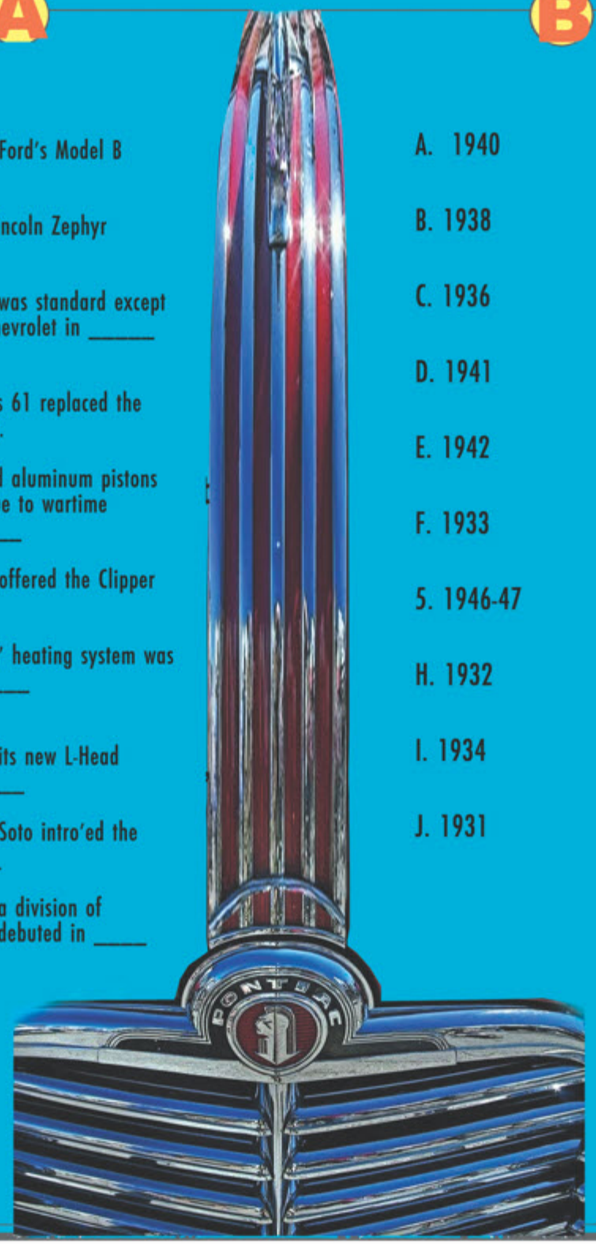
OLD CAR

MATCH GAME

(Answers on Page One)

	A	B
☐	1. Last year for Ford's Model B	A. 1940
☐	2. 1st year for Lincoln Zephyr	B. 1938
☐	3. Vacuum shift was standard except on all models Chevrolet in _____	C. 1936
☐	4. Cadillac Series 61 replaced the LaSalle this year.	D. 1941
☐	5. Buick replaced aluminum pistons with cast iron due to wartime shortages in _____	E. 1942
☐	6. Packard only offered the Clipper in _____	F. 1933
☐	7. "Weather Eye" heating system was introduced in _____	5. 1946-47
☐	8. Olds intro'ed its new L-Head straight 8 in _____	H. 1932
☐	9. Chrysler & DeSoto intro'ed the Airflow in _____	I. 1934
☐	10. Rockne was a division of Studebaker and debuted in _____	J. 1931

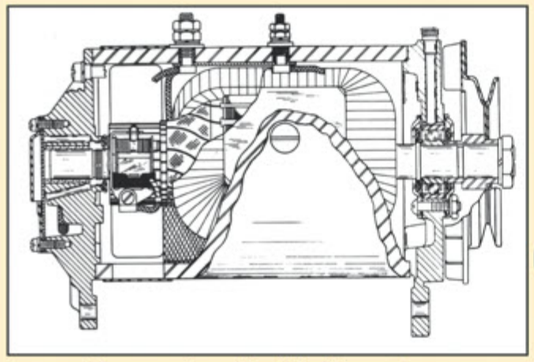


RESTORATION TIP
USE THE RIGHT OIL!

When changing oil in European cars, always check your manual. Many of these cars call for "European" oil that will be labeled on the front of the container. For instance, Mobil 1 European Car Formula.

DRIVING OLD CARS

1946-1954 Packard Generator/Regulator & Starter



Cross-section of Autolite Generator

by Bill Johnson — Publisher

Recently, I replaced my generator and voltage regulator on my 1951 Packard Mayfair Coupe. Unlike the gauges of the previous models, Packard introduced what used to be called "idiot lights." So when my Red GEN light came on, I knew I had to check it out. (See S/W Archives December 2024, online)

Now I'm going through my '46 Packard Custom Super 8 and the Amp gauge shows full charge *all the time*. I have driven the car quite a bit, and it overcharged the battery on my way back from Atlanta. Now it's time to thoroughly check it out. I have an original Packard manual with a good breakdown on what that entails. It covers the Autolite system Packard used in the '40's and Delco Remy used in 1951-54.

REGULATOR

The regulator consists of three units; the circuit breaker (cutout relay), a current regulator, and a voltage regulator mounted on the same base. Each unit must be tested individually in any check of the regulator.

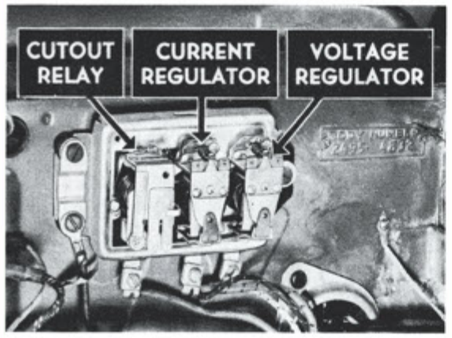


Figure 4—The Regulator with the Cover Removed

Circuit Breaker (Cutout Relay)

The circuit breaker is a magnetic switch permitting the generator to charge the battery and preventing the battery from discharging through the generator. It contains a set of contacts, one stationary, one mounted on the armature, and two windings, the voltage winding and the current winding. Its contacts are open when the generator is not operating.

Current Regulator

The current regulator is a magnetic switch employed to protect the generator from overloading by limiting the generator output to a safe level. The current regulator is mounted on the same base as the circuit breaker and voltage regulator, and all three units are enclosed by the same cover.

The Auto-Lite current regulator unit has two windings; the series winding and the reverse winding. It contains a set of contacts (one stationary and one mounted on the armature), which are normally closed when the current regulator is not operating.

The Delco-Remy current regulator unit has one winding of heavy wire, known as the series winding, which carries the full output of the generator. It contains a set of contacts (one stationary, one mounted on the armature), which are normally closed when the current regulator is not operating.

The Delco-Remy current regulator unit has a bi-metal hinge on the armature for thermostatic temperature control. This permits a somewhat higher generator output when the unit is cold, and causes the output to drop off as the temperature increases.

Voltage Regulator

The voltage regulator is a magnetic switch used to keep the voltage in the electrical system at a safe level. The Auto-Lite voltage regulator unit has one winding known as the *"voltage winding."* It contains a set of contacts (one stationary, one mounted on the armature), which are normally closed when the voltage regulator is not operating. The contacts are in series with the field circuit and the current regulator contacts.

The Delco-Remy voltage regulator unit has two windings; the current winding and the voltage winding. It contains a set of contacts (one stationary, one mounted on the armature), which are normally closed when the voltage regulator is not operating. The current winding is connected in series with the voltage regulator contacts and the current regulator contacts in the field circuit. The voltage winding carries full battery voltage at all times when the cutout relay contacts are closed.

The Auto-Lite voltage regulator is compensated for temperature variations through the use of a nickel-iron magnetic by-pass whereby a higher voltage is required to vibrate the contacts under cold operating conditions than is required under hot operating conditions.

Delco-Remy voltage regulators are compensated for temperature by means of a bi-metal thermostatic hinge on the armature. The bi-metal hinge will automatically regulate to a higher voltage when cold, and a lower voltage when hot. This is necessary, as it requires a higher voltage to charge a battery that is cold.

Either the voltage regulator or the current regulator of a three unit regulator can operate at any one time, but *never* operate at the *same time*. When the battery is low or the current requirements of the electrical system are great, the *current* regulator *operates* to protect the generator against excessive output due to overload. When the load on the electrical system is great, the voltage drops; thus, the voltage regulator *does not* operate. When the battery is fully charged the voltage regulator *operates* to maintain a safe voltage level. The generator output drops, thus, the current regulator *does not* operate.

Regulator Checks and Adjustments

Inasmuch as the three units of the regulator are mounted on the same base under the same cover, it is advisable to test each unit in any check of the regulator.

Circuit Breaker

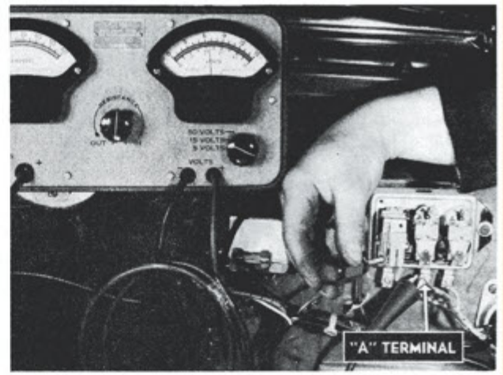


Figure 5—Setting the Cutout Relay Closing Voltage on a Delco-Remy Regulator

To check the closing voltage of the circuit breaker, connect a voltmeter (0 to 15 volt scale, 1/10 volt graduations) from the "A" terminal of the regulator to ground.

Slowly increase the generator speed and note the reading on the voltmeter the instant the contacts close. The closing voltage should be 6.5 to 7.0 volts.

To adjust the circuit breaker closing voltage on Auto-Lite regulators, bend the lower spring hanger (the one nearest the base of the regulator) toward the regulator base to increase the closing voltage; bend up to decrease the setting.

On Delco-Remy regulators, adjust the cutout relay closing voltage by turning the adjusting screw clockwise to increase the setting and counterclockwise to decrease the setting. Recheck the setting by slowing the generator until the contacts open and slowly increase the generator speed. Note the voltage at which the contacts close. Repeat this procedure if necessary.

Current Regulator

Next check the current regulator setting. Disconnect the lead at "B" terminal and connect an ammeter (0 — 50 ampere scale) into the charging circuit at the regulator "B" terminal. During this test, the voltage regulator must not operate if an accurate setting is to be made. To keep the voltage regulator from operating, connect a short jumper lead with two clips across the

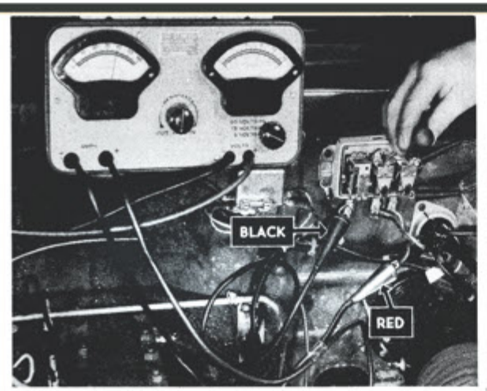


Figure 6—Adjusting the Current Regulator Setting on a Delco-Remy Regulator

voltage regulator contacts.

With the regulator at operating temperature, turn on the lights and accessories to prevent the battery from overcharging. Operate the generator at medium speeds and observe the reading of the ammeter. The maximum current regulator setting is 39 to 41 amperes.

To adjust the current regulator setting on Auto-Lite regulators, bend the lower spring hanger toward the base to increase the setting. Bend up to decrease the setting.

On Delco-Remy regulators, turn the adjusting screw clockwise to increase the setting, and counterclockwise to decrease the setting.

After each change of setting, to check the adjustment:

(a) Replace the regulator cover.

(b) Cycle generator by reducing the speed until the circuit breaker contacts open and then bring the generator speed up as required.

(c) Make sure the regulator is at operating temperature.

(d) When completed, remove the jumper from the voltage regulator.

Voltage Regulator Setting

There are two methods for accurately checking the voltage regulator. The fixed resistance and the variable resistance method.

Fixed Resistance Method

Disconnect the lead at the regulator "B" terminal. Connect a ¾ ohm resistance and a (0 to 10 volt scale) voltmeter from the "B" terminal to the regulator base.

Operate the generator at medium speed and observe the voltmeter reading. Voltage regulator should be set at 7.2 to 7.4 volts. In making the voltage regulator

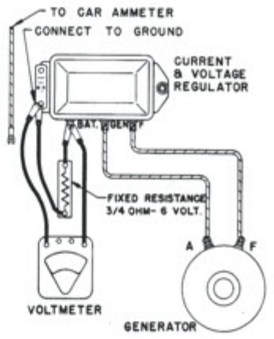


Figure 7—Connection for Setting Voltage Regulator (Fixed Resistance Method)

check, the regulator must be at operating temperature, the regulator cover must be in place, and the generator must be operating at medium speed when the voltage reading is taken.

Variable Resistance Method

To check the voltage regulator setting by the variable resistance method, a ¼ to 1 ohm variable resistance, an ammeter, and a voltmeter are used. Any good combination testing instrument which includes these units may be used.

Disconnect the lead at the "B" terminal of the regulator. Connect the ammeter and variable resistance *in series* into the charging circuit, at the "B" terminal of the regulator. Connect the voltmeter from the "A" terminal to the regulator base.

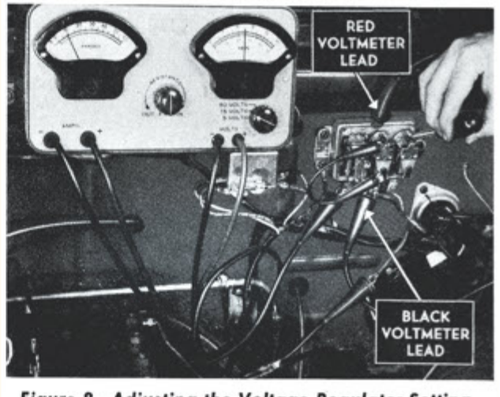


Figure 8—Adjusting the Voltage Regulator Setting (Variable Resistance Method)

Operate the generator at medium speed. If less than 8 amperes are produced, adjust the variable resistance unit until the generator output is adjusted to 8 to 10 amperes, and then after cycling generator, observe the operating voltage.

Be sure the regulator cover is in place, that the regulator is at operating temperature, and that 8 to 10 amperes are flowing in the line.

Adjust the voltage regulator to 7.2 to 7.4 volts on Auto-Lite regulators by bending the lower spring hanger toward the base to increase the setting. Bend the hanger up to reduce the setting. On Delco-Remy regulators, turn the adjusting screw clockwise to increase the voltage setting and counterclockwise to decrease the setting.

After each change of setting, to recheck the adjustment:

(a) Replace the regulator cover.

(b) Cycle the generator by reducing the speed until the circuit breaker contacts open and then bring the generator to medium speed.

(c) Make sure the regulator is at operating temperature.

(d) Readjust the variable resistance to return the current to 8 to 10 amperes. Remove the test instruments and connect the lead at "B" terminal.

Note: Adjustment should be confined to bending the lower spring hanger only. If the regulator is faulty or badly out of adjustment, so that an accurate adjustment cannot be obtained, the regulator should be replaced with the same type and model unit.

Regulator Service

One of the most important operations the Packard serviceman may be called on to perform is the cleaning of the regulator contacts and making the mechanical adjustments. Extreme care should be exercised during this operation.

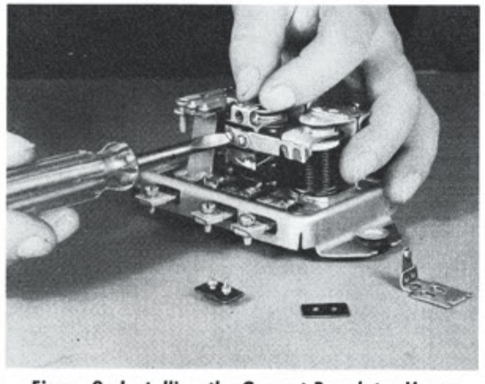


Figure 9—Installing the Current Regulator Upper Contact Bracket (Delco-Remy)

The contacts should be cleaned, one at a time, with a riffler or spoon file. A flat file cannot successfully be used to clean flat contacts, as it will not clean out the slight cavity formed in the contact surface during normal operation.

Emery cloth or sandpaper should never be used to clean contacts, as the embedding of sand or emery particles in the contacts would prevent normal operation.

The current regulator and voltage regulator contacts may be cleaned by removing the upper contact brackets. Clean the stationary contacts in the upper contact bracket and the contact in the armature. After all oxidation and corrosion has been removed from the contacts, they may be reassembled very carefully. Be sure that all insulators are in place and that they are not cracked or burned. Note that the connector strap is connected to the voltage regulator frame while it is insulated from the current regulator frame.

The circuit breaker contacts may be cleaned without removing. After the contacts have been cleaned, the air gaps must be adjusted and the contacts must have a minimum gap as follows:

MECHANICAL ADJUSTMENTS (AUTO-LITE)

Circuit Breaker

Air Gap: The air gap should be .034" to .038" and is measured between the armature and the core with

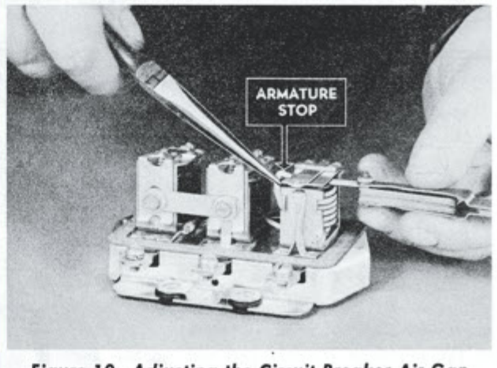


Figure 10—Adjusting the Circuit Breaker Air Gap (Auto-Lite)

the contacts open. Adjust the air gap by bending the armature stop as shown in figure 10.

Contact Point Gap: Contact point gap must be a minimum of .015" and is adjusted by expanding or contracting the bridge supporting the stationary contact.

CONTINUED

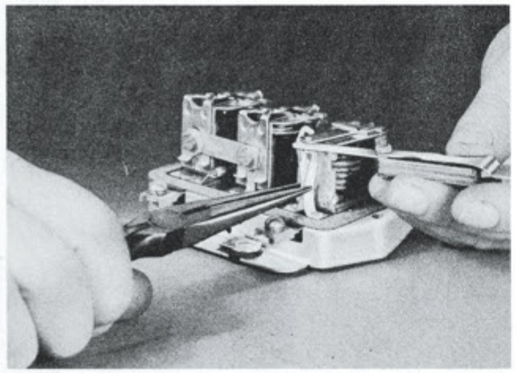


Figure 11—Adjusting the Circuit Breaker Contact Gap (Auto-Lite)

Current and Voltage Regulator Units

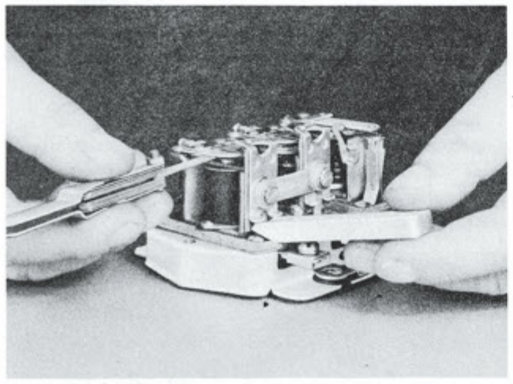


Figure 12—Adjusting the Voltage Regulator Air Gap (Auto-Lite)

Air Gap: The air gap should be .048" to .052" and is measured between the armature and core next to the residual pin with the contacts closed. Adjust by loosening the upper contact bracket mounting screws and raising or lowering the bracket as needed. Tighten the mounting screw, making sure that the contacts are aligned.

Contact Point Gap: With the air gap correctly set, the contact point gap should be a minimum of .012" with the armature held down against the residual pin.

MECHANICAL ADJUSTMENTS (DELCO-REMY)

Cutout Relay (Circuit Breaker)

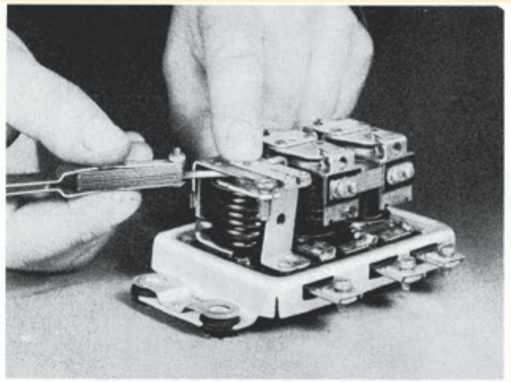


Figure 13—Measuring the Cutout Relay Air Gap (Delco-Remy)

Air Gap: The air gap should be .075" and is measured between the armature and the winding core with the contacts held closed. To adjust the air gap, loosen the two adjusting screws and raise or lower the upper contact bracket as required. Tighten the attaching screws.

Contact Point Opening: The contact point opening should measure .020" and is adjusted by bending the upper armature stop.

Current Regulator

Air Gap: The air gap should be .080" and is measured between the armature and the winding core with the contact points just touching. To adjust the air gap, loosen the two contact mounting screws and raise or lower the upper contact bracket as required. Tighten the mounting screws.

Voltage Regulator

Air Gap: The air gap should be .075" and is measured between the armature and the winding core with

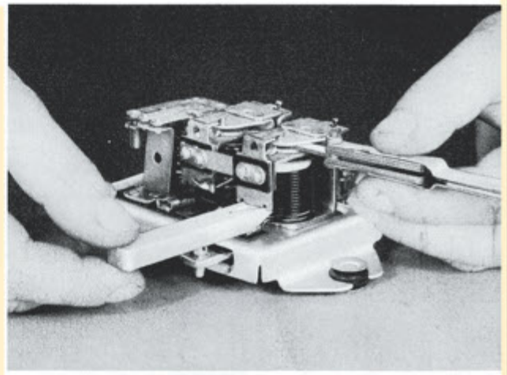


Figure 14—Adjusting the Voltage Regulator Air Gap (Delco-Remy)

the contact points just touching. To adjust the air gap, loosen the two contact mounting screws and raise or lower the upper contact bracket as required. Tighten the mounting screws.

The electrical adjustments may now be made on a test stand or after the regulator is installed on the car as previously explained.

Regulator Exchange Plan

Packard has worked out an exchange plan which enables the Packard serviceman to replace regulators quickly and economically when replacement is advisable, or where necessary material and testing equipment is not available for servicing regulators.

After any check or adjustment of the regulator, always polarize the generator correctly by momentarily connecting a jumper lead between the "A" and the "B" terminals of the regulator. This allows a momentary surge of current to flow to the generator, which will correctly polarize the fields.

Generator Inspection and Tests

The checks on the regulator provide a check on the generator too, since the generator has to produce the output required to operate the current regulator. Nevertheless, the generator must pass additional tests before it can be considered to be in first-class condition. Because of the danger of burning out the armature, do not operate the generator on open circuit above 1500 rpm, or for more than a few minutes at any speed.

Remove the cover band and inspect it for thrown solder. Thrown solder indicates the generator has been overheated, probably from excessive output. With this condition, the generator should be removed and disassembled so that the armature can be tested, resoldered, turned down, and mica undercut. Test the armature in a growler for possible short circuits.

GENERATOR

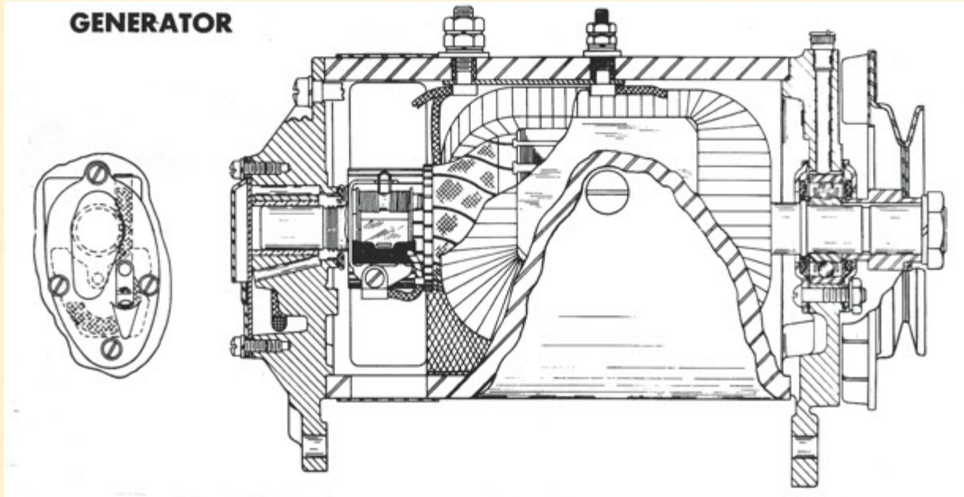


Figure 15—Cross Section of the Auto-Lite Generator

Two makes of generators are used on the 24th Series Packard cars: Delco-Remy 1102745 and Auto-Lite GGW-6003-A. Both generators are shunt wound, two-pole type, with clockwise rotation at the drive end.

Generator Test Specifications

Generator Make	**Delco-Remy**	**Auto-Lite**
Model	**1102745**	**GGW-6003-A**
Maximum Output @ 8 volts	**40 Amperes**	**40 Amperes**
Field Current Amperes	**1.90—2.05**	**1.6—1.8**
Brush Spring Tension	**24—28 oz.**	**35—53 oz.**

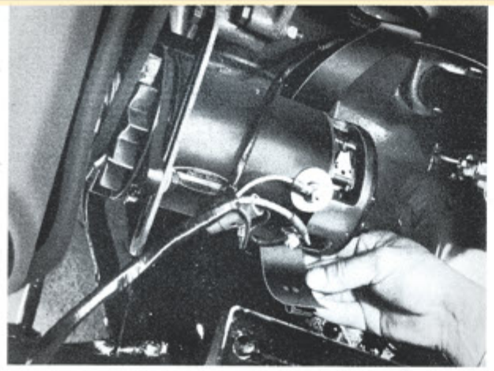


Figure 16—Inspecting the Generator and Cover Band for Thrown Solder

The current regulator should then be checked after the generator is assembled and reinstalled on the car to make sure it is not set too high, causing the generator to be overloaded.

Generator Service

Check the generator brushes for wear and make sure they are not sticking in the holders. They must make good, clean contact with the commutator. If the brushes are worn shorter than half their original length, they should be replaced. Be sure the brush screws, brush leads, and field leads are tight. Examine the commutator for wear, roughness, out of round, and high mica.

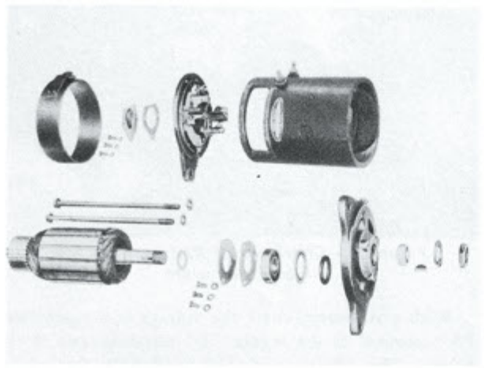


Figure 17—A Disassembled Generator

If any of these conditions exist, the generator must be removed and disassembled so that the commutator can be turned down in a lathe. Undercut the mica after turning down the commutator. Test the armature in a growler for possible shorts. Test the armature for open windings.

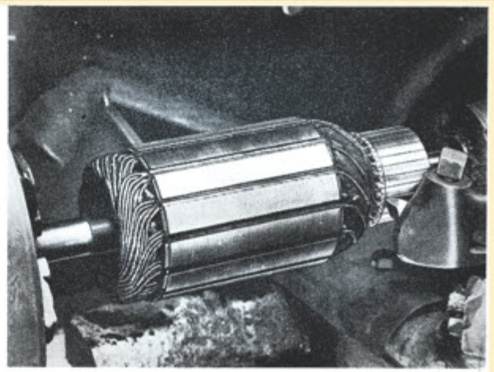


Figure 18—Turning the Armature Commutator in a Lathe

Test the field windings for shorts, using a 6 volt battery and an ammeter, connected in series with the field winding. If the current draw exceeds 1.9 amperes, the fields are shorted. If the draw is less than 1.6 amperes, there is high resistance in the fields.

Replace the field windings if the test results do not come within the specifications for that particular make, model, and type generator.

Clean the generator drive end, field frame, commutator end, and brush holders. *Do not soak the field frame and windings in a solvent cleaner.* On reassembly, check the generator bearings for wear and tightness by noting side play and freeness of rotation. Tight or worn bearings should be cleaned or replaced.

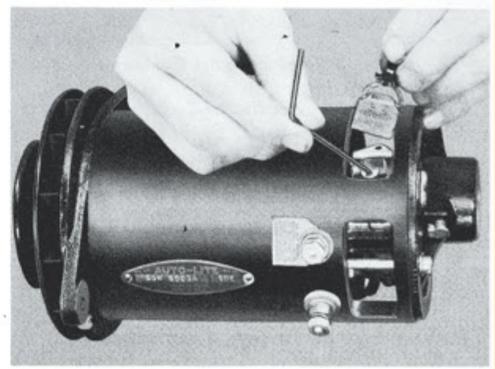


Figure 19—Installing New Generator Brushes

Install new brushes and seat them by placing a strip of #00 sandpaper between the brushes and commutator, with the abrasive side toward the brushes, and rotate the commutator with the sandpaper to seat the brushes. Remove the sandpaper and blow out the abrasive dust with compressed air.

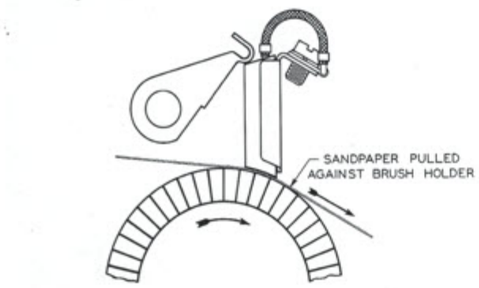


Figure 20—A Method of Seating Generator Brushes

Install the cover band and add 8 to 10 drops of oil to the oilers on the generator. The generator is now ready to install.

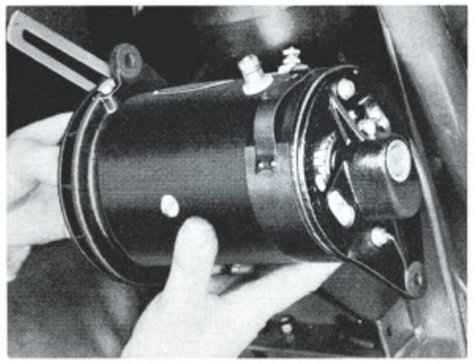


Figure 21—Installing the Generator

After the generator is installed, check the fan belt and replace it if it is worn. Tighten the belt to the proper tension. Connect the armature and field leads to their proper terminals on the generator.

Caution: Be sure to connect the radio condenser to the armature.

Never connect it to the field terminal.

If the commutator is only slightly worn, dirty, or glazed, it will not be necessary to turn it down in a lathe. In this case, hold a strip of #00 sandpaper or a brush seating stone against the commutator with the generator in operation, moving it back and forth across the area contacted by the brushes. This will remove the glaze and dirt from the commutators.

Caution: Never use emery cloth to clean commutator, as particles of emery will embed and cause arcing, burning, and rapid wear of the brushes and commutator.

Resistance in the Electrical System

Even though the generator, regulator, and battery may all be in good condition, trouble may still exist due to excessive resistance in the circuits between these units.

Excessive resistance caused by loose, dirty, and poor connections or defective leads, tends to prevent sufficient current from reaching the battery. This, of course, will not permit the battery to charge, leaving the battery in a run-down condition. In fact, authorities say that more than 80% of all automobile electrical troubles are caused by bad connections and defective leads. This is true, in spite of the ease with which these conditions can be located and corrected.

To check for high resistance in these circuits, temporarily ground the "F" terminal of the regulator with a jumper lead so that the voltage regulator and current regulator will not operate.

Disconnect the battery lead at the "B" terminal of the regulator and connect a test ammeter into he circuit. Slowly increase the generator speed until 20 amperes are flowing from the generator to the battery. Do *not* turn on the lights or other electrical accessories.

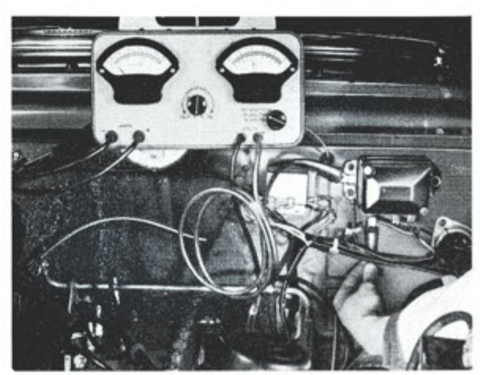


Figure 22—Checking for Resistance in the Electrical System

With a voltmeter, check the voltage at the generator "A" terminal at the regular "B" terminal, and at the battery. The difference of these readings is the voltage drop due to resistance. Although all circuits have some resistance, any drop of voltage over ¾ volt with 20 amperes flowing in the circuit indicates excessive resistance in that circuit which must be located and corrected.

Check all the leads and connections between the battery, the regulator, and the generator. Clean and tighten the connections, replace any leads that are frayed, have

broken strands or are otherwise defective, to eliminate the resistance.

Obviously, with electrical troubles the starting motor will not operate properly. This simple test will tell you whether this condition is due to battery, cables, or the starting motor. Turn on the headlights, attempt to operate the starting motor, and watch the lights. If the lights go out when the starter switch is closed, check for a bad connection or a faulty cable between the battery and the starting motor.

If the lights dim considerably, but do not go out, check for a run-down battery. Mechanical trouble in the starting motor or the car engine itself may be causing an excessive draw on the battery.

If the lights stay bright and there is no action in the starting motor, check the starting motor switch and brushes for an open circuit. These quick checks give an indication of the trouble and its location, but a further and more complete check must be made to diagnose the trouble correctly.

STARTING MOTOR

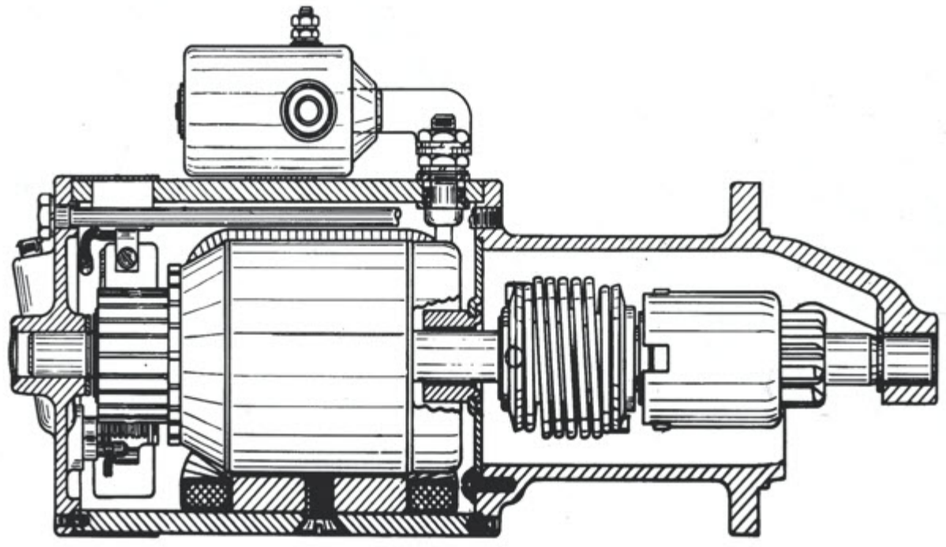


Figure 23—Cross Section of the Delco-Remy Starting Motor

Starting Motor Specifications

Starting Motor Make	Delco-Remy	Auto-Lite	Auto-Lite
Model	1107943	MCL-6113	MCL-6114
Stalled Torque Ft. Lbs.	16	25	25
Running Free Amps.	65	65	65
Cranking Engine Amps.	175-225	175-225	175-225
Brush Spring Tension	24-28 oz.	42-53 oz.	42-53 oz.
Starter Drive	Bendix	Bendix	Over-running Clutch

Description

Two makes and three types of starting motors are used on the 24th Series Packard cars: The Delco-Remy 1107943 and Auto-Lite MCL-6113 are both a two-pole, four-brush type, and are equipped with Bendix Drive type engaging mechanism. The Auto-Lite MCL-6114 is similar to the MCL-6113, except it is equipped with an over-running clutch type engaging mechanism.

The starting motor is operated by a magnetic solenoid switch mounted on top of the starting motor. The solenoid switch is controlled by a starting switch incorporated in the carburetor throttle body, which is actuated by the throttle shaft.

Starting Motor Inspection and Tests

To check the starting motor, remove the cover band and examine it for thrown solder and burned commutator riser bars caused by overheating as a result of excessive long periods of operation.

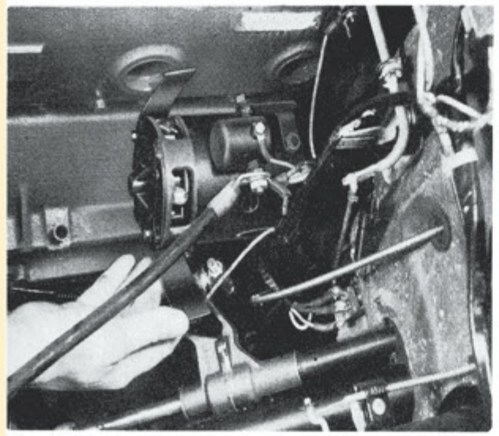


Figure 24—Inspecting the Starting Motor

Note: A starting motor must *never* be operated for more than thirty seconds at a time. Overload and excessive periods of operation may seriously damage the starting motor by overheating.

A small amount of dirt or a slight glaze can be removed from the commutator without removing the starting motor from the car by holding a strip of #00 sandpaper or a brush seating stone against the commutator while the starting motor is operated without cranking the engine.

Starting Motor Service

If the commutator is burned, rough, out of round, or has high mica, the starting motor should be removed and disassembled so that the commutator can be turned down and mica undercut. If burned riser bars or thrown solder is noticed, the starting motor should be removed and disassembled so that the armature may be serviced.

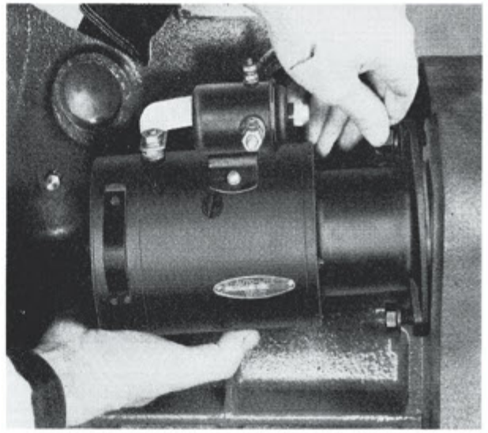


Figure 25—Removing the Starting Motor

Caution: Do not soak field frame and winding or the armature in a solvent cleaner.

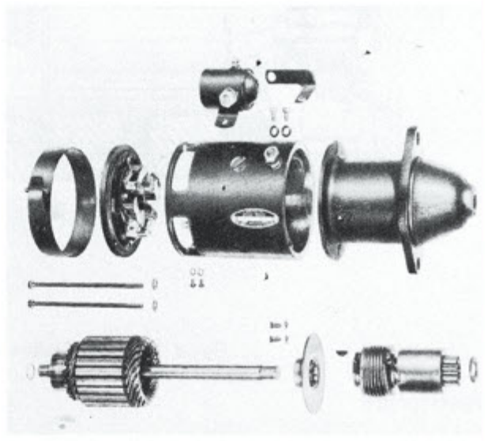


Figure 26—A Disassembled Starting Motor

After the starting motor is disassembled and cleaned, service the armature as follows:

Carefully resolder the commutator connections at the riser bars, using rosin flux solder. Turn the commutator down in a lathe and undercut the mica to a depth of about .030".

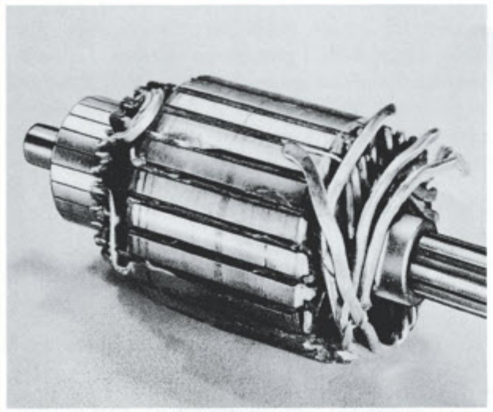


Figure 27—Thrown Armature Windings as the Result of a Faulty Starter Switch

Figure 28—Installing Starter Motor Brushes

Thrown armature windings, as shown in figure 27, may result from a faulty starter switch on the carburetor, a faulty starter solenoid, or a faulty over-running clutch. Carefully inspect the operation of the starter switch and the solenoid, whenever the starting motor is serviced.

Broken Bendix housings, broken or wrapped-up Bendix-Drive springs, will result if the driver depresses the starter switch during the "rock-back" of the engine, after it starts and stops again. Faulty or out-of-adjustment "car-starter" switch on the carburetor can also cause the condition.

As a precaution against such failure, the driver should pause a few seconds after a false start, before depressing the accelerator again to make sure the engine is completely at rest before the starting motor drive is engaged again. Engine backfire may also cause this failure. If this condition is caused by engine backfire, the ignition timing should be checked.

On reassembly, examine the brush holders for cracked insulators and loose rivets. Check the freeness of the brushes in their holders. Install new brushes if they are worn in excess of half their original length. The brush spring tension should be within specification limits to insure good, firm contact of the brushes against the commutator. Replace any parts that do not meet the specification requirements.

Check the solenoid to make sure that it operates satisfactorily. Add 8 to 10 drops of engine oil to the hinge cap oiler every 1,000 miles. Do not over-oil, as the oil would get on the commutator where it would gum and reduce the starting motor efficiency.

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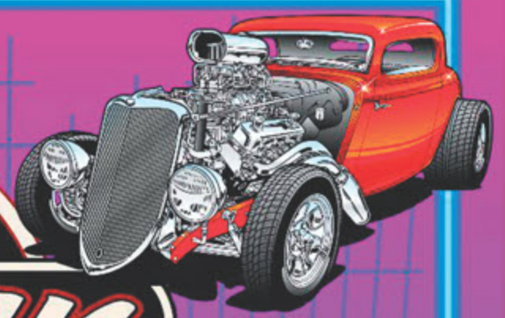

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