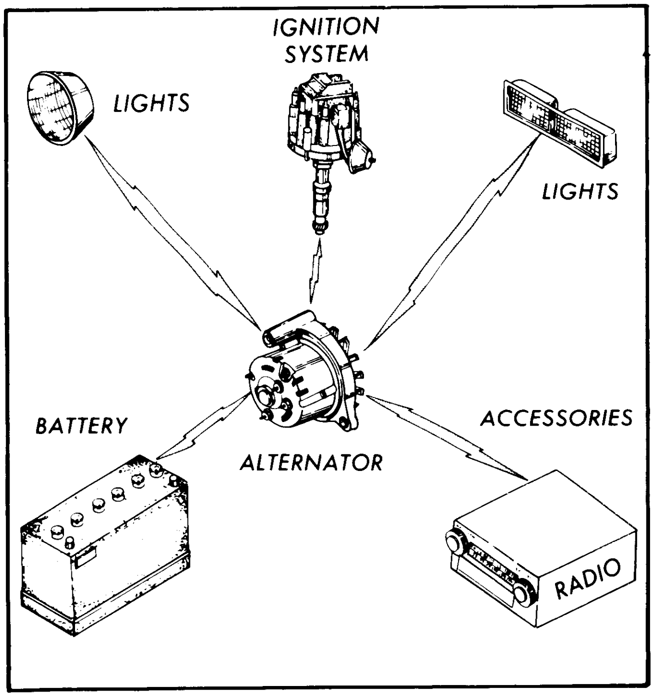
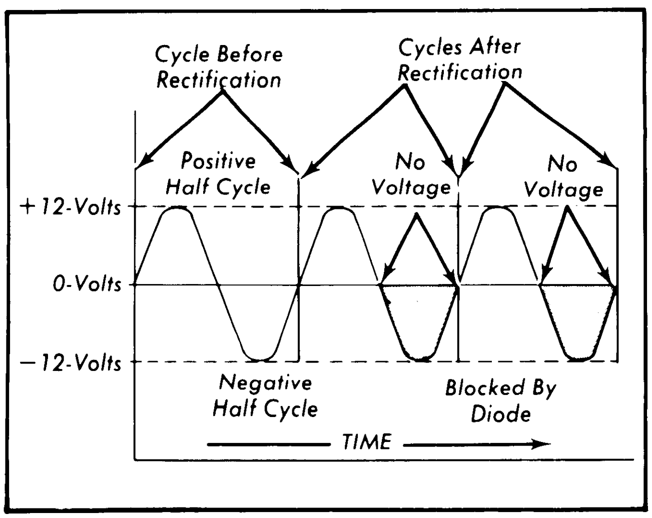
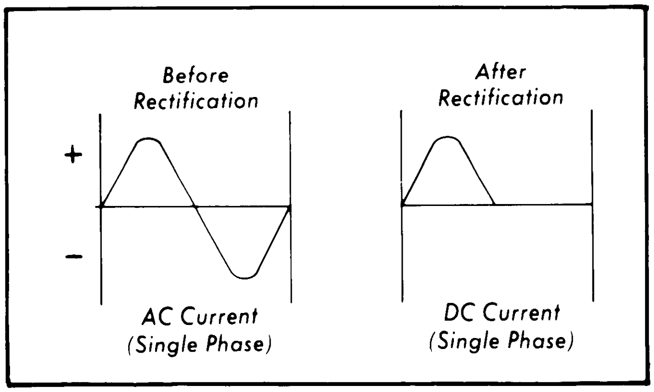
GENERAL SERVICING



ALTERNATOR SUPPLYING ELECTRICAL POWER



ALTERNATING CURRENT & DIODE RECTIFICATION



SINGLE PHASE AC & DC CURRENT

DESCRIPTION & THEORY OF OPERATION

Alternator

The alternator is an electro-mechanical device used to change mechanical energy into electrical energy. It has two functions which it performs. One is to charge and maintain the battery voltage and the other is to supply voltage and current to all electrical components of the vehicle when the engine is running. With the aid of a voltage regulator which may be mounted either external or internal to the alternator, the voltage output of the alternator is controlled to prevent higher than proper operating voltages. The battery may supply operating voltage when peak electrical loads exceed the capability of the alternator or when engine speed is not sufficient to bring the alternator to a charging condition. When the engine speed is increased or electrical load decreased, the alternator will again supply all necessary operating voltage and current.

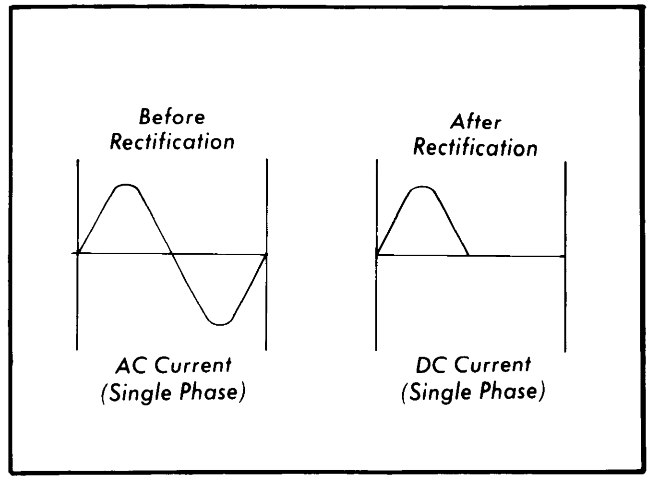
The alternator produces alternating current (AC) and voltage. This AC current must be changed to direct current (DC) before the battery can be charged or electrical components may be operated. The AC voltage is rectified (changed) to DC voltage by solid state devices called diodes which will permit voltage and current to pass through in one direction only.

As the alternator produces AC current, the voltage coming from the alternator goes through cycles. During one complete cycle the voltage goes from zero volts to approximately 12-15 volts positive (+). After reaching the maximum positive voltage (maximum voltage controlled by voltage regulator), the voltage then drops to zero to complete the first half of the cycle. All of this time current is flowing in a forward direction. As the voltage goes through the zero point, it continues the downward (negative) half of the cycle until it reaches the maximum negative (−) voltage. The voltage again returns to

GENERAL SERVICING (Cont.)

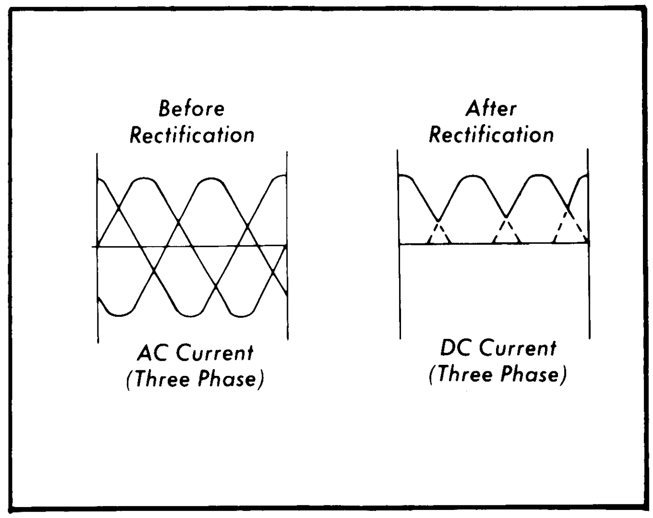
DESCRIPTION & THEORY OF OPERATION (Cont.)

zero to complete one alternating cycle. During the negative half-cycle, the direction of current flow is reversed and opposite to positive half-cycle. As the automotive electrical system and battery are direct current (DC) devices, we must rectify (change) the AC current to DC current. When we pass current through a diode it will allow current to flow in one direction only. Therefore only one half of the alternating current will be allowed to pass through the diode. We now have produced a pulsating DC voltage and current which can be used by the vehicle electrical system.



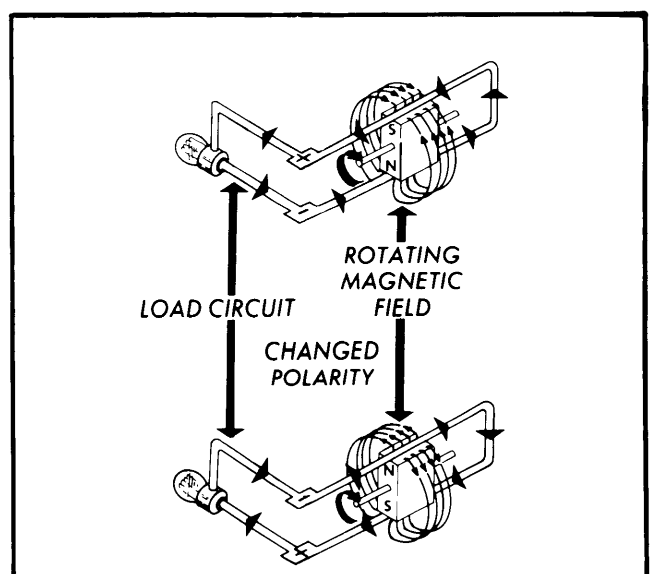
SINGLE PHASE AC & DC CURRENT

The pulsating (part time) DC current does not produce sufficient current for the vehicle electrical needs, so we add more electrical windings (stator windings) to the alternator until we have created an almost continuous DC current. These windings (three in number) are constructed and installed in the alternator in such a manner that they form a three phase circuit. The three phases are timed so that all positive and all negative voltage half-cycles will occur at equally spaced time intervals, and when the current is rectified (changed), it will be changed to continuous DC current. As can be seen from the illustrations, as the number of phases (windings) are increased the amount and quality of the direct current is increased until good operational DC voltage is achieved.



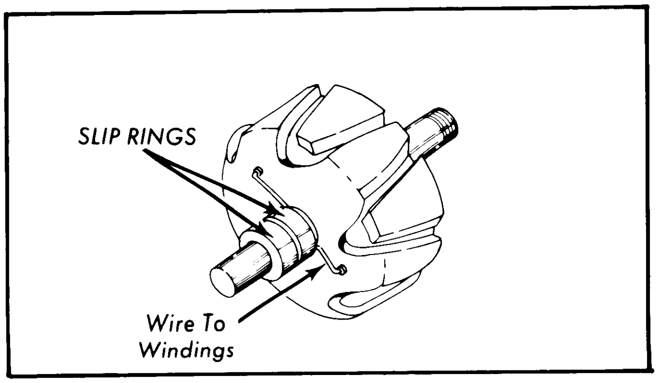
THREE PHASE AC & DC CURRENT

To understand how an alternator produces alternating current and voltage take a loop of wire and place a magnet inside of the loop. When the magnet is rotated inside the wire loop, the rotating magnetic field surrounding the magnet induces (causes) an electrical current to flow in the wire loop. As shown in the illustration, the magnet has a north pole (N) and a south pole (S). When the north pole is near one side of the loop and the south pole is near the other side of the loop, while rotating, the current will be induced to flow in one direction. When the magnet rotates the poles to opposite (alternate) ends, the current will reverse to the opposite direction. As the magnet is rotated, the voltage will rise and fall, go from positive (+) to negative (−) and reverse direction from forward to reverse during one complete revolution.

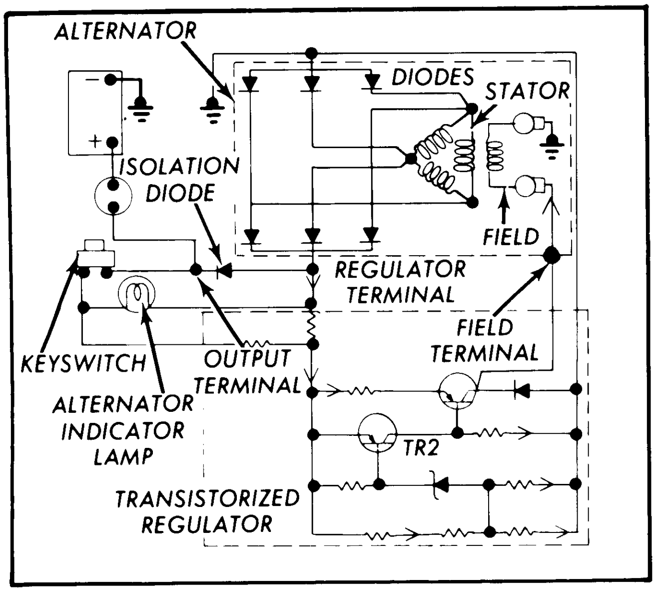


BASIC ALTERNATOR OPERATION

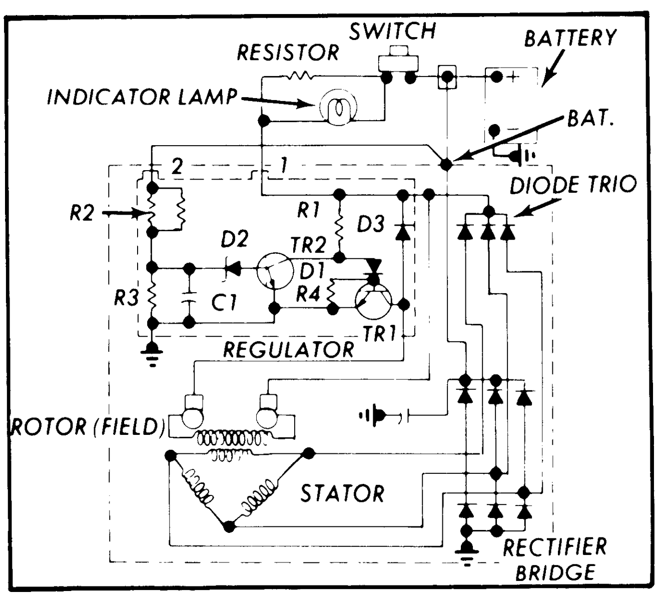
GENERAL SERVICING (Cont.)



ROTOR ASSEMBLY (TYPICAL)



GROUNDED FIELD ALTERNATOR
(WITH TRANSISTORIZED VOLTAGE REGULATOR)



ISOLATED FIELD ALTERNATOR
(WITH TRANSISTORIZED VOLTAGE REGULATOR)

DESCRIPTION & THEORY OF OPERATION (Cont.)

In an actual alternator, the rotating magnet is called a rotor. It is constructed with an iron core surrounded by many turns of wire to form an electromagnet. The ends of the winding are connected to a pair of slip rings. Power to the slip rings is provided by a pair of brushes connected to the DC power source (battery).

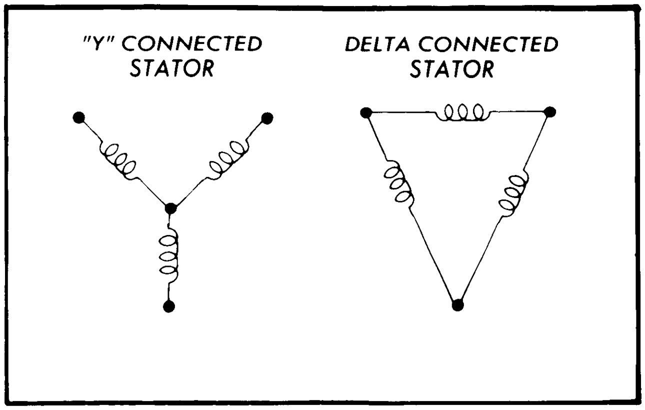
Two methods of connecting the rotor field winding are used; one is the grounded field and the other is the isolated field type. In the grounded field type, one of the slip ring brushes is connected directly to ground and the other brush is connected to the voltage regulator and battery positive terminal.

In the isolated field type, both slip ring brushes are insulated from ground. The ground side of the rotor winding is connected to the voltage regulator and receives its ground internally through the voltage regulator. The other slip ring brush is connected to the alternator and battery in the same manner as the grounded field type.

GENERAL SERVICING (Cont.)

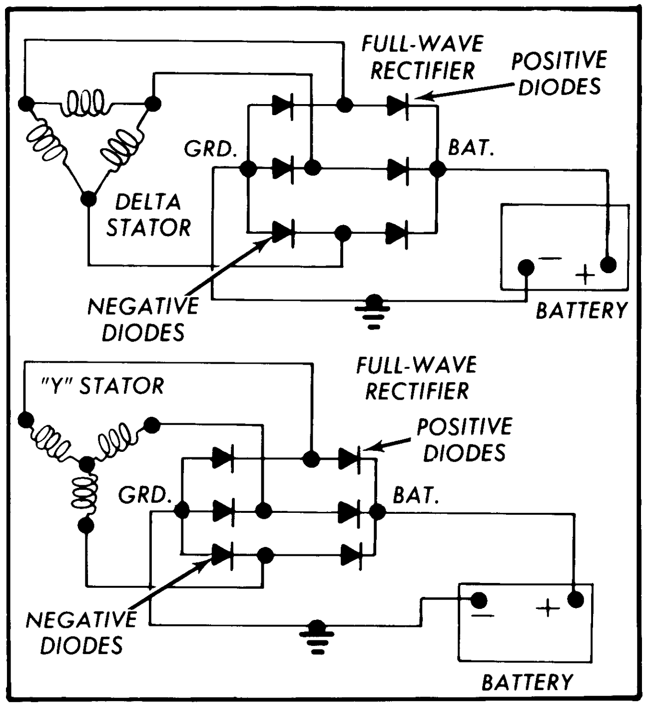
DESCRIPTION & THEORY OF OPERATION (Cont.)

The wire loop is called the stator (Stationary winding) and is made up of three windings in a laminated iron core. These stator windings have two different ways in which they are connected in the alternator. One is a "Y" connected stator and the other is a Delta connected stator. The Delta stator is generally found in the high output type alternators. It is from these windings where the electrical current is produced that power from the alternator is taken.



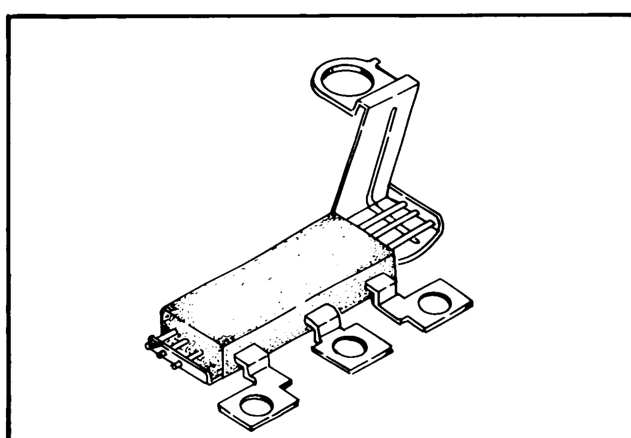
"Y" & DELTA CONNECTED STATOR WINDINGS

When the alternating current comes from the stator windings it goes through a full wave bridge rectifier circuit made up of six diodes. These diodes change the alternating current to dirrect current. Three of these diodes are negative (−) diodes and are connected between the stator windings and ground. The other three diodes are positive (+) and are connected between opposite ends of the stator windings and the alternator output.



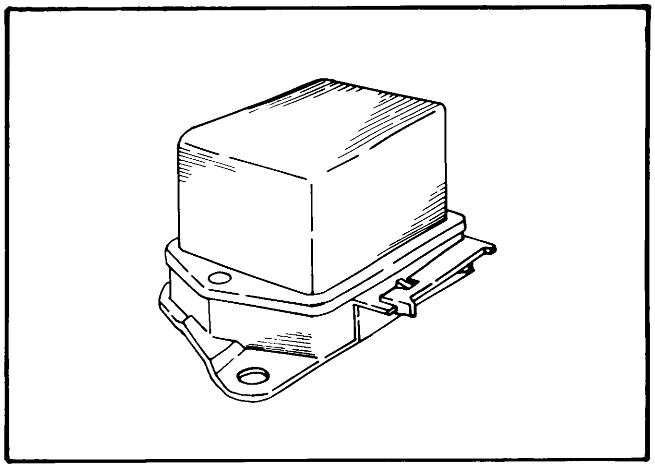
DELTA & "Y" STATOR THREE PHASE FULL-WAVE RECTIFICATION

Another type of diode is also found in some alternators with transistorized regulators, it is called an isolation diode. Its primary function is to act as an automatic switch between the battery and the alternator. It will block any current flow from the battery back to the alternator and regulator when the alternator is not operating. Instead of a single isolation diode, a three diode assembly (Diode Trio) may also be found in the alternator performing the same function as the single isolation diode. Where the mechanical or electro-mechanical voltage regulators are used, no isolation diodes are required. The field relay contacts will block current flow when the alternator is not operating.

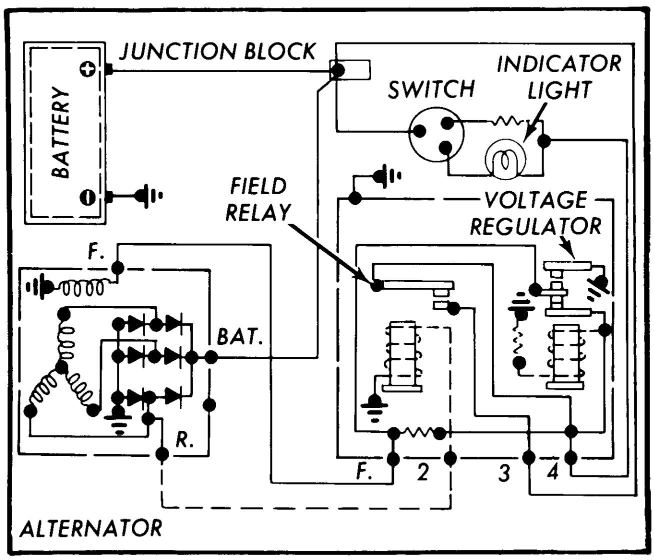


DIODE TRIO

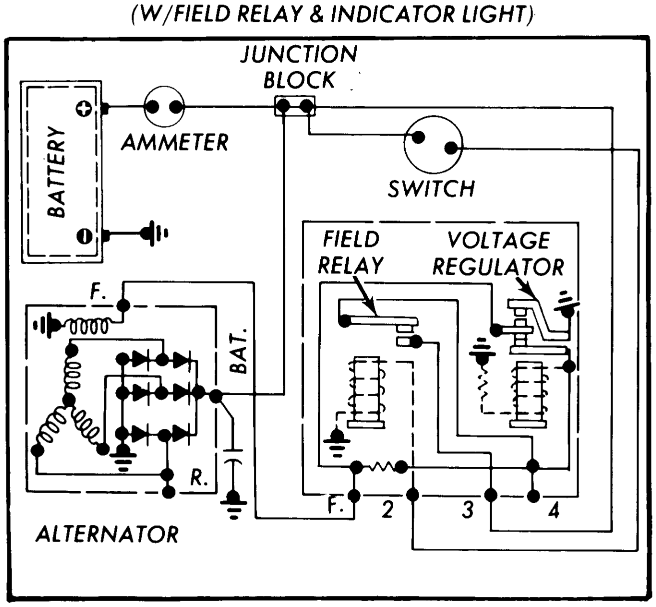
GENERAL SERVICING (Cont.)



VOLTAGE REGULATOR (TYPICAL)



VOLTAGE REGULATOR (W/FIELD RELAY & INDICATOR LIGHT)



VOLTAGE REGULATOR (W/FIELD RELAY & AMMETER)

DESCRIPTION & THEORY OF OPERATION (Cont.)

Alternator Regulator

The voltage regulator limits the alternator output voltage by controlling the amount of the alternator field (rotor) current. The alternator maximum current output is limited to a specific amount by the basic design of the alternator; because of this feature, no current-regulating device is required. Alternators are available in many different current outputs depending on the electrical requirements of the various vehicles.

On some charging systems a field relay is used along with the voltage regulator. In a circuit with an ammeter, the relay is used to open and close the field circuit. Where a charge indicator light is used instead of an ammeter, the relay controls the charge indicator light as well as the field circuit. The field relay may be mounted within the same housing as the voltage regulator or it may be a separate unit.

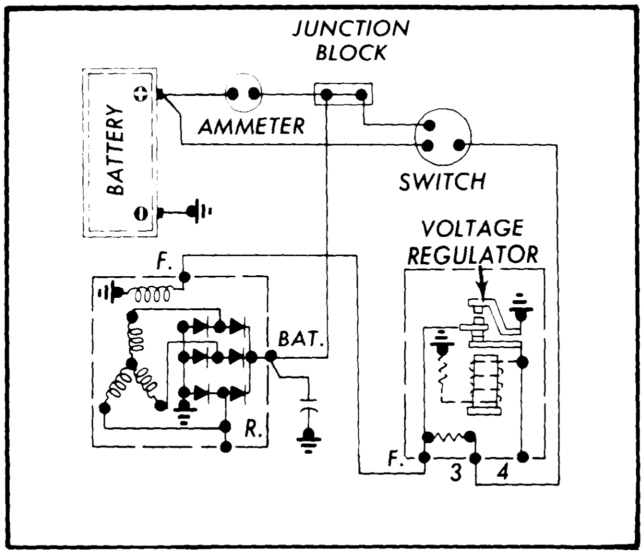
Field Relay – On vehicles equipped with a charge indicator light, when the ignition switch is turned to the "ON" position, current flows from the battery through the indicator light, through the voltage regulator, and through the alternator field coil to ground. This current flow illuminates the indicator light and energizes the alternator field. When the engine begins to run and the alternator begins to supply voltage and current, voltage is delivered to the field relay coil. This closes the relay contacts and completes a circuit that provides an alternate path for system voltage to the regulator. Voltage is also applied to the opposite terminal of the indicator light. The system voltage is now applied to both sides of the indicator light, and the voltage difference across the light is zero. When the voltage is zero, no current flows through the bulb and it goes out. As long as the alternator is operating the field relay contacts remain closed.

On vehicles with an ammeter and field relay, current flows from the battery, through the ignition switch, to the field relay coil. When the coil is energized, the relay contacts are closed. The battery current then flows through the relay contacts, through the voltage regulator, and to the alternator field. As long as the igntiion switch is "ON" the relay contacts remain closed.

GENERAL SERVICING (Cont.)

DESCRIPTION & THEORY OF OPERATION (Cont.)

On vehicles with an ammeter and no field relay, field current flows from the battery, through the ignition switch directly to the voltage regulator. Current flows through the regulator to the alternator field.

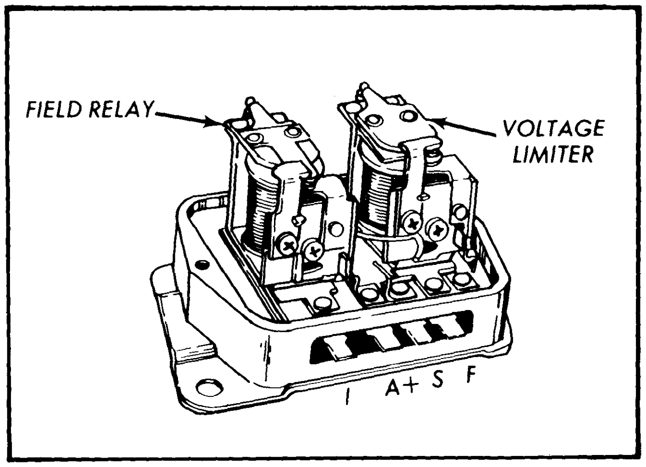


VOLTAGE REGULATOR (W/O FIELD RELAY)

Voltage Regulator Types

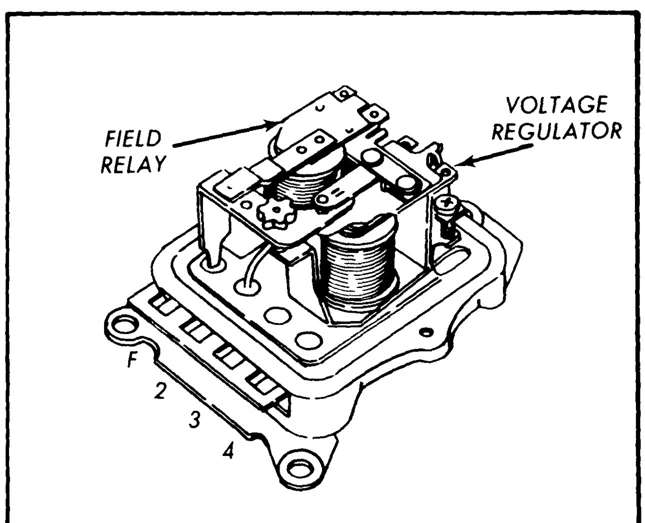
Alternator voltage regulators are usually one of four common types: the double contact, the single contact transistorized, the fully-transistorized and the integrated microcircuit regulators. The fully-transistorized and integrated microcircuit regulators are composed only of solid-state electronic devices and use no relays.

Double Contact Regulator – In a double contact regulator, two fixed and one movable contacts are used to vary the current flowing in the alternator field coil.



DOUBLE CONTACT REGULATOR (FORD)

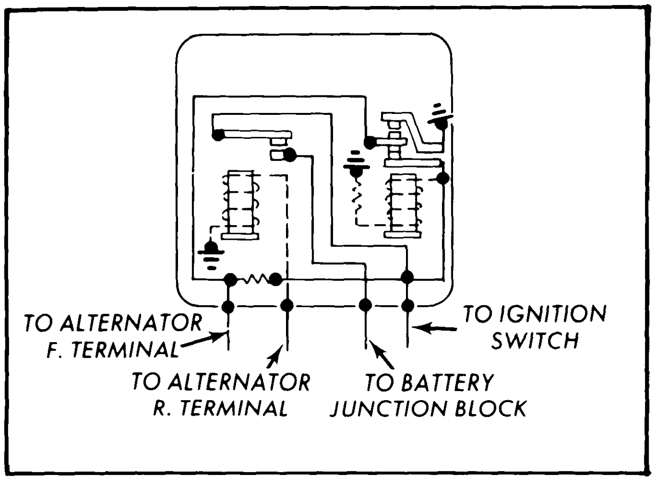
Before double contact regulators came into general usage single contact types were used. A problem with this design was that during high speed operation, the alternator output voltage was high enough to force sufficient current through the resistor in the regulator to produce a higher than desired alternator output.



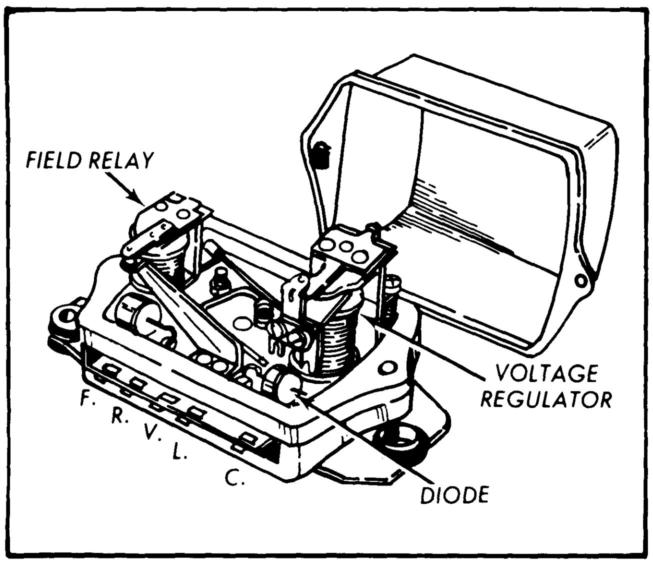
DOUBLE CONTACT REGULATOR
DELCO-REMY

In the double contact regulators, a second or "shorting" set of contacts shorts out the field current when a predetermined alternator voltage is reached. While this set of contacts are closed the charging output is reduced to zero. By this method of output control, voltage "creep" is eliminated and output voltage is stabilized regardless of engine speed. The lower contacts control alternator output during low speed operation. The contacts are normally held closed by an armature spring permitting full field current of about two amperes. During this time the alternator is putting out its full output voltage governed only by how fast it is being turned.

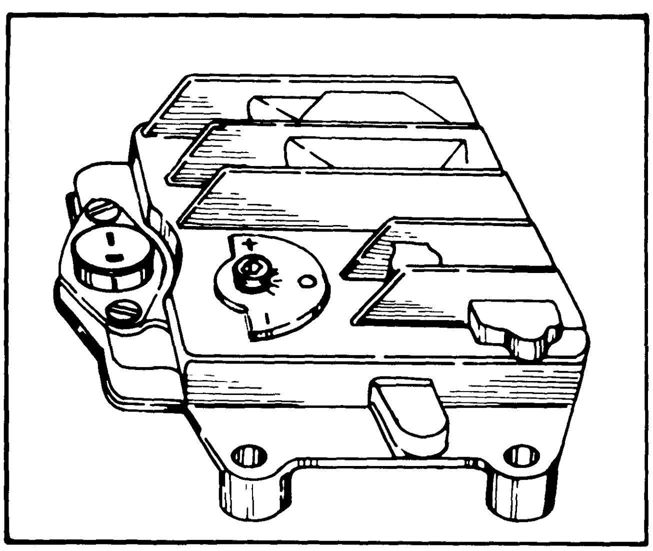
GENERAL SERVICING (Cont.)



VOLTAGE REGULATOR WIRING DIAGRAM



SINGLE CONTACT TRANSISTORIZED REGULATOR



ADJUSTABLE TRANSISTORIZED REGULATOR (DELCO-REMY)

DESCRIPTION & THEORY OF OPERATION (Cont.)

When a predetermined voltage is applied to the voltage regulator coil, the magnetic field it produces pulls the armature down, opening the lower contacts, thereby forcing the field current to flow through the resistor. Field current is now reduced to approximately $3/4$ of an ampere. The reduced field strength results in a proportionate reduction in alternator output voltage and a reduction of voltage applied to the voltage regulator coil. The reduced voltage decreases the magnetic field of the coil and the lower contacts are allowed to close. With full alternator output restored, the regulator begins to repeat voltage regulation cycle. The vibrating of the relay contacts is very rapid, between 75 to 250 times per second. This cycling action is continuously repeated as long as the voltage limiting action is required.

During periods of high engine speed and low electrical requirements, the increased magnetic field strength of the voltage regulator coil causes the upper contacts to come into operation. When this happens, the alternator field current is reduced to between $3/4$ ampere (current flow through the resistor) and zero amperes (upper contacts shorting field current to ground). This cycling action of the contacts sharply limits the alternator output voltage.

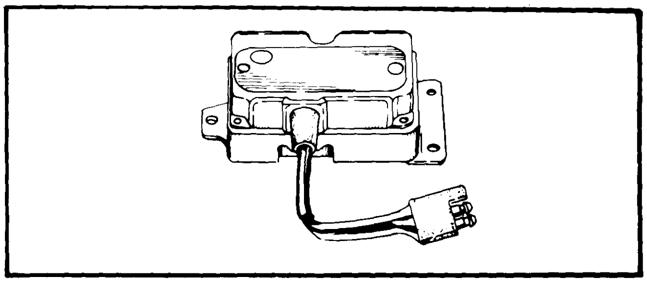
Single Contact Transistorized Regulator – The single contact transistorized voltage regulator uses a regulator with one set of contacts and a transistor to vary the alternator field current. The vibrating action of the regulator contacts alternately turns the transistor off and on to control the alternator field current and alternator output voltage.

Fully Transistorized Regulator – In a fully transistorized regulator there are no relays used. It is made up of solid state electronic devices which make it a voltage sensitive electronic switch. A large transistor is in series with the alternator field winding and a control circuit which senses the system voltage. The control circuit turns the large transistor on and off as required to vary the alternator field current. Some regulators of this type provide for adjustment of the output voltage. Others are sealed and must be replaced if the alternator output voltage is not within limits.

GENERAL SERVICING (Cont.)

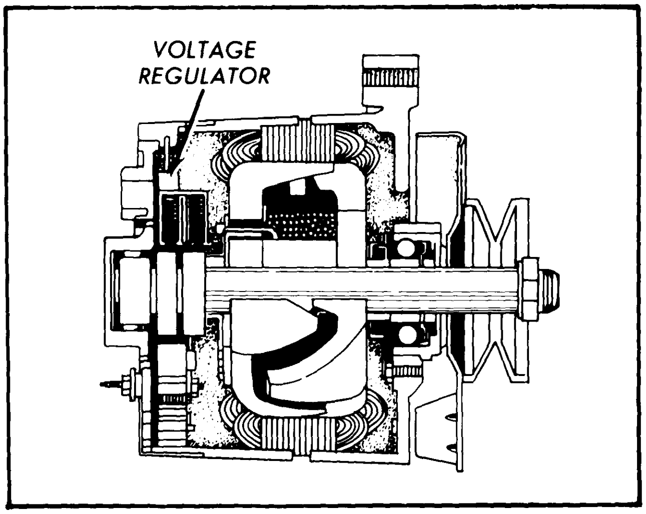
DESCRIPTION & THEORY OF OPERATION (Cont.)

Integrated Microcircuit Regulator – The integrated mircocircuit regulator is similar to that of a fully transistorized regulator, except it is much smaller. The microminiature electronic components are too small to be seen in detail with a microscope. These regulators are sealed and have no provisions for adjustment. If the regulator voltage reading is not within specifications, the regulator must be replaced.



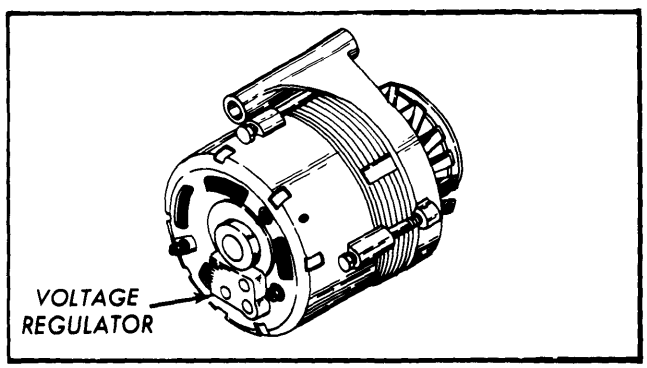
NON-ADJUSTABLE TRANSISTORIZED REGULATOR (MOTOROLA)

These voltage regulators come in different sizes, shapes and mounting locations. Delco-Remy regulators are mounted in the alternator housing. Some Ford regulators are mounted on the outside of the alternator. Chrysler Corp. electronic regulators are mounted on the firewall in the engine compartment.



GENERAL MOTORS ALTERNATOR (DELCO-REMY)

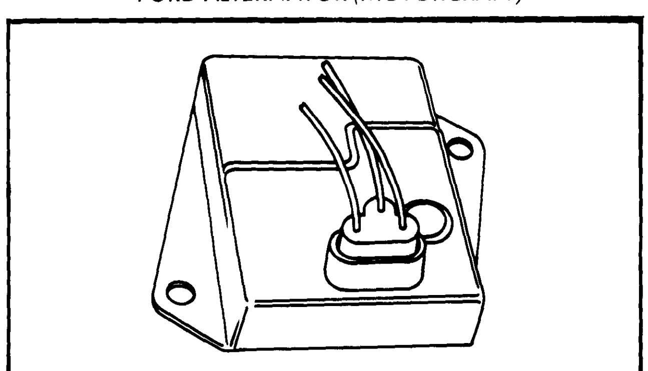
Voltage Settings – Voltage regulators which are set to low will cause the battery to be in a constant state of undercharge, causing the battery to fail when a heavy load is placed on it. If undercharging is allowed to continue, a condition known as "sulphation" will occur which leads to gradual failure of the battery. A lowered operating voltage reduces the vehicles operating efficiency.



FORD ALTERNATOR (MOTORCRAFT)

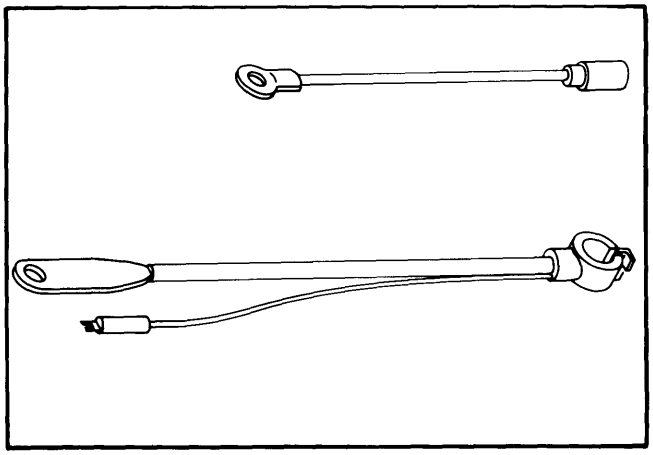
Voltage regulators which are set to high will overcharge the battery and shorten its life. High voltage will also damage such components as light bulbs, transistors, diodes, ignition points and ignition coil. One of the first indications of a high voltage setting is the frequent need for battery water.

Double contact regulators and some transistorized regulators can be adjusted to keep charging voltage within specifie ' limits, See *Vehicle Manufacturer's Recommenda* Sealed electronic regulators must be replaced age is not within limits.

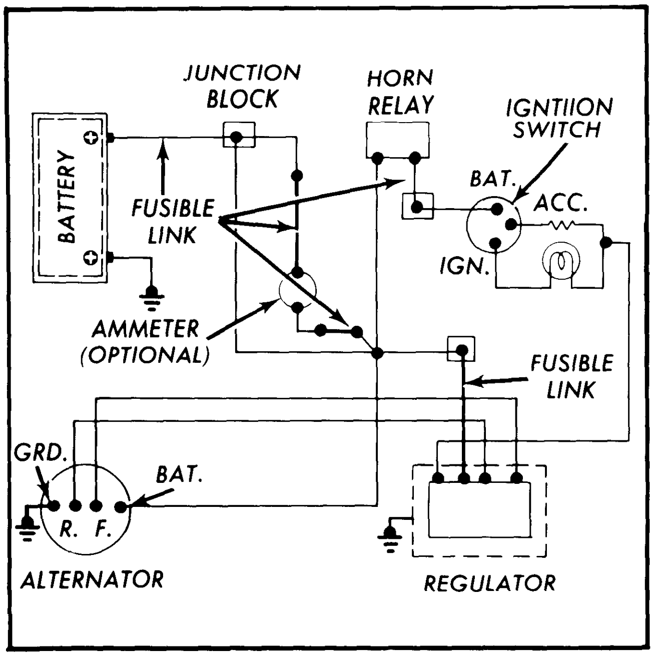


CHRYSLER CORP. VOLTAGE REGULATOR

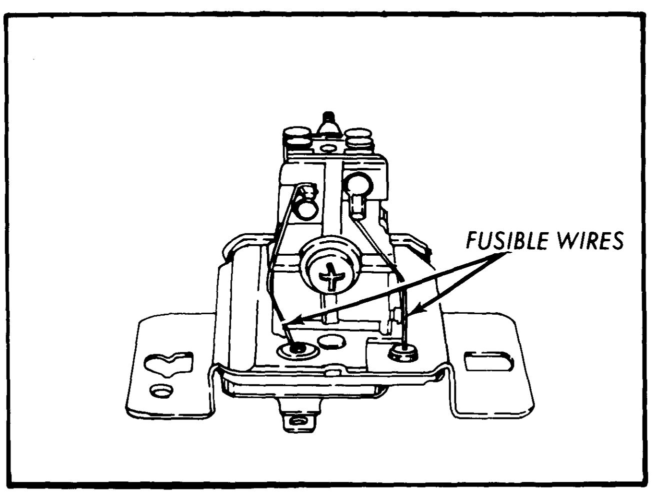
GENERAL SERVICING (Cont.)



FUSIBLE LINKS (TYPICAL)



FUSIBLE LINK LOCATIONS (TYPICAL)



CHRYSLER CORP. *VOLTAGE REGULATOR*

DESCRIPTION & THEORY OF OPERATION (Cont.)

Fusible Links

Fusible links are pieces of wire specially designed to melt when excessive current is passed through them. They act in the same manner as a fuse does to protect electrical circuits. They have a special insulation which will withstand high temperature, but will increase in diameter and bubble when the wire has melted. The wire in a fusible link is generally four gauges smaller than the circuit it protects. Fusible links may be individual wires with connectors at each end or they may be incorporated into the insulated battery cable.

Fusible links are found in some charging systems, inserted in the chassis wiring at a junction block in the engine compartment and at a starter connection. Number and location of fusible links varies with vehicle and manufacturer.

NOTE – *In some Chrysler Corp. vehicles, fusible wires are used in the voltage regulator to protect the charging system from excessive field current draw or from accidental grounding of the field.*

GENERAL SERVICING (Cont.)

TESTING

Charging System

There are several different types and brands of test equipment for checking alternators and regulators. Although all are designed to measure the voltage and current output of the charging system, their test methods may vary. Always follow the hook-up and operating instructions for the specific equipment that you are using.

Although most alternators and regulators are of the types described earlier and perform the same basic functions, design details and current connections will vary on different vehicles. The vehicle maker's test specifications and instructions are essential for accurate diagnosis. The following paragraphs contain important safety precautions, general oscilloscope test indications and the basic alternator checks.

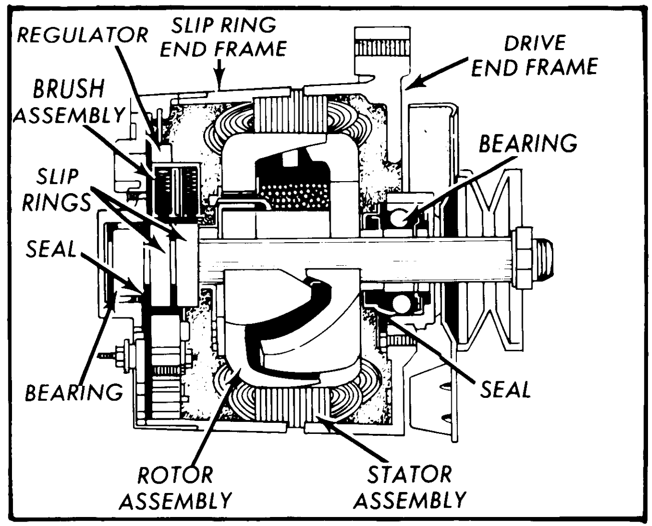
Charging Indicator Light – This dash light alerts driver to charging system malfunctions. The light is operating properly if it meets the following conditions:

Ignition Switch	Indicator Light	Engine
Off	Off	Stopped
On	On	Stopped
On	Off	Running

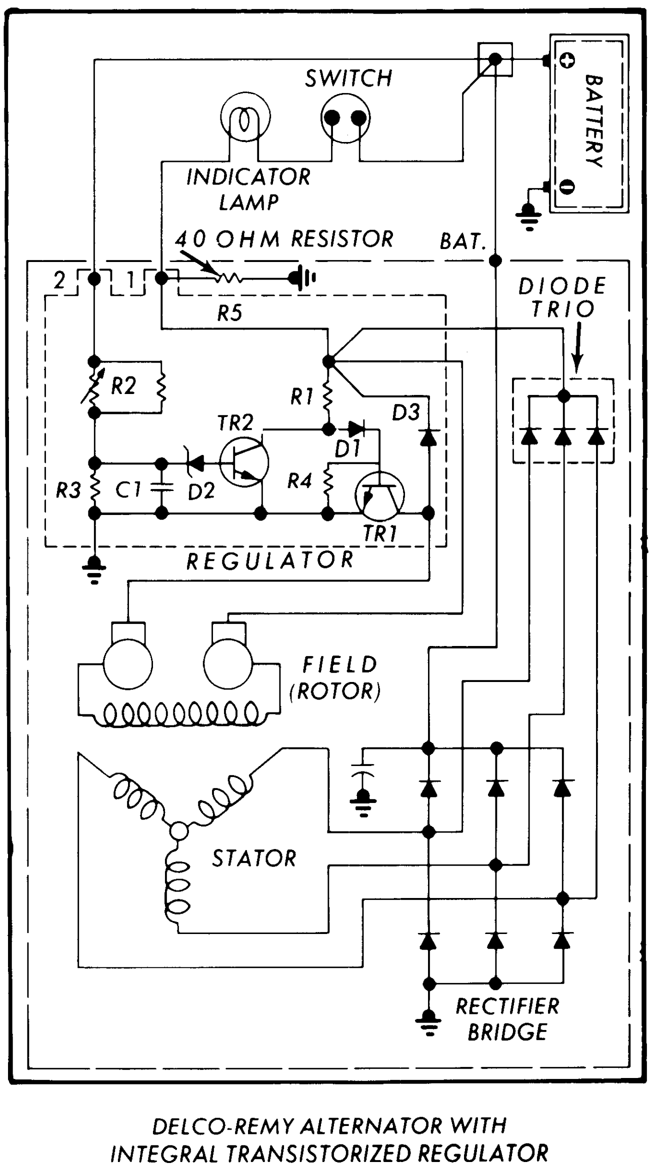
If the indicator light is working properly and the light comes on when the engine is running, a complete check of the charging system must be made to determine the defective component.

NOTE – *Delco-Remy charging systems in some 1975 and later vehicles have a feature to warn the driver of a charging system open circuit malfunction, such as an open field winding in the alternator or an open voltage regulator. If a problem of this kind occurs, the indicator lamp will light. This is accomplished by the addition of a 40 ohm resistor across the voltage regulator in the alternator. With this system, the indicator lamp may glow when the engine is first started and remains at a lower idle RPM. This does not indicate a charging system problem. As the engine speed increases to 900 RPM or more, the lamp will go out and remain out even when the engine returns to idle-RPM.*

CAUTION – Observe the following safety rules and procedures when any testing is to be done to the alternator or voltage regulator:

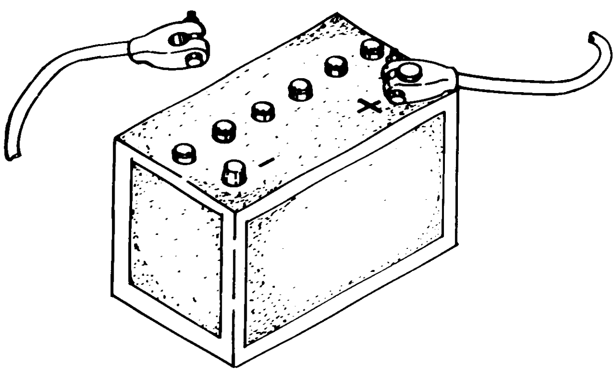


BASIC ALTERNATOR (TYPICAL)



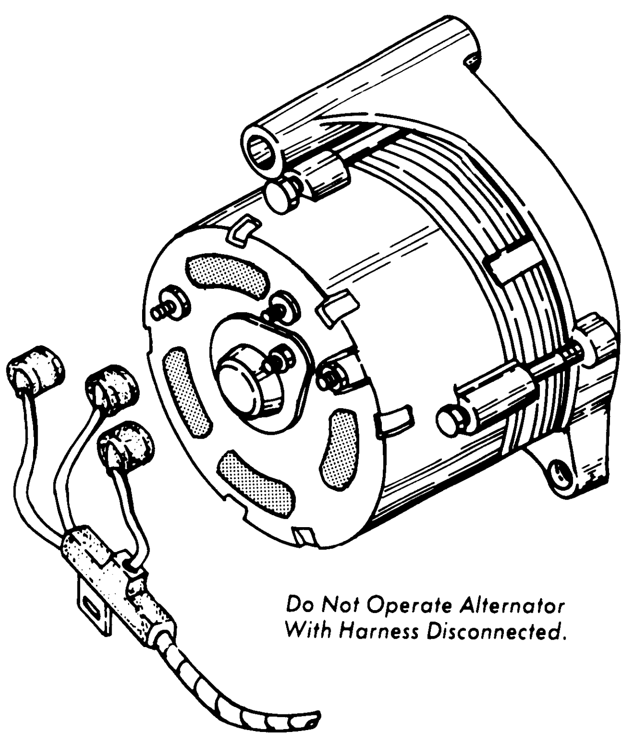
DELCO-REMY ALTERNATOR WITH INTEGRAL TRANSISTORIZED REGULATOR

GENERAL SERVICING (Cont.)



Always Disconnect Battery Negative Cable Before Changing Any System Connections.

BATTERY SAFETY DISCONNECT



Do Not Operate Alternator With Harness Disconnected.

ALTERNATOR HARNESS

TESTING (Cont.)

1. Check condition and charge level of the battery. A minimum specific gravity of 1.220 is required for proper operation. If the specific gravity is low, charge the battery to at least the minimum level. A defective battery can put an excessive demand on the alternator. Battery voltage will be low and the alternator will operate at or near its maximum output. An alternator can be damaged if operated for sustained periods at its maximum output. Prolonged high charge rates can result in overheating of the stator windings and eventual failure.

2. When connecting a charger or booster battery to the vehicle battery, place a shop towel over the battery openings. Connect the positive cable from the booster battery to the discharged battery first, then connect one end of the negative (ground) cable to the booster battery and the other end to a good ground connection away from the discharged battery. This procedure will prevent arcing at the battery which might result in an explosion or fire. It is also recommended that safety goggles be worn when performing this operation.

3. Inspect battery cables. Replace all frayed or worn cables. Be sure cable is correct gauge and meets OEM specifications. Cable connections must be clean and tight.

4. Always disconnect the battery ground cable from the battery negative post before making any test connections or removal of any components. This procedure will prevent arcing or accidental short circuits.

5. Make sure the alternator and battery have the same ground polarity. **NOTE** – *Some early model vehicles have a positive ground electrical system.*

6. Do not short out or ground any terminal of the alternator or regulator.

7. Do not operate an alternator without the proper electrical load. Extremely high voltages which are both dangerous and damaging to the alternator will result if the alternator is operated on an open circuit.

8. When adjusting belt tension be careful in applying pressure to the alternator as the aluminum housing can be easily cracked.

GENERAL SERVICING (Cont.)

TESTING (Cont.)

9. Do not attempt to polarize an alternator. Polarizing an alternator is not necessary since it contains no permanent magnets.

10. Be certain the alternator drive belt(s) has proper tension to assure correct alternator output and to avoid excessive drive belt and alternator bearing wear.

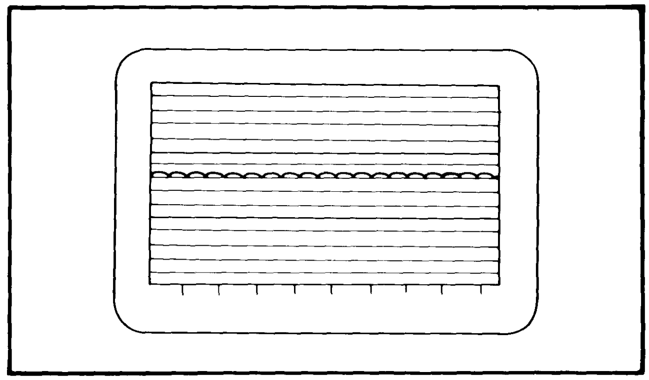
NOTE – *Before beginning testing of the charging system, inspect all wire connectors, battery terminals and ground connections for loose connections, corrosion, damage or broken wires. Clean, tighten or repair any poor connections and check charging system.*

Oscilloscope Test Pattern

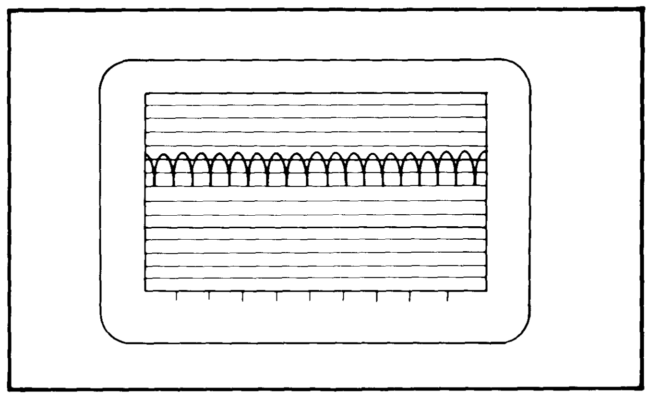
The oscilloscope, among other pieces of test equipment, may be used to check the condition of the alternator. When the alternator diodes and stator are functioning properly, the scope pattern appears as a series of small waves with the headlights and accessories turned off.

By positioning the scope controls, the pattern may be enlarged to show the wave forms as being regularly spaced and all of the same height with the headlights on high beam.

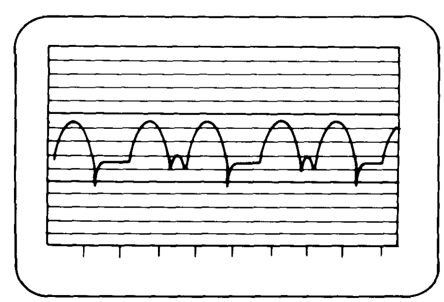
Breaks in the pattern indicate open diodes or stator or shorted diodes or stator. The defective alternator must be replaced.



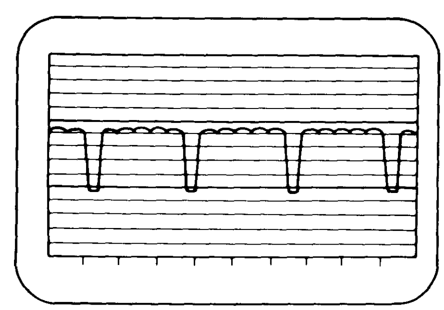
NORMAL PATTERN
HEADLIGHTS & ACCESSORIES TURNED OFF



NORMAL PATTERN
HEADLIGHTS ON HIGH BEAM



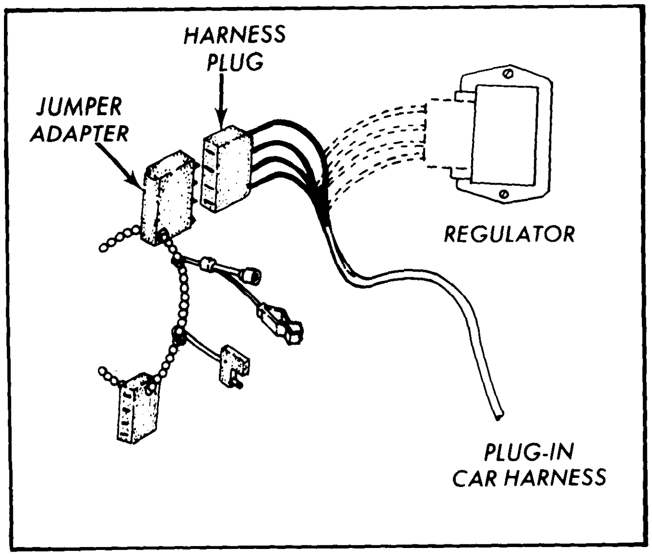
SHORTED DIODES OR STATOR



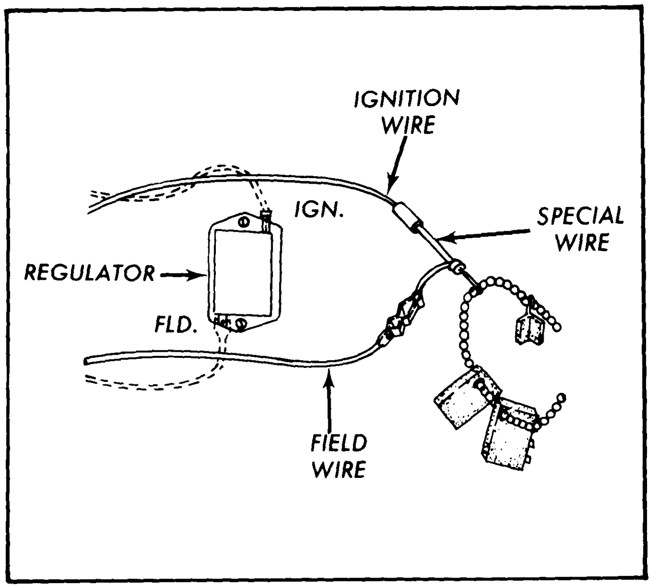
OPEN DIODES OR STATOR

ABNORMAL PATTERN

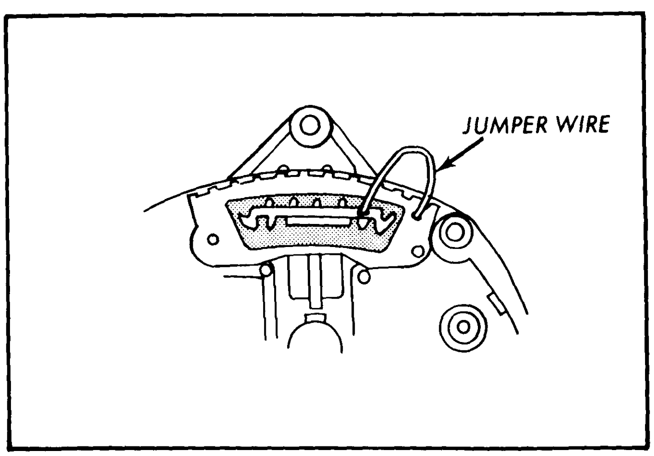
GENERAL SERVICING (Cont.)



HARNESS JUMPER CONNECTION (TYPICAL)



HARNESS JUMPER CONNECTION (CHRYSLER CORP.)



DELCO-REMY ALTERNATOR (1968)

TESTING (Cont.)

Charging System Testing

When tests of the charging system indicate a defective alternator or voltage regulator, the malfunctioning unit should be replaced.

The alternator drive belt must be properly tensioned and belt in good condition before it is assumed the alternator is at fault for lack of output.

Alternator System Testing

Many different models of test equipment are available for testing the voltage and current output of the various alternators systems. Connect and operate the equipment in accordance with the manufacturers instructions.

If voltage or current output of the complete system is below specifications, by-pass the voltage regulator and test the alternator alone. If output is still below specifications, the alternator is at fault. If the output rises to specifications when the regulator is by-passed, the regulator is at fault.

On the common regulators several methods of by-passing can be used for testing. On regulators with plug-in connectors, remove the harness from the regulator and plug a jumper adapter into the harness plug.

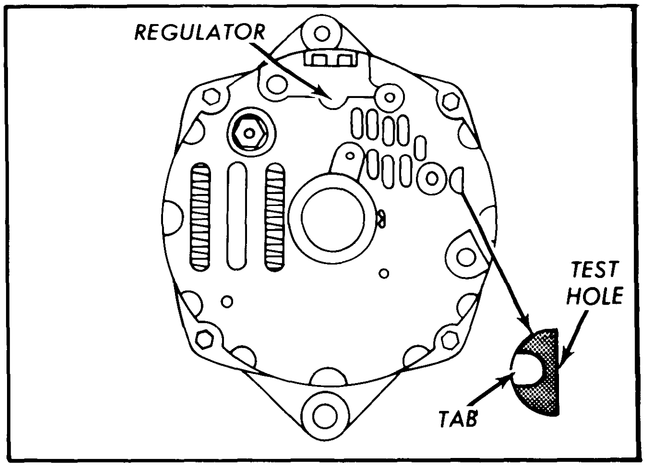
On Chrysler Corp. vehicles with open terminal regulators, disconnect the ignition and field wires and connect them together with a jumper lead.

On 1968 Delco-Remy alternators with integral regulators, attach a jumper wire between the regulator heat sink and the alternator frame.

GENERAL SERVICING (Cont.)

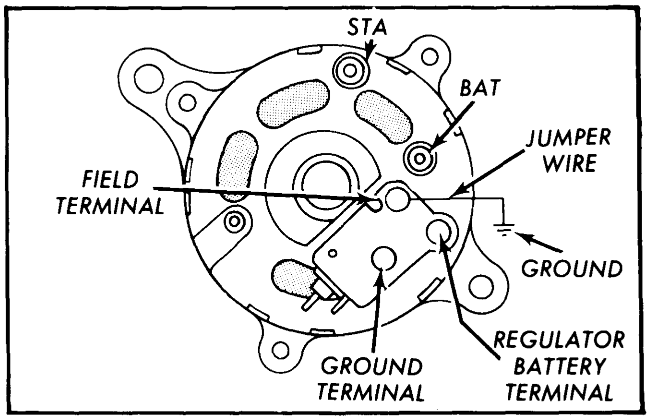
TESTING (Cont.)

On 1969 and later Delco-Remy alternators with integral regulators, insert a screwdriver into the "D" shaped test hole in the end of the alternator to ground field winding. **NOTE** – *Grounding tab is within ¾" of casting surface. Do not force screw-driver deeper than one inch into the end-frame.*



DELCO-REMY ALTERNATOR (1969 & LATER)

On Ford (Motorcraft) alternators with integral regulator, connect a jumper wire between the regulator field terminal and ground on the alternator frame.

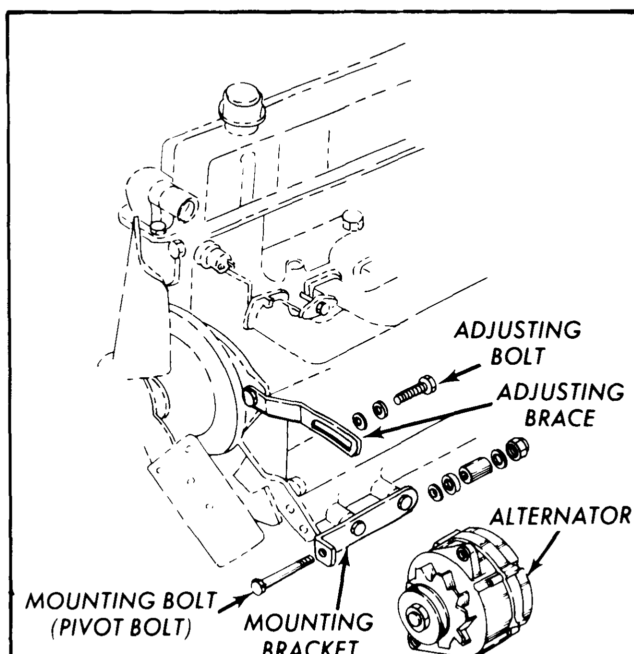


FORD (MOTORCRAFT) ALTERNATOR (W/INTEGRAL REGULATOR)

INSTALLATION

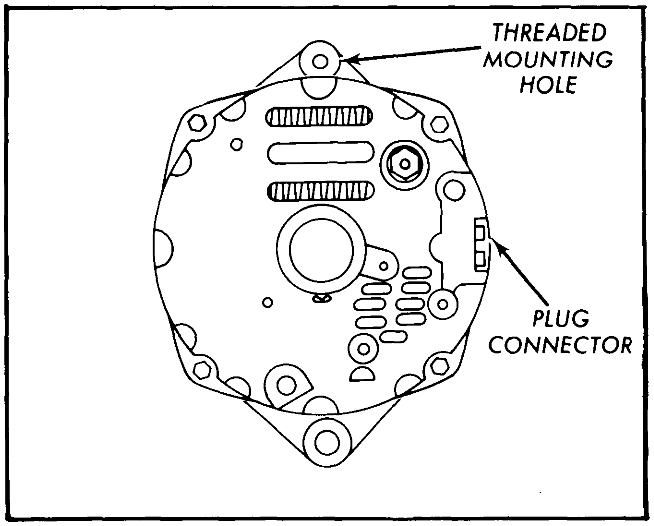
1. REMOVAL – Disconnect the battery ground cable. Disconnect and tag all the wiring harness terminals or connectors to the alternator to insure correct wiring when installing the replacement unit. Loosen, but do not remove the alternator mounting bolt (pivot bolt).

2. Remove the adjusting bolt(s), spacer(s) (if equipped), and nut(s) from the adjusting brace. Loosen and remove the alternator drive belt (s). While supporting the alternator, remove the mounting bolt (pivot bolt) and lift the alternator from the vehicle.

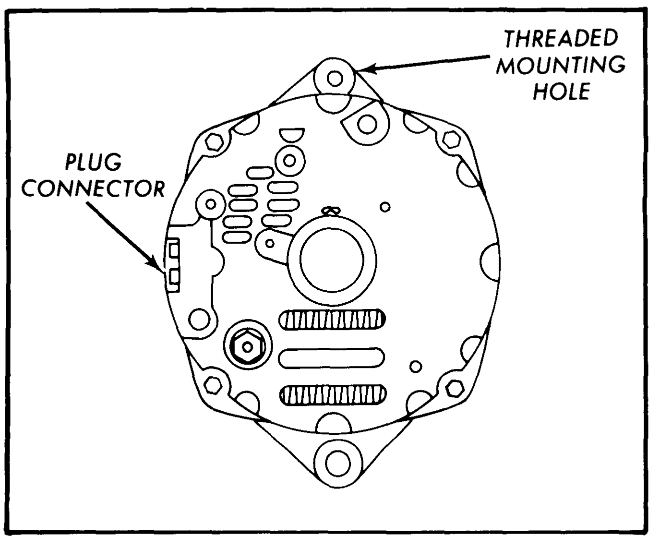


ALTERNATOR MOUNTING INSTALLATION (TYPICAL)

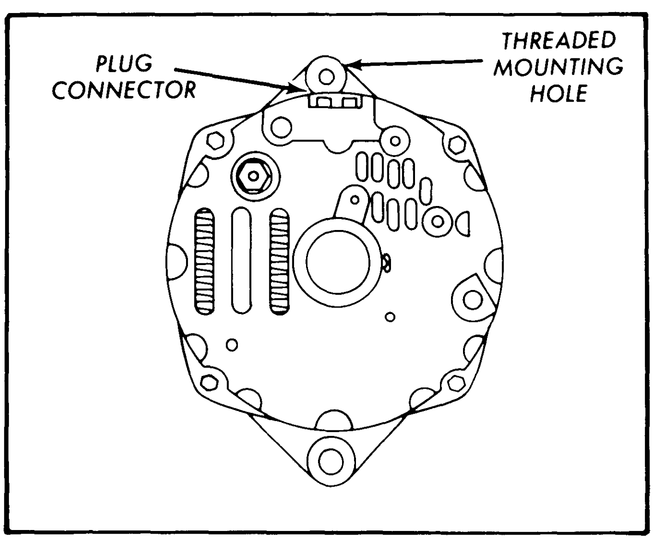
GENERAL SERVICING (Cont.)



DELCO-REMY W/3 O'CLOCK POSITION



DELCO-REMY W/9 O'CLOCK POSITION



DELCO-REMY W/12 O'CLOCK POSITION

INSTALLATION (Cont.)

CAUTION – The OEM Delco-Remy alternator with integral regulator can be found in different end housing (location of plug-in connection) positions. This is required to allow the wiring harness plug to reach the alternator plug-in connection.

It is Not recommended that service personel attempt to disassemble a replacement alternator and rotate the end plate to match the OEM mounting position as the alternator brushes can easily drop off the slip ring and be damaged.

To determine the correct alternator plug position, remove the old alternator and place the alternator small threaded mounting hole on top in the 12 O'clock position. The plug position is then determined by its clock position - 3 O'clock - 9 O'clock - 12 O'clock.

GENERAL SERVICING (Cont.)

INSTALLATION (Cont.)

1. INSTALLATION – Position the alternator in the mounting bracket and install the mounting bolt (pivot bolt). Tighten the mounting bolt just finger tight at this time. Install the adjusting bolt(s), spacer(s) and nut, do not tighten. Install drive belt(s) and tension per manufacturers instructions. Tighten the adjusting bolt(s).

CAUTION – When tensioning the alternator drive belts, DO NOT pry in the middle of the side of the alternator as internal damage may result.

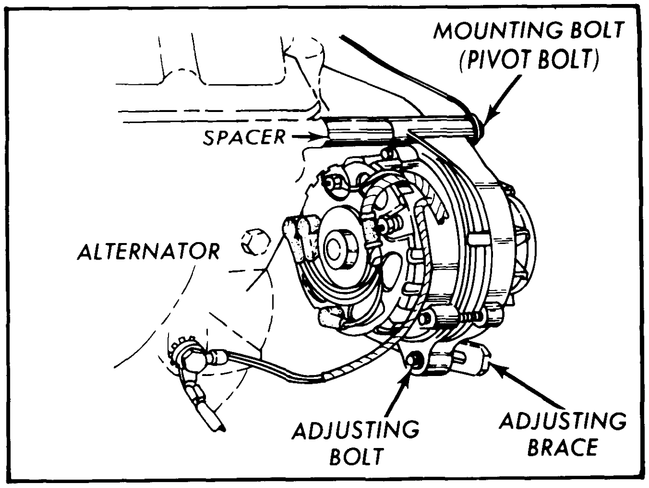
2. Tighten the mounting bolt (pivot bolt). Install the wiring harness terminals or connectors, making sure all connections are clean and tight. If necessary, polish all terminals and ground connections to bright metal to insure a good electrical connection. Make an inspection to be sure all wires are connected to the proper alternator terminal. Reconnect the battery ground cable. Start the engine and make sure the charging system is operating properly.

3. Before installing the voltage regulator, make sure the battery negative cable is disconnected at the battery. Clean the mounting points on the firewall or fender to insure a good ground connection. Place the regulator and ground straps (if equipped) in position. Make sure no harness wires will be pinched under the regulator mounting base. Install mounting screws and connect harness connector or leads to regulator. Reconnect battery lead and check charging system for correct operation.

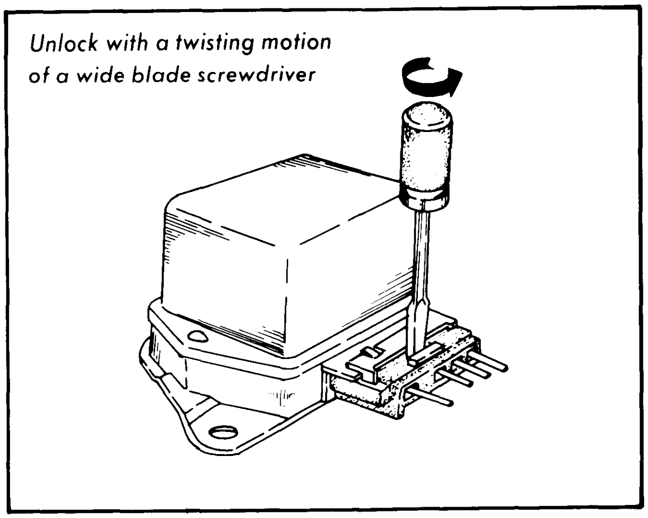
IDENTIFICATION

MOTORCRAFT

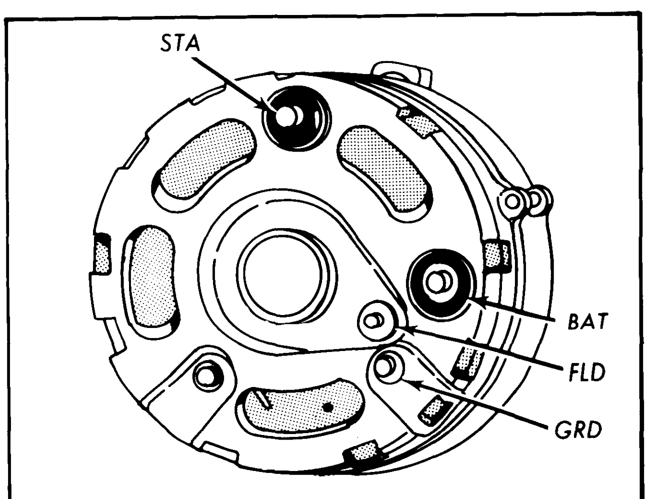
(Ford Motor Co.)



ALTERNATOR MOUNTING INSTALLATION (TYPICAL)

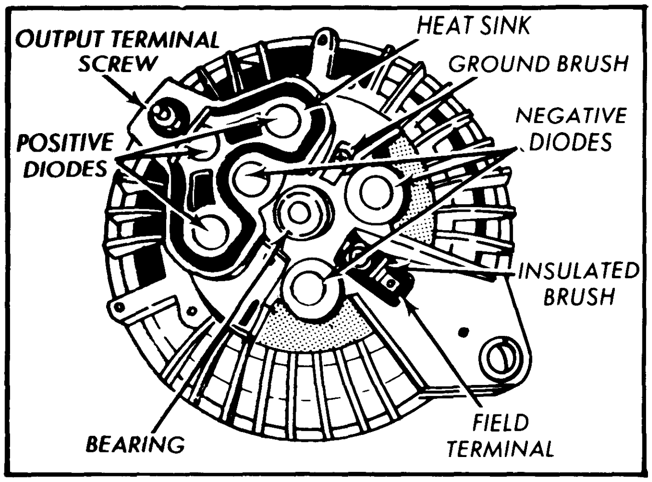


DISCONNECTING WIRING HARNESS CONNECTOR (FORD MOTOR CO.)

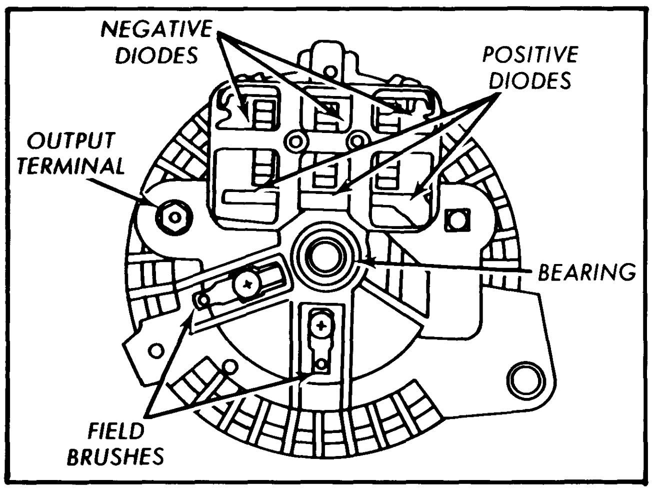


MOTORCRAFT REAR TERMINAL ALTERNATOR (W/EXTERNAL MECHANICAL REGULATOR)

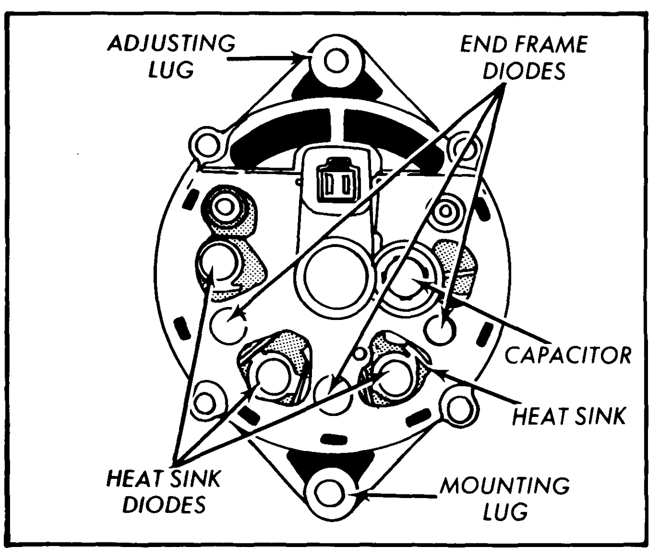
GENERAL SERVICING (Cont.)



CHRYSLER CORP. ALTERNATOR
(W/EXTERNAL MECHANICAL REGULATOR)



CHRYSLER CORP. ALTERNATOR
(W/EXTERNAL TRANSISTORIZED REGULATOR)



DELCO-REMY ALTERNATOR
(W/EXTERNAL MECHANICAL REGULATOR)

IDENTIFICATION (Cont.)

CHRYSLER CORP.

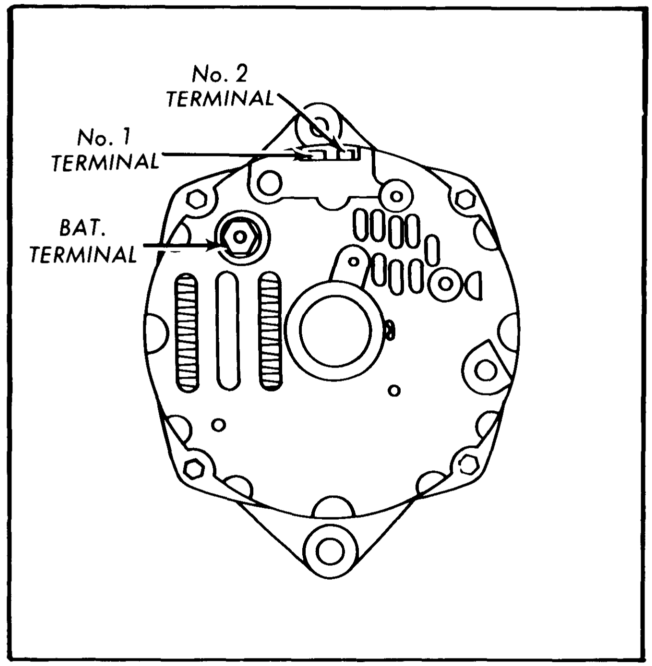
CHRYSLER CORP.

DELCO-REMY

GENERAL SERVICING (Cont.)

IDENTIFICATION (Cont.)

DELCO-REMY



DELCO-REMY ALTERNATOR (DELCOTRON)
(W/INTEGRAL TRANSISTORIZED REGULATOR)