improper regulator adjustment is only one possible cause of incorrect charging voltage. It can also be caused by high resistance, a short, or an open anywhere in the system, so you'll have to make a complete system checkout before you touch the regulator adjustment.

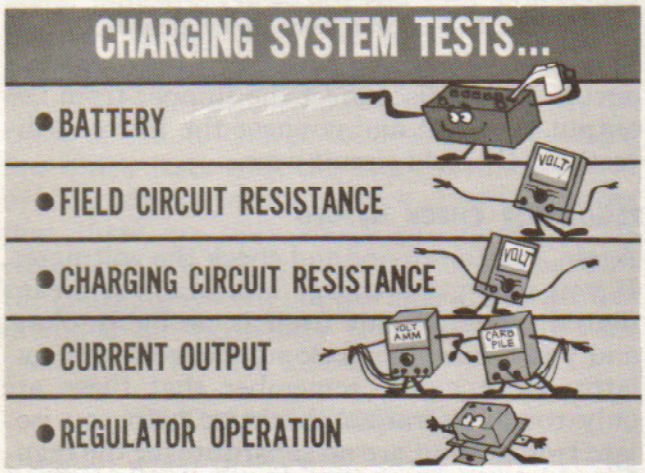


Fig. 6—Make system tests in sequence

TEST SEQUENCE IS IMPORTANT

Charging circuit tests are made in five steps: Battery, Field Circuit Resistance, Charging Circuit Resistance, Current Output, and Voltage Regulator Operation. Be sure to follow this sequence because the specification for each test depends on the one before it. For example, test specifications for alternator current output and regulator operation are based on knowing that field circuit and charging circuit resistances are within specified limits. The regulator setting specification, in turn, is based on specified alternator output and a fully charged battery.

BATTERY TEST

We begin our tests at the battery because it is the basic reference point for all electrical measurements on the car. As we mentioned earlier, the battery must be in good condition and fully charged so our test results will be accurate and reliable.

OXIDE MEANS TROUBLE

There's always a possibility that lead oxide has formed under the cable connector clamps or on battery post surfaces. This thin, dark oxide coating can build up enough resistance to upset voltage regulator operation, and may even put the whole electrical system out of business if it's high enough.

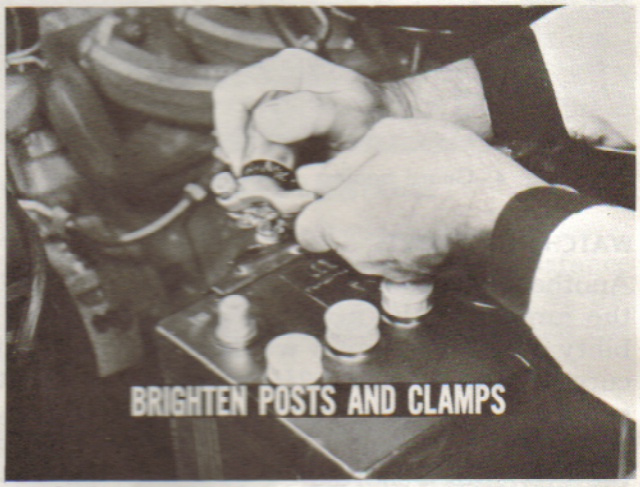


Fig. 7—Remove oxide and corrosion

CLEAN 'EM UP

As a regular part of a tune-up, or any electrical system test, always brighten up the battery posts and inner surfaces of the cable clamps with a wire brush or sandpaper, so you'll be sure there's no high resistance at these points.

CHECK BOTH ENDS

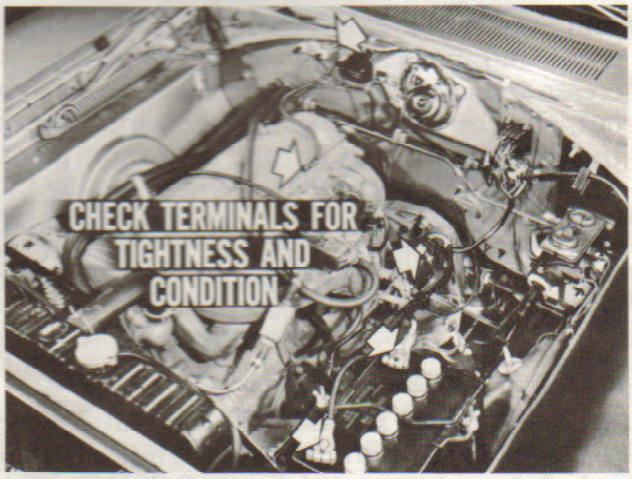


Fig. 8—Inspect cables at both ends

When you clean up the connector clamps and terminal posts, check the connections at the other ends of the cables for tightness and general condition. And don't forget the body ground cable connections at the engine and bulkhead. If you tighten the connector screws, keep the terminals from turning and causing tension which can break the cable strands under the insulation.

IS THE BATTERY OKAY?

After inspecting the cables, you can begin the charging system tests by checking the battery charge and capacity. The Service Manuals cover battery testing in detail, so there's no need to repeat the tests here. If you find a partial charge, sulphation, or defective cells, install a good, fully charged battery before you go any further.

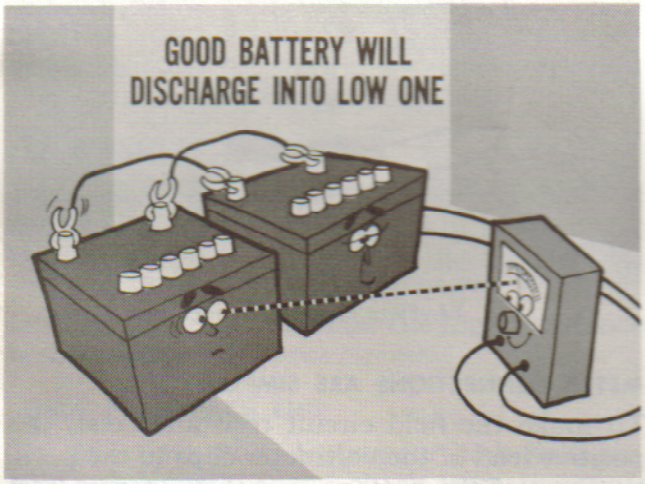


Fig. 9—Low battery must be disconnected

ONE BATTERY AT A TIME

Don't try to save time by clipping a good battery on with booster cables unless you disconnect the discharged or defective battery first. If the poor battery is not isolated, the good battery will discharge into the low one and drop the voltage. Besides, the voltage regulator will keep alternator output higher than we want for testing as it tries to charge the low battery.

FIELD CIRCUIT RESISTANCE TEST

If the battery is in good shape, the field circuit resistance is next. The field and charging circuits share a common path from the battery

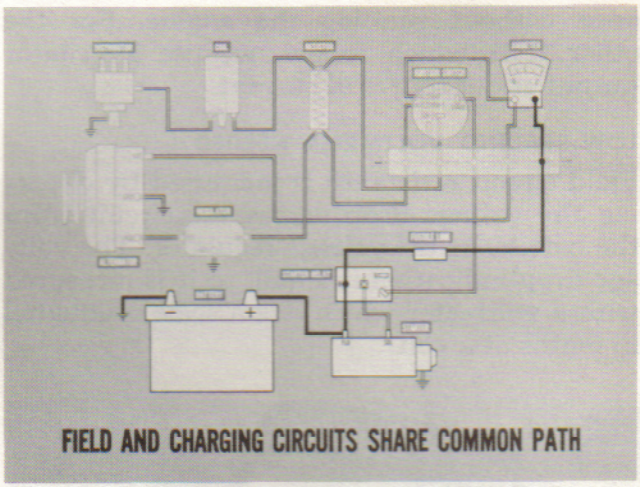


Fig. 10—Main feed goes to ammeter

to the junction terminal of the starter relay, and then on through the bulkhead connector to the ammeter. From the ammeter the two circuits are separate.

FIELD CIRCUIT SUPPLIES ROTOR CURRENT

The field circuit continues from the ammeter to the ignition switch. From there, it goes back through the bulkhead connector out to the voltage regulator. From the regulator it goes to the alternator field terminal, and internally, through the rotor windings and the alternator frame to ground.

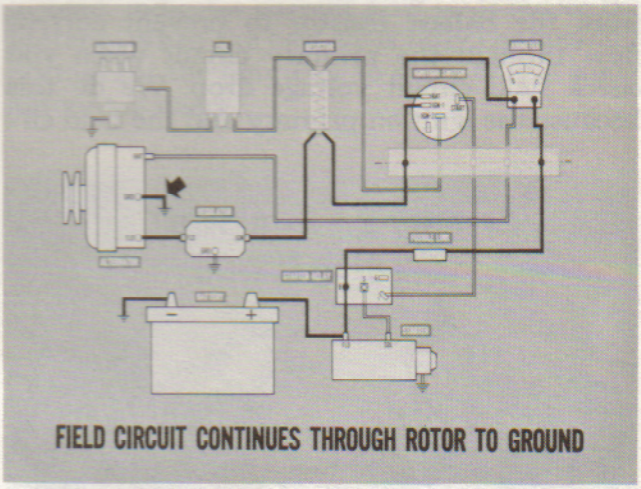


Fig. 11—Field circuit controls voltage

JUST SWITCH IT ON

Since current normally flows through the field circuit from the battery when the ignition switch is on, we can check the circuit resist-

ance without running the engine. For the other tests which follow, we use alternator output as our source of current.

LOW-READING VOLTMETER NEEDED

Field circuit resistance is measured by checking the voltage drop across the circuit from the battery to the voltage regulator. The voltage drop indication is small, so it is measured with a voltmeter which has a scale graduated in tenths of a volt.

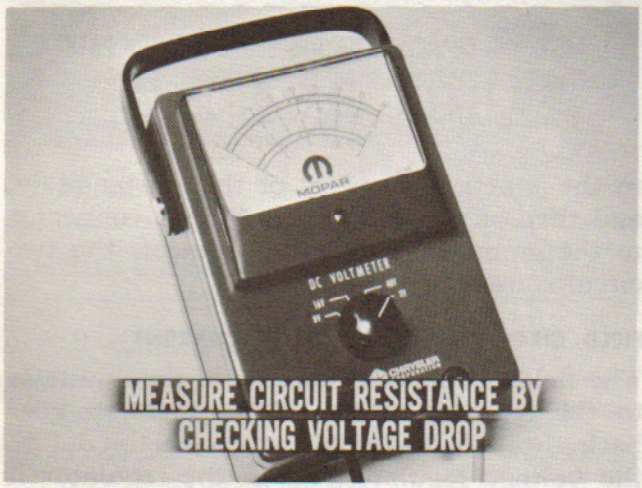


Fig. 12—Use low voltage scale for tests

CIRCUITS ARE IN PARALLEL

The primary ignition wire is disconnected from the ballast resistor to prevent current flow through the primary circuit when you check field circuit voltage drop. We do this because the ignition primary and the field circuits are in parallel when the ignition points are closed. This condition allows enough extra current flow to upset the field circuit resistance test.

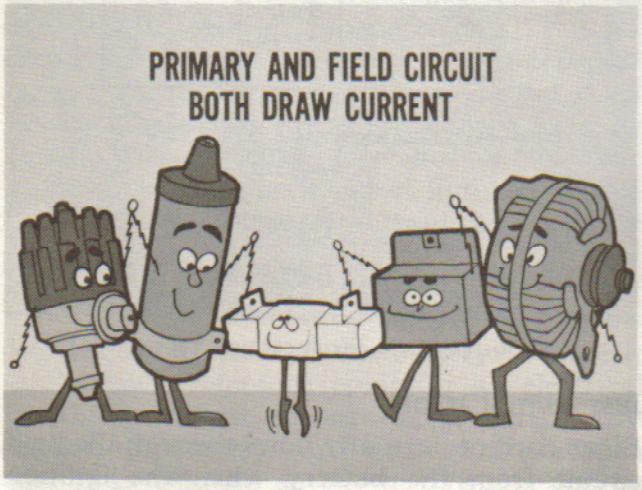


Fig. 13—Extra current heats field circuit

HEAT RAISES RESISTANCE

The extra current which flows in the parallel circuit heats the field circuit and increases its resistance enough to produce misleading voltage drop indications. In other words, the voltage drop specification is based on current flow through the field circuit alone, so if the flow in this circuit is higher than normal, the voltage drop indication will be off.

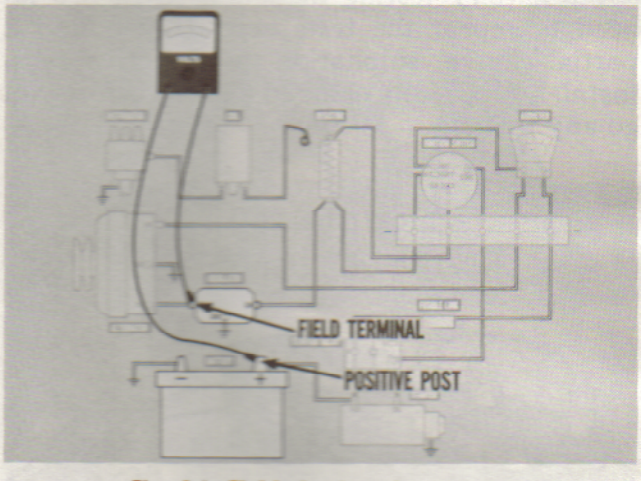


Fig. 14—Field circuit resistance test

METER CONNECTIONS ARE SIMPLE

To make the field circuit resistance test, the positive lead of the voltmeter clips to the positive post of the battery, and the negative lead goes to the field terminal of the voltage regulator. This hook-up does not check alternator rotor resistance, but we'll check that later as part of the Charging Circuit Test.

HIGH READING MEANS RESISTANCE

Make sure all lights and accessories are off and then, with the voltmeter connected for the test, turn on the ignition switch and check the meter indication. Overall field circuit voltage drop should not be higher than .55 of a volt. More drop than this indicates high resistance somewhere between the regulator field terminal and the battery.

CHECK EACH POINT

To locate points of high resistance, move the

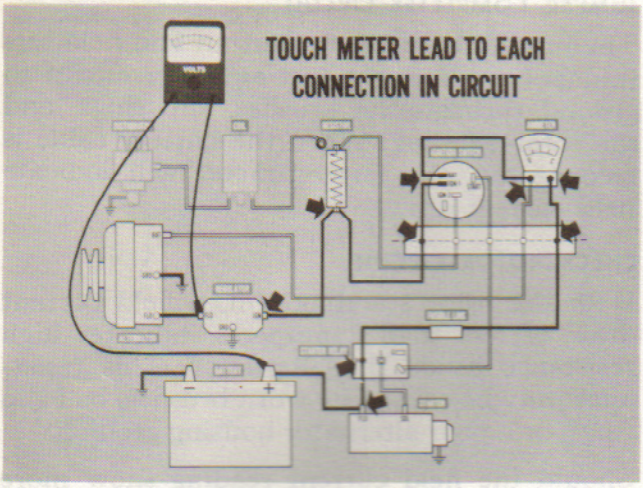


Fig. 15—Check for drop at connections

negative voltmeter lead from the regulator field terminal and touch it to the remaining connections in the field circuit. When you reach a point where the voltage indication drops sharply, the high resistance is between that terminal and the last point tested.

USE JUDGMENT IN CHECKING

Incidentally, voltage at the regulator ignition terminal is normally 0.1 to 0.2 of a volt lower than at the field terminal. If the drop at this point does not exceed 0.2 of a volt, the regulator is probably okay and the high resistance is somewhere else in the circuit.

CHECK FROM EACH END

To save time when testing for high field circuit resistance, you can check from the regulator to the bulkhead connector first, and then work backward from the battery to the starter relay. Any high resistance which remains after these points are checked out is in the bulkhead connector, or in the ammeter-ignition switch part of the circuit.

WATCH THE POINTER

Wiggle the wires and connectors while you watch the voltmeter. Pointer movement can mean that you've located a loose or dirty connection, or a broken wire. Don't overlook the possibility of poor connections in the bulkhead connector itself.

CHARGING CIRCUIT RESISTANCE TEST

If the field circuit resistance is okay, the

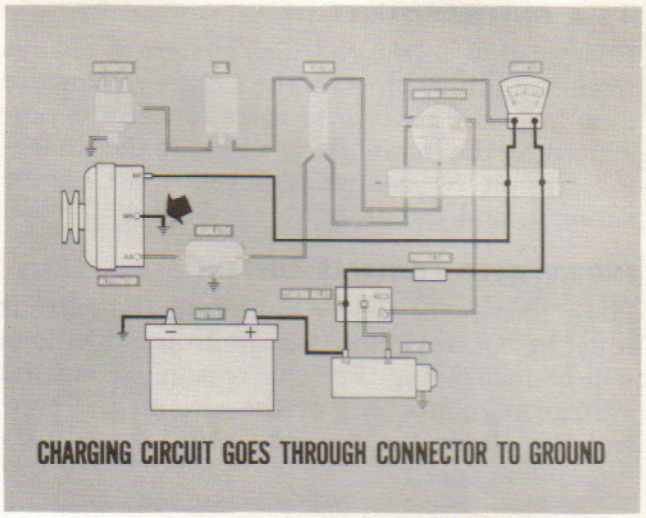


Fig. 16—Circuit feeds current to stator

Charging Circuit Resistance Test is next. As mentioned earlier, the field and charging circuits share a common path to the ammeter. But, from the ammeter, the charging circuit goes back through the bulkhead connector to the alternator output terminal, and internally through the alternator frame to ground.

AMMETER IS BATTERY INDICATOR

Since the ammeter was just mentioned, this is a good place to point out that the car ammeter does *not* indicate alternator output, but instead, indicates current flow in or out of the battery. When the battery is fully charged, it's normal for the ammeter to show only a slight amount of charge.

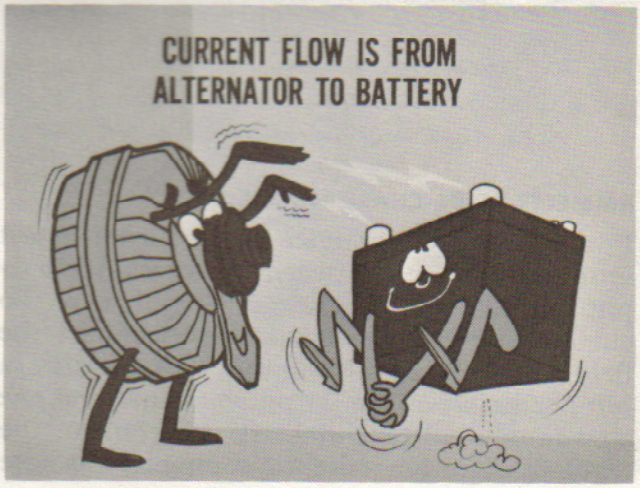


Fig. 17—Rectifiers prevent reverse flow

IT'S A ONE-WAY STREET

Current flow in the charging system is always from the alternator to the battery. Reverse flow from the battery to the alternator is prevented by the rectifiers, so we make the Charging Circuit Resistance Test with the engine running, and the alternator charging.

ENGINE SPEED CONTROLS CURRENT

Here, like in the field circuit test, the current must be controlled or voltage drop indications will be misleading. For this reason, we cut the voltage regulator out of the circuit and control the alternator current output by adjusting engine speed.

AN OUNCE OF PREVENTION

Since the entire charging circuit is hot, it's best to play it safe by disconnecting the battery ground cable before setting up for the circuit test. If the output terminal or its connecting wire is accidentally grounded, the charging system or test equipment can be badly damaged.

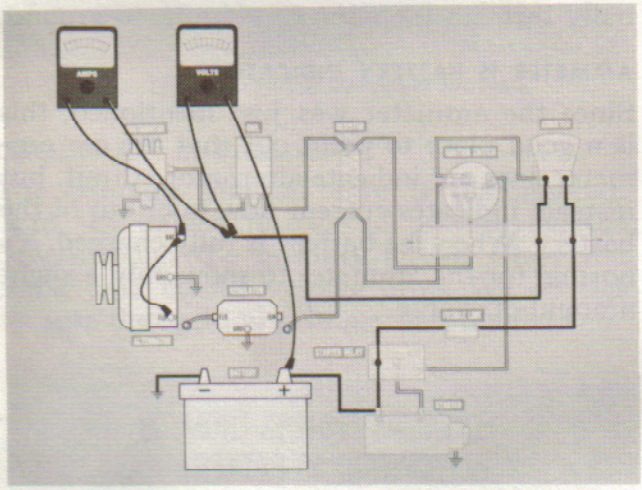


Fig. 18—Charging circuit resistance test

AMMETER IS IN CHARGING CIRCUIT

For the circuit resistance test, connect a test ammeter in series between the alternator output terminal and the charging circuit wire. To cut out the voltage regulator, disconnect the field wire at the alternator, and connect a jumper between the output terminal and the alternator field terminal. Also disconnect the regulator ignition wire to completely isolate the regulator.

JUMPER COMPLETES CIRCUIT

The jumper between the output and field terminals completes the test ammeter circuit to ground through the brushes, slip rings, and the rotor winding. When the battery cable is reconnected, the test ammeter will indicate field current draw.

CHECK ROTOR CIRCUIT

With the rotor standing still, a field current draw of less than 2 amperes indicates high resistance inside the alternator. This resistance may be caused by worn brushes, bad slip rings, or a poor alternator housing ground.

Should the field current reading show more than 3½ amperes, it probably means an internal short in the insulated brush lead, or a short in the rotor winding itself.

ADD VOLTMETER TO HOOK-UP

If the alternator field circuit resistance checks out, we can complete our charging circuit test hook-up. Connect the positive voltmeter lead to the charging circuit wire, along with the ammeter lead. Clip the negative voltmeter lead to the positive battery post.

ADJUST ENGINE SPEED

To make the test, start the engine and adjust the speed to get 10 amperes on the test meter. The voltage drop should not be more than 0.3 of a volt. If the drop is higher, all charging circuit connections must be checked in the manner described for the field circuit test.

CURRENT OUTPUT TEST

If resistance in both the field and the charging circuit is okay, the Current Output Test is next in the sequence. Here, the test specifications call for a specific current output at a specific engine speed.

READINGS ARE HIGHER

For the output test, we can use a voltmeter with a larger scale range than the low-reading type needed for the voltage drop tests. Here, the voltmeter is connected across the circuit from the charging circuit wire to a good ground. The test ammeter and the field jumper remain connected as in the previous test and the voltage regulator remains disconnected from the circuit.

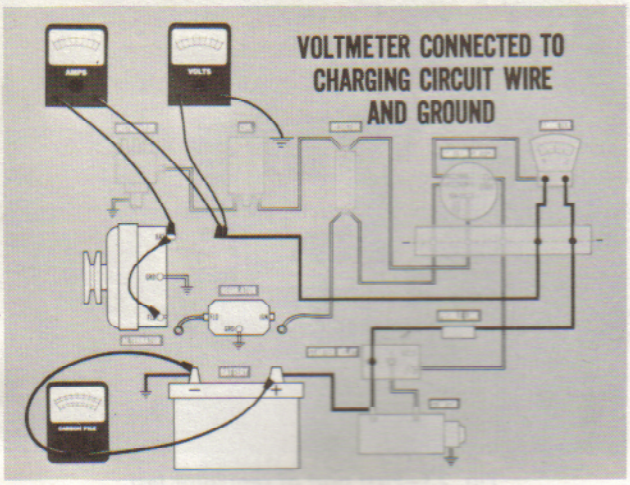


Fig. 19—Current output test

ADJUSTABLE LOAD NEEDED

Because the output current specification is based on holding the charging voltage at a specific point, we connect a carbon pile across the battery to provide an adjustable load so we can maintain the proper voltage.

HOLD SPEED AND VOLTAGE EXACTLY

Adjust engine speed to exactly 1250 rpm, and load the battery with the carbon pile to get exactly 15 volts on the voltmeter, then read the current output on the ammeter. Be sure to remove the load as soon as the test is finished to prevent needless battery discharge. If the current output is not within specs, the alternator must be removed for bench tests.

OUTPUT SPECIFICATIONS VARY

Engine speed and voltage specs are the same for all of our alternators, but the current output varies according to the model. Be sure to check the Service Manuals so you'll have the correct current output specs for the alternator under test.

VOLTAGE REGULATOR OPERATION TEST

If all the preceding test results are okay, you have eliminated the variables which can throw off the operation of the voltage regulator. For the Voltage Regulator Operation Test, first remove the field jumper and reconnect the regulator field wire to the alternator field terminal. Also reconnect the wire which was removed from the regulator ignition terminal to put the regulator back in the circuit.

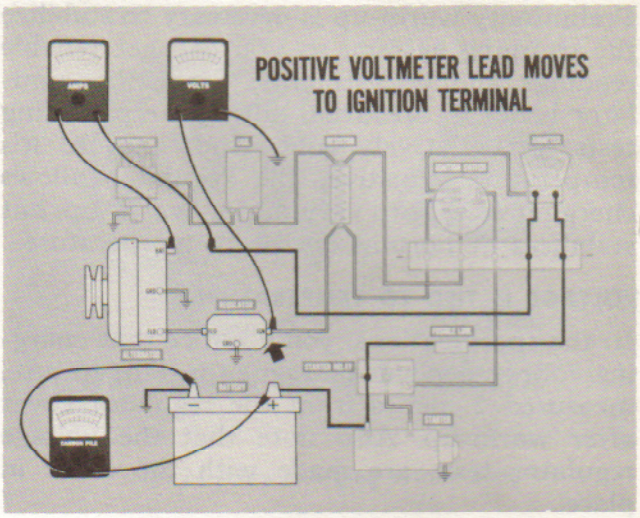


Fig. 20—Voltage regulator operation test

CHANGE VOLTMETER CONNECTION

The only change needed in the meter hook-up is to move the positive voltmeter lead from the charging circuit wire to the ignition terminal of the voltage regulator. The ammeter and carbon pile remain connected as in the Current Output Test, but the pile is turned off during the warm-up period before the regulator test is made.

WARM UP SYSTEM

Start the engine and again adjust the speed to 1250 rpm. Load the system by turning on lights or accessories until the test ammeter shows 15 amperes, and run the engine at least 15 minutes to warm up the charging system.

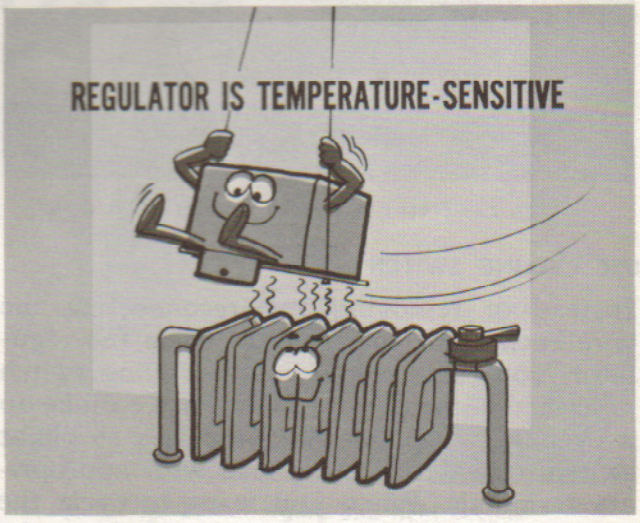


Fig. 21—Warm-up stabilizes regulator

REGULATOR MUST STABILIZE

Preliminary warm-up is necessary to stabilize the charging system, so you can get reliable readings and adjustments. Since the regulator is not in operation during the preceding tests, it's relatively cold. And, because it's temperature sensitive, the regulator allows charging voltage to vary during warm-up, but stabilizes at normal operating temperature.

VOLTAGE IS TIED TO TEMPERATURE

In the specifications, you'll notice that charging voltage depends on regulator temperature, measured 2 inches from the regulator cover *after* warm-up. Also note that the voltage regulator tests are made with the cover in place.

CYCLE BEFORE READING

Besides checking regulator temperature, the unit must be cycled before you take each test reading. Cycling simply means disconnecting the wire at the regulator ignition terminal to remove all residual magnetism in the regulator voltage coil so test indications will be accurate and consistent.

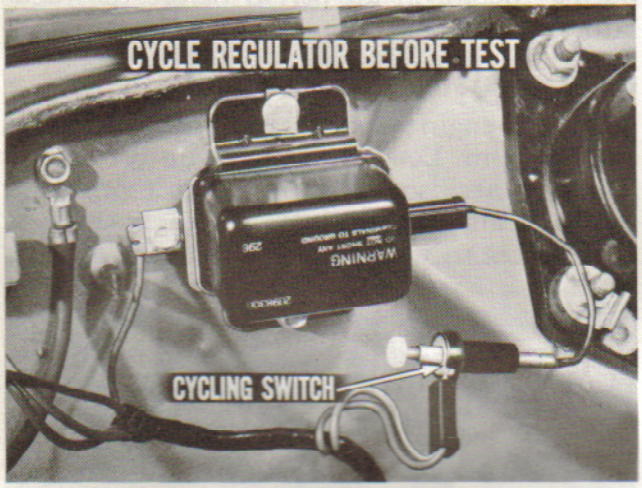


Fig. 22—Press and release plunger to cycle

USE CYCLING SWITCH

Instead of removing and reconnecting the wire each time you want to cycle the regulator, you can use the handy cycling switch described in the Service Manuals. To make up a cycling switch, all you need is a stoplight switch and a connecting lead with appropriate terminals. When you want to cycle the regulator, simply press and release the switch plunger. Don't forget to remove the cycling switch and reconnect the field wire when tests are completed.

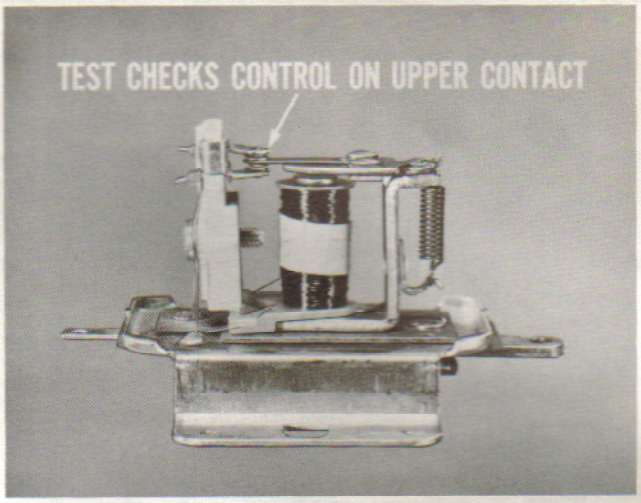


Fig. 23—First part of regulator test

CHECK UPPER CONTACT FIRST

The Voltage Regulator Operation Test is made in two steps. The first part of the test checks voltage control with the regulator operating on the upper contact. This is the normal condition when the charging system is carrying a high electrical load at relatively low speeds.

MAINTAIN SPEED AND LOAD

For the test, recheck engine speed to make sure it is at 1250 rpm, and adjust the carbon pile to maintain the specified 15 amps. Then check the charging voltage and the regulator temperature against the specifications.

TENSION CONTROLS VOLTAGE

If you find that the voltage is higher than the maximum specification, armature spring tension is probably too high. Adjust the spring as needed and be sure to replace the cover and cycle the regulator before retesting. In the opposite direction, when you find the voltage *below* the minimum specification, armature spring tension is most likely too low.

MOVE TO SECOND STEP

If the charging voltage indication is within spec limits, you can go on to the second part of the regulator test, operating on the lower

contact. For this part of the test, you raise engine speed to 2200 rpm, turn off the lights and accessories, and adjust the carbon pile load to reduce output from 15 to 7 amperes.

VOLTAGE RISE IS SLIGHT

After you cycle the regulator, the voltage should be at least 0.2 but not more than 0.7 of a volt higher than in the first test step. Where the voltage does not meet the specs for this test, you'll probably find the regulator air gap, or the point gap incorrect. If the test voltage is okay, the regulator is working properly and the testing job is finished.

VOLTAGE REGULATOR FUSIBLE WIRES

The upper-contact fuse wire in the voltage regulator protects the field circuit against a short to ground in the field wire to the alternator, or in the rotor portion of the circuit.

If there's no output in the first part of the voltage regulator test, the upper contact fuse wire may be burned out. When this fuse wire is open, it cuts out the part of the circuit that supplies high alternator field current to produce full output. However, when the output in the second part of the test is higher than the specs allow, the lower contact fuse wire may be open.

CHARGING SYSTEM TESTS—ELECTRONIC REGULATOR

System tests for the new insulated brush-type alternator and electronic voltage regulator are simpler and a bit different from the tests used with conventional systems. To point up the differences, first let's consider that in the conventional system with electro-mechanical voltage control, the regulator is series-connected in the field circuit between the insulated field brush of the alternator and the positive battery post. The grounded brush completes the field circuit to ground through the alternator frame.

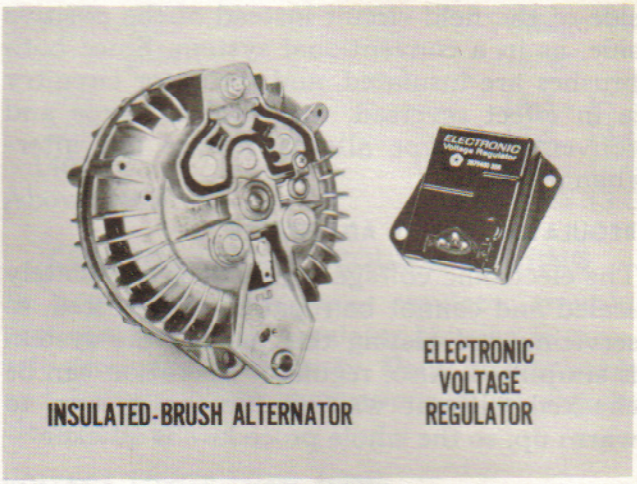


Fig. 24—New charging system units

BOTH BRUSHES ARE INSULATED

In the new insulated brush alternator, both brushes are insulated. The former ground brush is now an insulated positive brush which connects directly to the rectifier heat sink. In this case, the field current flows from the positive brush through the rotor winding and through the field brush to ground at the regulator. It means there is always a direct connection between the positive brush and the positive terminal of the battery.

CIRCUIT IS REVERSED

The new electronic voltage regulator is connected to the field brush, but here, this has become the ground side of the field circuit. In other words, the new regulator is still in series with the rotor, but it's in the negative

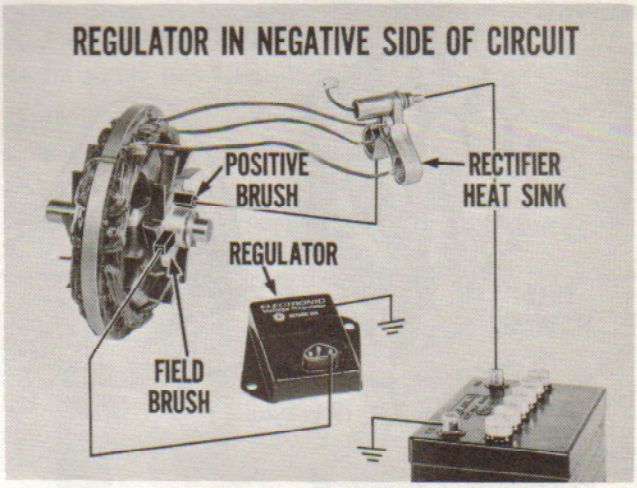


Fig. 25—Charging and field circuits

side of the field circuit instead of the positive side, as in a conventional system. Since both brushes are insulated, and the rotor circuitry is in effect reversed, the insulated-type and conventional-type alternators are not interchangeable.

REGULATOR IS NOT ADJUSTABLE

The electronic voltage regulator is completely sealed and cannot be repaired or adjusted, so servicing and testing this part of the system is simplified. Also, regulator operation can be checked without waiting for the system to warm up, so the whole procedure is quicker.

CHARGING CIRCUIT RESISTANCE AND CURRENT OUTPUT TESTS

For system testing, we essentially follow the same steps described for checking the conventional system but in a different sequence. The usual drive belt check and battery inspection should come first. The battery, of course, must be charged and in good condition.

CONNECT TEST METERS

(See Back Cover for Test Connections)

Next we check charging circuit resistance and test the current output. Before making test connections, disconnect the battery ground cable to protect the system and test equipment. Then, disconnect the charging circuit wire at the alternator output terminal and connect a 0-75-amp test ammeter between the terminal and the disconnected wire end.

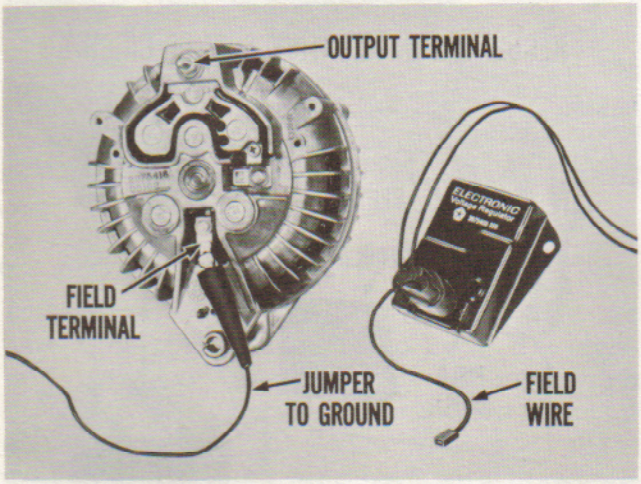


Fig. 26—Jumper completes circuit

The positive lead of our test voltmeter also connects to the end of the wire, while the negative lead goes to the positive terminal of the battery.

JUMPER GOES TO GROUND

As in checking circuit resistance and current output of a conventional system, the field wire is disconnected at the alternator so we can connect a jumper at the field terminal to bypass the voltage regulator. But here, because the rotor circuitry is reversed, the free end of the jumper connects to ground instead of to the alternator output terminal. Both tests are made at a specific speed and electrical load, so we use a tachometer and connect a carbon pile across the battery.

KEEP VOLTAGE DOWN

To check the charging circuit, reconnect the battery ground cable and start the engine. Be sure to reduce engine speed to idle immediately after starting, so charging voltage will not rise above 16. Adjust engine speed and the carbon pile to get 20 amps on the test ammeter and then check the voltmeter.

CHECK VOLTAGE DROP

The voltage drop indication should not be higher than 0.7 of a volt. When the drop is above this limit, clean and tighten all charging circuit connections, and if necessary, check the voltage drop at each connection. If circuit resistance is okay, reduce engine speed, turn off the carbon pile, and shut off the engine.

OUTPUT TEST CONNECTIONS

For the current output test, move the negative voltmeter lead from the battery terminal to a good ground. Also move the positive voltmeter lead from the charging circuit wire to the alternator output terminal.

CURRENT OUTPUT TEST

Start the engine and reduce the speed to idle. Next, adjust engine speed and the carbon pile in alternate steps until you get 1250 rpm at 15 volts, but do not exceed 16 volts at any time. Current output should be within the following limits:

Standard with 440 V-8 (Imperial only)	34.5±3 amps

Special Equipment, or Imperial with air conditioning	41.0±3 amps
Special Equipment	51.0±3 amps

When current output is below specs, the alternator must be removed for further testing. If the output checks out okay, reduce engine speed, turn off the carbon pile and stop the engine. Then disconnect the battery ground cable, both meters and the carbon pile. Finally, remove the jumper, replace the field wire, connect battery ground cable, and the test is finished.

VOLTAGE REGULATOR TEST

We only need a voltmeter, tachometer and thermometer for this test. As mentioned earlier, there is no need to warm up the system before testing, so the voltage readings can be taken without delay. The battery, of course, must be charged and in good condition so test indications will be dependable.

CONNECT VOLTMETER

To set up the regulator test, connect the voltmeter positive lead to the ignition terminal of the ballast resistor. This terminal has two blue wires, while the one at the opposite end has a brown and blue, or plain brown wire. The negative voltmeter lead goes to any good body ground. Also connect the tachometer in the usual manner.

REGULATOR OPERATION TEST

Voltage regulator operation is first checked with no load and then with a load on the electrical system, determined by the drop in battery charge caused by operating the starter.

No-Load Test: With the engine running at 1250 rpm, check the no-load voltage with all lights and accessories turned off.

Load Test: If the panel ammeter pointer moves less than ¼-scale toward charge, turn on the headlamp high beams and switch the heater blower on to the high setting. When the ammeter indication is higher than ¼-scale, you'll only need the heater blower load for the test.

The voltage regulator is working properly when the no-load and load voltages are within the following limits.

Temperature Near Regulator	Voltage Range
−20F	14.3 - 15.3
80F	13.8 - 14.4
140F	13.3 - 14.0
Above 140F	Less than 13.8

CONTROL CIRCUIT TROUBLESHOOTING

In any check for voltage regulator trouble, first make sure the regulator housing is properly grounded to the body. Body ground cable and battery cable connections must also be clean and tight.

VOLTAGE LOWER THAN LIMITS

Assuming that the alternator is working properly, turn off the ignition and then disconnect the voltage regulator connector for testing. With the ignition switch off, check for battery voltage at the terminals of the black and the green leads. Then, without starting the engine, turn on the ignition switch and check for voltage at the blue lead terminal.

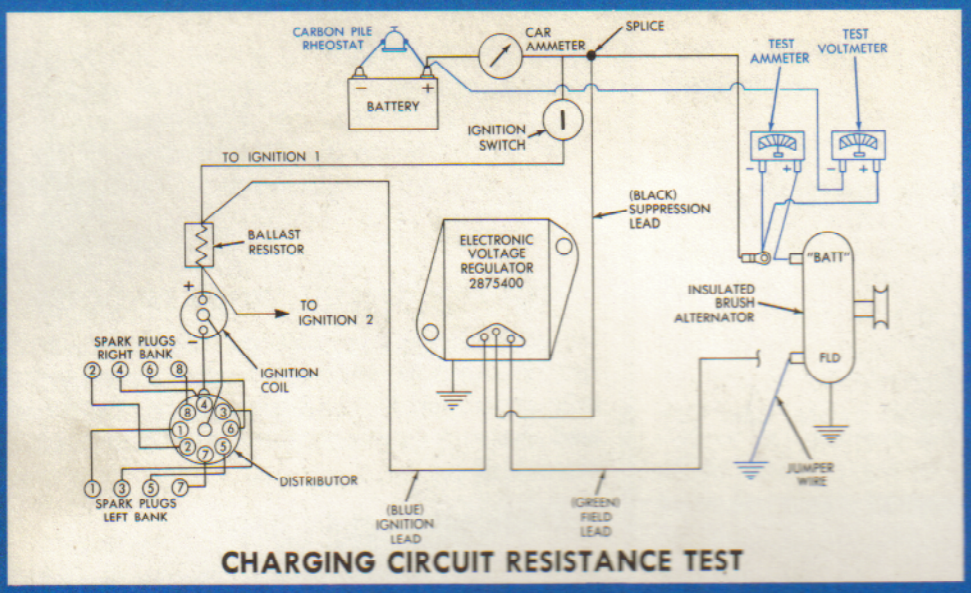
If there's no voltage at any of the three terminals, you'll have to check the circuit wiring. Be careful with the voltmeter probe so you won't distort the connector terminals. When the terminal voltages check out okay, install a new regulator and recheck the charging voltages.

VOLTAGE HIGHER THAN LIMITS

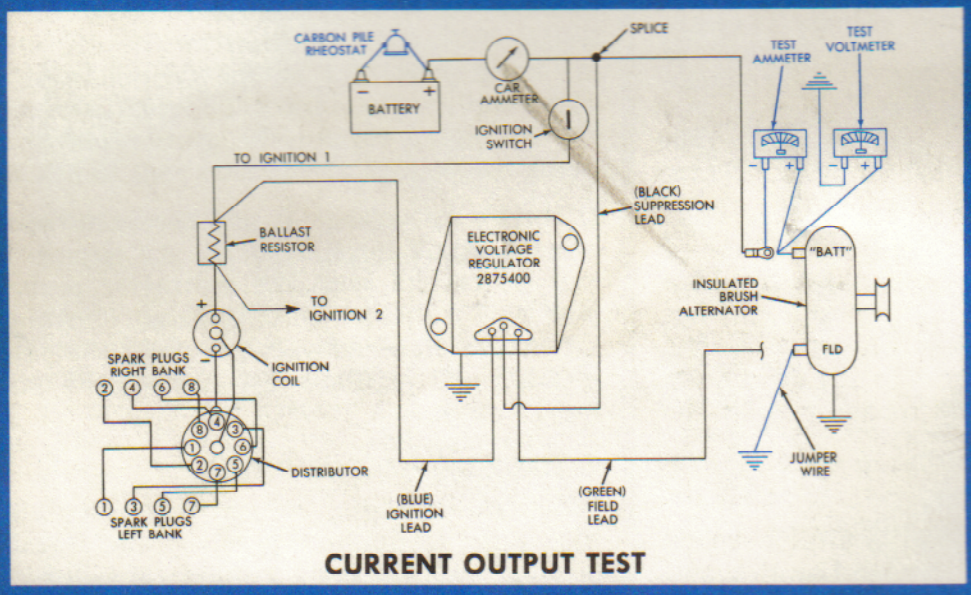
When the charging voltage is slightly above the limits, or fluctuating, check the regulator housing and the body ground cable for good grounding. Also clean the battery terminals and make sure the connections at the engine and starter are clean and tight.

If the test indication is more than 0.5 of a volt higher than the limits after checking ground and battery connections, install a new regulator and recheck the charging voltage.

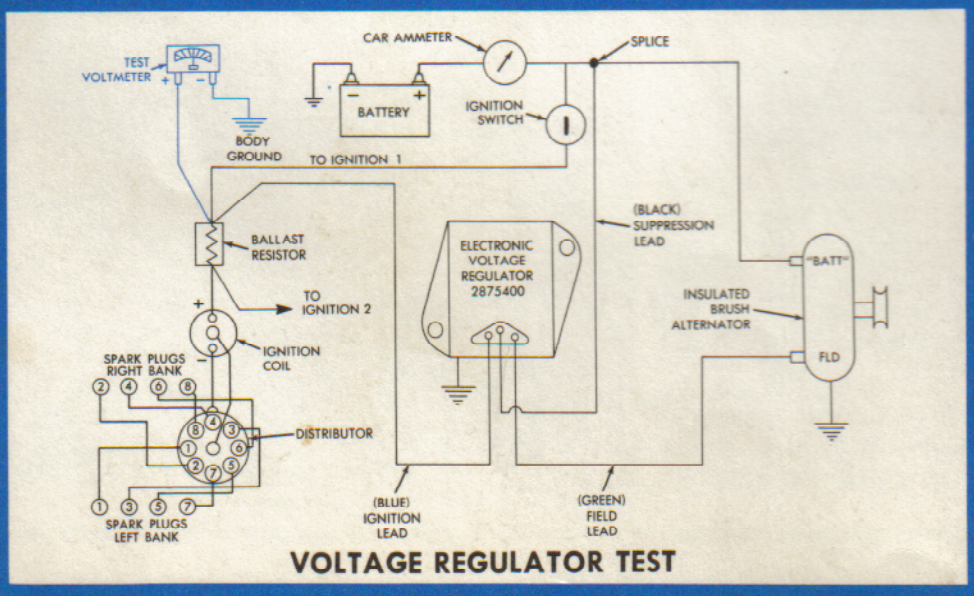
TEST CONNECTIONS—ELECTRONIC REGULATOR SYSTEM



CHARGING CIRCUIT RESISTANCE TEST



CURRENT OUTPUT TEST



VOLTAGE REGULATOR TEST

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