GENERAL: This group contains information on the electrical equipment. It encompasses the electrical components from the coach battery, through engine ignition system, to the wiring and instrumentation on the driver's instrument panel.

SPECIFICS: As applicable

...Battery
...Clock
...Engine Alternator
...Engine Distributor
...Engine Starter
...Engine Voltage Regulator
...Fuses
...Headlights
...Horn
...Identification Lights
...Ignition Wiring
...Instruments
...Instrument Sending Units
...Instrument Wiring
...Relays
...Spark Plugs
...Switches
...Taillights
...Windshield Washers (front and rear)
...Windshield Wipers (front and rear)
...Wire Connectors
...Wiring

# GROUP 4

## AUTOMOTIVE ELECTRICAL

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# GROUP 4

# AUTOMOTIVE ELECTRICAL

## 4-1. DESCRIPTION

a. General (fig. 4-1). The automotive electrical system is comprised of a 12 volt, direct current (VDC) electrical power supply system, a power distribution system, and the various 12 VDC operated systems and components.

b. 12 Volt DC Electrical Power Supply System. The 12 VDC automotive electrical power supply system is negatively grounded and consists of an 85 amp alternator, electronic voltage regulator, 12 VDC 105 amp battery, alternator indicator light, voltage gauge, and interconnecting wiring. The automotive electrical system is supplied power by the engine-driven 85 amp alternator, with an electronically regulated voltage output set slightly above battery voltage, and the 12 VDC 105 amp battery. An equalizer is incorporated in the alternator output circuit between the alternator and automotive and domestic batteries. A certain amount of current, produced by the alternator for operation of the automotive electrical system, is diverted to the domestic batteries; refer to paragraph 4-1c.

(1) Alternator (fig. 4-2). The 85 amp alternator is mounted on support brackets and bosses located on the left hand side, aft upper end of the engine. The alternator diameter is 6.6 inches, length is 8.3 inches, and weight is 21 pounds. Two belts (set), driven by the engine, rotate the alternator dual pulley set installed on the end of the rotor shaft. A fan is also installed on the rotor shaft, just forward of the pulleys, to provide a cooling air flow across the alternator stator, rotor, and rectifier heat sinks during operation. Two brushes are installed in the brush holder located on the forward end of the alternator and housing. Both brushes are insulated and spring loaded to press against the rotor slip rings to conduct current to the rotating field windings. The alternator is fundamentally an ac generator incorporating two rectifier assemblies which convert the ac current to dc current. Each rectifier assembly contains three silicone diodes, encased in a heat sink.

**NOTE**

Silicone diodes are utilized because of their ability to operate with high amperage current and withstand temperatures up to about 185 degrees F. Although heat is generated during high amperage operations, the alternator fan and heat sinks function to keep diode temperatures from exceeding maximums.

The silicone diodes have a very high resistance to current flow in one direction, and a low resistance in the opposite direction. Full-wave rectification is provided by the two rectifier assemblies. The rectifiers permit the induced current in the three stator windings to flow only toward the output (positive) terminal of the alternator.

**NOTE**

Reverse current flow (current flow from battery to alternator when alternator is producing less than battery voltage) is also prevented by the diodes in the positive case rectifier, thus eliminating the requirement for a reverse-current relay in the alternator-to-battery circuit.

One end of each of the three stator windings is connected to the lead wire of a positive case rectifier and to the lead wire of the negative case rectifier. The other ends of the three stator windings are connected together at a "Y" connection.

(2) Electronic Voltage Regulator. The electronic voltage regulator is mounted on the upper left hand end of the start-ignition panel which is located in the upper central area of the engine compartment firewall. The regulator transistor cavity has three drain holes and is mounted so that any water will drain off through the holes and not accumulate around the power transistor. The regulator is a solid state full transistor voltage regulator and contains no moving parts. The components are attached to a printed circuit board (module) which is mounted in a cast aluminum housing. Besides serving as a mounting and protection for the components, the finned housing serves as a heat sink which prevents the transistor from overheating. The electronic voltage regulator functions to regulate the electrical system voltage by limiting the output voltage that is generated by the alternator. This is accomplished by controlling the amount of current that is allowed to pass through the alternator field windings. Basically, the electronic regulator operates as a voltage sensitive switch. A transistor is connected in series with the alternator field winding. A control circuit that senses system voltage functions to turn the transistor on and off as required. The regulator utilizes a voltage sensitive zener diode to detect voltage changes in the system. When the voltage reaches a predetermined value, the zener diode completes the driver transistor base circuit; this in turn allows the driver

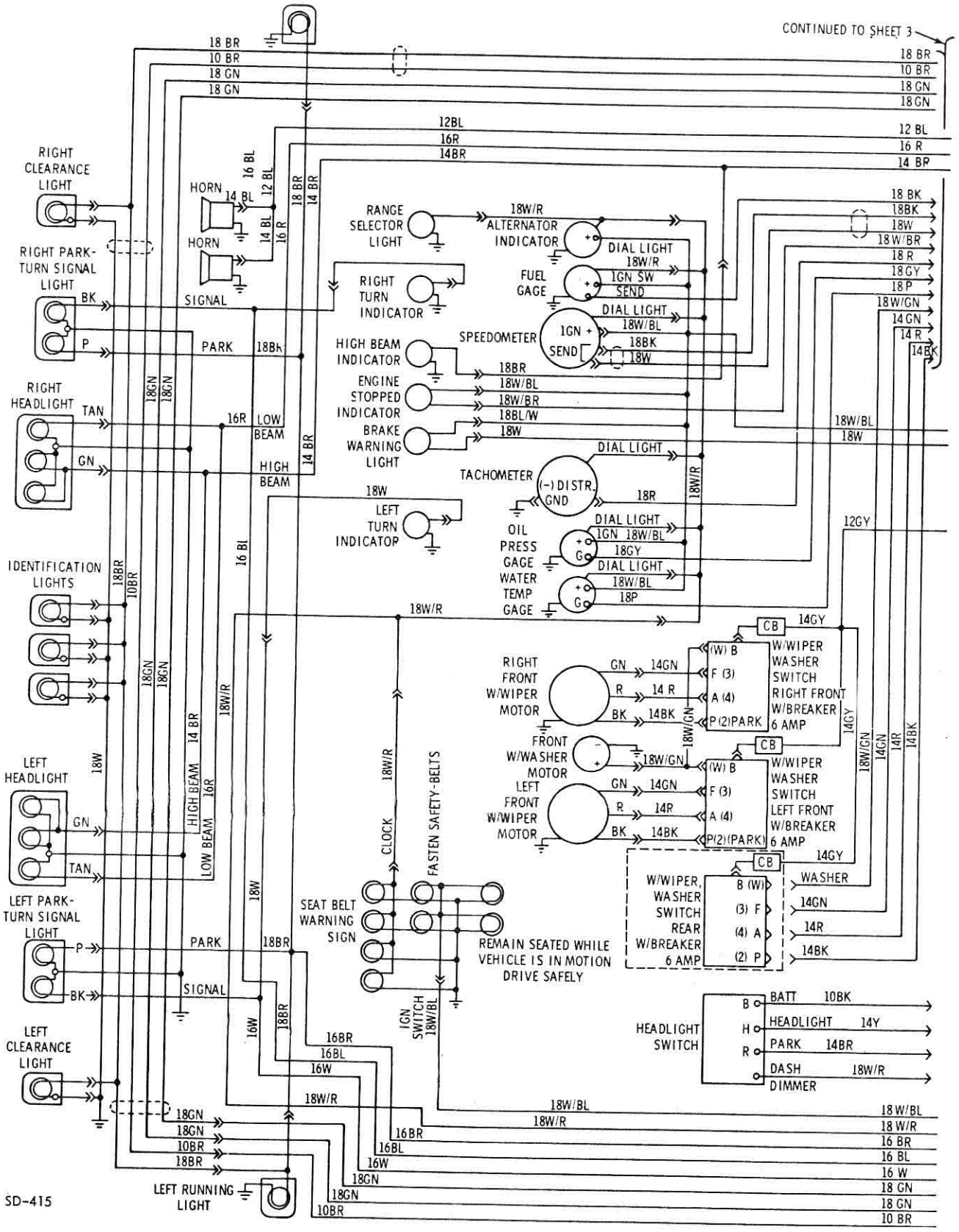


Figure 4-1. Automotive Wiring Diagram (Sheet 1 of 4)

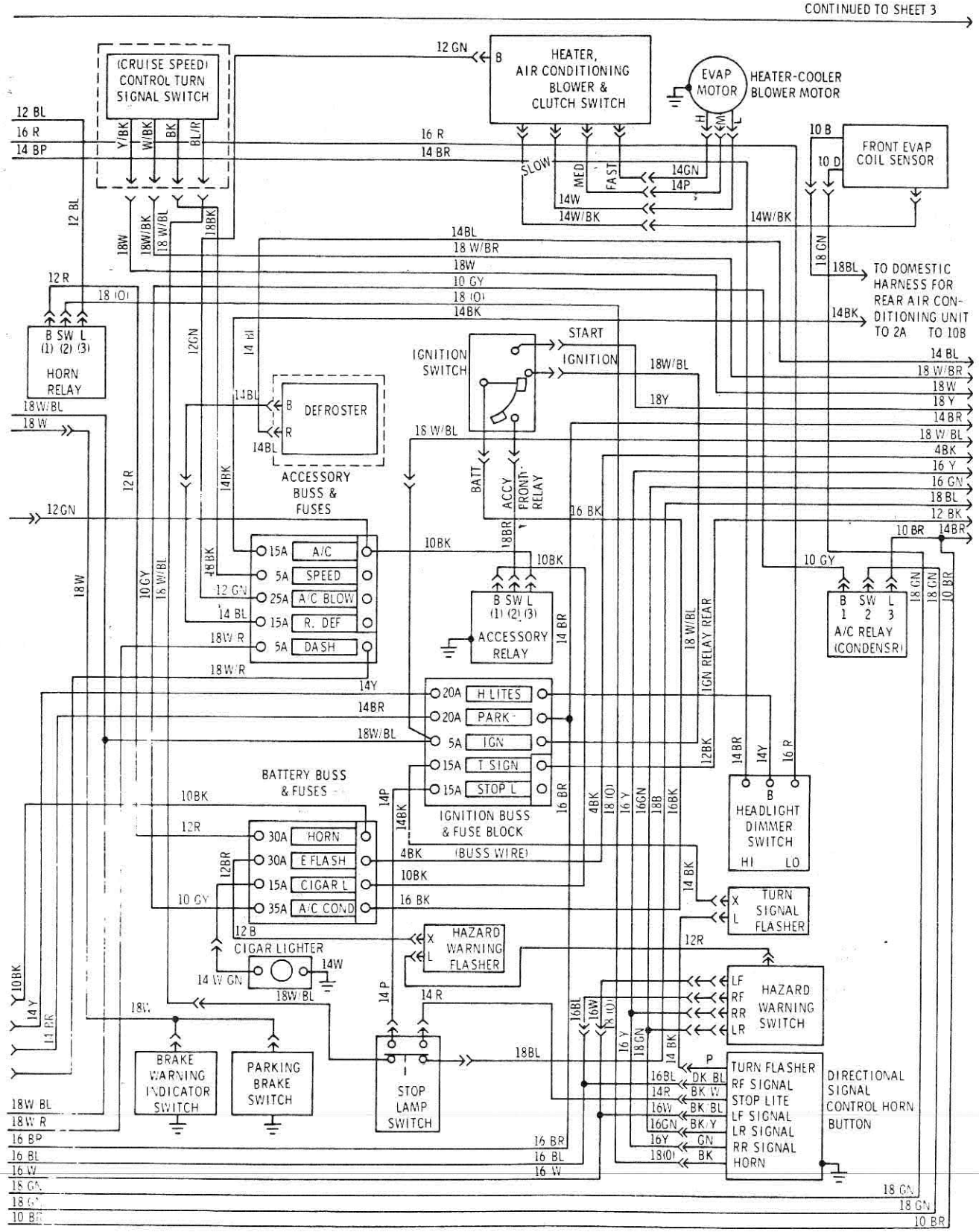


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Figure 4-1. Automotive Wiring Diagram (Sheet 2 of 4)

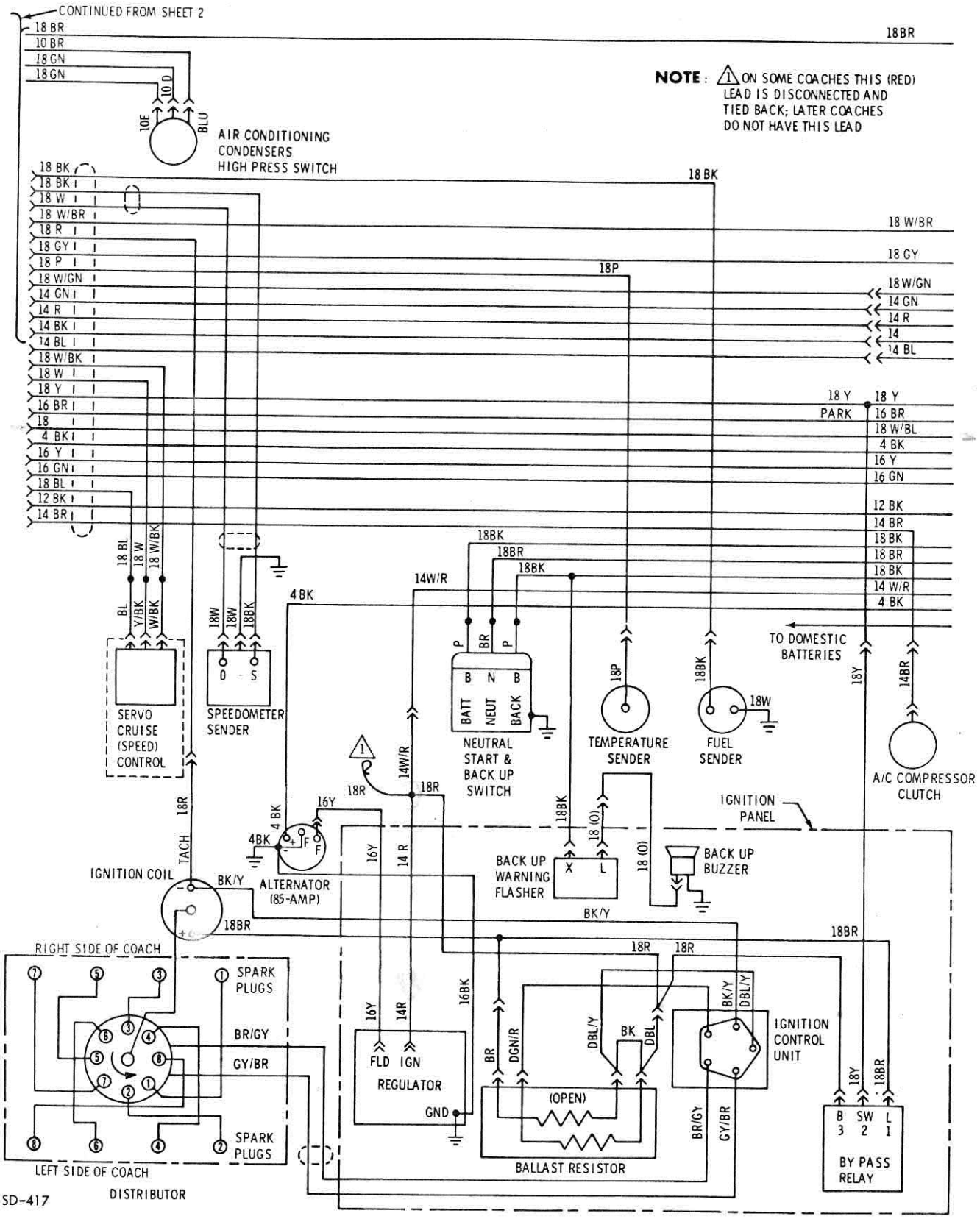



Figure 4-1. Automotive Wiring Diagram (Sheet 3 of 4)

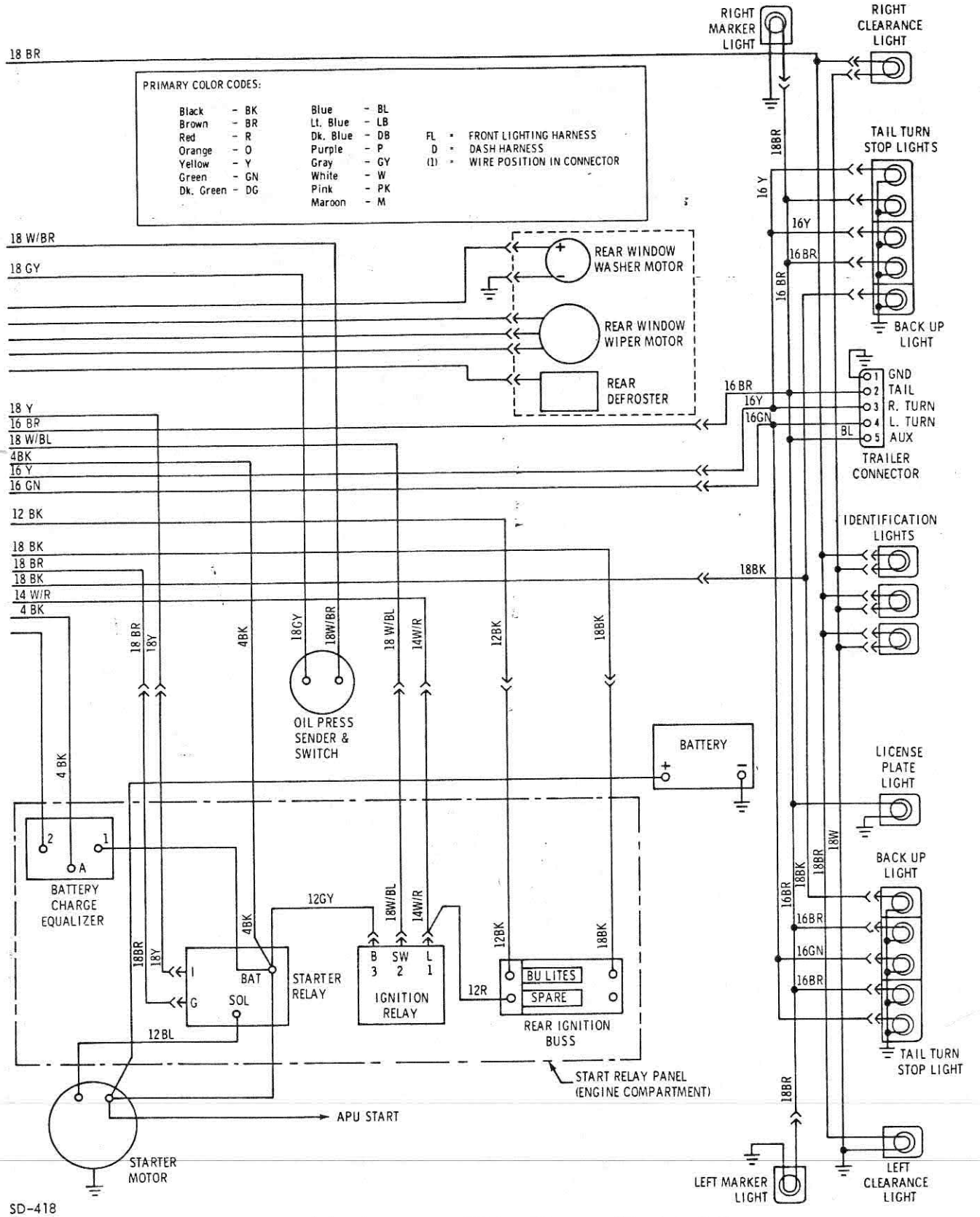



Figure 4-1. Automotive Wiring Diagram (Sheet 4 of 4)

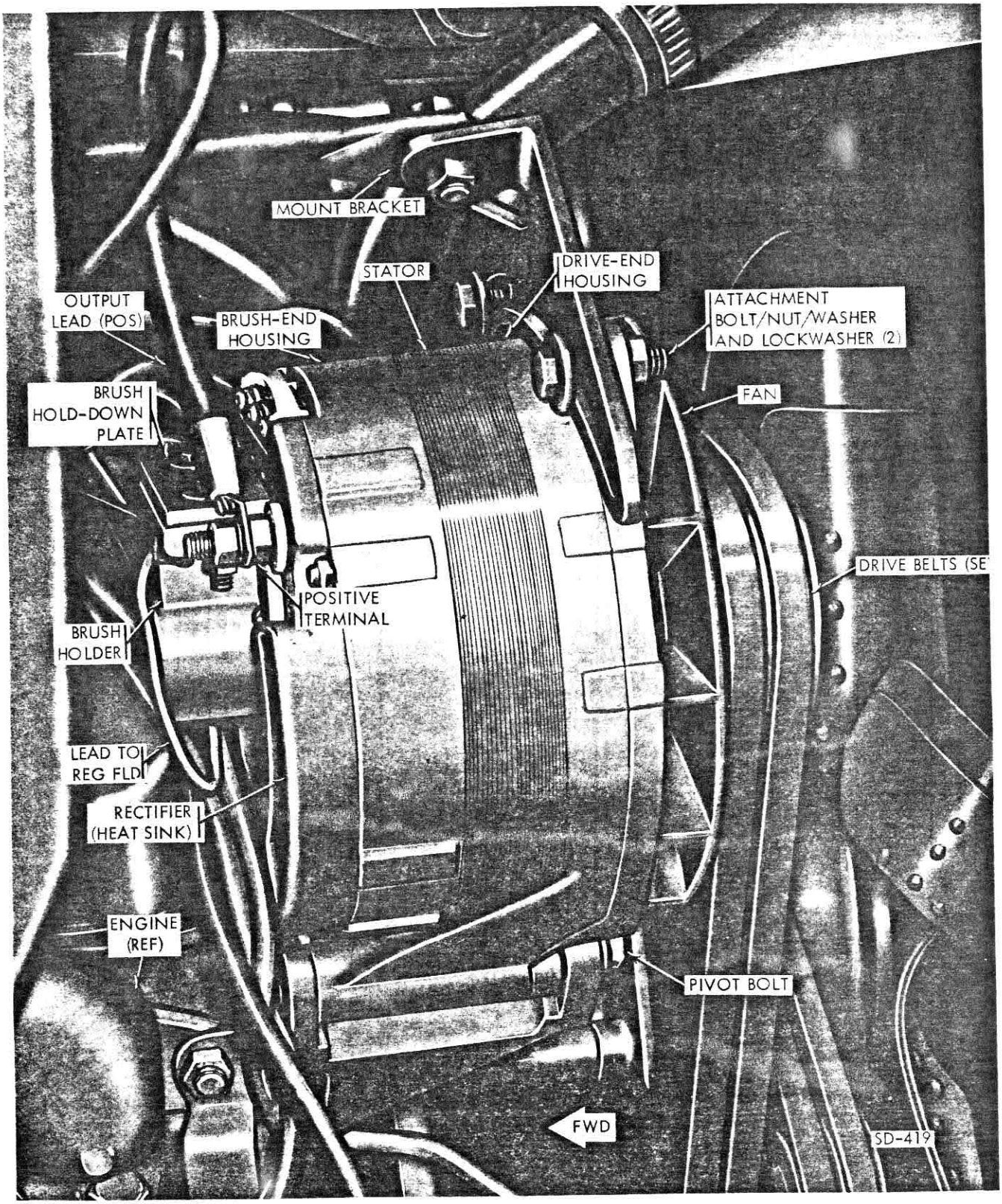



Figure 4-2. Alternator (85-Amp)

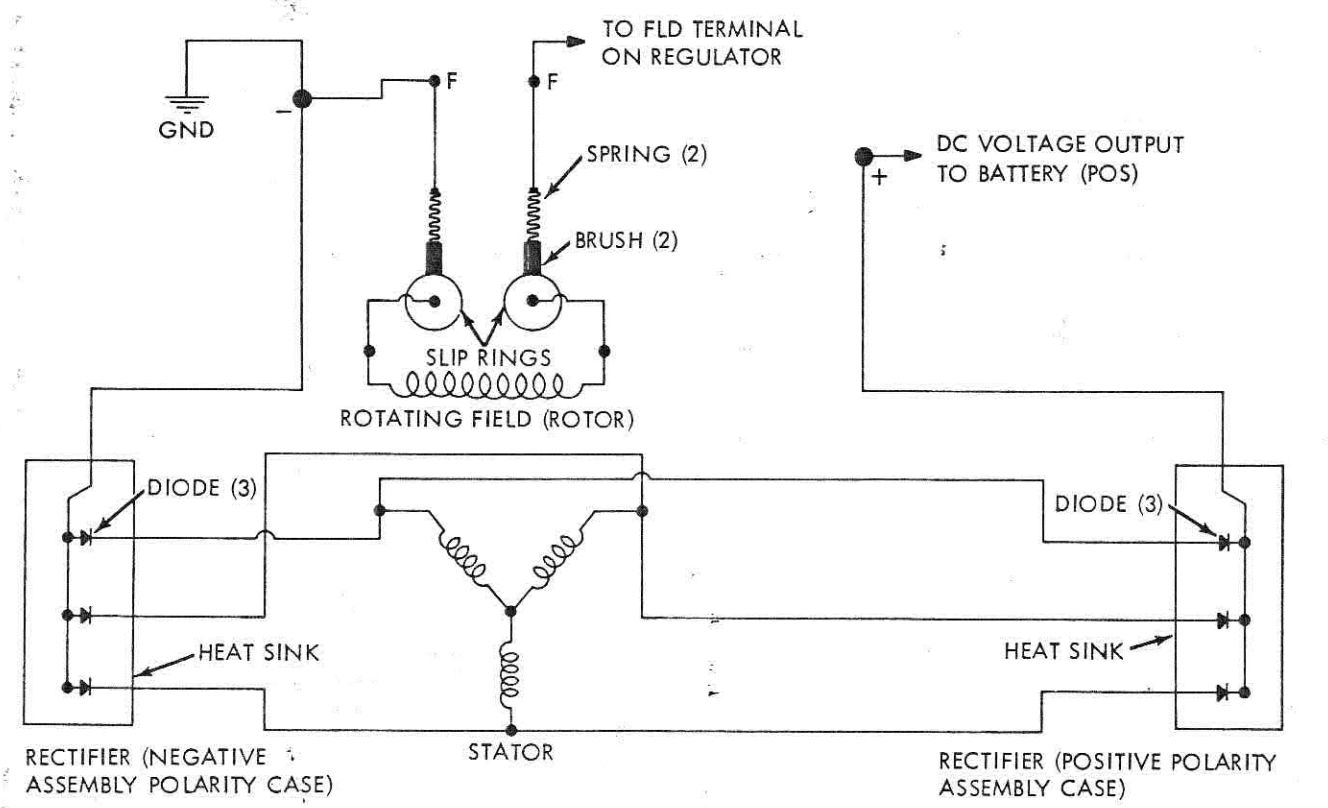



Figure 4-3. Alternator Internal Circuit Schematic

transistor to conduct a reverse bias current to the power transistor that stops the flow of current in the emitter and collector circuit of the power transistor to the field circuit of the alternator. When the voltage drops, the zener diode opens the driver base circuit, stopping the reverse bias current flow to the power transistor and allowing it to conduct in a forward bias direction and to the alternator field circuit. This sequence of events repeats itself very rapidly while the regulator is operating. A field discharge rectifier is included to short out any self induced field current when the power transistor is not conducting. The zener diode operating voltage is derived from an externally adjustable potentiometer driver transistor base circuit resistance. As alternator speed and electrical system load conditions change, the control circuit is turning the transistor on and off many times per second almost all of the time that the engine is in operation. The only time that the transistor is not turning on and off rapidly is during low engine speed operation when high electrical loads are present, requiring that the alternator field be in the "ON" state continuously. One other important feature of the electronic regulator is the ability of its control circuit to vary the regulated system voltage up or down as the temperature changes. This provides the best charging conditions for the coach battery throughout the seasons of the year. The power transistor is of the germanium type, while the other semiconductor components are silicone. The regulator will operate in a maximum ambient temperature of 180 degrees F. Voltage is adjusted by removing the socket head plug in the regulator case to expose the adjusting screw. Refer to paragraph 4-5b for adjustment procedure.

(3) 12 Volt Battery (fig. 4-4). The 105 amp, 12 VDC 90-plate automotive battery is located in the aft right hand side of the engine compartment. The battery is a lead-acid, electrochemical device assembled in a one-piece molded container. It is divided into six cells. Each fully charged cell, on open circuit, has a voltage of slightly over 2 volts.

**NOTE**

The battery does not actually store electricity but it does convert electricity into chemical energy which is stored until the battery is connected to an external circuit, at which time the chemical energy is transformed back into electrical energy and current flows through the circuit.

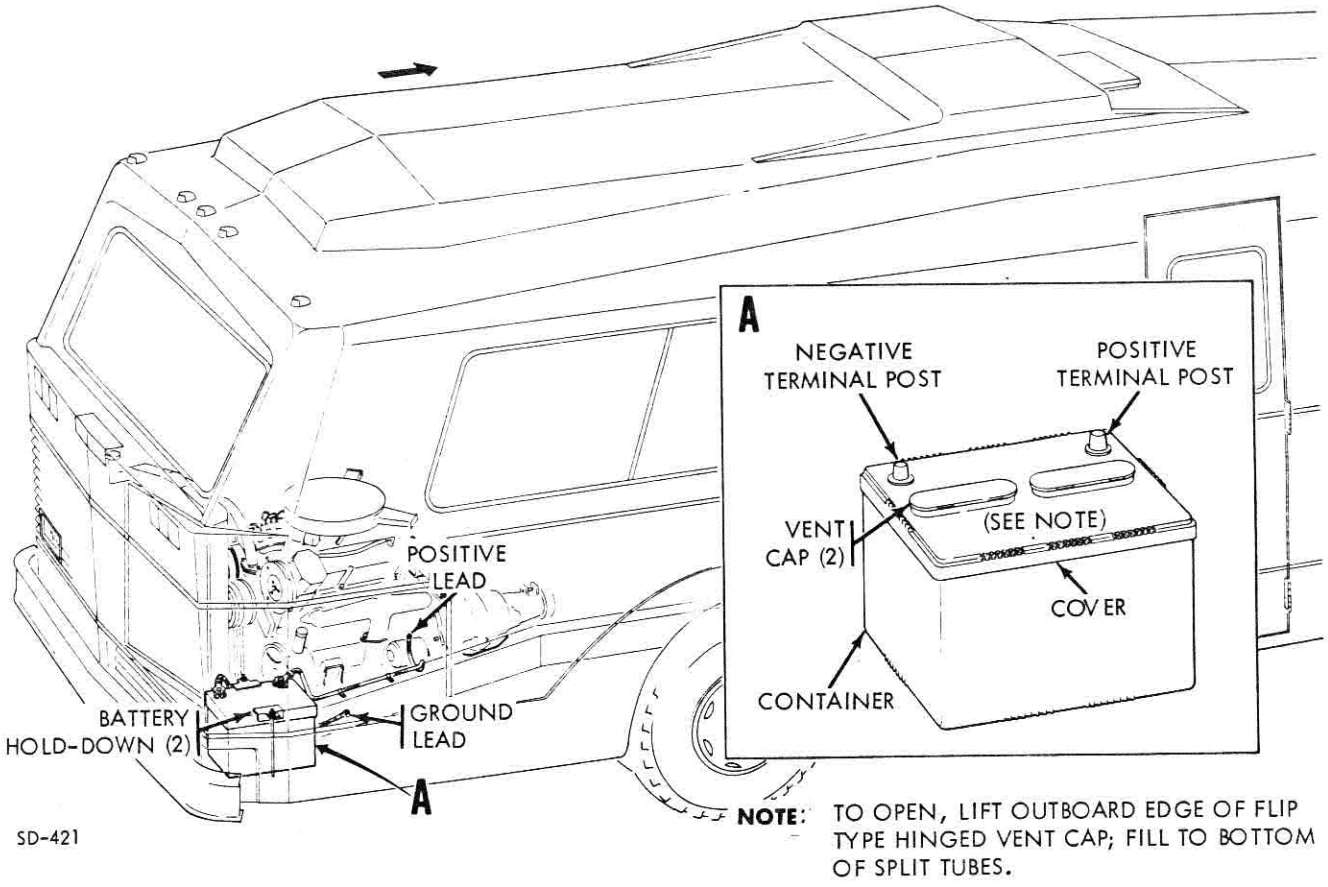



Figure 4-4. 12 Volt Battery

The battery cover is sealed to the container and over the positive and negative post straps with an epoxy compound. There are four essential chemicals present in the battery; lead peroxide in the positive plate, lead in spongy form in the negative plates, and sulphuric acid and water solution in the electrolyte (the liquid portion). The positive plate is a lead-alloy grid-like structure filled with lead peroxide active material, chocolate brown in color. The negative plate is a lead-alloy grid, filled with sponge lead, of slate gray color. The positive plates in a cell are grouped in spaced relation and lead welded into a unit. The negative plates are assembled likewise. The two groups are nested together with positive and negative plates interleaved. Each cell has one more negative plate than total positive plates. Separators, consisting of porous plastic with raised ribs, are inserted between each positive and negative plate to keep them from touching and causing an internal short circuit. Glass fiber mats are used in conjunction with separators to retain the active material in the plates and to protect the separators from oxidation. The complete assembly of plates and separators in a cell is called an element.

The element is covered with the electrolyte. The specific gravity of the battery varies with the temperature and the state of charge. In order to obtain an accurate indication of the condition of the battery, the specific gravity should always be corrected to the standard temperature (80 degrees F). When the circuit is closed, the sulphate of the electrolyte starts combining with the active material of both positive and negative plates, changing these materials to lead sulphate, and the battery begins to discharge. The loss of the sulphate from the electrolyte reduces its weight, making it possible to check the battery's state of charge by measuring the specific gravity with a battery hydrometer. At the same time, the oxygen displaced from the positive plates enters the electrolyte and combines with the hydrogen to form water. A completely discharged battery, therefore, has identical positive and negative plates with lead sulphate

active material and water for electrolyte. The chemical action in the battery removes electrons from the positive plate and deposits electrons on the negative plate. When the plates are connected to an external circuit, a current flows.

The characteristic of the battery which makes it so adaptable is its reversibility. When discharged, it is reactivated by passing an electrical current through it in the opposite direction. Doing so reverses the foregoing chemical action. The lead sulphate is changed to lead peroxide in the positive plates and sponge lead in the negative plates. The sulphate leaves the plates, combines with the water, and changes the electrolyte to sulphuric acid. Water must be added to replace that which is decomposed into hydrogen and oxygen gases during charge. The efficiency of a fully charged battery is in direct relation to atmospheric temperatures, which raise and lower the temperature of the electrolyte. A fully charged battery with an electrolyte temperature of 80 degrees F is considered to be capable of 100 percent performance. An electrolyte temperature of 32 degrees F renders the battery 65 percent effective in cranking power, and an electrolyte temperature of 0 degrees F leaves the battery only 40 percent effective.

The grid framework of the battery plates is cast from an alloy of antimony and lead containing from 6 percent to 12 percent antimony. During charging, a small amount of antimony dissolves from the positive plate grids and deposits on the sponge lead of the negative plates, where it sets up a local electrochemical action with the sponge lead. This discharges the negative plates slowly. Small quantities of other impurities may affect, to a lesser extent, either the positive or negative plates or both. All wet batteries will therefore slowly discharge on standing and will discharge much faster when warm than when cold. They will discharge faster when fully charged than when only partially charged. To minimize the extent of self-discharge, store wet batteries in as cool a place as possible, away from hot air ducts or heaters in winter and shielded from direct sunlight in summer.

c. 12 Volt DC Electrical Power Distribution System. The 12 VDC automotive electrical power system is supplied by the alternator through an equalizer to provide power for maintaining the charge of the automotive battery, for operation of the 12 VDC electrically operated automotive systems and components, and to provide voltage to the domestic electrical system batteries. The coach incorporates a single-wire, ground-return (negative ground) type 12 VDC automotive electrical power distribution system, in which the metallic frame structure is used as the major conductor for the return circuit. A ground-return connecting cable (bonding braid) is incorporated between the lower forward end of the right hand side of engine block and the adjacent coach frame. The alternator and battery ground (negative) terminals are connected by cables to the engine block and coach frame, respectively.

(1) Equalizer (fig. 4-5). The equalizer is installed in the alternator output circuit between the alternator and the automotive system and battery, and the domestic batteries, at the location shown in figure 4-5. The equalizer case is surrounded by vertical fins to provide exposure of large radiating surface areas for dispersion of heat away from the internal diodes inside the equalizer. Four mount holes are incorporated in the equalizer for attachment to the start-ignition panel. Three threaded studs (with nuts) protrude from the equalizer case for attachment of the terminals of the interconnecting electrical leads. The equalizer functions both as a current divider and as a one way current flow controller, to allow alternator output current (when output voltage exceeds battery voltage) to flow only in the direction toward the automotive electrical system's dc operated components and battery, and to simultaneously allow flow toward the domestic batteries. In the event the alternator voltage drops below the voltage of either the automotive or domestic battery, reverse current flow toward the alternator is blocked by the diodes in the equalizer, and the flow of current from either battery toward the other is also blocked.

**NOTE**

In addition to the diodes in the equalizer, diodes in the alternator's positive case rectifier also prevent reverse current flow (current flow from battery to alternator when alternator is producing less than battery voltage). This provides dual protection against reverse-current damage to the ac power supply system components and eliminates the requirement for a reverse-current relay in the alternator-to-battery circuit.

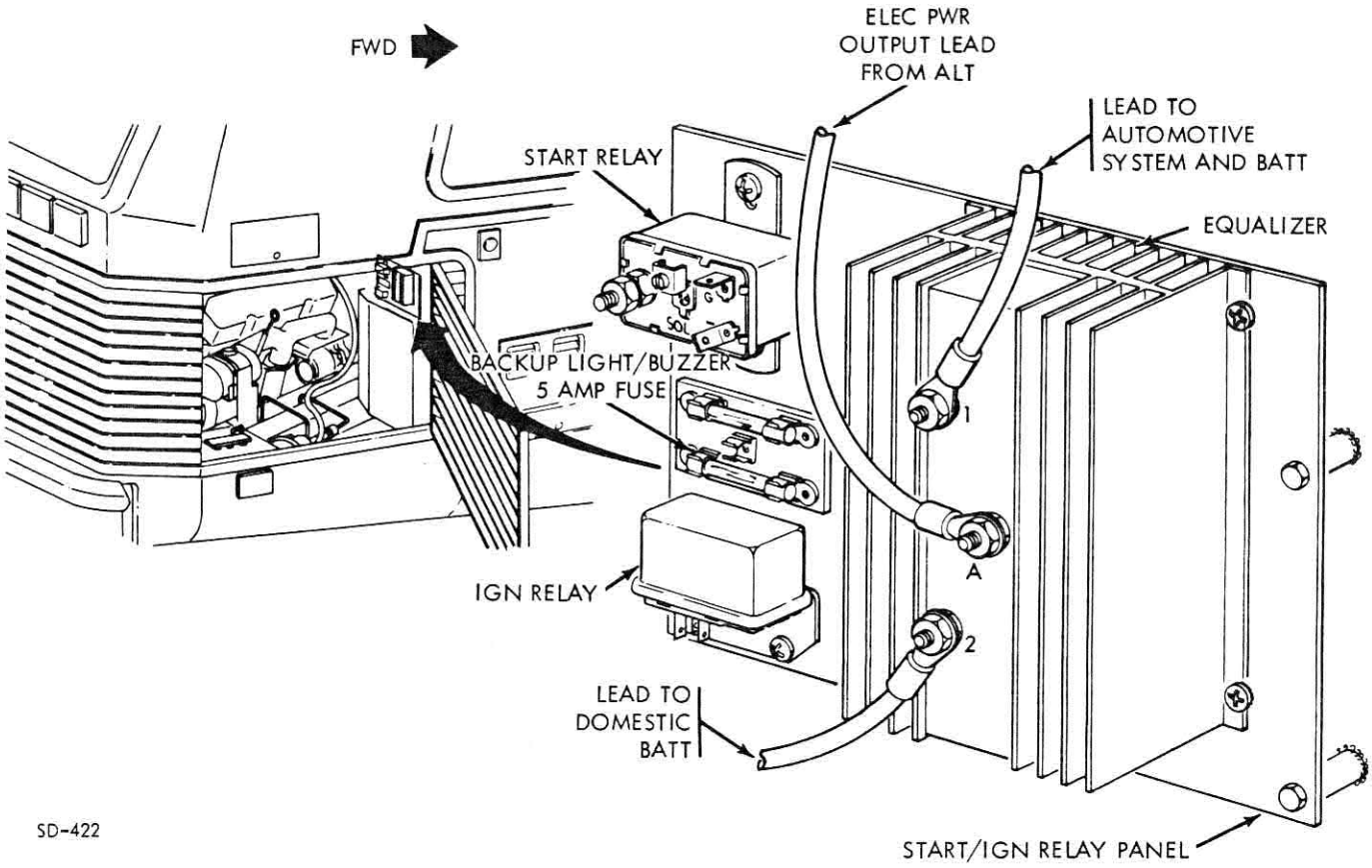



Figure 4-5. Equalizer

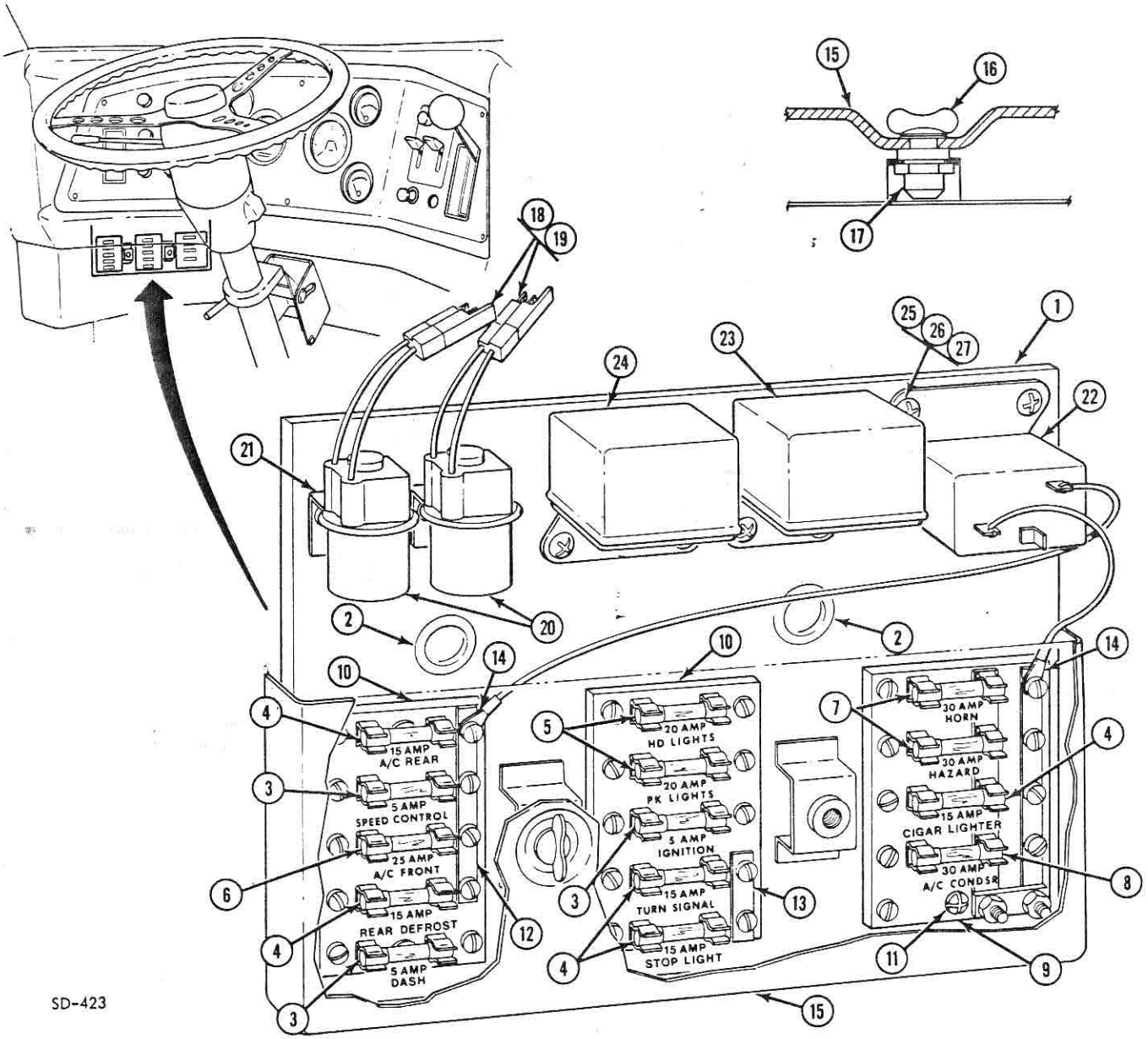
(2) Wiring Harnesses. The electrical power is distributed by color coded, insulated wires, grouped together and bound with non-metallic, vinyl, electrical tape into harness assemblies. The harnesses are routed to prevent damage from bends and contact with heated, abrasive, or sharp objects. The edges of holes in metallic members, through which the harnesses pass, are bushed with rubber grommets for protection. For harness or cable routing and construction details, refer to the applicable figure in the 2900R Parts Catalog, Group 4. The following is a list of the harness and cable assemblies:

- Front automotive wiring harnesses
- Rear automotive wiring harnesses
- Battery and engine compartment cables
- Drivers instrument panel harness
- Front lights, steering column, wiper and washer harness
- Identification and clearance lights and roof air conditioning unit harness
- Instrument panel to engine compartment harness
- Engine ignition harness
- Rear lights and trailer connection harness
- Engine starter relay harness

(3) Fuses (fig. 4-6). The electrical wiring is protected from overloads and short circuits by fuses installed in fuse holders attached to gang busses on fuse block assemblies. The amperage capacity and the title of the circuit protected are imprinted on the inside of the front fuse panel detachable cover as shown in figure 4-6.

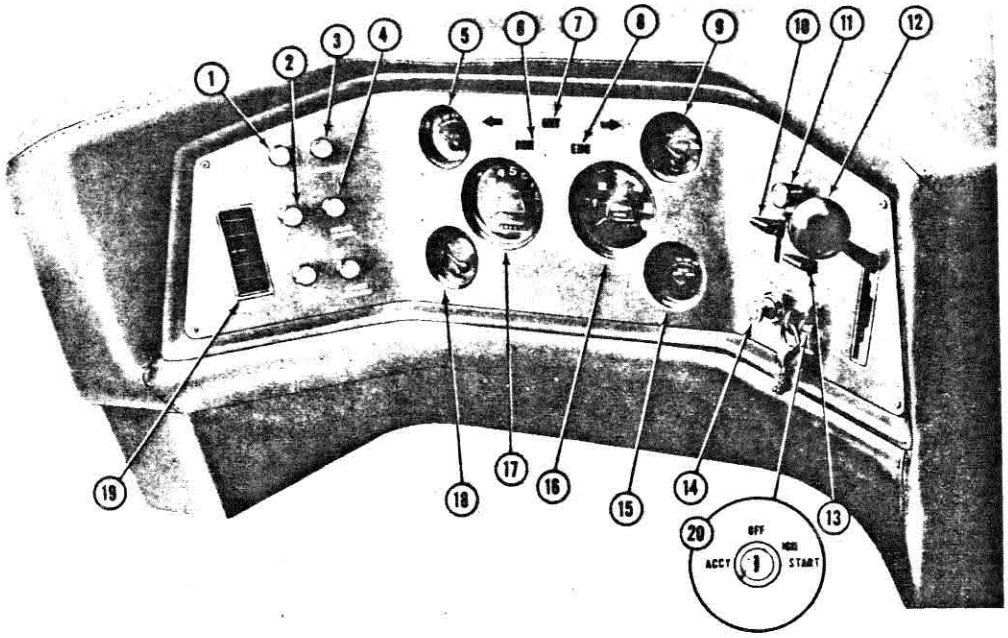
**NOTE**

The rear fuse panel, containing the 5 amp back-up light and buzzer fuse, is shown in figure 4-5.




1. PANEL, Fuse
2. BUSHING, Main fuse panel, blue
3. FUSE, Dash, ignition (speed control) (5 ampere)
4. FUSE, Air cond, rear defrost, turn signal, stop light (cigar lighter) (15 ampere)
5. FUSE, Headlights (parking lights) (20 ampere)
6. FUSE, Air conditioning front unit (25 ampere)
7. FUSE, Horn and hazard lights (30 ampere)
8. FUSE, Air conditioner condenser, Slo Blo (30 ampere)
9. FUSE BLOCK ASSY, 4 gang buss
10. FUSE BLOCK ASSY, 5 gang buss
11. SCREW, Fuse block attaching, self tapping
12. BUS BAR, Fuse block (2-3/4 lg. 4 holes)
13. BUS BAR, Fuse block (1-1/4 lg. 2 holes)
14. TERMINAL, Fuse block (No. 10 to 12 wire, No. 6 stud)
15. COVER ASSY, W/labels main fuse panel
16. STUD, Cover to panel, wing head
17. RECEPTACLE, Cover to panel stud
18. CONNECTOR, Turn and flasher unit to front lighting harness male, 2 pin
19. TERMINAL, Turn and flasher unit to front lighting harness male (No. 14 to 16 wire)
20. FLASHER, Hazard and turn signal
21. CONNECTOR AND BRACKET ASSY, Hazard and turn signal
22. RELAY, Accessory buss (60 ampere)
23. RELAY, Air conditioner (25 ampere)
24. RELAY, Horn (25 ampere)
25. BOLT, Relay and flasher, connector to panel
26. NUT, Relay and flasher connector bolt
27. WASHER, Relay and flasher connector bolt, spring (No. 10)

Figure 4-6. Front Fuse Panel

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1. LIGHT SWITCH
2. LEFT WIPER
3. HAZARD SWITCH
4. RIGHT WIPER
5. OIL PRESSURE GAUGE
6. BRAKE
7. HIGH BEAM
8. ENGINE
9. COOLANT TEMPERATURE GAUGE
10. HEATER
11. BLOWER
12. TRANSMISSION RANGE SELECTOR
13. A/C-HEAT SELECT
14. CIGAR LIGHTER
15. ALTERNATOR INDICATOR
16. TACHOMETER
17. SPEEDOMETER
18. FUEL GAUGE
19. A/C VENT
20. START – IGNITION SWITCH

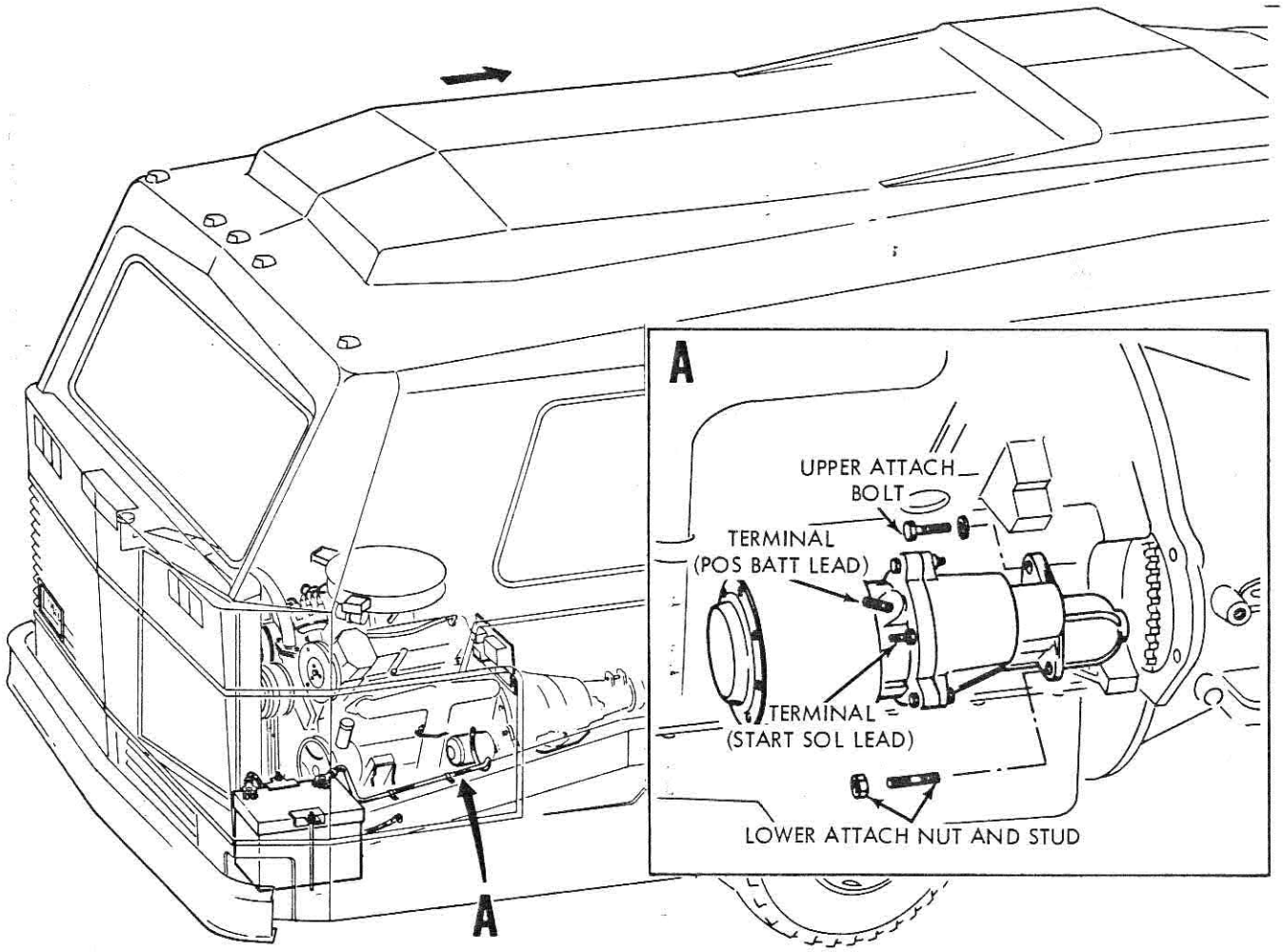
Figure 4-7. Indicators and Controls

(4) Indicators and Controls (fig. 4-7). The majority of the 12 VDC automotive electrical system circuit controls and indicators are located on the dash panel. The foot-operated headlight dimmer switch is located on the floor at the lower left hand side of the steering column. Detailed information regarding the controls and indicators is contained in subsequent sections, included within the automotive 12 VDC system in which they function.

d. 12 Volt DC Operated Systems. The 12 VDC operated systems include the engine starting, electronic ignition, air conditioning (automotive), indicators and sending units, lighting (internal and external), warning system hazard lights (horns and back-up buzzer), and the right hand and left hand windshield wiper/washer systems.

(1) Engine Starting System. The engine starting system is comprised of a starter assembly, starter relay, and a control switch. The starting system and the electronic ignition function simultaneously during the starting cycle; refer to paragraph (2) below. When the key-operated start-ignition switch (fig. 4-7, item 20) is held in the start position while gear selector is in PARK or NEUTRAL position, the starter relay is activated, closing a set of contactor points which complete the 12 VDC power circuit to the starter solenoid. When energized, the starter solenoid completes the circuit to the starter motor to turn the armature and to shift the drive gear to engage the engine ring gear. The starting ring gear is press-fit (shrunk) around the outer diameter of the torque converter front cover, which is connected through a flexible drive plate to the engine crank shaft. The starter drives the engine crankshaft when the drive gear is brought into mesh with teeth of the driven gear (ring sear) on the rim of the torque converter front cover. The starter drive gear shaft clutch provides a means of quick disengagement of the drive gear when the engine starts.

The starter (fig. 4-8) incorporates a 12 VDC powered motor and is mounted on the lower forward right hand side of the engine. Two mount holes are located in the starter drive-end housing. The starter is attached to the aft end of the transmission housing by a threaded stud and nut in the lower hole, and a bolt with captive washer in the upper hole. The starter assembly is enclosed in an aluminum die casting housing, and has a built-in 3.5 to 1 reduction gear set. The starter utilizes a solenoid activated clutch shifting device. The housing of the solenoid is integral with the starter drive-end housing.



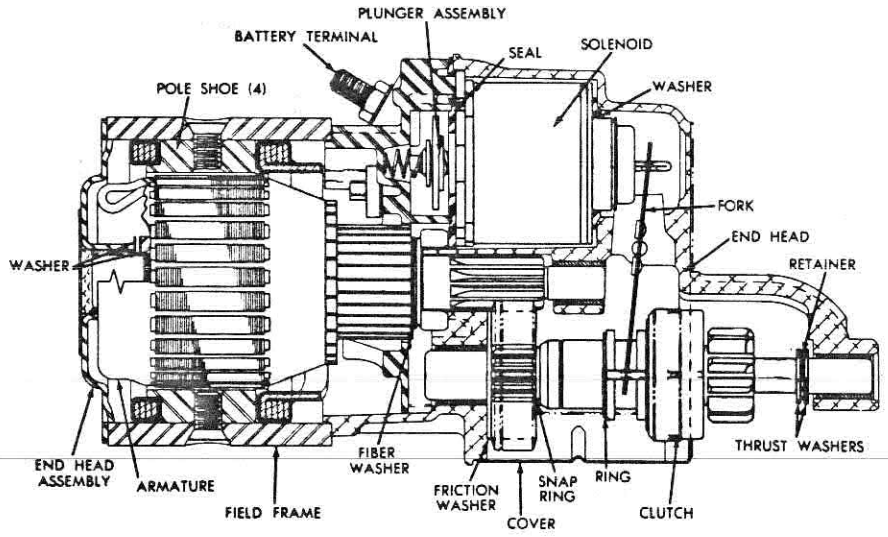




Figure 4-8. Engine Starter

(2) Electronic Ignition System (fig. 4-1). The coach engine incorporates an electronic ignition system which functions to deliver high amperage current impulses through electronic suppression type ignition cables to precision fire the spark plugs. The spark plugs ignite the atomized fuel/air mixture in the cylinder at 7-1/2 degrees before the piston reaches top center (BTC) during each compression (power) stroke. During acceleration, this firing position is automatically varied by the vacuum operated advance mechanism on the distributor. The magnetic pickup and reluctor in the distributor work in conjunction with an electronic control unit to perform the functions which in a conventional system are performed by a set of mechanical breaker points and condenser. The magnetic pickup (permanent magnet and coil) in the distributor does not wear out, thus reducing maintenance, since there are no points or condenser to change or adjust. By electronically controlling ignition timing and dwell, improved consistency of optimum firing is attained throughout the engine's varying operational modes. More complete burning of the fuel/air mixture minimizes the amount of unburned exhaust gases to be handled by the positive crankcase ventilation clean air emission system and improves gasoline mileage. Table 4-1 describes the components of the electronic ignition system.

Table 4-1. Electronic Ignition System Components

| Component | Location | Function |
|---|---|---|
| Starting ignition switch, key-operated, 4 positions:<br>ACCY<br>OFF<br>IGN<br>START | Lower right hand side of dash panel | The key-operated start-ignition switch has four positions: ACCY, OFF, IGN, and START. When key is turned to the ACCY position, the following circuits are energized: windshield wipers and washers, heater and defroster, instrument lights, and automotive air conditioning system. With gear shift lever in neutral or park, turning to START position activates the start, ignition, and by-pass relays to energize the starter motor and engine ignition system. When operator releases the switch key, the spring-loaded switch automatically positions to IGN, where it remains until manually turned. In the IGN position, the engine ignition system, instrument panel lights, brake lights, and turn signal lights are energized. To start the engine, refer to 2900R Owner's Manual, and accomplish "Starting The Engine" procedure |
| Ignition coil | Top aft left hand side of engine intake manifold just aft of carburetor air cleaner | Houses primary and secondary coil windings |
| Distributor | Top of aft end of engine close to ignition coil | Contains magnetic pickup and coil, reluctor, rotor, and distributor cap; distributes timed impulses to the control unit |

Table 4-1. Electronic Ignition System Components (Continued)

| Component | Location | Function |
|---|---|---|
| Control unit (electronic) | On upper right hand corner of ignition panel on fire-wall in center of engine compartment | Upon signal from reluctor, control unit transistor interrupts primary coil current flow and electromagnetic field collapses across secondary windings. This induces high amperage current flow through the distributor and ignition cables to fire the spark plug. |
| Dual ballast resistor | On lower right hand corner of ignition panel | During engine operation, compensating resistor maintains constant current available to primary coil during all variations of engine speed, protecting the ignition coil from high current flow regardless of engine rpm. The resistor is automatically bypassed (by-pass relay) during cranking, allowing full battery voltage to the primary coil to provide maximum hot spark for starting. The auxiliary resistor, on the other side of the dual unit, protects the control unit by limiting current flow in the electronic part of the circuit. |
| Spark plugs (8) | One in each cylinder. | To ignite the fuel/air mixture in the cylinder combustion chamber. |

(3) 12 Volt DC Operated Indicating Systems. Indicating systems provide visual read-outs on instrument dial faces of coach speed, engine rpm, engine oil pressure, fuel quantity, engine coolant temperatures, and 12 VDC power supply system output; see table 4-2. Indicator lights show operation of turn signal exterior lights, and glow if headlights are on high beam, if engine becomes inoperative, if parking brake is in ON position, and if either brake hydraulic system loses operating pressure.

(4) Lighting Systems. The 12 VDC power supply system supplies all coach exterior, interior, and warning light systems.

Table 4-2. Indicator Systems and Components

| System and Components | Type of Indication | Location | Function |
|---|---|---|---|
| Coach speed indicating and recording of distance traveled: Speedometer with integral total odometer | Pointer and dial face marked to read 0 to 100 in miles per hour (mph) and digital read-out of total miles coach has traveled (odometer) | See figure 4-7, item 17 | Pointer moves to mph figure on dial face at which coach is traveling |

Table 4-2. Indicator Systems and Components (Continued)

| System and Component | Type of Indication | Location | Function |
|---|---|---|---|
| Sender unit | N/A | Mounted on a bracket at aft lower right hand longitudinal frame beam near transmission inboard and just aft of the rear wheel well | Attached to the transmission by drive cable and is turned by transmission drive train to generate on electrical signal which is transmitted to the speedometer by interconnecting electrical wiring, when coach is moving |
| Engine speed indicating: Tachometer | Pointer and dial face marked to read 0 to 50 (thousands) revolutions per minute (rpm) | See figure 4-7, item 16 | Pointer moves to right hand figure at which engine crankshaft is running |
| Sender unit | N/A | (integral with tachometer) | Electrically connected to ignition coil to pick up firing impulse and calibrated to convert these to accurate read-out of actual crankshaft rpm on dial face |
| Engine coolant temperature indicating: Temperature gauge | Pointer and dial face marked to read 120 to 300 degrees F | See figure 4-7, item 9 | Pointer moves to the $^{o}$F temperature figure above 120, based on the intensity of the heat that coolant is encountering |
| Sender unit | N/A | Protrudes into (thread into housing) the engine water jacket just above the water pump located on aft left hand end of engine | Electrically connected to gauge to vary electrical current flow in proportion to water temperature to move the gauge indicator needle |
| 12 VDC power system output indicating: Volt indicator gauge (sometimes referred to as alternator indicator or voltmeter) | Pointer and dial face marked to read 0 to 16 volts; 0 to 11.5 volts has RED strip; 11.5 to 12.5 volts has GREEN/RED crosshatch strip; 12.5 to 16 volts has GREEN strip; above 16 volts has RED strip | See figure 4-7, item 15 | Electrically connected to 12 VDC power supply output and ground to sense system voltage and provide read-out on gauge |
| (No sending unit) | N/A | N/A | N/A |
| Fuel quantity indicating: Fuel gauge | Pointer and dial face marked to read from 0 to 1/1 (full) contents of fuel tank | See figure 4-7, item 18 | Pointer moves to the dial marker approximating the quantity of gasoline in the fuel tank |

Table 4-2. Indicator Systems and Components (Continued)

| System and Component | Type of Indication | Location | Function |
|---|---|---|---|
| Sending unit | N/A | In fuel tank; refer to group 11 | The fuel level sending unit electrically connects to the fuel gauge. The fuel level sending unit contains a float installed on one end of a pivot arm which rises or falls as the fuel level changes. The opposite end of the arm has a wiper which sweeps the windings of a variable resistor as it moves. The resistor is electrically connected to the fuel gauge which reacts to move an integral pointer across the dial face, according to the level change signals emitted by the sender. The sending unit electrical terminal (connector) and two suction tube outlets protrude from a 2-inch diameter plate installed in the top center of the tank |
| Engine oil pressure indicating: Oil pressure gauge | Pointer and dial face marked to read 0 to 150 lb/sq/inch | See figure 4-7, item 5 | Pointer moves to the dial lb/sq/inch marker representing the pressure of the oil in the engine |
| Sending unit | N/A | Mounted on the top forward end of the engine near the transmission housing | Electrically connected to the oil pressure gauge; varies electrical signal in proportion to the oil pressure and transmits to gauge to move pointer accordingly |

(a) Headlights (fig. 4-9). The coach is equipped with dual sealed beam headlights, low beam and high beam. The outboard headlights contain low and high beam elements and the inboard lights contain a single high beam element. Keep headlights clean and free of dirt for complete effectiveness. A high beam foot switch is located to the left of the steering column. Activate switch with foot to turn high beams on or off. When high beam is on, a beam indicator (blue light) labeled BRT on dash panel illuminates.

(b) Lights Switch. The main light switch is located on the left side of the dash panel. The switch controls all the exterior lights and the instrument panel lights. Pulling knob to the first stop activates all the exterior lights, except the headlights; pulling knob all the way out turns on headlights. Brightness of instrument panel is controlled by rotating knob to left for bright, to right for dim. The high beam foot switch dimmer is on the left side of the floor board.

(c) Signal and Park Lights. The park and turn sighal lights contain a dual element bulb and an amber lens. When parked, pulling light switch to first position causes the normal intensity element to go on. The high intensity element operates when making a turn or when hazard switch is in ON position. The rear lights, including the stop, turn, tail, and back-up, are horizontally mounted and recessed in the coach body. With light switch

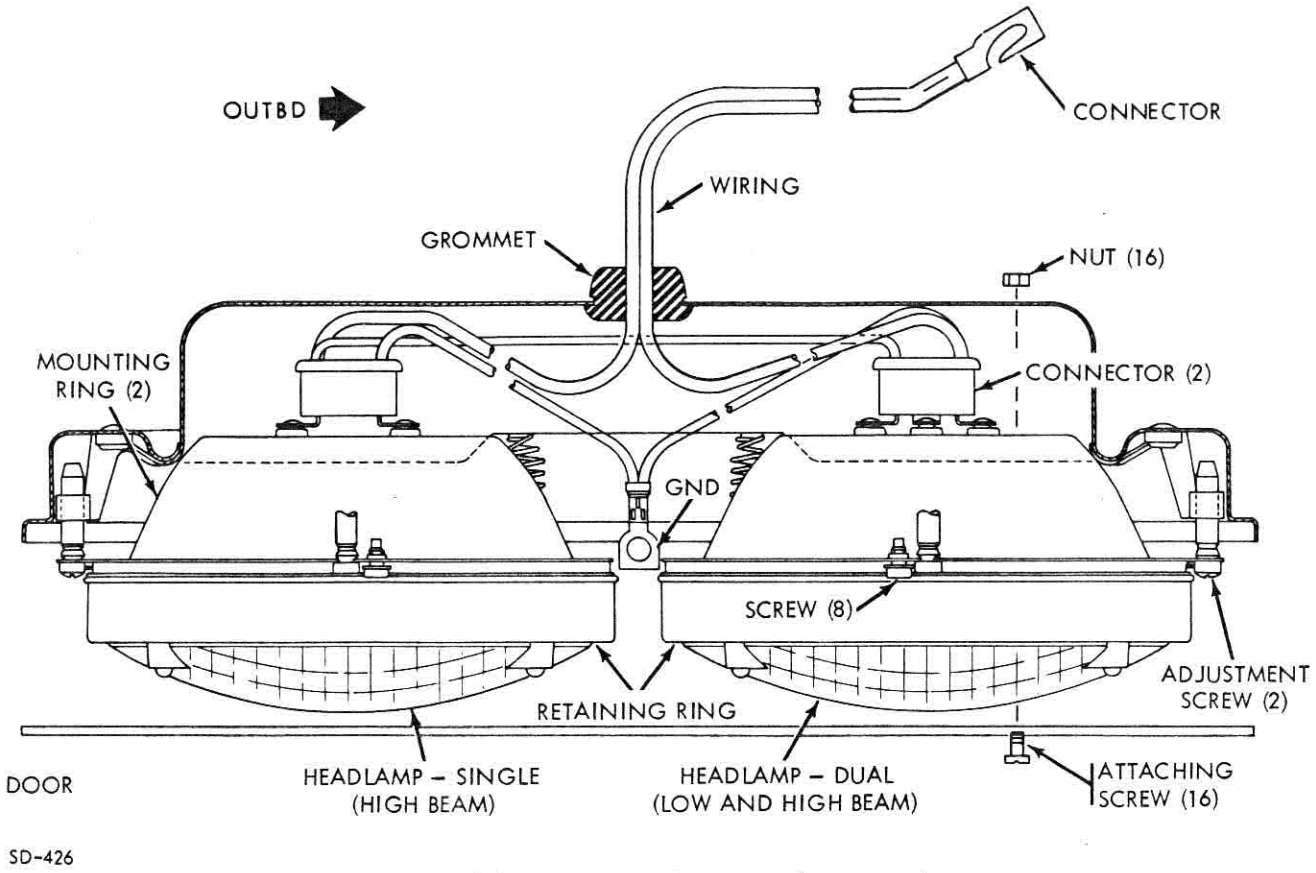



Figure 4-9. Headlight Assembly (Left Hand)

in first or second position, taillights will go on. The back-up lights and back-up buzzer operate when transmission range selector lever is placed in R (reverse). Stop lights go on when brake pedal is depressed, and the turn signal lights go on when indicator lever on steering wheel is activated. The turn signal control lever is on the left side of the steering column below steering wheel. Pull lever to signal for a left turn; push lever to signal for a right turn. The signal will remain on until the normal turn is completed or until the lever is returned to neutral by hand. Turn indicators, located on the dash panel, (green light) flash in unison with the outside lights when the turn signal is operated. A hazard signal light switch is located on the dash panel to the left of driver. This switch activates the emergency warning system and is not intended for use when coach is in motion. Pull out to place hazard switch in ON position. The front turn signal lights (park) and rear brake lights will flash. The emergency flasher system will operate even with the ignition key removed.

(d) Side-Marker Lights (Front and Rear) (fig. 4-10). Located on the lower side panels, these lights go on when light switch is pulled to first or second position. Each light is equipped with a reflex lens which reflects light to identify the coach. Front light has an amber lens; rear has a red lens.

(e) Clearance and Identification Lights (Front and Rear Roof) (fig. 4-10). Clearance lights are mounted at each roof corner, and the identification lights are in the middle (set of three) at front and rear of coach. All the front lights are equipped with an amber lens and the rear lights have a red lens. All clearance and identification lights go on when light switch is pulled to first or second position.

(f) Electric Clock (fig. 4-11). An electric clock is mounted above the center rear view mirror on coaches serial numbers 00001 through 00100. Clock panel contains a "fasten seat belt" sign to be observed while coach is in motion. To set clock, manually rotate hands to the correct position.

(g) Trailer Lights Connector, Stop, Tail, Turn, License Plate, and Back-Up Lights (fig. 4-11). The trailer lights connector, installed at rear of the coach, is incorporated to permit connecting

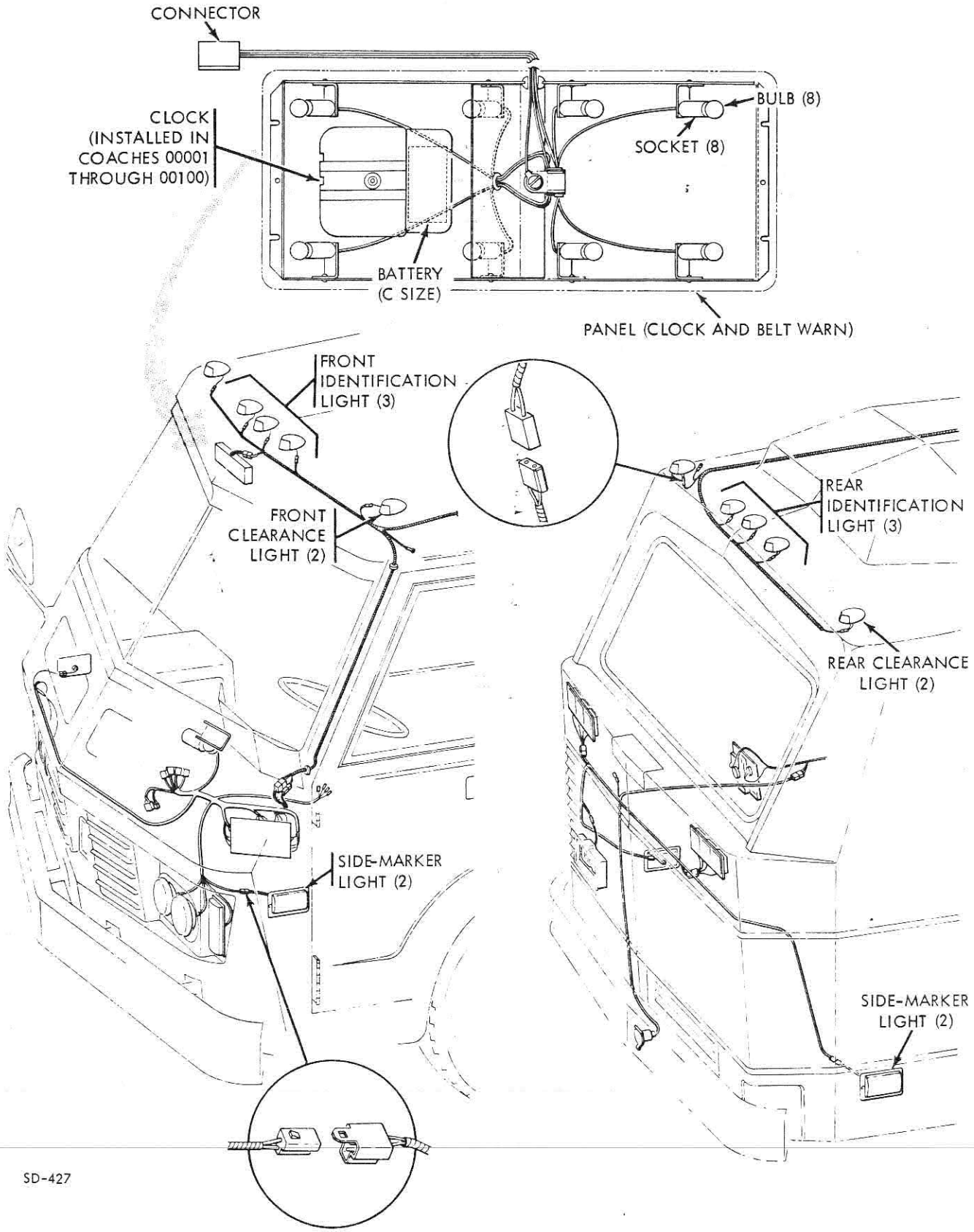



Figure 4-10. Side-marker, Clearance, and Identification Lights, and Clock

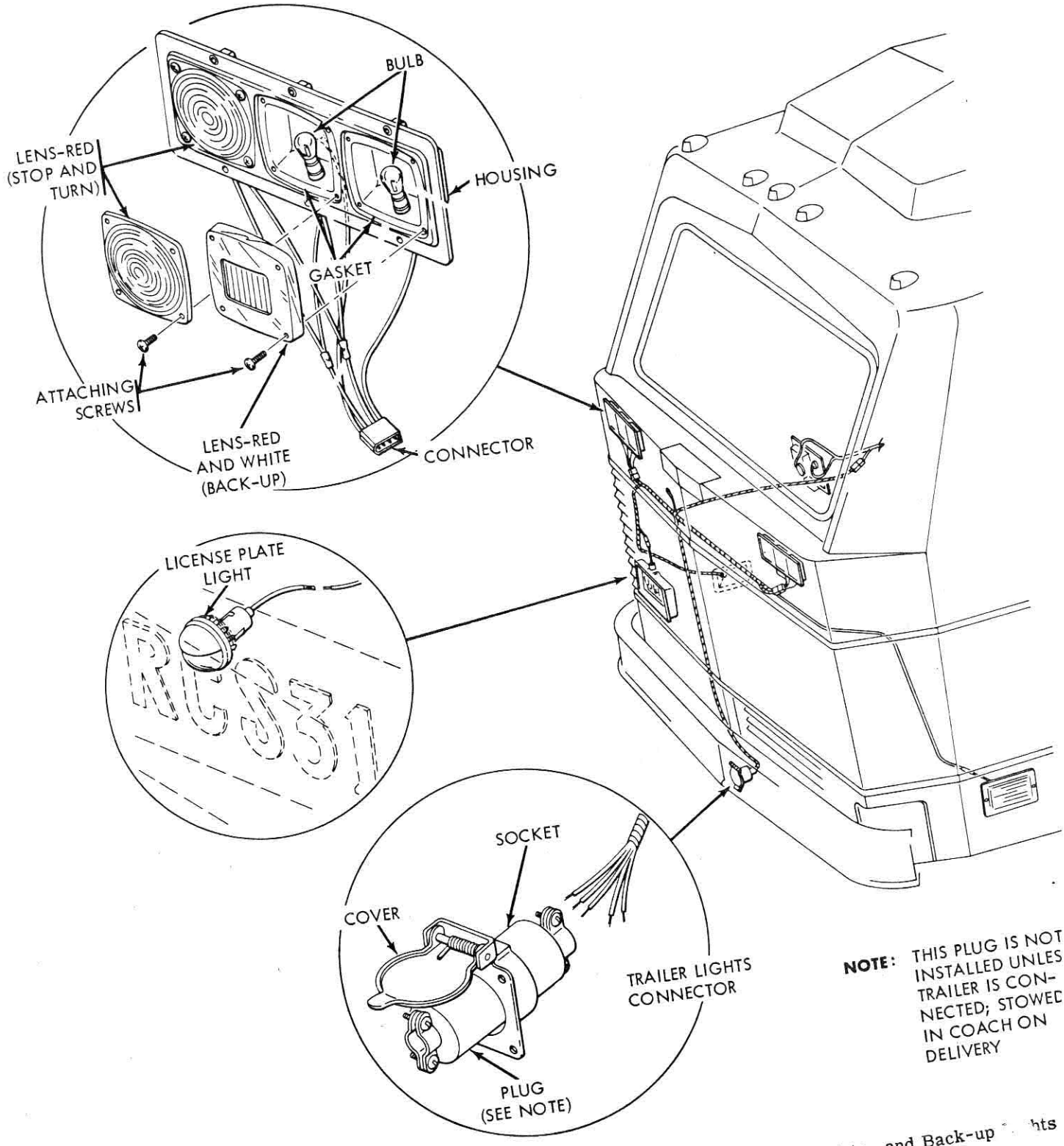



Figure 4-11. Trailer Lights Connector, Stop, Tail, Turn, License Plate, and Back-up ·hts

trailer lighting system into the coach automotive electrical system. When connected, the coach light switch and brake light switch control the trailer lights. To use, lift connector cover and insert trailer plug. Lock plug in place by hooking end of cover over the plug. To remove, lift cover and pull trailer plug from connector.

The stop, turn, tail, and back-up lights are horizontally mounted and recessed in the coach body. With light switch in first or second position, taillights will go on. The back-up lights and back-up warning buzzer operate when transmission range (gear) selector lever is placed in "R" (reverse). Stop lights go on when brake pedal is depressed, and the turn signal lights go on when indicator lever on steering wheel is activated.

The license plate light is a single bulb white lens over the rear license plate, and illuminates when headlight switch is in the first or second position.

(5) Windshield Wiper and Washer Assemblies (fig. 4-12). The coach incorporates individually controlled left hand and right hand windshield wiper and washer assemblies. The washers are the hydro-electric type with variable nozzle for adjustment of spray angle. The washer assembly includes a washer bottle (reservoir), accessible through the front access door, to contain the cleaner fluid (water or windshield cleansing solvent), electric pump, fluid distribution lines (plumbing), and two spray nozzles.

Two switches located on the dash panel to left of the driver control the left and right windshield wipers. Each wiper switch incorporates an integral circuit breaker (thermal element type, self-actuating, to open when circuit heat exceeds 6 amp draw and automatically close when temperature is below this point). If wiper motor becomes overloaded due to wiper-arm blade encountering excessive ice or snow buildup or high wind conditions, the breaker will temporarily open motor circuit until condition improves sufficiently for load draw to fall within limits.

The wiper motors function at two speeds to insure clear vision at varying speeds. Rotate switch to left for OFF, one position to right for HALF speed,

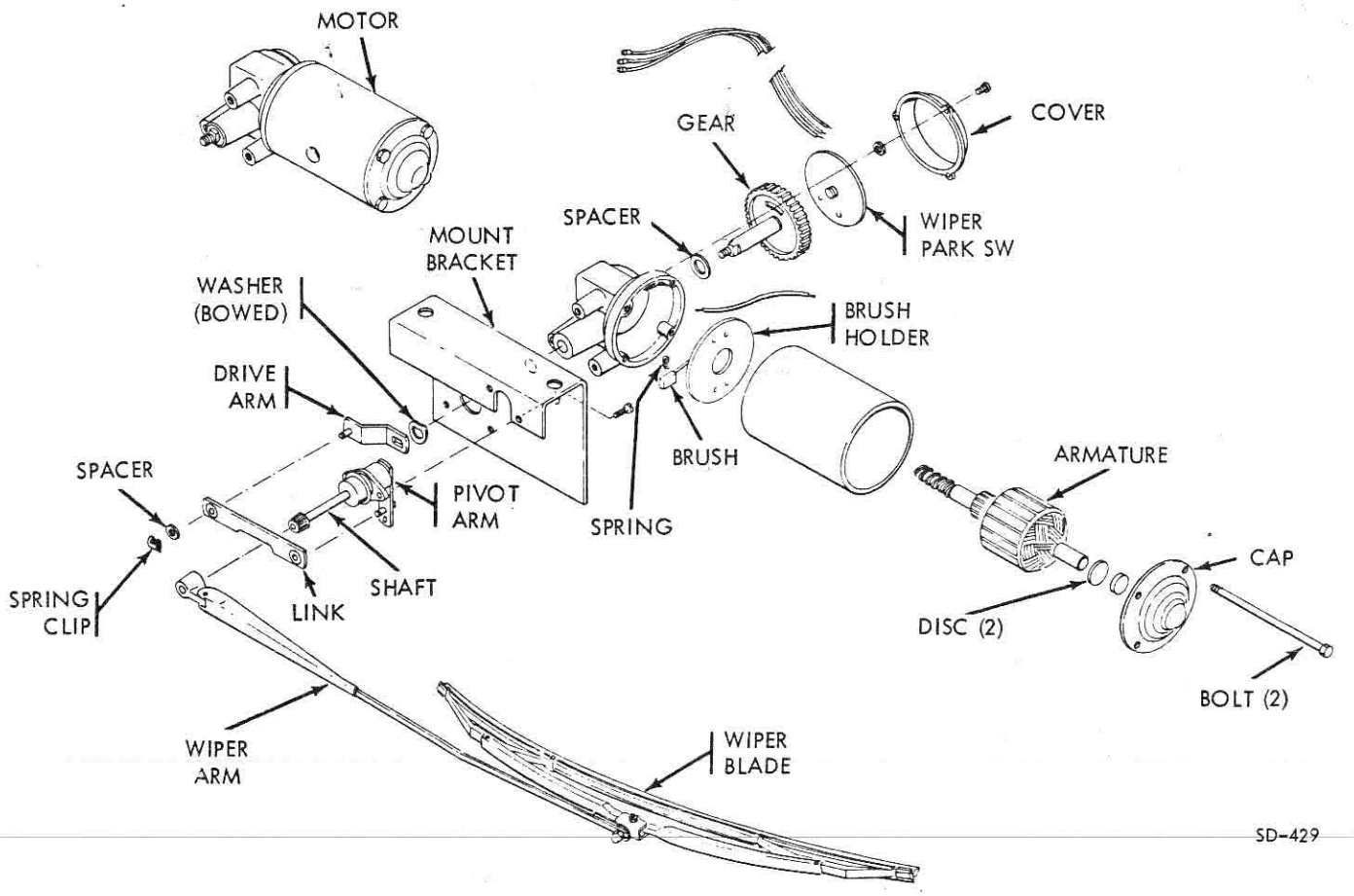



Figure 4-12. Windshield Wiper Motor, Arm, and Blade

and two positions to right for FULL speed. Push knob in to activate washers as desired; release knob to stop washers. Pushing knob activates an electric pump to spray fluid (water, windshield solvent) from washer reservoir as desired. Wet glass with washers before operating wipers. If interior of coach is cold, operate the defroster for a few minutes after the engine has warmed up to reduce possibility of smearing or freezing the fluid on the windshield. During cold weather, make sure washer solution contains antifreeze specifically made for this use.

(6) Horns. The coach incorporates two 12 VDC powered (matched-twin) horns, located on lower right hand frame just forward of the front wheel well. The horns are energized by pressing the button in the center of the steering wheel, which closes a relay mounted on the front fuse panel, in the horn 12 VDC power circuit. The horn circuit is protected by a 30 amp fuse on the front fuse panel. Both horn trumpets are positioned parallel to one another to point straight forward.

(7) Air Conditioning System. The automotive air conditioning system is supplied electrical power from the 12 VDC automotive electrical power supply system. For detailed description and service instructions on the air conditioning system, refer to Group 14.

## 4-2. TROUBLESHOOTING

a. General. The following includes instructions for the determination and isolation of automotive electrical system component or circuit malfunctions. The troubleshooting instructions are presented in sequential steps in tabular form. Troubles are listed in a descending order, from those most likely to occur to those occuring infrequently and troubles caused by the interaction of integrated components. Troubles for which remedies are obvious are not included. Repair procedures for correction of specific malfunctions are appropriately referenced in the troubleshooting table remedy column.

b. 12 VDC Open or Short Circuit Checks. Circuit checks may be accomplished with a volt/ohmmeter, continuity tester, or by substitution of a known serviceable item. If an electrical unit fails to operate when its control switch is turned on, check the power lead to the unit to determine that it is neither shorted to ground nor open. To locate a circuit malfunction, proceed as follows:

(1) A lead that is shorted to ground, to another electrical lead, or that has become overloaded due to fault within the operative electrical unit will cause the protective fuse, located on the front fuse panel, to blow. When this condition is encountered, inspect the wire from the fuse throughout its visible length to the electrical unit to which it is connected. Inspect for chafing against another lead or structural member. If wire is not defective, check the item of electrical equipment for visible mechanical defects which would cause electrical overload.

(2) An open circuit between an electrical unit and the power source will not cause the fuse to blow. To locate an open circuit, make a continuity check of the wire. Make sure that the wire under check is electrically isolated from the other wires so that a false continuity indication is not obtained through an interconnecting circuit. Using a continuity tester, connect one tester lead to one end of the wire under test, and touch opposite test lead to next wire segment connection point. Progressively check each wire segment until an open or disconnected area is found.

> **Caution**
>
> Continuity tester lead probes should be inserted at segment connection points only. A probe or other sharp instrument should not be used to pierce the insulation at intermediate points in the wire, as permanent damage to the insulation will result.

If continuity check reveals that a particular section of wire is open, but a visual check of the wire does not disclose the broken wire, locate the break by feeling the insulation until a soft spot is found.

c. Troubleshooting the 12 VDC Automotive Electrical Power Supply System. Prior to troubleshooting, a preliminary inspection should be made to assist in locating the problem; refer to paragraph 4-4b. The following is a list of precautions to be observed while working on this system to avoid damaging the various components:

(1) Never short circuit either the alternator field terminal or the field terminal at the regulator to ground. Short circuiting either of these terminals with the ignition switch in "ON" position may cause the "IGN" fuse to be blown and could also damage the regulator.

(2) Never short circuit the battery or alternator positive (+), starter relay "BAT," equalizer "1" or "2," or the starter main power input terminals to ground. These terminals are directly

connected to the battery. A short circuit to ground of any of these terminals can burn the insulation from the wiring and heat a shorting device to its melting point.

(3) Never install a battery backwards. Installing a battery backwards will result in damage to the equalizer and/or alternator diodes (rectifiers) and the insulation on the charging system wiring harness. A battery that is installed backwards creates a short circuit through the diodes (rectifiers). The battery negative post is the ground post and must always be connected to the ground cable.

(4) When charging a battery while it is connected in the electrical system, it is essential that any external charger be properly connected to the battery. Positive (+) charger lead must be connected to the positive (+) battery post, and the negative (-) lead must be connected to the grounded negative (-) battery post. If this is not done, the wiring between the alternator and the battery, and possibly the diodes (rectifiers), may be burned. A safe procedure is to disconnect the battery ground (negative) cable before connecting charger.

(5) When using an external booster (battery or high rate charger) as an aid in cranking an engine, use extreme caution, to be certain that the booster leads are properly connected.

> **Caution**
>
> When connecting a negative lead from an external booster, make sure it is connected to the battery negative terminal post. Failure to connect the booster leads properly with respect to polarity may result in damage to the equalizer and/or alternator.

(6) Be careful not to spill oil into the alternator air vents when servicing the engine. Oil that is spilled into the alternator may get on the slip rings and cause output failure.

(7) It is essential that the alternator regulator base have a good connection at the regulator ground terminal and at the alternator negative (-) terminals. Without a good ground connection there can be no regulation.

(8) Instructions for troubleshooting the 12 VDC automotive electrical power supply system are contained in table 4-3.

Table 4-3. Troubleshooting the 12 VDC Automotive Electrical Power Supply System

| Malfunction (symptoms) | Probable causes | Corrective action (remedies) |
|---|---|---|
| Alternator output low (voltmeter pointer below green with engine at 1500 rpm) | Drive belts loose | Tighten, and add belt dressing; refer to paragraph 4-3e, step (4) |
| | Regulator set too low | Adjust; refer to paragraph 4-5b |
| | Loose field lead connection at alternator | Tighten |
| | Brushes excessively worn | Replace; refer to paragraph 4-3f |
| | Brushes not properly contacting slip rings due to weak springs | Replace; refer to paragraph 4-3f |
| | Shorted diode in rectifier assembly | Replace alternator; refer to paragraphs 4-3d and e |

Table 4-3. Troubleshooting the 12 VDC Automotive Electrical Power Supply System (Continued)

| Malfunction (symptoms) | Probable causes | Corrective action (remedies) |
|---|---|---|
| Alternator output too low or too high (voltmeter pointer in low red or in red above 16) | Faulty voltage regulator | To determine if regulator is at fault, after all wiring has been thoroughly checked, disconnect field wire from regulator "FLD" terminal and connect it to the SW terminal on by-pass relay located on lower portion of the ignition panel, or any accessible 12 V supply. When performing this test, do not run the engine any longer than necessary, and not above a fast idle. Turn off all accessories that may be damaged by high voltage such as radio, headlights, running lights, etc., as the regulator is being bypassed. If output is now obtained, (with regulator field lead connected to another 12 VDC power supply) the regulator is faulty and should be replaced. If charging/rate is excessively high and cannot be lowered by means of the adjustment, remove the field wire from regulator. If output drops, regulator is defective and should be replaced. If the above tests do not indicate a defective regulator, point-to-point voltage checks should be made<br><br>**NOTE**<br><br>When troubleshooting the electronic voltage regulator, many so-called regulator failures may be traced to other faults such as loose, broken, or corroded connections or loose and slipping alternator drive belts. For this reason, all wiring, connections, belts, and brackets should be thoroughly inspected before proceeding to the regulator. The regulator is not designed to be dismantled for inspection; refer to paragraph 4-4b |
| Noisy alternator | Alternator mounting loose | Properly install and tighten alternator mounting |
| | Worn or frayed drive belts | Install a new set of drive belts and adjust |
| | Worn bearings | Remove and install new alternator; refer to paragraphs 4-3d and 4-3e |
| | Rotor fan damaged | Remove and install new alternator; refer to paragraphs 4-3d and 4-3e |

Table 4-3. Troubleshooting the 12 VDC Automotive Electrical Power Supply System (Continued)

| Malfunction (symptoms) | Probable causes | Corrective action (remedies) |
|---|---|---|
| Battery electrolyte level consistently found low during periodic checks | Excessive alternator output | Replenish battery; refer to paragraph 4-5c, and adjust regulator; refer to paragraph 4-5b |
| | Cracked or leaking battery case (container) | Replace battery |
| Coach voltmeter reads below 12 VDC with engine at 1000 to 1500 rpm and alternator output 13.8 to 14.2 VDC checked at equalizer "A" terminal | Defective diode in equalizer | Replace equalizer |

d. Troubleshooting Engine Starting System. Instructions for troubleshooting the engine starting system are contained in table 4-4. Prior to troubleshooting, a preliminary visual inspection to assist in locating the problem should be made as outlined in paragraph 4-4b.

Table 4-4. Troubleshooting the Engine Starting System

| Malfunction (symptoms) | Probable cause | Corrective action (remedies) |
|---|---|---|
| Starter will not operate with gear shift lever in NEUTRAL and ignition switch on START | Weak battery | Test specific gravity; recharge or replace battery<br>**NOTE**<br>The hydrometer is used for determining the specific gravity. The following gives an indication of specific gravity value (based on an ambient temperature of 80°F), related to battery charge condition:<br>Specific Gravity Reading / Battery Charged Condition<br>1.260-1.280 Fully charged<br>1.230-1.250 Three-quarter charged<br>1.200-1.220 One-half charged<br>1.170-1.190 One-quarter charged<br>1.140-1.160 Just about flat<br>1.110-1.130 All the way down |
| | Loose switch wiring connection to start relay | Check and tighten |

Table 4-4. Troubleshooting the Engine Starting System (Continued)

| Malfunction (symptoms) | Probable causes | Corrective action (remedies) |
|---|---|---|
| | Gear shift lever not properly activating the neutral, park, and back-up light starting switch on transmission when in neutral or park position | Check and adjust interconnecting linkage, starting at transmission end |
| | Loose or open connection at start relay SOL terminal or start solenoid terminal (small) on starter | Check continuity and tighten or repair as required |
| | Loose positive or negative cable connections or excessively corroded battery cable post(s) | See fig. 4-4. Tighten positive and negative cable connectors nuts/bolts or clean posts or cable attachment to starter and to coach frame |
| Starter turns, but drive gear does not engage | Broken teeth on ring gear of torque connector front cover | Replace the torque converter front cover and examine teeth on the starter drive gear |
| | Drive gear shaft rusted or dirty | Remove starter, and clean |
| Starter solenoid chatters when start switch is actuated | Battery discharged | Recharge or replace battery |
| | Faulty wiring | Test for open circuit between starter relay terminal and start switch on automatic transmission |
| | Neutral, park, and back-up light starting switch on transmission faulty | Replace |
| | Start relay faulty | Replace |
| | Ignition-start switch faulty | Replace |
| Engine will not turn over | Run down battery | Recharge or replace |
| | Starting circuit open | Locate and eliminate open circuit |
| | Cranking motor jammed | Remove starter for teardown and correction or replacement |
| Engine turns over slowly but does not start | Excessively worn battery cable end clamps | Replace cable assemblies |
| | Run down battery | Recharge or replace |
| | Defective cranking motor | Replace or repair starter |
| | Bad connections in starting circuit | Clean and tighten |

e. Troubleshooting Electronic Ignition System.

(1) Instructions for troubleshooting the electronic ignition system are contained in table 4-5. Prior to troubleshooting, a preliminary visual inspection to assist in locating the problem should be made as outlined in paragraph 4-4b.

Table 4-5. Troubleshooting the Electronic Ignition System

| Malfunction (symptoms) | Probable causes | Corrective action (remedies) |
|---|---|---|
| Engine turns over at normal speed but does not start | Electronic ignition unit overheated | Open rear access doors and allow unit to cool, then try again |
| Engine will not start (fuel and carburetion known to be good) | Dual ballast resistor wiring connections loose | Tighten |
| | Faulty ignition coil | Inspect for carbonized tower; replace Check primary and secondary resistances |
| | Coil damaged by excessive heat from engine | Replace coil. Inspect condition of the distributor |
| | Faulty ignition switch | Replace |
| | Improper pickup air gap in distributor | Check distributor pickup coil gap; 0.010 inch feeler gauge should not slip between pickup coil core and an aligned reluctor blade<br>**Caution**<br>A feeler gauge can be forced between a properly adjusted reluctor and pickup. Do not use force to insert feeler gauge. No evidence of pickup coil striking reluctor blades should be visible |
| | Faulty wiring | Visibly inspect wiring for brittle insulation. Inspect connectors. Molded connectors should be inspected for rubber inside female terminals |
| | Faulty control unit | Replace |
| Engine surges severely (not lean carburetor) | Faulty wiring | Inspect for defects, and open or loose connections |
| | Ignition coil | Check for loose input or ground lead terminal nuts |
| Engine misses (carburetion known good) | Spark plugs | Check plugs. Clean and regap, or replace if necessary |
| | Arcing at distributor cap | Inspect for carbonized tower |
| | Faulty wiring | Check for loose or open connections |
| | Faulty pickup oil leads | Disconnect vacuum advance if miss stops; replace pickup |
| | Faulty control unit | Replace |

Table 4-5. Troubleshooting the Electronic Ignition System (Continued)

| Malfunction (symptoms) | Probable causes | Corrective action (remedies) |
|---|---|---|
| Engine runs but misses (one cylinder) | Defective spark plug | Clean or replace |
| | Distributor cap or lead defective | Replace |
| Engine runs but misses (different cylinders) | Defective ignition | Check timing and ignition |
| Engine lacks power, acceleration, or high-speed performance, hot or cold | Defective ignition | Check timing and plugs; replace plugs and adjust timing in accordance with paragraphs 4-3q and r, and 4-5d |

(2) Troubleshooting of the coach electronic ignition system may also be accomplished using the Chrysler Ignition Tester C-4166 or C-4166A. Design changes in the 1973 electronic control units require that an adapter (number C-4166-1) be used when testing with the C-4166. The new C-4166A tester tests all electronic ignition systems, and no adapter is needed. Condensed instructions for using the tester are printed on the back panel. The first set of instructions is for bench tests, and the other is for testing the system while units are installed on the coach. Two leads with five-prong connectors are used to connect tester to the coach ignition circuit.

(a) With the ignition switch off, remove the screw and disconnect the wiring harness from the control unit. Connect the wiring harness from the control unit. Connect the female connector of the tester to the control unit and the male connector to the wiring harness of the system to put the tester in the ignition system circuit.

(b) The diagnosis chart at the right side of the panel is to be used in connection with on-coach testing. The 6-step system test instructions and the diagnosis chart are used for on-coach troubleshooting. The chart is based on the condition of the lights on the front of the tester. When testing the system on the coach, the two green lights should come on as soon as the tester is connected into the system. This does not necessarily mean that everything is okay in the entire system, but it does mean that you can proceed with the test. On the other hand, if both or either of the green lights do not come on, trouble exists which must be corrected before proceeding with the remainder of the test. The three red lights on the front of the tester are "trouble lights". If one or more of them comes "ON," something is definitely wrong and the appropriate item indicated by an "X" on the chart should be checked. In other words, an "OFF" condition in the green lights or an "ON" condition in the red lights indicates trouble.

f. Troubleshooting Windshield Wiper and Washer Assemblies. Instructions for troubleshooting the windshield wiper and washer assemblies are contained in table 4-6. Prior to troubleshooting, a preliminary visual inspection to assist in locating the problem should be made as outlined in paragraph 4-4b.

Table 4-6. Troubleshooting the Windshield Wiper and Washer Assemblies

| Malfunction (symptoms) | Probable cause | Corrective action (remedies) |
|---|---|---|
| Wiper operates but washer does not spray fluid | Fluid reservoir empty | Replenish |
| | Fluid distribution line disconnected from reservoir | Connect fluid line |
| | Pump motor defective | Replace |
| Wiper arm will not move with control switch positioned to right FULL speed | 6 amp circuit breaker in switch open due to overloaded wiper motor | Turn off switch and check wiper arm for obstructions (ice or foreign objects lodged between arm and recess area of forward panel); remove obstruction, allow motor to cool, then recycle switch to FULL speed |
| Wiper operates intermittently | Binding condition in wiper arm shaft assembly, connecting links, gear or shaft assembly | Detach dash panel for access, and inspect and repair as required |
| | Faulty wiring connections at parking switch or brush holder assembly | (same as preceding) |
| | Brushes binding in holders or not seated properly | (same as preceding) |
| | Dirty or oily motor armature commutator | Detach dash panel and clean commutator, then replace brushes |
| Wiper motor noisy | Improperly seated brushes | Detach dash panel and replace brushes |
| | Excessive armature end play | Detach dash panel to gain access, and readjust end play to 0.001 to 0.005 inch. Make certain that both thrust discs are in the end cap bearing bore; replace gear and shaft |
| | Lack of lubrication | Detach dash panel to gain access, and lubricate |
| | Loose pole shoes | Detach dash panel to gain access, and replace motor |
| Stripped drive gear teeth | Wiper blades striking windshield molding during operation | Adjust blades to park a minimum of 1-1/2 to 2 inches from molding |
| | Excessive armature end play | Detach dash panel to gain access, and readjust end play to 0.001 to 0.005 inch. Make certain that both thrust discs are in the end cap bearing bore; replace gear and shaft assembly |

4-3. REMOVAL/INSTALLATION.

a. General. Step-by-step instructions (including how to gain access) for replacement of the automotive electrical system components, where procedures are not obvious, are provided in this section. Replacement parts should be ordered from those listed in Group 4 of the 2900R Parts Catalog. Substitution parts are used only when necessary. Defective electrical or electronic parts such as fuses, lamps (bulbs), relays, indicators, equalizers, voltage regulators, ignition control units, ballast resistors, and sending units are replaced rather than repaired. Some parts, such as controls switches, relays, and alternators with slight damage are repairable. In either case, the replaced or repaired part must be equivalent to the original part to maintain performance, reliability, and safety.

b. Replacement of Fuses, Fuse Posts, and Fuseholders. Use fuses, fuse posts, and fuseholders of the type in the 2900R parts lists. See figure 4-6. Replace corroded or oxidized fuses regardless of other conditions. If prescribed fuses are not available, use substitute fuses in non-critical circuits, providing the physical size of the fuse satisfies requirements, the current rating of the substitute does not exceed the rating of the original fuse, and the voltage rating is NOT lower than the voltage rating of the original fuse.

c. Battery Replacement (fig. 4-4). Replace the 12 VDC automotive battery as follows:

(1) Note location of the positive and negative terminals of the old battery. Loosen cable clamp terminal nuts, and remove clamp terminals with a screw type terminal puller.

(2) Inspect mount tray and hold-downs for acid damage and excessive dirt or mud. Replace hold-downs if necessary. Otherwise, wash with baking soda/water solution and stiff brush. Rinse and dry. Paint corroded parts with black acid-proof paint.

(3) Check cables for worn or frayed insulation. Replace cable or attachment bolts if corroded.

(4) Clean and tighten the ground connections. Make certain starter connection stud terminal nut is tight.

(5) Be sure replacement battery is fully charged.

(6) Place battery in mount tray. See that it seats level. Tighten hold-down nuts evenly at each point until battery is secure. If hold-down nuts are tightened excessively, they will cause distortion and damage to battery container.

(7) Make sure that cables do not cause strain on posts and covers. Clean battery terminals and inside of clamp terminals with sandpaper or wire brush. This is very important, as a poor contact causes low current in a voltage regulated system. Apply petroleum grease to posts and inside of clamps.

(8) Make sure that the battery is connected correctly with regard to polarity. Temporarily slip cable clamps over posts, and turn on start-ignition switch. Voltmeter on dash should read approximately 12 volts. This is important, as transistors may be damaged by reversed battery polarity.

(9) Arrange cable clamps so they will not interfere with opening of flip type hinged vent caps or rub on hold-down clamp, then tighten.

(10) Check charging rates. A fully charged battery and a low charging rate, after engine has been running a few minutes, is normal. If the charging rate is too high or too low, check the wiring, alternator, and regulator.

d. Alternator Removal (fig. 4-2). To remove the alternator, open the rear engine compartment access door and proceed as follows:

(1) Disconnect the electrical leads from the alternator terminals. Note the terminal locations to which each lead is connected.

(2) Remove the two nuts, lockwashers, bolts, and plain washers attaching the alternator to the upper bracket.

(3) Support alternator with hands, then remove the lower pivot bolt and washer. Rotate alternator toward engine until pulleys clear the drive belts, then remove alternator.

e. Alternator Installation (fig. 4-2). Install alternator on coach engine as follows:

(1) Position alternator so that pivot bolt can be inserted through hole in alternator hose to thread into engine aft mount hole, then install washer and pivot bolt. Snug-up bolt but do not tighten.

(2) Align drive belts with pulley slots, and rotate alternator away from engine until belts seat in pulleys.

(3) Install attaching bolts, washers, and nuts through support bracket slot and alternator mount holes. Insert bolt with head end and flat washer on bracket side, and install lock washer and nut on aft side of alternator mount holes (fig. 4-2). Snug-up nuts but do not tighten.

(4) Using suitable prying device, pry outward from engine against alternator drive-end housing (near drive pulleys) to obtain approximately 50 to 60 pounds tension on drive belts, then torque upper nuts/bolts to 30 foot pounds. Tighten pivot bolt to 30 foot pounds.

**NOTE**

If a new set of drive belts is being installed, they must be tightened initially to 100 pounds tension, and thereafter to tension specified above. New belt tension should be checked after about 50 miles of operation and retightened if loose.

(5) Connect electrical leads to alternator terminals (fig. 4-3). Make sure the short jumper wire from "F" to "–" (ground) is properly installed on forward end of alternator. The other "F" terminal must be connected to the lead attaching to the "FLD" terminal on the regulator. Position all leads to clear the engine and surrounding structural components. Tighten all terminal nuts.

**NOTE**

Make sure alternator pulley shaft nut is tight. Torque should be 40 to 50 foot-pounds.

(6) Perform operational check of 12 VDC power supply system.

f. Alternator Brush Replacement (fig. 4-2). Alternator brush replacement is required if brush length becomes less than 3/16 inch or if the brush springs are deteriorated to the point of resiliency loss. To replace brushes, proceed as follows:

(1) Remove two nuts, lockwashers, and guard washers securing the brush hold-down plate (terminal cover); retain.

(2) Remove plate, gasket, and tab jumpers; retain.

(3) Remove two brush assemblies.

(4) See figure 4-13. Insert replacement brushes in holes in brush holder.

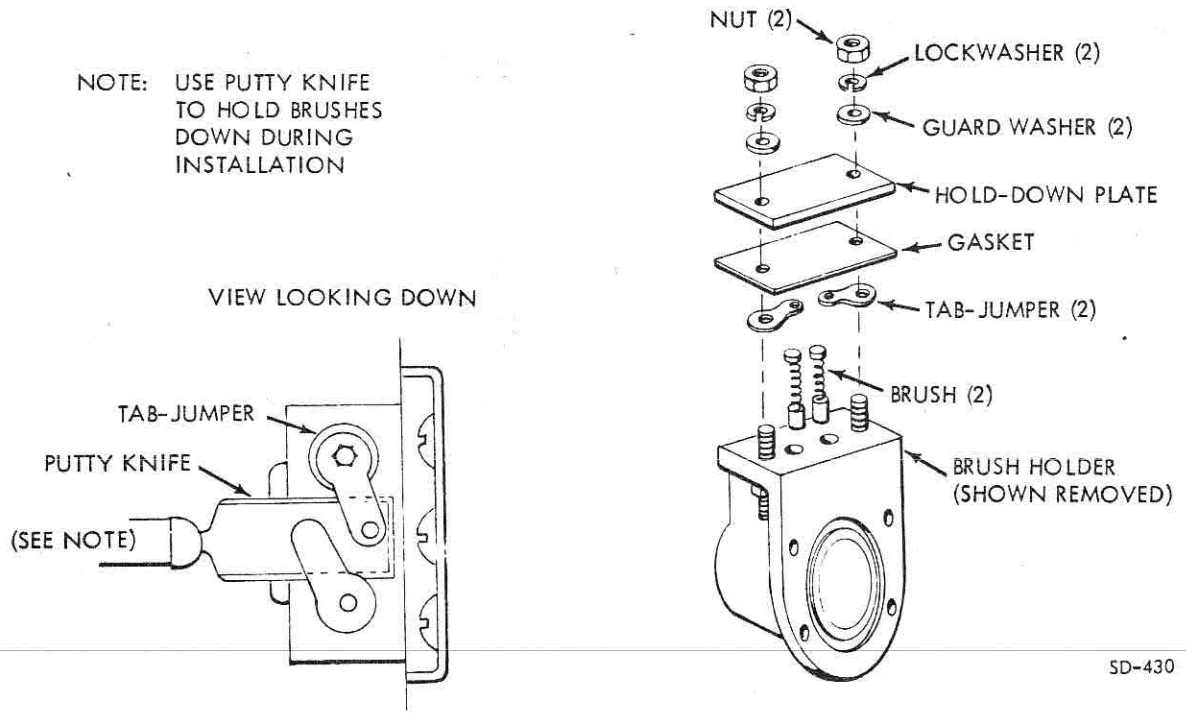



Figure 4-13. Alternator Brush Replacement

(5) Reassemble the brush holder housing, using a putty knife or similar piece of flat metal to compress the brush springs. With the knife holding the springs down, install the two tab jumpers on two screws. Place the gasket and brush hold-down plate over the screws, and hold in position. The knife blade can now be removed, then guard washers, lockwashers and retaining nuts installed and tightened.

(6) Perform operational check of 12 VDC power supply system.

g. Electronic Voltage Regulator Replacement. To replace the electronic voltage regulator, gain access to the ignition panel through the rear engine compartment access door, then proceed as follows:

(1) Note wire color and terminal to which each lead is connected on the regulator, then disconnect.

(2) Remove attaching screws from each side of regulator, and remove regulator; retain screws.

(3) Install replacement regulator using two screws from previous step.

(4) Attach wiring, making sure exact color coded lead-to-terminal connections are made as noted in step (1). See fig. 4-1. Attach red insulated wire to "IGN" terminal, yellow to "FLD" terminal, and black to "GND" terminal.

(5) Make sure all terminals are clean and tightened.

> ***Caution***
>
> Never attempt to ground or jumper the field terminal wire. Any attempt to do so will permanently damage the regulator.

(6) Perform operational check of the 12 VDC electrical power supply system.

(7) Adjust regulator, if required, to obtain system output voltage of 13.8 to 14.2 VDC; refer to paragraph 4-5b.

h. Equalizer Replacement (fig. 4-5). To replace the equalizer, gain access to the start-ignition relay panel by opening right hand engine compartment access door, then proceed as follows:

(1) Turn off electrical power (disconnect domestic and automotive batteries), then remove wires from equalizer as follows:

(a) Remove black number 4 size wire from equalizer terminal "A" and tag (with tape) as letter A.

(b) Remove black number 4 size wire from equalizer no. "1" terminal and tag as number 1.

(c) Remove black number 4 size wire from equalizer no. "2" terminal and tag as number 2.

(2) Remove the four screws and washers attaching the equalizer to panel; retain screws and washers.

(3) Install new equalizer on panel assembly in original position with screws and washers retained in step 2.

(4) Reconnect wiring, disconnected from removed equalizer, as follows:

(a) Connect the black number 4 size wire, tagged as A, to the "A" (center) terminal on the equalizer.

(b) Connect the black number 4 size wire, tagged as 1, to the number "1" (upper) terminal of the equalizer.

(c) Connect the remaining black number 4 size wire, tagged at 2, to the number "2" (lower) terminal on the equalizer.

(5) Remove tape (tags) from wires, and check all terminals for tight connections.

(6) Reconnect automotive and domestic batteries.

**NOTE**

In the following steps, touch the voltmeter positive lead to the equalizer terminal being tested, and touch the negative lead to ground (coach frame).

(7) With engine not running, check for 12 VDC reading at the number 1 terminal of the equalizer (automotive battery).

(8) Check the number 2 equalizer terminal for 12 VDC reading (from domestic batteries).

(9) Check the "A" terminal on the equalizer for zero (or minimal) voltage reading.

(10) With engine running at 1500 rpm and alternator charging, check number 1 and number 2 terminals of the equalizer for equal voltage readings, which should be above 12 VDC. The "A" terminal should read 13.8 to 14.2 VDC and should be 0.8 to 1.0 volt higher than the readings of number 1 and number 2 terminals.

i. Replacement of Dash Panel Mounted Indicators and Controls. Replacement of instruments, switches, control levers, and knobs on the dash panel consists of gaining access to these components by detaching the dash panel. The procedure for replacement of each component on the panel is simple and obvious, and therefore not repeated here. To detach and reattach the dash panel in its mounts, proceed as follows:

(1) Turn off electrical power by disconnecting automotive battery.

(2) Position steering column as far to rear as possible.

(3) Remove gear shift lever, heater/cooler knobs, and all switch knobs; retain.

(4) Remove six Phillips attaching screws. Remove mylar face panel (overlay and film assembly) covering the dash panel.

(5) Remove four bolts and nuts attaching gear shift lever detent plate to dash panel, and remove and retain plate and attaching parts.

(6) Disconnect cables which are attached to heater/cooler control levers on dash at the point where they attach to the heater/cooler water flow control valve lever.

(7) Remove two bolts and nuts from lower center attaching dash panel to mount bracket. Depress padding, pull out panel slightly, and remove clamp from air duct; continue pulling panel out about 5 inches for access to indicators and controls.

(8) Reattach panel by moving in enough to install air conditioner duct on outlet; install clamp and heater/cooler control cables. Install panel in place and secure with nuts and bolts retained from previous step.

(9) Reinstall gear shift lever detent plate and heater/cooler cables.

(10) Reinstall mylar face panel (overlay and film assembly) with screws retained from previous step.

(11) Reinstall gear shift and switch knobs.

(12) Reconnect automotive battery.

j. Engine Starter Removal (fig. 4-8). To remove the starter from the engine, proceed as follows:

(1) Gain access through the right hand engine compartment access door, and disconnect the positive lead from the automotive battery positive (+) terminal post.

(2) Remove nuts and washers, disconnect all wiring from both large and small terminal posts protruding from starter, and secure wiring clear of starter mount area. Retain nuts and washers.

(3) Remove the lower nut from stud attaching starter end lead to engine transmission housing.

**NOTE**

If stud turns with nut, continue turning and remove stud with nut in place. Use liquid wrench to separate nut and stud. Reinstall stud until non-threaded area is in position to align with starter mount hole 1D when reinstalled.

(4) Support weight of starter, and remove upper bolt and washer attaching starter to engine transmission housing. Remove starter.

k. Engine Starter Installation (fig. 4-8). To install the starter on the engine, proceed as follows:

(1) Gain access to the right hand engine compartment access door. Make certain battery is disconnected as specified in paragraph j, step (2) above.

(2) Hold starter in mount position with attachment holes on forward end of starter aligned with attachment stud protruding from transmission. Install upper attaching bolt and washer; torque bolt to 50 foot-pounds.

(3) Install nut on lower attaching stud; torque nut to 50 foot-pounds.

(4) Connect electrical wiring to starter large and small terminals, and secure with nuts and washers retained during removal.

(5) Connect positive lead to automotive battery positive (+) terminal post and tighten.

(6) Perform operational check of starter.

l. Start-Ignition Switch Replacement. Refer to paragraph i above. Turn off power, and gain access to forward end of switch to facilitate replacement. Note position of wiring connections on switch terminals, disconnect wiring, and remove switch. Install new switch, and reconnect wiring to same switch terminals as previously connected to on removed unit. Reattach dash panel, and perform check of switch operation.

m. Ignition Coil Replacement. Gain access to the ignition coil, located at top aft left hand side of engine intake manifold just aft of carburetor, through the engine compartment rear access door. Remove carburetor air cleaner. Make sure start-ignition switch is off, then remove nuts and disconnect leads to negative (-) and positive (+) terminals of coil (note which lead connects to each terminal). Remove secondary cable from coil tower. Remove two mount bracket hold-down bolts, and remove coil. Reverse procedure to install replacement coil.

> ***Caution***
>
> Every time an ignition coil is replaced because of a burned tower, carbon tracking, or any evidence of arcing at the tower, replace cable. Any arcing at the tower will carbonize the nipple so that placing it on a new coil will cause another coil failure. If the secondary cable shows any signs of damage, the cable should be replaced with a new cable and nipple, since the old cable can cause arcing and ruin a new coil.

n. Distributor Removal. Gain access to the distributor, located on top of aft end of engine close to ignition coil, through the engine compartment rear access door. Remove carburetor air cleaner. To remove distributor, proceed as follows:

(1) Clean all dirt from distributor and mount area.

(2) Disconnect distributor pick-up coil wiring at connector plug.

(3) Disconnect vacuum hose at distributor vacuum chamber.

(4) Unfasten distributor cap attaching springs, and lift off distributor cap with spark plug cables and coil cable intact.

(5) Scribe a mark on the edge of distributor housing and engine to indicate position of the rotor for reference when reinstalling distributor.

(6) Remove distributor hold-down clamp bolt and washer and clamp; retain.

(7) Remove distributor assembly and 0 ring by lifting distributor straight out of its mounting well.

(8) Place protective cover over opening of the distributor mounting well unless replacement distributor is to be immediately installed.

**NOTE**

Engine should not be cranked while distributor is removed. The position of the internal timing gear slot, in which the distributor shaft end (tongue) inserts, would change, thus destroying internal timing.

o. Distributor Installation. Gain access to distributor as described in paragraph n above. Then install distributor as follows:

(1) Remove protective cover from distributor mounting well in engine.

(2) Clean top of cylinder block to insure a good seal between distributor base and block.

**NOTE**

If engine has been cranked while distributor is removed, establish the proper relationship between distributor shaft and number 1 position by turning crankshaft until timing mark on crankshaft pulley is set at 0 (top dead center). Number 1 piston must be at top dead center on compression stroke (both valves closed).

(3) Hold distributor over mounting well opening in block with vacuum advance chamber pointing toward center of engine.

(4) Turn distributor rotor until it points forward to the approximate location (when it is installed in normal position) of the number 1 cap tower terminal of distributor cap.

(5) Position O ring around mount well hole, then lower distributor into well to engage tongue of shaft with slot in drive gear.

(6) Install distributor hold-down clamp using bolt and washer retained from removal. Snug-up bolt but do not tighten.

(7) Install distributor cap. Make sure all cables are firmly inserted in cap towers.

(8) Connect distributor coil pick-up wire connector plug.

(9) Adjust ignition timing; refer to paragraph 4-5d, then tighten hold-down clamp bolt.

p. Spark Plug Cable and Distributor Cap Replacement. Gain access to cables and the distributor cap by opening right hand engine access door as described in paragraph n above. Remove carburetor air cleaner.

(1) Determine if replacement is required by checking high tension cable connections for good contact at the coil and distributor cap towers and at the spark plugs. Terminals should be fully seated. The nipples and spark plug covers should be in good condition. Nipples should fit tightly on the coil cap towers, and spark plug covers should fit tightly around spark plug insulators. Cable connections that are loose will corrode, increase the resistance, and permit water to enter the towers, causing ignition malfunction. To maintain proper sealing between the towers and nipples, cable and nipple assemblies should not be removed from the distributor or coil towers unless nipples are damaged or cable testing indicates high resistance or broken insulation. If necessary, clean high tension cables with a cloth moistened with a non-flammable solvent, and wipe dry. Bend cables to check for brittle or cracked insulation. Cables can be tested as follows:

(a) With engine not running, connect one end of a test probe to a good ground, and leave other end free for probing.

(b) Disconnect cable at spark plug end. Insulate cable end from grounding.

(c) With engine running, move test probes along entire length of cable. If punctures or cracks are present, there will be a noticeable spark from the faulty area to the probe. Secondary coil wire may be checked in the same manner. Be sure one spark plug cable is disconnected from spark plug while running probe along coil wire secondary cable. Cracked, leaking, or faulty cables should be replaced.

(d) Check cables for open circuits, loose terminals, or high resistance with an ohmmeter. Remove cable from spark plug, and install the proper adapter between cable and spark plug. Lift distributor cap from distributor with cables intact. Do not remove cables from cap. Connect the ohmmeter between spark plug adapter and the corresponding electrode inside the cap, making sure ohmmeter probes are in good contact. If resistance is more than 30,000 ohms, remove cable at cap tower, and check the cable resistance. If resistance is more than 30,000 ohms on cables under 25 inches long or 50,000 ohms on cables over 25 inches long, replace cable assembly. Test all spark plug cables in same manner.

(2) To test coil-to-distributor cap high tension cable, remove distributor cap with the cable intact. Do not remove cable from the coil or cap. Connect the ohmmeter between center contact in the cap and either primary terminal at coil. If the combined resistance of coil and cable is more than 25,000 ohms, remove the cable at coil tower and check cable resistance. If resistance is more than 15,000 ohms, replace the cable. If resistance is less, check for a loose connection at the tower or for a faulty coil. Also check coil tower for cracks, carbon tracking, or oil leaks.

(3) If tests performed in previous step indicate cable(s) or distributor cap is defective, replace. When installing new cable assemblies, install new high tension cable and nipple assembly over cap or coil tower. Insert the terminal into the tower, push lightly, then pinch the large diameter of the nipple to release trapped air between nipple and tower. Continue pushing on the cable and nipple until cables are properly seated in the cap towers. Use the same procedure to install cable in coil tower. Use the following procedure when removing the high tension cable from the spark plug. First, remove the cable from the retaining bracket (separator clip). Then grasp the insulator as close as possible to the spark plug and use a straight and steady pull. Do not use pliers and do not pull the cable at an angle.

**Caution**

During withdrawal of the ignition cable connection from the plug, take care to pull the lead straight out and in line with the centerline of the plug barrel; otherwise, a side load will be applied, which will frequently result in damage to the insulator and connector.

(4) Wipe spark plug insulator clean before reinstalling cable and cover. The ignition cables are equipped with a silicone outer covering that is highly flexible and is extremely heat resistant. A fiberglass jacket is incorporated to increase strength and durability. Each cable is identified by the words "Electronic Suppression" printed on the cable jacket. No additional resistors are necessary. Figure 4-1, sheet 3 contains a schematic diagram of the cylinder numbers depicting the firing order of the spark plug in each cylinder in relation to distributor cap connection points.

q. Spark Plug Removal. In the course of engine operation, carbon and other combustion products will be deposited on the end of the spark plug, and may penetrate the lower threads to some degree. As a result, greater torque is required for removing a plug than for its installation. Torque limitations given do not apply to plug removal, and sufficient torque must be used to remove the plug. The higher torque in removal is not as detrimental as in installation, since it cannot stretch the threaded section. Higher torque does impose a shearing load on this section, and may, if sufficiently severe, produce a failure at this location.

> ***Caution***
>
> Because of the higher torque involved in plug removal, precautions against tilting and slipping of the wrench are of increased importance to prevent breaking the plug's ceramic insulator.

As spark plugs are removed from the engine, they should be placed in a tray that will identify their position in the engine before removal. By inspecting the removed spark plugs, it is possible to determine the condition of the cylinder and if further maintenance is required. Check for the following conditions:

(1) Excessive carbon on firing end of spark plug.

(2) Oil in the spark plug firing end.

(3) Damaged electrodes or ceramic insulator.

(4) Spark plug fouling.

(5) Spark plug is proper type specified for the engine. When it is noted that a spark plug has not been firing, the cause should be located and corrected prior to any further engine operation.

r. Spark Plug Installation. To insure optimum operation of spark plugs, inspect and accomplish steps (1) through (6) prior to performing installation procedures in steps (7) through (9).

(1) Make certain that spark plug is the type specified for engine. See nameplate on lower aft right hand side of engine. Use Champion J11Y spark plugs for H440 engines, or Champion BL-9Y spark plugs for I440 engines.

(2) Check for evidence of rust-preventive compound on spark plug exterior, core, and interior of barrel end. If rust-preventive compound is evident, it should be removed by cleaning the plug with cleaning solvent.

(3) Check for nicked or damaged threads and indication of cracks in the insulator.

(4) Inspect barrel end of plug for rust at center electrode contact and for foreign material which would result in poor contact. Foreign material may be removed with compressed air.

(5) Make certain gap between center electrode and ground electrode is 0.035 inch. Adjust if necessary.

**NOTE**

Proper insertion and torque are important to the proper installation of spark plugs. Insertion refers to screwing the plug into the cylinder. If the spark plug can be inserted into the head by using fingers only, this indicates good threads.

(6) Apply a very light coat of oil on plug threads.

(7) Insert the spark plug in cylinder, screwing it in with the fingers.

(8) After this insertion, tighten with wrench until plug is fully seated, then torque to 10 foot-pounds.

(9) Connect spark plug cables.

s. Left Hand Windshield Wiper Motor Assembly Replacement. To replace the left hand windshield wiper motor, gain access by detaching the dash panel in accordance with paragraph i above, then proceed as follows:

(1) Remove crown nut from forward end of wiper blade arm drive shaft.

(2) Use a tuning fork type tool to pry the wiper blade arm forward off the drive shaft splines.

(3) Remove splined tapered bushing from shaft forward end.

(4) Remove rubber boot, nut, metal washer, and fiber washer from shaft forward end.

(5) Remove two bolts and washers, located adjacent to the drive shaft, that insert through the bulkhead into the motor mount bracket inside the coach. Retain bolts and washers.

(6) From inside of coach, disconnect the ground wire by removing terminal attaching bolt from the wiper motor drive gear cap.

(7) Disconnect the three electrical leads (color coded red, green, and black) by cutting approximately 6 inches from motor. Stagger cuts an inch or so apart to facilitate later connection of new motor wiring by splicing.

(8) Remove wiper motor together with mounting bracket and linkage mechanism by pulling out aft from mount hole.

(9) Disconnect motor from mounting bracket and linkage by removing the center drive shaft-to-linkage arm attaching serrated nut, then removing arm and bowed-spring washer. Remove screws and half-round spacers attaching motor housing to bracket, then remove motor. Retain attaching hardware.

(10) Connect replacement motor to mounting bracket by using attaching hardware retained from previous step and reversing the order of the procedures of that step. Torque motor-to-bracket attaching screws to 40 to 60 INCH-pounds.

(11) Insert motor and bracket into mount area and splice three red, green, and black color coded wires to coach wires of same color.

(12) Connect ground wire to motor cap attachment bolt head.

(13) Insert windshield wiper arm drive shaft through hole in coach bulkhead and align mount bracket holes with bulkhead holes. Brace in this position. From outside forward end of coach, install fiber washer, metal washer, and nut (turn only a few turns).

(14) From outside forward end of coach, install attachment bolts through holes in bulkhead into the threaded holes in bracket. Tighten bolts, then tighten nut installed in previous step.

(15) Install rubber boot, tapered bushing, wiper arm, and crown nut on shaft.

(16) Adjust wiper blade park position; refer to paragraph 4-5e.

(17) Reinstall dash panel in accordance with paragraph i above.

(18) Perform operational check of wiper motor assembly.

> **Warning**
>
> Keep hands away from linkages when motor is in operation.

t. Right Hand Windshield Wiper Motor Assembly Replacement. To replace the right hand windshield wiper motor, gain access by detaching the defrost ducting under the panel near the left hand end of the glove box, then accomplish steps (1) through (16) of paragraph s above, reinstall ducting, and perform an operational check of the wiper motor assembly. Observe warning above.

## 4-4. INSPECTION/CLEANING

a. General. This section contains information necessary for inspection and cleaning of the electrical system components.

b. Inspection. Inspect the electrical system according to table 4-7.

Table 4-7. Electrical System Component Inspection

| Component | Inspect | Corrective Action |
|---|---|---|
| Alternator | Leads and terminals for evidence of overheating or looseness | Replace lead and/or tighten terminal nuts |
| | Mount brackets for security | Tighten attaching nut/bolts; refer to paragraph 4-3e |

Table 4-7. Electrical System Component Inspection (Continued)

| Component | Inspect | Corrective Action |
|---|---|---|
| Alternator (cont) | Drive belts for excessive wear or looseness | Replace belt set, tighten; refer to paragraph 4-3e step (4) |
| | Belt pulley shaft nut for looseness | Torque to 40 to 50 foot-pounds |
| | Brushes for excessive wear | Replace if length is less than 3/16 inch; refer to paragraph 4-3f |
| Voltage regulator (electronic) | Leads for tight connection and damage | Tighten or replace |
| | Cooling fins for cleanness | Clean if required |
| | Drain hole in base for obstruction | Clean if required |
| Battery | Terminals for corrosion | Clean; refer to paragraph 4-3c |
| | Mount tray and hold-downs for acid damage, excessive dirt, mud, or corrosion | Clean; refer to paragraph 4-3c; replace if damage is excessive |
| | Hinged vent cap for damage and proper operation | Repair, or replace battery if damage is excessive |
| | Low electrolyte level | Replenish; refer to paragraph 4-5c |
| | Loose cable clamp at terminal posts | Tighten |
| Cables | Insulation damage | Replace |
| | Clamp bolt and nut thread damage | Replace |
| Equalizer | Cable terminal attaching nut for looseness | Tighten |
| | Cooling fins for cleanness | Clean if required |
| | Attaching screws for looseness | Tighten |
| Wiring harnesses | Damaged insulation or wrapping, or loose terminal connections | Tighten |
| | Improper routing | Reroute and tie in place |
| | Connector plugs for secure mating | Fully insert plug prongs into receptacle of mating plug |

Table 4-7. Electrical System Component Inspection (Continued)

| Component | Inspect | Corrective Action |
|---|---|---|
| Distributor | Cap for cleanness | Clean if required |
| | Cap for cracks | Replace |
| | Hold-down clamp bolt for tightness | Tighten if loose |
| | Vacuum chamber hose for damage or loose connection | Replace hose if damaged or deteriorated to extent vacuum leaks at connections |
| Spark plug leads | Insulation for brittleness, heat, damage, or cuts | Replace |
| | Security of attachment to spark plug and attachment in distributor cap | Connect properly, as required |
| | Lead separator clips for damage | Replace |
| Electronic ignition unit | Harness plug for secure mating in receptacle | Fully insert plug in receptacle on unit |
| | Heat sink for cleanness | Clean if required |
| Ballast resistor | Wiring connections for security | Tighten as required |
| | Housing for cracks | Replace |
| Starter | Terminal nuts for tightness | Tighten as required (see fig. 4-8) |
| | Attaching bolts for tightness | Torque to 50 foot-pounds |
| | Cable for damage (refer to previous "cable" listing in component column) | |
| Start relay | Wiring connections for security | Tighten as required |
| Windshield wiper/ washer | Blade for deterioration | Replace |
| | Washer fluid nozzles outlet jet for obstruction and proper aim | Clean, adjust, or replace, as required |

c. Cleaning

(1) The coach electrical and electronic equipment requires general cleaning prior to final inspection for serviceability. This type of equipment must be kept free of the following contamination:

(a) Metal chips and other foreign matter.

(b) Loose, spattered, or excess solder.

(c) Excess oils and greases.

(d) Fingerprints, grime, dust, dirt, etc.

(e) Corrosion due to alkalies or acids.

(f) Oxidation such as rust.

(2) Clean moderately contaminated components as indicated in table 4-8.

(5) Use immersions or spray when adaptable and when damage to the equipment will not result.

(6) Use solvents when applicable (immersion or spray) to achieve high, commercial quality cleaning, providing the equipment and the safety of personnel are not endangered.

(7) The organic solvents listed below dissolve or soften oily or greasy compounds, although they may not be completely interchangeable. In general, the more active solvents attack finishes, insulation, etc. In order of increasing activity, the solvents are:

(a) Stoddard solvent.

(b) Isopropyl alcohol.

(c) Aliphatic naphtha.

Table 4-8. Cleaning Electrical/Electronic Components

| TYPE OF CONTAMINATION | CLEANING TECHNIQUE |
|---|---|
| Rust or other oxidation | Sand (use nonmetal abrasive). Aluminum wool may be used on aluminum surfaces of items such as mountings, cases, covers, stripped chassis, etc. |
| Loose solder, metal chips | Brush or vacuum |
| Excess oil and grease | Wipe with disposable paper towelling |
| Dust and dirt | Blow with compressed air of suitable pressure |
| Grime and fingerprints | Wipe with clean detergent moistened cloth |

(3) Water base solutions are especially useful when the removal of lubrication must be controlled. Precautions must be taken to insure complete and rapid drying when using water base solutions. Solvent and detergent solutions shall be maintained at the manufacturers' recommended temperature but should never exceed 130 degrees F when cleaning electronic components. Exposure time in both solvent and detergent should be determined by type of item being cleaned.

(4) Use vapor blasting when necessary. However, equipment containing electrical circuits or moving parts, such as relays, bearings, or motors, will not be cleaned by this method. Remove painted or plastic parts prior to vapor blasting.

(d) Trichloroethylene.

(e) An alternate solvent, trichloroethane, sold under the trade name Chlorothene.

(f) Methyl-ethyl ketone.

(8) The following aerosol cleaners may be used for removing dust, dirt, oil, grease, oxide film, and similar contaminants from electrical contacts, either assembled or disassembled. These materials will be supplied with a 6 inch long tube for directing the cleaner into areas of limited access. Cleaner type "A" shall be used where a coating of residual lubricating oil is not required.

Cleaner type "B" contains a lubricant, and shall be used where a coating of residual lubricant is required. In general, use of a contact cleaner for low temperature operations should be limited to type "A" cleaner.

Type A: MS-230 Contact Re-Nu
CO Contact Cleaner
Lectron 13 Contact Cleaner

To use: Hold can upright about 4 to 6 inches from the surface to be cleaned, and direct a heavy wet spray onto the contacts. The force of the spray may be used to loosen and remove heavy deposits.

Type B: GC Spra Kleen
Tuner Cleaner and Lubricant Spray Nr. 1333
Electronic Contact Cleaner Lubricant Spray Nr. 1326

To use: Hold can upright about 4 to 6 inches from the surface to be cleaned, and direct a light spray onto the contacts. When applied to a rotary type switch, rotate the switch several times to clean, and reapply a thin coating for lubrication.

(9) Other cleaning methods which may be used to clean and treat specific parts, when removal from the equipment is not feasible or necessary, are as follows:

(a) Connectors - where small amounts of rust, corrosion or oxide deposits are present on connectors, either internally or externally, clean the connectors with a brush. Care must be exercised to make certain that no metal filings or residue remains inside the connector. Be sure the connector is thoroughly dry before the male and female portions are joined. Where rust, corrosion, or oxide deposits are present in large quantities, replace the connector.

(b) Components - remove small amounts of rust, corrosion, or oxide deposits on components to the bare metal, and touch up or refinish with a suitable paint or protective coating unless the portion of the metal involved is used as a ground connection. In these instances, the metal must remain free of any type of protective coating. In general, use the least abrasive method possible to remove the contaminant from the affected surface, and follow with a non-corrosive solvent and thorough drying prior to applying a protective coating. When using an abrasive to remove the rust, corrosion, or oxide deposit, exercise care to make certain that residue does not enter any parts or components, such as relays, gears, sockets, or switches, as this may cause malfunction of the equipment.

Clean aluminum surfaces with a cloth, brush, aluminum wool, or fine sand paper. Steel surfaces may require the use of a wire brush or emery cloth; however, wire brushes should be used only if there is no danger of fire due to sparks generated from the friction of the metals.

d. Corrosion Preventive Treatments. Equipment, parts, and accessories used in the coach electrical/electronic equipment possess protective finishes resistant to corrosion. Retouch or spot-paint equipment exteriors whenever a scratch, mark, or scar penetrates to the bare metal or basic structural material of the unit. After cleaning connectors, apply minimum amount of Dow Corning 4X spray, or equivalent, on mechanical mating surfaces to prevent corrosion and extend connector life by easing mating and demating pressures.

## 4-5. GENERAL INFORMATION

a. General. This section contains general information related to electrical system data contained in the previous paragraphs.

b. Electronic Voltage Regulator Adjustment. After the regulator has been installed and all wiring properly connected, the regulator may be adjusted. To perform this adjustment, an accurate voltmeter should be used. The vehicle battery must be fully charged or a 1/4 ohm resistor connected in the charging circuit when making a regulator adjustment. All electrical loads such as lights, heater, radios, etc., should be turned off. Do not attempt to force the adjusting screw beyond its normal range of travel or damage will result. After the vehicle has been operating for a while, it may be necessary to reset the voltage to accommodate special operating conditions. An ideal regulator setting will maintain a fully charged battery without causing the battery to use excess amounts of water. Adjust regulator, if required, to obtain system output voltage of 13.8 to 14.2 VDC. To adjust, unscrew socket head plug in regulator case. With engine running at 1000 to 1500 rpm, turn adjustment screw in regulator clockwise to raise and counterclockwise to lower, until specified voltage is obtained. Check with voltmeter with positive lead of "A" terminal on equalizer and negative lead on ground (coach frame). Reinstall socket head plug in regulator when complete.

c. Battery Servicing. Two important things must be done periodically in order to obtain long life from a battery:

(1) First, the electrolyte must at all times be kept above the plates and separators. The liquid level should be brought up to the bottom of the split tubes. Acid shall be added only by an experienced battery serviceman, and then only when it is definitely known that acid has been lost by spillage.

**Warning**

The sulfuric acid contained in the battery is very corrosive and will destroy most things with which it comes in contact. It will cause painful and serious burns if it gets on the skin. In case of accident, the acid should be quickly flushed away with a large quantity of water, which dilutes while washing away the acid. Also, baking soda may be used to neutralize the acid. A quantity of baking soda may be kept at hand to sprinkle on anything on which the acid may be spilled. Water should then be used to flush off the acid and soda.

(2) Second, be sure that the battery is kept charged at all times. The state of change should be checked at frequent intervals by making specific gravity readings with a battery hydrometer. It is suggested that gravity readings be made and evaporated water be replaced every two weeks. Should the gravity fall more than 0.040 below specific gravity specified for fully charged battery, remove the battery and have it charged. Batteries in a low state of charge should be recharged, preferably at a low rate. A sulphated battery (in which a crystalline sulfate has been deposited on plates due to undercharged condition) may require a further reduction of the charge rate. This can be determined by making periodic temperature tests of the electrolyte. The temperature should never be permitted to rise above 125 degrees F and should be maintained preferably at approximately 110 degrees F. A battery is considered fully charged when specific gravity readings do not increase for 3 hourly intervals. If the gravity of a battery is found to be 1.300 or higher, it is an indication that too much acid has been added.

**Warning**

Gases from a charging battery will explode if contacted by a spark or flame.

Overcharging or excessive temperature while charging will cause damage to the battery plates and separators. After a battery has been charged, it should have the top washed with water and baking soda and dried to remove any electrolyte. The actual hydrometer reading will vary with temperature variations of the electrolyte. (Most hydrometers have a built in thermometer.) A hydrometer reading of a cell with electrolyte temperature above 80 degrees F will be lower than the reading with the electrolyte at 80 degrees F. The opposite is true where the electrolyte temperature is below 80 degrees F. Hydrometer floats are calibrated to indicate a correct reading only at 80 degrees F. Expansion and contraction of the electrolyte due to temperature changes requires the use of corrections in order to arrive at the true specific gravity of the electrolyte. Temperature correction of the specific gravity of the electrolyte is 0.004 specific gravity (4 points of gravity) for each 10 degrees F change in temperature. Add four points of gravity for each 10 degrees F change in temperature above 80 degrees F. Subtract four points of gravity for each 10 degree F change in temperature below 80 degrees F. Excessive water evaporation (decomposition) from all cells of a battery indicates overcharging or excessive heat. The alternator and regulator operation should be checked if this condition exists; refer to paragraph 4-3g.

It is more desirable for a battery to show consistent, periodic gravity readings of between three fourths to full charge than to always show full charge readings. One knows then that the battery is neither being overcharged nor undercharged. Several harmful effects result in charging a battery in excess of its requirements, such as the following:

(a) Water of electrolyte decomposes into hydrogen and oxygen gases. Gas bubbles tend to wash active material from the plates and carry electrolyte from the cells as a fine mist.

(b) Decomposition of water leaves acid more concentrated. Concentrated acid is harmful to separators and negative plate material at high temperature over a prolonged period of time. The separators become charred and the negative plate material becomes granular.

(c) High internal heat is created, which accelerates oxidation of the positive plate grids and damages separators and negative plates. Also, containers may be softened and distorted and sealing compound displaced.

(d) Overcharging alone or in combination with a previous condition of undercharging may result in buckling and warping of positive plates, causing them to perforate or pinch through the separators and touch the negative plates, resulting in internal short circuits.

(e) Electrolyte may be forced from the cells, causing damage by corrosion to hold-down, brackets, tray, cables, and other parts of the coach.

Some bad effect can also be created even though the battery is not being overcharged, strictly speaking. Excessive demands upon the battery because of a faulty starter, electrical shorts, leaks, or more than normal use of electrical equipment will mean prolonged high charging rates, assuming the voltage regulator is functioning properly. The plates and separators assume the characteristics of overcharging, and shortened battery life follows from this hard use. No satisfactory electrolyte has been found as a substitute for the simple mixture of sulphuric acid in water. Excessive use of electrical equipment or insufficient input to the battery because of low voltage regulator setting, faulty alternator, corroded terminals, or insufficient time of charging will result in a starved or undercharged battery. Operation in this undercharged condition over a period of time may permit a type of sulphate to develop in the plates which is hard and crystalline. These crystals cannot be easily decomposed and electrochemically coverted to active material again. A difference in density between crystalline areas and the normal active material of the positive plates induces strains, so that distortion or buckling may result. Buckling will be accelerated when a sulphated battery is subjected to prolonged overcharging, either while undergoing a bench recharge or while in the coach, such as on an extended trip, or when the voltage regulator is out of adjustment. Buckled plates will pinch through separators and cause internal short circuits. A battery operated in an undercharged condition will not only be unable to deliver full power, but is also liable to freeze during severe winter weather. The freezing point of the electrolyte varies with specific gravity variations. Table 4-9 indicates the freezing points at various gravity readings.

Table 4-9. Battery Specific Gravity and Freezing Points

| Specific gravity (corrected to 80 degrees F) | Freezing point of battery |
|---|---|
| 1.285 | -90 degrees F |
| 1.250 | -62 degrees F |
| 1.200 | -16 degrees F |
| 1.150 | 5 degrees F |
| 1.100 | 19 degrees F |

Keep batteries charged in cold weather and while in storage.

To determine whether the battery is capable of meeting requirements of the starting motor, it is necessary to duplicate operating conditions by subjecting the battery to a load test. To obtain a true test, the battery should be at least three-fourths charged. State of charge is determined by taking hydrometer readings. There are two methods of making the battery load test, and the battery electrolyte temperature should be at or near 80 degrees F for these tests.

First - By cranking the engine for 15 seconds with the starting motor and measuring the battery voltage. The voltage should not be less than 9.6 volts for the 12 volt automotive battery at the end of 15 seconds.

Second - By using high rate discharge test equipment. The test consists of discharging the battery, by means of a heavy duty carbon pile, at a rate of three times the ampere-hour capacity. After 15 seconds, the battery voltage should not be less than 4.5 volts for a 6 volt domestic battery or less than 9.0 volts for the 12 volt automotive battery.

If the battery fails to meet the load test, it indicates loss of capacity or internal short circuits. Any battery that passes the load test is a good battery and can be relied upon to fulfill the requirements of the starting motor under all normal conditions. Where ampere-hour capacity cannot be determined and equipment does not have a built-in load, discharge rate should be 200 amperes for all batteries. The same minimum voltage applies (9.0 volts for 12 volt automotive battery or 4.5 volts for 6 volt domestic batteries).

d. Ignition Timing Adjustment. To obtain optimum engine performance, the distributor must be correctly positioned on the engine to give proper ignition timing. Procedures are as follows:

**NOTE**

It is recommended that a clean-air-emission-system certified technician accomplish these procedures.

(1) Connect a suitable power timing light to number 1 cylinder (refer to the equipment manufacturer's instructions for correct connecting procedures).

**Caution**

Do not puncture cables, boots, or nipples with test probes. Always use proper adapters. Puncturing the spark plug cables with a probe will damage the cables. The probe can separate the conductor and cause high resistance. In addition, breaking the insulation may permit the high voltage secondary current to arc to ground.

(2) Set idle engine speed at carburetor.

**NOTE**

The preferred method of adjusting is to adjust mixture using an exhaust analyzer with engine warmed up to normal and the distributor vacuum hose connected and plugged. Adjust idle speed screw and mixture screws to give 1 percent carbon monoxide (14.1 A/F ratio), with lowest hydrocarbon level or smoothest idle at 700 rpm. If exhaust analyzer is not available, adjust as specified in steps (a) through (d).

(a) Remove carburetor idler screw caps, and disconnect distributor vacuum hose from vacuum chamber inlet and plug.

(b) With engine at normal warm-up, adjust idle speed and mixture screws to lean best idle at speed drop idle of 780 rpm.

(c) Without touching speed screw, turn mixture screws clockwise (lean) equally to reduce speed to 700 rpm.

(d) Reinstall limiter caps with stop one-fourth turn from rich limit.

(3) Loosen distributor hold-down clamp bolt just enough so the distributor housing can be rotated in its mounting.

(4) Aim power timing light at timing plate on engine. If light flash occurs when timing mark on vibration damper is located before the specified degree 7-1/2 mark on timing plate in the direction of engine rotation, timing is advanced. To adjust, turn distributor housing in direction of rotor rotation (counterclockwise). If flash occurs when the vibration timing mark is located after the specified 7-1/2 degree mark in the direction of engine rotation, timing is retarded. To adjust, turn distributor housing against direction of rotor rotation (clockwise). Moving the distributor housing against shaft rotation advances timing, and moving with shaft rotation retards timing. Rotate distributor until specified 7-1/2 degree BTC firing setting is obtained.

**Caution**

Do not use distributor vacuum chamber as a turning handle when turning distributor.

(5) Tighten distributor hold-down clamp bolt after timing has been set, and recheck timing adjustment with a power timing light.

(6) When ignition timing is correct, reconnect vacuum hose to distributor vacuum chamber.

(7) If engine idle speed has changed, readjust carburetor as specified in step (2) above. Do not reset timing.

e. Adjustment of Windshield Wiper Blade Arm Park Position. To adjust the windshield wiper blade to stop in the park position when switch is turned off, proceed as follows:

(1) Gain access to the left hand wiper motor in accordance with paragraph 4-3i, and gain access to the right hand motor as described in paragraph 4-3t.

(2) Loosen the screws holding cover over the motor drive gear mechanism, from which the hexagon shaped white plastic adjustment shaft protrudes aft.

(3) The cover contains metal stamped abbreviations adjacent to the adjustment shaft for advance (ADV) and for retard (RET). To adjust the park position in a more clockwise (higher) setting, turn the shaft in direction of "ADV" and for more counterclockwise (lower) settings turn toward "RET".

(4) Upon completion of adjustment, torque cover screws loosened in step (2) to 18 to 22 INCH-pounds.

(5) Operate wiper, and make certain proper park position has been obtained. Reinstall access items as referenced in step (1).

**Warning**

Keep hands away from linkage when motor is in operation.

333 Brokaw Road Box 664 Santa Clara California 95052

☐ MANDATORY ☒ INFORMATIONAL

# Service Bulletin

DATE 1 July 1974 NUMBER 2904 40003

ATTENTION: SERVICE MANAGERS AND OWNERS

GROUP
4
AUTOMOTIVE
ELECTRICAL

SUBJECT

CHARGING CIRCUIT RELAY KIT - P/N 5106692

MODEL (S) AFFECTED

2900R

(Factory Use Only)
Information added to:

OWNER MANUAL (S)

SERVICE MANUAL (S)

PARTS MANUAL (S)

WARRANTY MANUAL (S)

OTHER

## DESCRIPTION

It has been determined that improvements to the automotive electrical circuit will increase the charging capability to the domestic batteries. This is accomplished by installing a relay so that the engine-driven alternator voltage output regulator will sense the voltage level of both the automotive battery and the domestic batteries. Currently, the domestic batteries receive charging amperage through the automotive charging circuits only when the automotive battery is being charged. If the automotive battery is fully charged, the domestic batteries will not receive a charge even though they may be in a discharged condition.

The installation of the relay in the system will allow the domestic batteries, as well as the automotive batteries, to be fully charged by the engine alternator.

## COMPLIANCE

This kit (P/N 5106692) is available for installation on all 2900R coaches. The parts are available from the FMC/RVD Service Department and will be furnished on a no-charge basis upon request by dealers. Owners desiring this kit should order through their dealer and make arrangements to have it installed at their expense.

## KIT COMPONENTS

| PART DESCRIPTION | PART NO. | QUANTITY |
|---|---|---|
| Relay Kit Assy. | 5106692 | 1 |

## INSTRUCTIONS (Refer to attached sketch)

1. Remove the top outer mounting screw (1/4-20 x 1/2 long) from the equalizer mounting plate and install the relay onto the plate as shown in the enclosed figure.

2. Attach the relay grounding wire to the 1/4 inch mounting screw.

F.M.C., AS OF 12/31/75, NO LONGER HONORS PARTS OR LABOR REIMBURSEME AS OUTLINED IN THIS BULLETIN

Recreational Vehicle Division
333 Brokaw Road Box 664 Santa Clara California 95052

☐ URGENT ☐ ROUTINE

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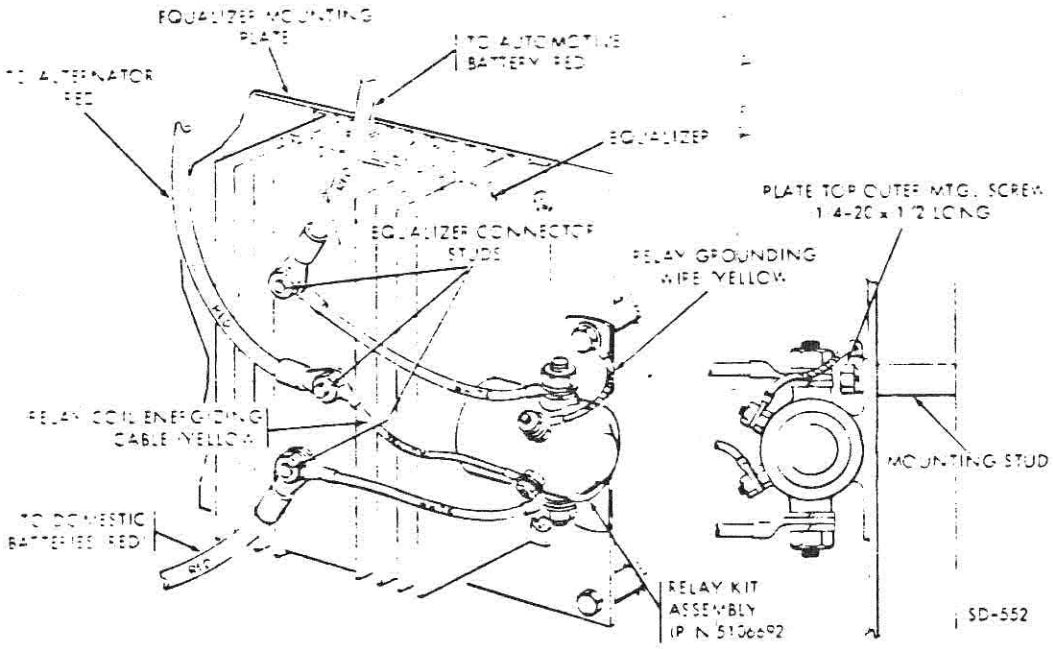
# Service Bulletin

DATE 1 July 1974 NUMBER 2904 40003

ATTENTION: SERVICE MANAGERS AND OWNERS




GROUP
4
AUTOMOTIVE ELECTRICAL

SUBJECT

CHARGING CIRCUIT RELAY KIT - P/N 5106692

MODEL (S) AFFECTED

2900R

*(Factory Use Only)*
Information added to:

OWNER MANUAL (S)

SERVICE MANUAL (S)

PARTS MANUAL (S)

WARRANTY MANUAL (S)

OTHER

FMC Corporation
Recreational Vehicle Division
333 Brokaw Road Box 664 Santa Clara California 95052

☐ URGENT ☐ ROUTINE
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# Service Bulletin

DATE 1 July 1974 NUMBER 2904 40003

ATTENTION: SERVICE MANAGERS AND OWNERS

3. Attach the other three (3) cables to the equalizer connector studs along with the existing cables already attached to these terminals.

NOTE

It is important to attach the cables to the correct terminals as shown in order to have proper relay operation.

John L. Strever

JOHN L. STREVER
Service Manager

GROUP
4
AUTOMOTIVE
ELECTRICAL

SUBJECT
CHARGING CIRCUIT
RELAY KIT -
P/N 5106692

MODEL (S) AFFECTED
2900R

*(Factory Use Only)*
Information added to:

OWNER MANUAL (S)

SERVICE MANUAL (S)

PARTS MANUAL (S)

WARRANTY MANUAL (S)

OTHER

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# INSTALLATION INSTRUCTIONS

Stewart SER 4195 Warner

## MODEL 960-AA ELECTRIC TACHOMETER

## For 8 Cyl., 4 Cycle, 12 V. Battery Ignition Engines

The 960-AA Tachometer is designed for 8 cylinder, 4 cycle gasoline engines with 12 Volt, negative ground distributor ignition systems only.

It features ZENER circuitry - a constant voltage supply without use of the battery and an easy to read 250° full sweep dial. Sturdy, one piece construction requires no sending unit.

As it comes in this package, the 960-AA is designed for Panel Mounting. Chrome Cup Mounting Kit No. 366-MS is available for mounting on Top of Panel or on Steering Column. Figure 2.

To install tachometer, obtain proper length of #16 stranded automotive wire and a lighting kit if required. Socket and Bulb Kit No. 366-FK is available. Figure 2.

## INSTALLATION

### PANEL MOUNTING

1. Select location in panel with not less than 3-1/2 inches clearance behind it.
2. A 3-3/8 inch hole in panel is required.
3. Remove mounting bracket from tachometer.
4. Feed wires through panel hole, from the rear and attach to back of tachometer. See Wiring Diagram. Figure 3.
5. If optional Range Markers No. 815898 are to be used, install and position them on bezel.
6. Insert tachometer into panel hole and secure with mounting bracket.

   NOTE: If panel thickness exceeds one inch, cut bracket ends enough to obtain a snug fit without distortion of mounting lugs.
7. Wire according to WIRING instructions and Wiring Diagram. Figure 3.

### CUP MOUNTING

1. Remove and discard mounting bracket.
2. Feed wires through grommet and attach to tachometer as in Wiring Diagram. Install light socket and bulb. Figure 3.

   IMPORTANT: Before encasing tachometer in cup: Attach one wire to Cadmium colored terminal, another wire to Copper colored terminal and a third (ground) wire to either of the Brass mounting studs. Identify these wires for reference outside of the chrome cup.
3. If optional Range Markers No. 815898 are to be used, install them on bezel at this point. Seat tachometer into cup, running grommet with wires into slotted hole in bottom of cup.

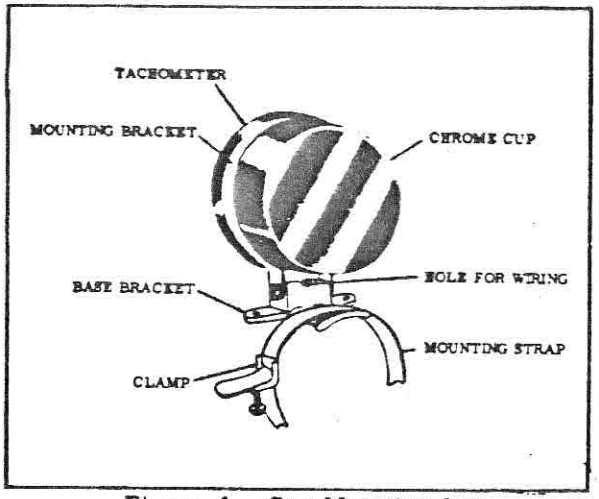


Figure 1 Cup Mounting Kit

4. IF MOUNTING ON TOP OF PANEL, drill two 3/16" holes with the center of one hole 1-3/4" apart from the center of the other. Drill one 5/16" hole directly between the other two.

   NOTE: The base bracket may be used as a template to mark positions of holes.
5. Install base bracket with bolts provided.
6. Position range markers, if used. Slide mounting bracket on the chrome cup. Fasten to base bracket with screws and star washers provided. Feed wires through center hole of base bracket. Figure 1.
7. IF MOUNTING ON STEERING COLUMN, follow steps 1, 2, 3 and 6 under CUP MOUNTING above.
8. Wrap mounting strap around steering column and over base bracket. Tighten strap and secure. Figure 1.

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1826 W. Diversey Parkway
Chicago, Illinois 60614

Printed in U.S.A. P.N. 434549 SER 4195 (3-66)

1. Disconnect ground cable from battery. Refer to Wiring Diagram while making installation. Figure 3.

2. Connect the wire from the Cadmium colored terminal on tachometer to the distributor side of ignition switch. This will pick up battery positive current when ignition is turned on.

   IMPORTANT: Ballast Resistor must be between Ignition Switch and positive side of Ignition Coil.

3. Attach wire from Copper terminal on tachometer to the primary connection of ignition coil which goes to the distributor. (This is usually the negative side of the coil.)

4. Connect ground wire from one of the Brass mounting studs to a good ground, preferably on the engine.

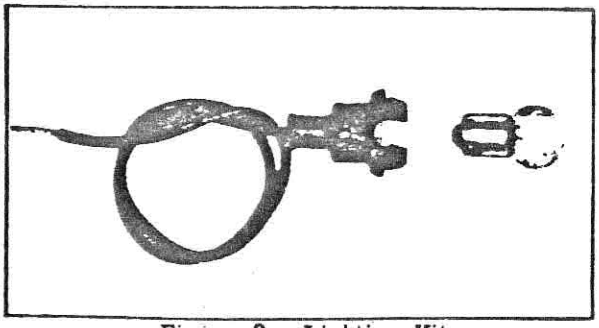

Figure 2 Lighting Kit

Socket and Bulb Kit No. 366-FK

This kit consists of light socket, 12 inches of single wire lead and a 12 Volt light bulb. Connect lead to rheostat terminal of vehicle light switch or one of the instrument panel's lighting lead wires.

NOTE: when wiring step 2 is not possible on certain G. M. vehicles, connect the wire from Cadmium colored terminal on tachometer to an accessory power source which is energized when ignition switch is on, such as heater motor, back up light, etc..
CAUTION: Using radio circuit may cause radio interference.

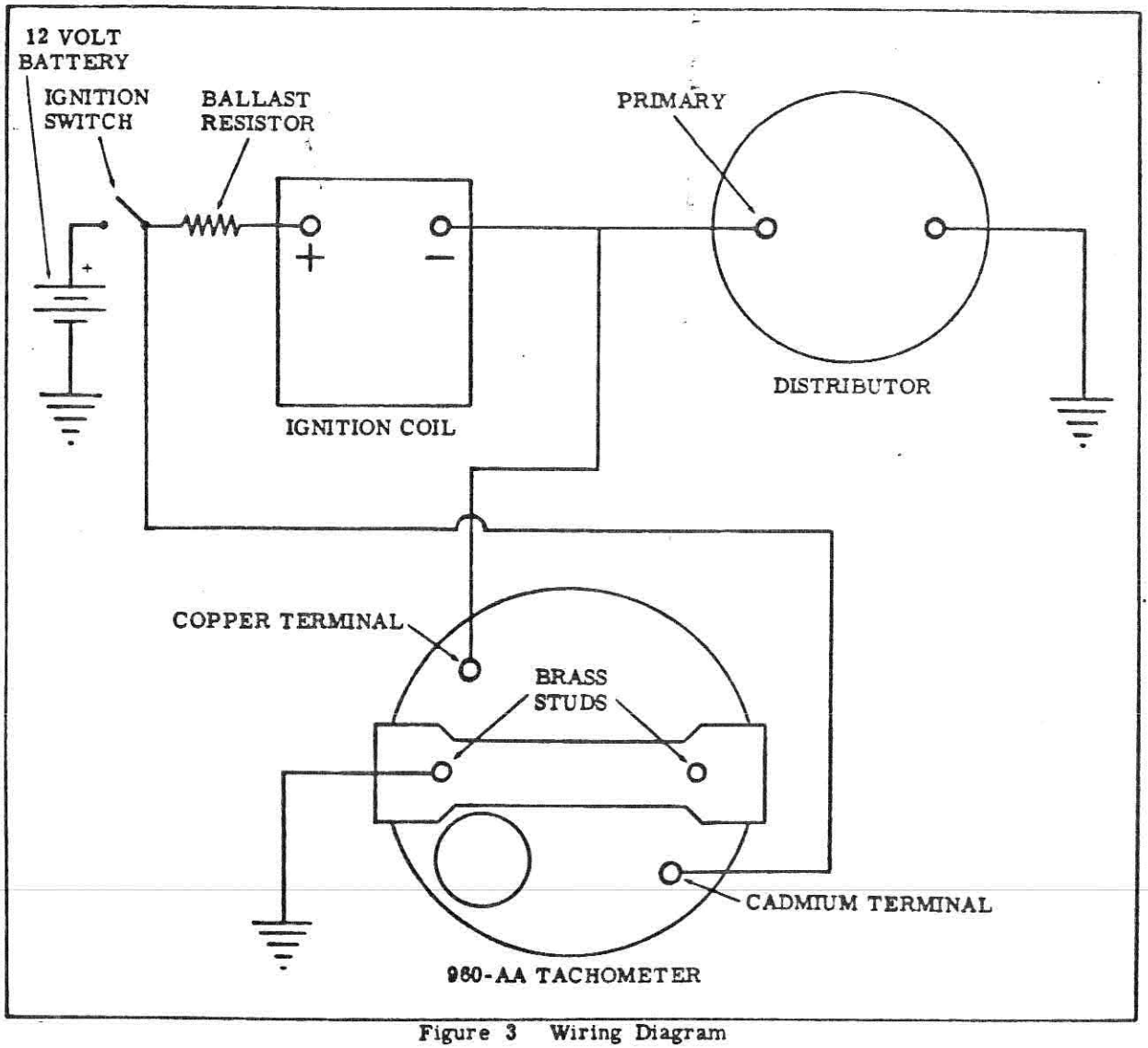


Figure 3 Wiring Diagram

IMPORTANT: Complete and mail the Warranty Card included with the 960-AA Tachometer.

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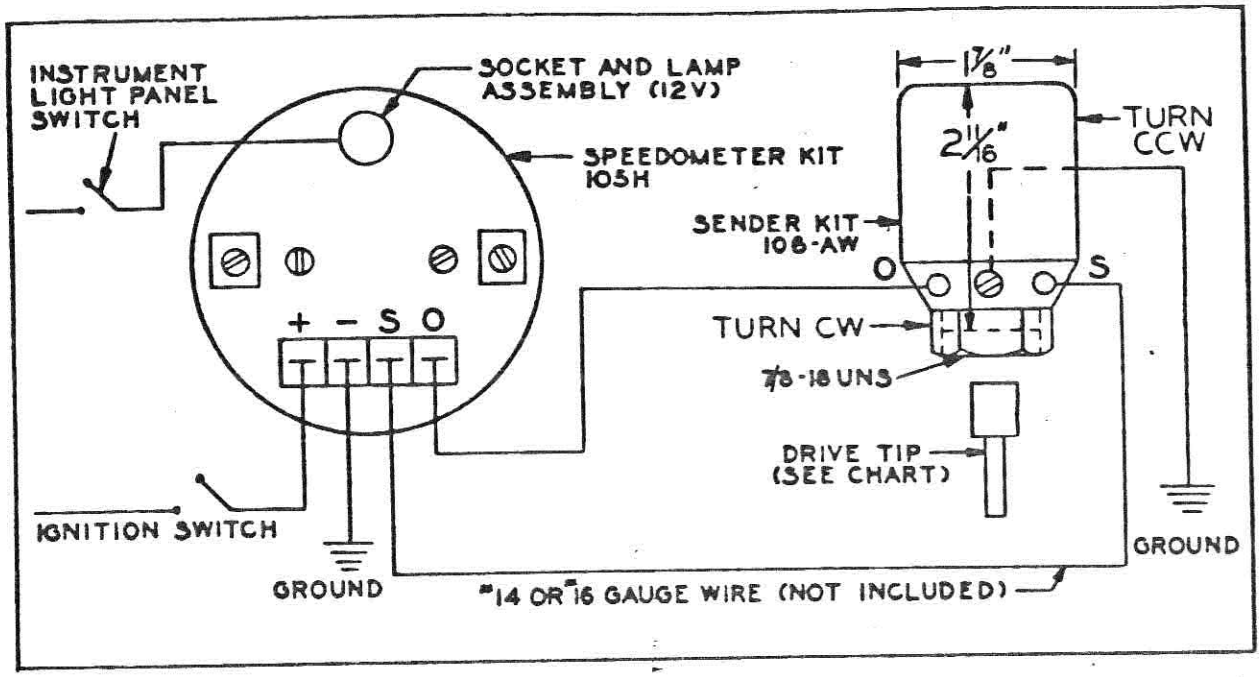
# INSTALLATION INSTRUCTIONS

## 105-H ELECTRIC SPEEDOMETER AND 106-AW SENDING UNIT

Stewart SER 4199 Warner

4




### KIT CONTENTS

| | 105-H | |
|---|---|---|
| 1 | 96196 | Lamp (12V) |
| 1 | 427157 | Socket & Wire |
| 1 | 821134 | Speedometer |
| 4 | 822013 | Terminal (For 14 or 16 ga. wire) |

| | 106-AW | |
|---|---|---|
| 3 | 331556 | Terminal (For 14 or 16 ga. wire, #10 screw) |
| 1 | 821135 | Sender |
| 2 | 821889 | Boot |

### DRIVE TIP SELECTION CHART

| PART NUMBER | TIP SIZE |
|---|---|
| 821870 | .104 sq. |
| 821871 | .150 sq. |
| 821872 | .1834 sq. |
| 821873 | .193 sq. |
| 821874 | .152 tang |
| 821875 | .187 tang |
| 821876 | .203 tang |

**NOTE:** Read instructions carefully. Make all connections as shown in diagram above. Sender may be operated in any mounting position and in either direction of rotation.

**CAUTION:** In mounting operation, do not hold sender while tightening because nut will unscrew from sender.

Ground on sender may be directly connected to ground on speedometer. If this is done, the use of a three conductor cable is recommended.

This speedometer can be used on any 12 Volt D.C. System either positive or negative ground. The terminal marked "+" (plus) must be connected to the ignition switch and the terminal marked "-" (minus) must be connected to the vehicle ground. The case must be grounded to vehicle ground to provide a circuit for the light bulb. Speedometer head fits panel opening of 3-11/32".

When installation is complete, see Installation Check Chart on reverse side.

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## INSTALLATION CHECK CHART

| TROUBLE | REMEDY |
|---|---|
| No odometer reading | Check ignition, odometer, & ground connections |
| No speed indication | Check sender and ground connections |
| No indication of any kind | Check sender, odometer, & ground connections |
| Erratic pointer indication & odom. reading | Check ground connections |
| No light | Check light switch connection and light socket ground in case and case to vehicle ground. |

If none of the above remedies eliminate the trouble, replacement of the sender or head is required.

Return items for replacement to your local Stewart-Warner Sales Office.

SW EXCELLENCE

# INSTALLATION INSTRUCTIONS

## 106-AW SENDING UNIT

SER 4204

WARNER

## DESCRIPTION

This sender transmits electrical impulses for proper operation of:

Model 105 Series Diesel Electric Speedometers
Model 960 Series Diesel Electric Tachometers
Model 994 Series Diesel Electric Tachometers
Model 272 Series Diesel Electric Tachometer Kits

The 106-AW Sender can be used with either direction of rotation and will mount in any position. In order to assure proper operation it has been designed to withstand extreme vibration and temperature.

NOTE: *Two styles of 106 Series Senders are now available, for convenience, having side or top terminals. In the illustrations following, both types of senders are shown.*

## DRIVE TIP SELECTION CHART

| PART NO. | SIZE | PART NO. | SIZE |
|---|---|---|---|
| 821870 | .104 sq. | 821874 | .152 Tang |
| 821871 | .150 sq. | 821875 | .187 Tang |
| 821872 | .1834 sq. | 821876 | .203 Tang |
| 821873 | .193 sq. | Tips purchased separately | |

## MOUNTING THE SENDER

Both senders, side and top terminal types, are mounted in the same way. The sender to be used in a speedometer installation will be mounted on the transmission (usually in place of the flexible shaft). The sender to be used in a tachometer installation will be mounted on the engine. Locate the proper take-off and select the applicable drive tip (refer to chart).

1. Insert tip into take-off on vehicle.
2. Place sender on tip and secure with nut on sender.

NOTE: *When securing sender, turn entire sender or nut will unscrew from sender body.*

IMPORTANT: *During operation of top terminal sender, a light clicking sound will be heard. This sound is normal and does not indicate a defective unit.*

## WIRING

NOTE: *Sender must be installed prior to wiring.*

IMPORTANT: *It is recommended that color coded, No. 16 AWG wire with insulated shank eyelet type terminals be used.*

Select from the following instructions, those which apply to your instrument. Model 272 Series Kits will include either the 960 Series or 994 Series Tachometers.

### MODEL 105 SERIES DIESEL SPEEDOMETER
(12 Volt-Negative Ground System Only)

1. Disconnect ground cable from battery.
2. Connect wire from terminal marked positive (+) on speedometer to ignition switch (Figs. 1 and 2).
3. Connect wire from terminal marked negative (–) on speedometer to a good ground (Figs. 1 and 2).

On Side Terminal Senders:

4. Attach wire from terminal marked "S" on speedometer and secure to terminal marked "S" on sender (Figure 1).
5. Connect wire from terminal marked "O" on speedometer on terminal marked "O" on sender (Fig. 1).
6. Attach wire to unidentified terminal of sender and secure to a good ground (Figure 1).
7. Reconnect ground cable to battery.

FOR FURTHER SERVICE, CONTACT YOUR LOCAL
STEWART-WARNER DISTRIBUTION CENTER

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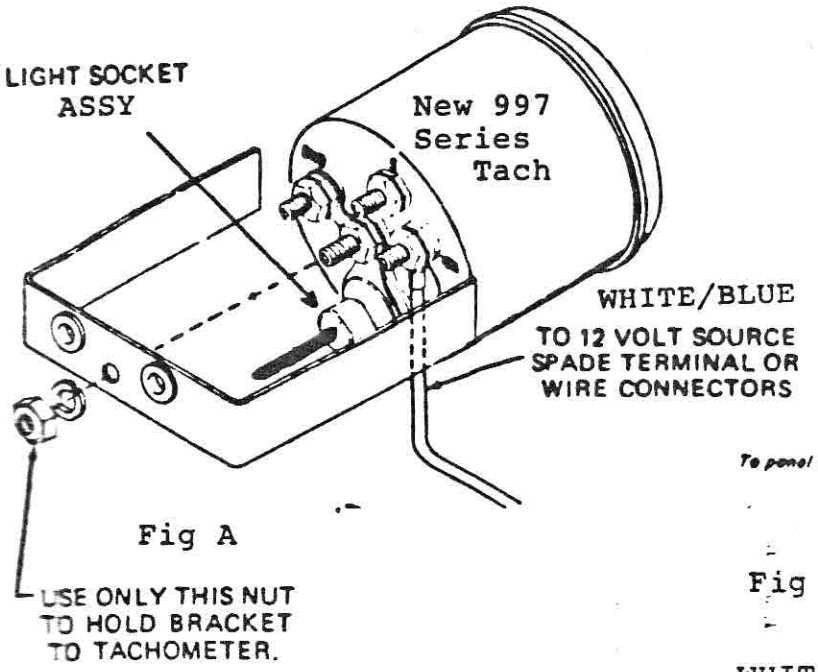



Fig A

Center Dash Facia

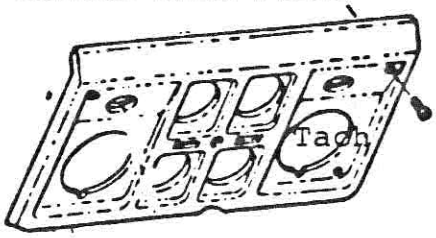



Fig C

Wiring Schematic

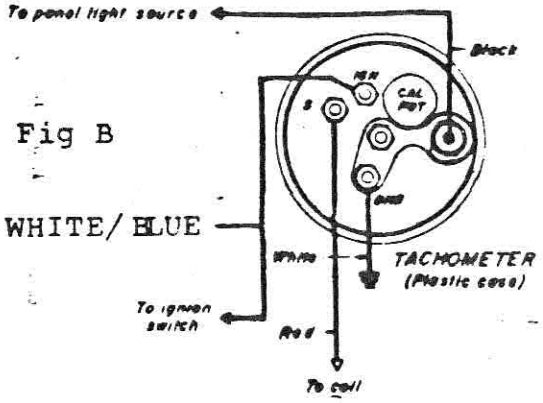



Fig B

1. Remove automotive positive + battery cable.
2. Remove four screws from center dash facia (Fig C).
3. Tilt facia down exposing back of instrument panel.
4. Remove (2) 7/16 nuts from securing brackets of tach (old style) not shown (new style has one 5/16 nut for bracket as shown Fig A.
5. Remove #18 white wire from post marked (GND) See Fig B.
6. Remove #18 red wire from post marked (S) (See Fig B).
7. Remove #16 white/Blue wire from post marked (ign) (See Fig B).
8. Pull light socket assembly out of tach housing (See Fig A).
9. Push tach housing out through cutout in dash facia (See Fig C).

To install new 997 tach reverse steps 9 through 4.*NOTE: Use old light assembly (do not use **new one in 997 kit** ). Before setting dash in place, connect positi battery cable and start engine to see if new tach is functional.

tach does not function, check wires for proper hook up and good contact.

(OVER)

*NOTE: TO ADJUST TACHOMETER READINGS

IMPORTANT: Tachometers are factory calibrated to within 2% of full scale accuracy. Any adjustment of selector dial, other than to change cycle-cylinder settings is per customer wishes and should only be made in conjunction with a tachometer checker or master tachometer.

Adjust tachometer readings at above normal engine idle speed as follows:

1. Locate and remove decal, on rear of tachometer case, identified by "CAL POT".

2. Using a small screwdriver, turn selector dial slowly counterclockwise to increase the RPM reading or clockwise to decrease reading.

3. Replace "CAL POT" decal to prevent foreign matter from entering mechanism.

Recreational Vehicle Service, Inc.
RR2 Box M140 Monterey Highway
Morgan Hill, CA 95037

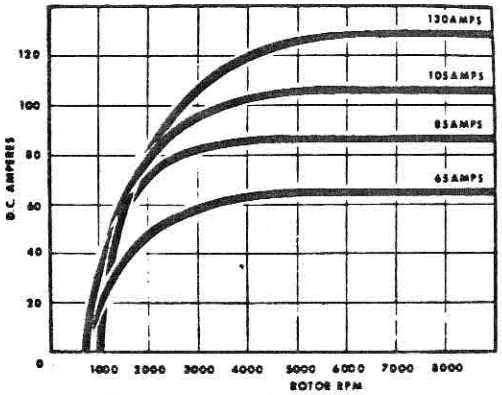
VLN Automotive Products
Leece-Neville
Since 1909
Division of VLN Corporation

# ALTERNATOR MAINTENANCE INSTRUCTIONS

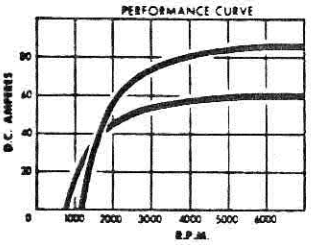
Form 3581-8
File: Alternator
Maint. Instr. Section
Date: August, 1973

| | | |
|---|---|---|
| 7000J SERIES | 14 VOLT | 65 AMPERE |
| 7500J SERIES | 14 VOLT | 85 AMPERE |
| 7600J SERIES | 14 VOLT | 105 AMPERE |
| 7700J SERIES | 14 VOLT | 130 AMPERE |
| 7509J | 28 VOLT | 60 AMPERE |
| 7510J | 28 VOLT | 60 AMPERE |
| 7511J | 28 VOLT | 85 AMPERE |
| 7512J | 28 VOLT | 85 AMPERE |

12 VOLT CURVES




24 VOLT CURVES




These are standard heavy duty alternators for 12 and 24 volt charging systems. They are self-current limiting units with a fully adjustable solid state integral regulator.

The alternators in these series have two diameter shafts. A .669 inch diameter shaft which can be driven to 12,000 RPM maximum and .875 inch diameter shaft which has a 10,000 RPM maximum. These maximum speeds are governed by the size of the drive end bearing. The units in these series use a 3 inch spindle for mounting and have attachment ear(s) for a belt adjusting arm.

The overall dimensions are as follows: Diameter 6-5/8 inches, Length 8-3/8 inches (shaft included) and the Weight approximately 21 pounds.

These units feature sealed ball bearings, with slip rings and brushes that are in a sealed housing mounted on the slip ring end housing of the unit. Six silicon diodes mounted in heat sinks convert alternating current from the delta wound stator into direct current. A capacitor connected between the heat sinks assists in suppressing transient voltage spikes which could possibly damage the diodes.

The brushes and voltage regulator are located in a waterproof housing that may be removed for replacement or inspection without dismantling the entire machine. A terminal is provided for connection of a charge indicator light on Negative Ground Systems only. The alternator has ungrounded output terminals so that they may be used on either positive or negative ground systems. Aside from connecting the proper vehicle wires to the correct output terminals, no other wiring is required on the alternator, eliminating field relays or ignition switch connections.

The regulator incorporates transient voltage protection.

NOTE: The system ampere output (established by the voltage setting of the regulator) can be less than the maximum alternator rating.

## PREVENTIVE MAINTENANCE

Mounting hardware must be periodically inspected and adjustments or repairs performed as required. It is important that mounting hardware be kept securely tightened to prevent vibration damage which will occur if mounting bolts work loose.

Vehicle wiring must be inspected at periodic intervals for loose or corroded connections and repairs made as needed.

At regular intervals inspect the brushes and brush springs. If the brushes or springs are cracked, broken, or burned; they should be replaced. Brushes worn to a length of less than 3/16 of an inch should be replaced. Refer to the regulator replacement section for proper procedure.

## TROUBLESHOOTING

Before performing troubleshooting procedures on the vehicle be absolutely certain that wiring is not defective.

To determine if the problem lies in the regulator or the alternator, connect an accurate voltmeter across the battery with the engine stopped, and note the reading. The engine should now be started. If the voltmeter reading rises excessively, the charging system may be defective or may require adjustment. Remove the cap from the regulator and with the engine at approximately 1000 RPM, attempt to bring the voltage to its proper value (13.5 to 13.7 approx.) by turning the adjusting screw back and forth with a small screwdriver (See Figure 1). If the voltage is excessively high and cannot be lowered by means of the adjustment, the regulator is probably defective and should be replaced. If the output voltage cannot be raised, either the alternator, regulator, or diode trio may be at fault. To determine if the fault is in the regulator or in the alternator, perform the following test.

Connect one end of a short jumper lead to the negative alternator output terminal and connect the other end of the jumper to a short stiff piece of wire at least 1-1/2 inches long. A piece of paper clip wire will be suitable. Insert this wire into the small hole in the end of the brush holder so that it firmly contacts the outer brush terminal (See Figure 2). If the voltmeter reading now rises with the engine at a fast idle, the alternator is OK and the fault is in the regulator or diode trio. Remove the diode trio and test (See "Component Testing"). If the diode trio tests OK, the regulator should be replaced.

The alternator may also be checked for output across each phase by using a test light as shown in Figure 3. The test light should be constructed from a two filament sealed beam unit the same voltage as the alternator, connected in such a manner that the filaments are in parallel. Such a light will act as a load as well as an indicator, and should light with equal brilliancy on each phase. If the lamp is noticeably dimmer on one or two phases, a defective diode trio, stator, or power diode is indicated. If the diode trio tests OK, then the alternator must be removed and dismantled for further tests.

The voltage regulator used in these alternators is a solid state device and for this reason will normally have an extremely long life. It can, however, be damaged by mechanical or electrical abuse.

If the system polarity is inadvertently reversed by installing a battery backwards, boosting or jump starting with the jumper connected backwards, or reversing the positive and negative alternator output leads when changing an alternator, the voltage regulator will be damaged. Although the polarity reversal may only be momentary and may not damage the alternator diodes, the regulator will still be damaged.

## ADJUSTMENT

Prior to adjusting alternator voltage, the wiring and connections should be checked and repaired as needed. The batteries should be fully charged and the engine should be running at a fast idle. Turn off all vehicle loads such as lights, radios, heaters, air conditioners, etc. when checking or adjusting voltage. An accurate voltmeter should be connected across the batteries to determine the charging voltage. Do not rely on dash mounted vehicle instruments. These are excellent indicators but usually lack the extreme accuracy required for regulator adjustment. Remove the plastic cap from the regulator (See Figure 1), and with a small screwdriver carefully turn the adjusting screw clockwise to raise or counterclockwise to lower the voltage. The ideal voltage setting will be a value which maintains a fully charged battery without resulting in an excessive usage of battery water. NOTE: When turning the voltage adjustment screw, do not attempt to force it past its stop as damage will result. Be sure to replace the plastic cap in the regulator adjustment hole to prevent the entrance of water and dirt.

## REGULATOR REPLACEMENT

If the regulator must be removed for a brush inspection or regulator replacement, determine if the regulator brush housing has one or two brush pin holes.

### REGULATOR BRUSH HOUSING WITH ONE (1) BRUSH PIN HOLE

1. The entire regulator brush housing must be removed from the alternator.

2. Remove the diode trio lead from the regulator charge light terminal.

3. Remove the 5/16-18 and 1/4-20 nuts from the positive and negative alternator output terminals, which will free the regulator jumpers.

4. Remove the four 8-32 screws securing the regulator brush housing in place. Remove the assembly. Refer to Figure 4. NOTE: Due to the application of "Loctite" to the four (4) brush housing screws during manufacturing it may be necessary, in some cases, to apply heat to assist in the removal of these screws. Use a large soldering iron or gun (300 to 500 watts) and hold the iron on each screw head for 45-60 seconds. (A drop of solder on the iron's tip will help heat transfer). After applying heat to the screw head, immediately remove with a GOOD screwdriver.

5. Remove the two (2) 6-32 nuts holding the regulator and positive and negative jumpers in place.

6. Remove the regulator from the brush holder housing. The brushes can now be checked. Replace the brushes or regulator if necessary.

7. Reinstall the regulator and brushes in the housing, attach the jumpers and tighten the nuts holding the assemblies together.

8. Using a small screwdriver push and pin the brushes in place, start pin from outside of housing. (A suitable pin can be made using drill rod material or a 1/32" diameter drill. (Refer to Figure 20).

9. Reinstall the regulator brush holder housing assembly and the "O" ring. Use a drop of Loctite Grade "A" on the four brush housing screws.

10. Remove the retaining pin, allowing the brushes to contact the slip rings.

11. Reinstall the nuts on the alternator output terminals and reconnect the diode trio lead to the regulator charge light terminal.

12. Connect the alternator output leads to the proper alternator terminals. Momentarily flash the field by connecting a jumper between the charge indicator light terminal on the regulator and the positive alternator terminal. (Do this regardless of whether the alternator will be used on a positive or negative ground system). (Refer to Figure 5).

### REGULATOR BRUSH HOUSING WITH TWO (2) BRUSH PIN HOLES

1. Remove the diode trio lead from the regulator charge light terminal.

2. Remove the two 6-32 nuts holding the regulator and the positive and negative jumpers.

3. Slowly pull the regulator heat sink (transistor mount) from the holder and remove the regulator, Refer to Figure 21.

4. The brushes can now be checked, replace the brushes or regulator if necessary.

5. Before reinstalling the regulator, insert the outer brush and spring assembly into the housing and compress the brush spring, using a small screwdriver or similar tool. While holding the spring compressed, insert a pin through the top hole in the rear of the housing so that the spring will be held in a compressed position. (A suitable pin can be made

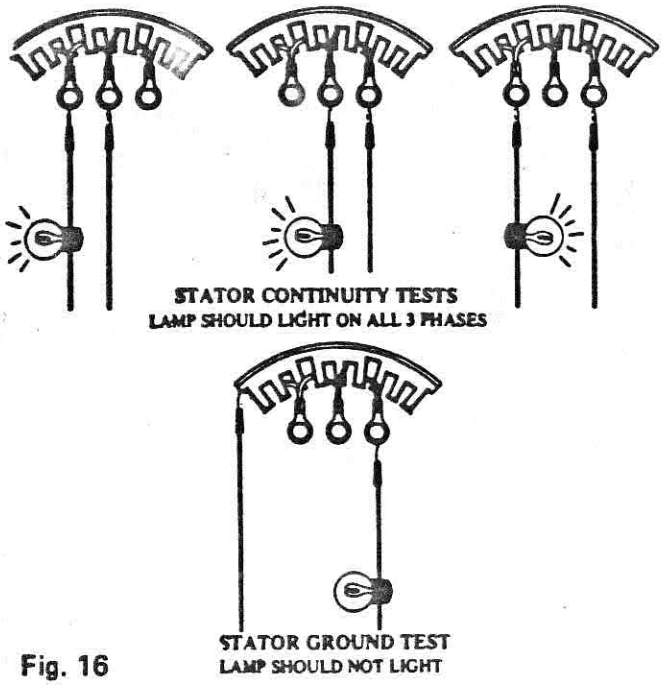
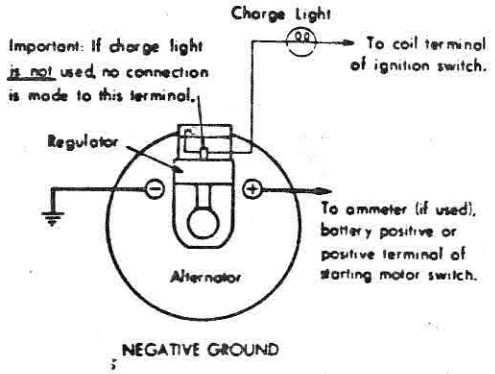



Fig. 16



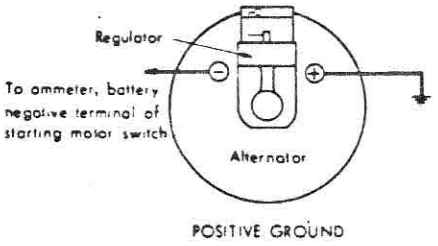




Fig. 19

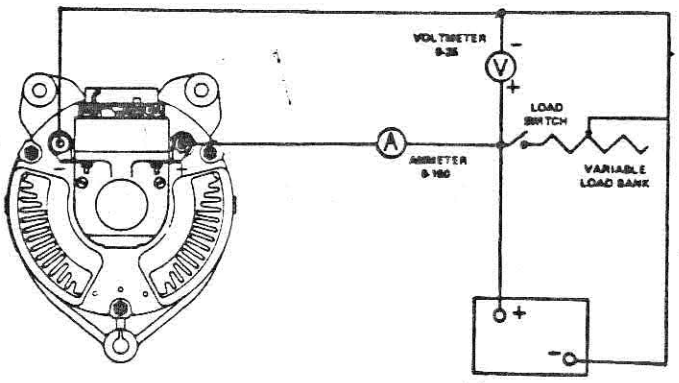



Fig. 17

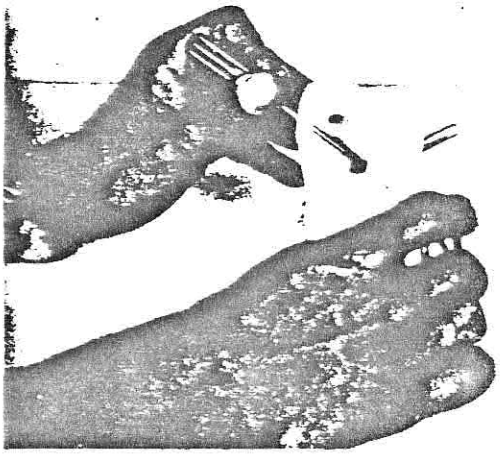


Fig. 20

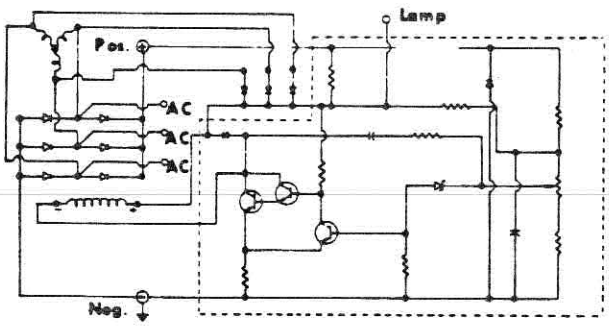



Fig. 18


Fig. 21

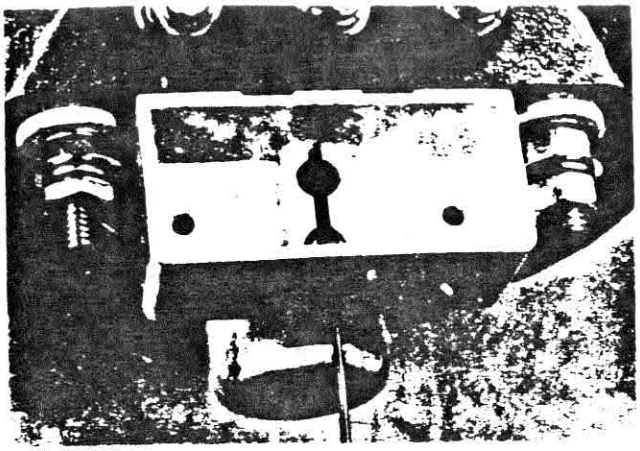


Fig. 22

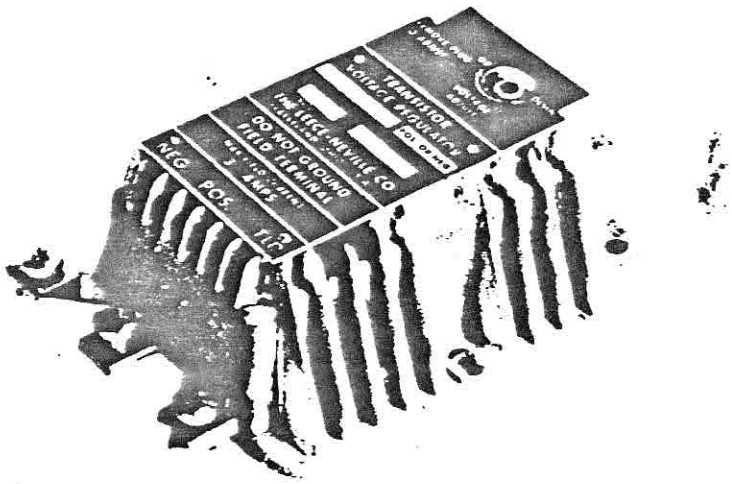
# maintenance instructions

FORM 3048-4
File: Regulator Maint. Instr. Section
Dated: February, 1968

4

## 5016R & 5028R TRANSISTOR REGULATORS






These maintenance instructions were written to cover both the 5016R and 5028R full transistor regulators. The 5028R regulator is the marine version (treated against corrosion) of the 5016R regulator. Throughout these instructions we refer to the 5016R, but actually all instructions apply to both regulators.

### DESCRIPTION

The 5016R Leece-Neville Regulator is a solid state or full transistor voltage regulator for 12 volt alternator systems with 3 amp maximum field current. It is designed for use with self current limiting alternators and for this reason does not contain a current limiter. The power transistor is of the germanium type, while the driver transistor and other semiconductor components are silicon. This regulator will operate in a maximum ambient temperature of 180°F.

The regulator case is not used as a ground return and all connections are brought to external terminals, making the regulator suitable for positive or negative ground installations.

NOTE: On positive ground systems this regulator operates between the field and the ground ( A circuit) while on negative ground systems, it operates between field and the positive output (B circuit). This necessitates different external system wiring diagrams in the installation section of this bulletin.

Voltage is easily adjusted by removing the socket head plug in the regulator case to expose the adjusting screw. By turning this screw the operating voltage may be raised or lowered as desired.

As the 5016R is solid state and contains no moving parts, it will operate in any position with no effect on the voltage setting. Care must be taken however, to see that water which may find its way into the transistor cavity will drain out through the holes provided for this purpose.

### PRINCIPLE OF OPERATION

The 5016R Regulator utilizes a voltage sensitive or zener diode to detect voltage changes in the system. When the voltage rises to a predetermined limit, the zener completes the driver transistor base circuit. This turns the driver transistor on which allows the power transistor to turn off and open the field circuit to the alternator. When the voltage drops, the zener opens the driver base circuit, turning the driver off and allowing the power transistor to turn on and close the field circuit. This sequence repeats itself very rapidly while the regulator is operating. A field discharge rectifier is included which shorts out any self induced field current when the power transistor is open. The zener derives its operating voltage from a potentiometer or adjustable resistance which allows the voltage to be varied to suit individual requirements. Additional components such as resistors, capacitors and diodes are used to insure stable accurate operation.

The components are attached to a printed circuit board which is mounted in an aluminum housing. Besides serving as a mounting and protection for the components, this housing serves as a heat sink which prevents the power transistor from overheating.

For a more complete discussion of transistor regulator operation and testing, consult Leece-Neville Transistor Regulator Bulletin, Form 2762-8.

### INSTALLATION

While the 5016R may be mounted in any position with no effect on its operating or voltage settings, a few simple precautions will insure easy maintenance and long regulator life.

The regulator should be mounted so that the adjusting screw is accessible. The transistor cavity has three drain holes and the regulator should be positioned so that any water will drain through these holes and not accumulate around the power transistor. (See Figure 1).

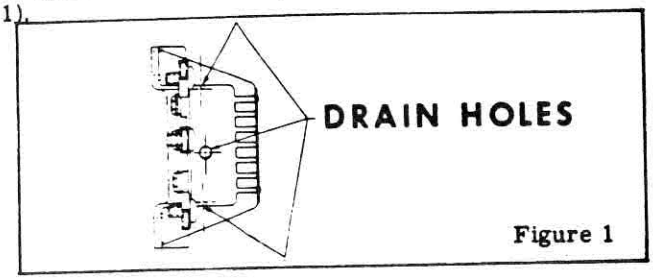


Figure 1

While the 5016R will operate in relatively high temperatures, care should be taken to avoid areas of excess heat. If possible, locate the regulator in the airstream and avoid close proximity to exhaust pipes or manifolds, which create extremely high temperatures.

The accuracy and reliability of any regulator depends to a great extent on its wiring and the 5016R is no exception. Be sure all leads are of adequate wire size and equipped with proper terminals. If possible, solder all terminals to the leads, using rosin core solder, and be sure all terminal screws are properly tightened.

CAUTION: UNDER NO CIRCUMSTANCES ATTEMPT TO GROUND OR JUMPER THE FIELD TERMINAL. ANY ATTEMPT TO DO SO WILL PERMANENTLY DAMAGE THE REGULATOR.

Wiring diagrams are illustrated for both positive and negative grounded systems equipped with either a chargelight or ammeter.

Note, that on ammeter circuits, all the field current passes through the ignition switch. This is permissible so long as the switch and wiring do not introduce a voltage drop. In cases where a voltage drop may occur across the ignition switch or wiring, it is advisable to use a relay such as our 6014R to carry the field current. This relay and its wiring are shown in the wiring diagram section.

The chargelight circuit shows a 25 ohm resistor connected across the chargelight. This resistor insures adequate bleed current to the field to obtain reliable low speed cut-in. If the chargelight is of adequate size, this resistor may not be required. NOTE: Many vehicles originally equipped with a chargelight and alternator may already have this resistor built into the wiring harness.

The wiring diagram shows the Number 3 terminal of the 6010R chargelight relay connected to any one of the three AC terminals of the alternator. If your alternator does not contain AC terminals, this lead should be connected to the "R" (relay) or "N" (neutral) terminal of the alternator.

Certain types of diesel powered equipment may not use an ignition, or "run" switch. In these cases an oil pressure switch may be used to energize the alternator system.

The switch should be installed in an engine lube oil gallery and should close when the engine is started and oil pressure rises. The system wiring is the same as the illustration except that the oil pressure switch is substituted for the ignition switch in this instance.

CAUTION - BE SURE THAT THE REGULATOR IS WIRED FOR THE CORRECT GROUND POLARITY. DO NOT CHARGE, BOOST, OR INSTALL THE BATTERY BACKWARDS.

## ADJUSTMENT

After the regulator has been installed and all wiring thoroughly checked, the regulator may be adjusted. To perform this adjustment, an accurate voltmeter should be connected across the battery terminals. Unscrew the socket head plug in the regulator case, and with the engine running at a fast idle (1000-1500 RPM), turn the adjusting screw in the regulator to obtain proper operating voltage. Turning the screw clockwise will raise the voltage and counter-clockwise to lower the voltage. Settings should be 13.8 to 14.2 volts as indicated on the voltmeter.

NOTE: The vehicle battery must be fully charged when making a regulator adjustment. All electrical loads such as lights, heaters, radios, etc., should be turned OFF. Do not attempt to force the adjusting screw beyond its normal range of travel or damage will occur. After the vehicle has been in operation for awhile, it may be necessary to reset the voltage to accomodate special operating conditions. An ideal regulator setting will maintain a fully charged battery without causing the battery to use excess amounts of water.

## SYSTEM TROUBLE SHOOTING

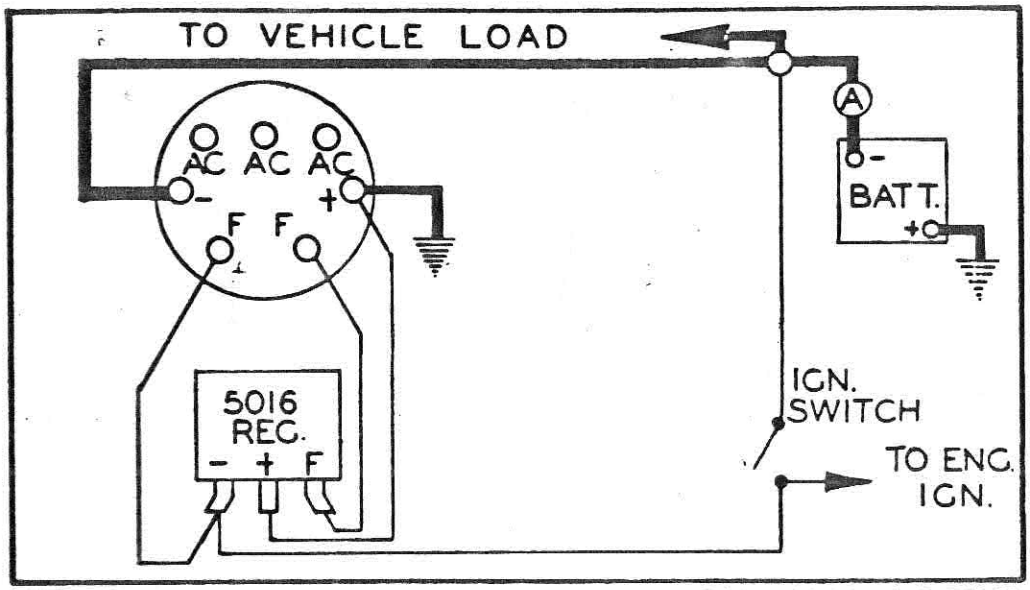
Many so called regulator failures may be traced to other faults such as loose, broken, or corroded wiring or loose and slipping alternator belts. For this reason all wiring, belts and brackets should be thoroughly checked before proceeding to the regulator.

As the 5016R is a sealed unit, it cannot be dismantled for inspection. To determine if the regulator is at fault, AFTER ALL WIRING HAS BEEN THOROUGHLY CHECKED: Disconnect the field wire from the regulator and connect it to the positive regulator terminal. If output is now obtained the regulator is faulty and should be replaced. When performing this test, leave the remaining wires on the regulator. When performing this test, do not run the unit any longer than necessary, and not above a fast idle. As the regulator is being bypassed, high voltage may be developed, which could damage the alternator.

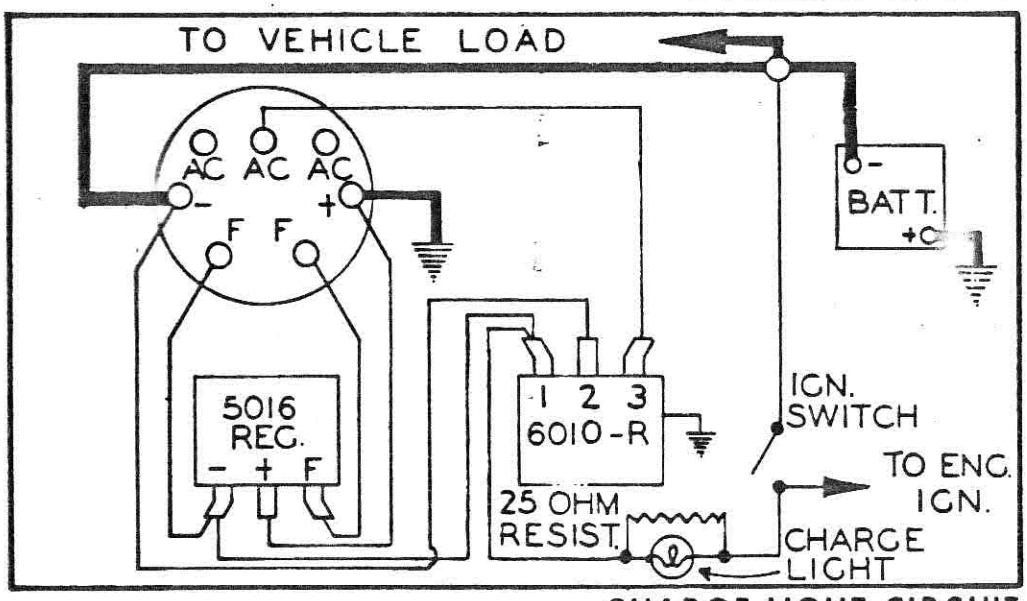
If the charging rate is excessively high and cannot be lowered by means of the adjustment, remove the field wire from the regulator. If the output drops, the regulator is defective and should be replaced. This applies to positive and negative ground systems.

If the above tests do not indicate a defective regulator, point to point voltage checks should be made. Check the alternator according to the specs for the particular alternator being used. Bypass any relays which may be in the system to determine if they are faulty.

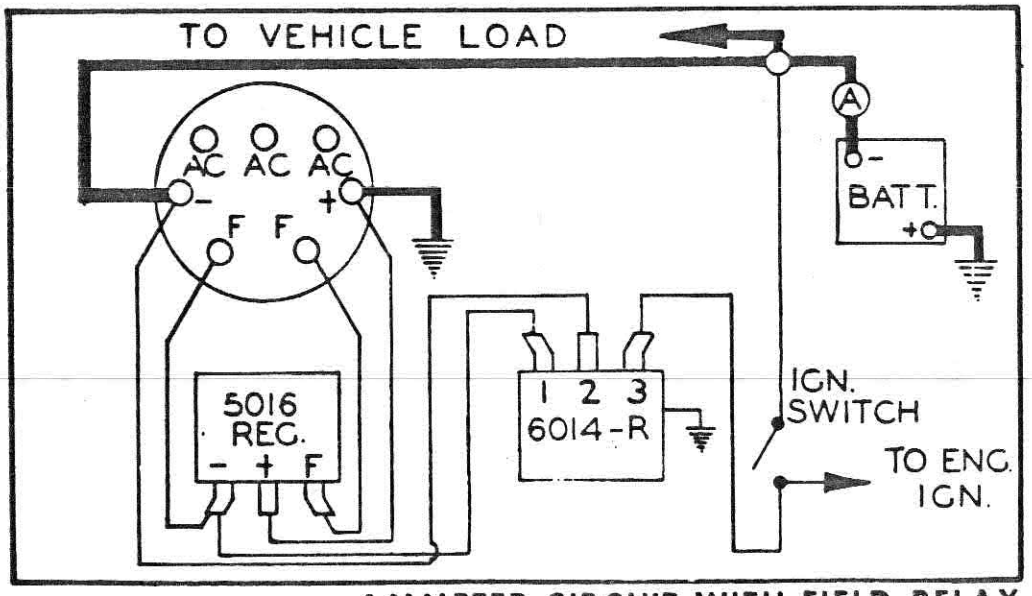
# POSITIVE GROUND SYSTEMS




**AMMETER CIRCUIT**

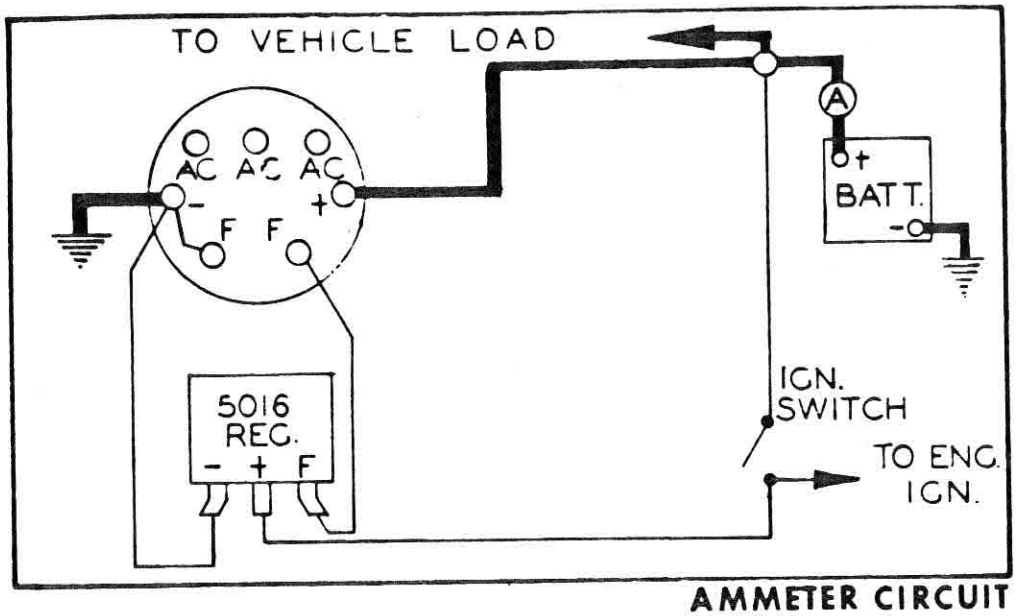



**CHARGE LIGHT CIRCUIT**

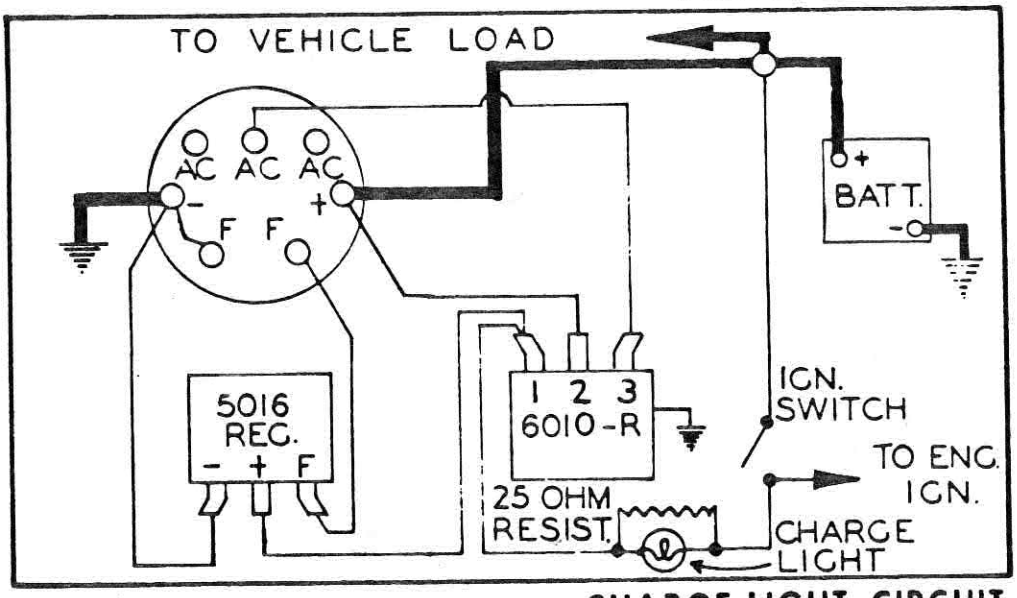



**AMMETER CIRCUIT WITH FIELD RELAY**

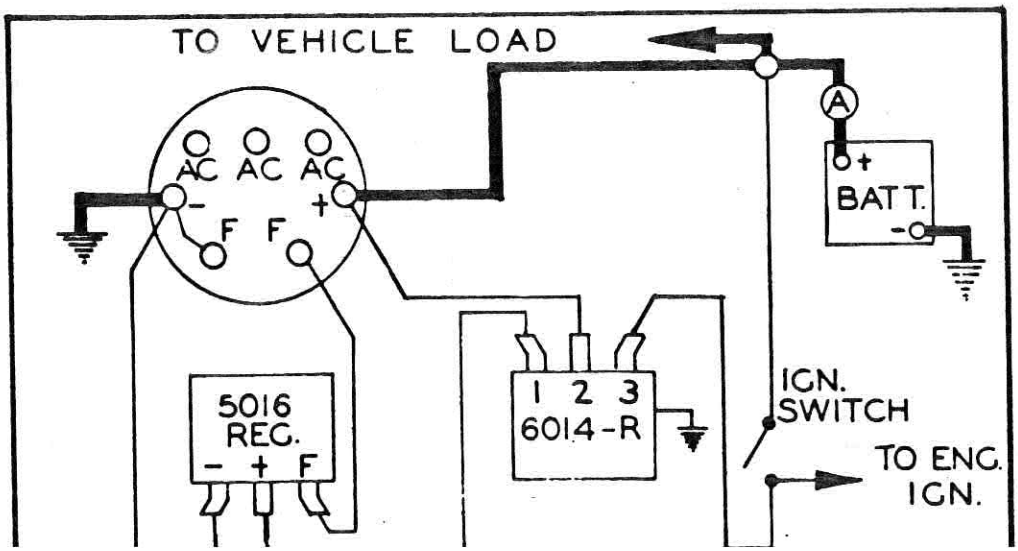
# NEGATIVE GROUND SYSTEMS




**AMMETER CIRCUIT**




**CHARGE LIGHT CIRCUIT**



PERFECT CIRCLE

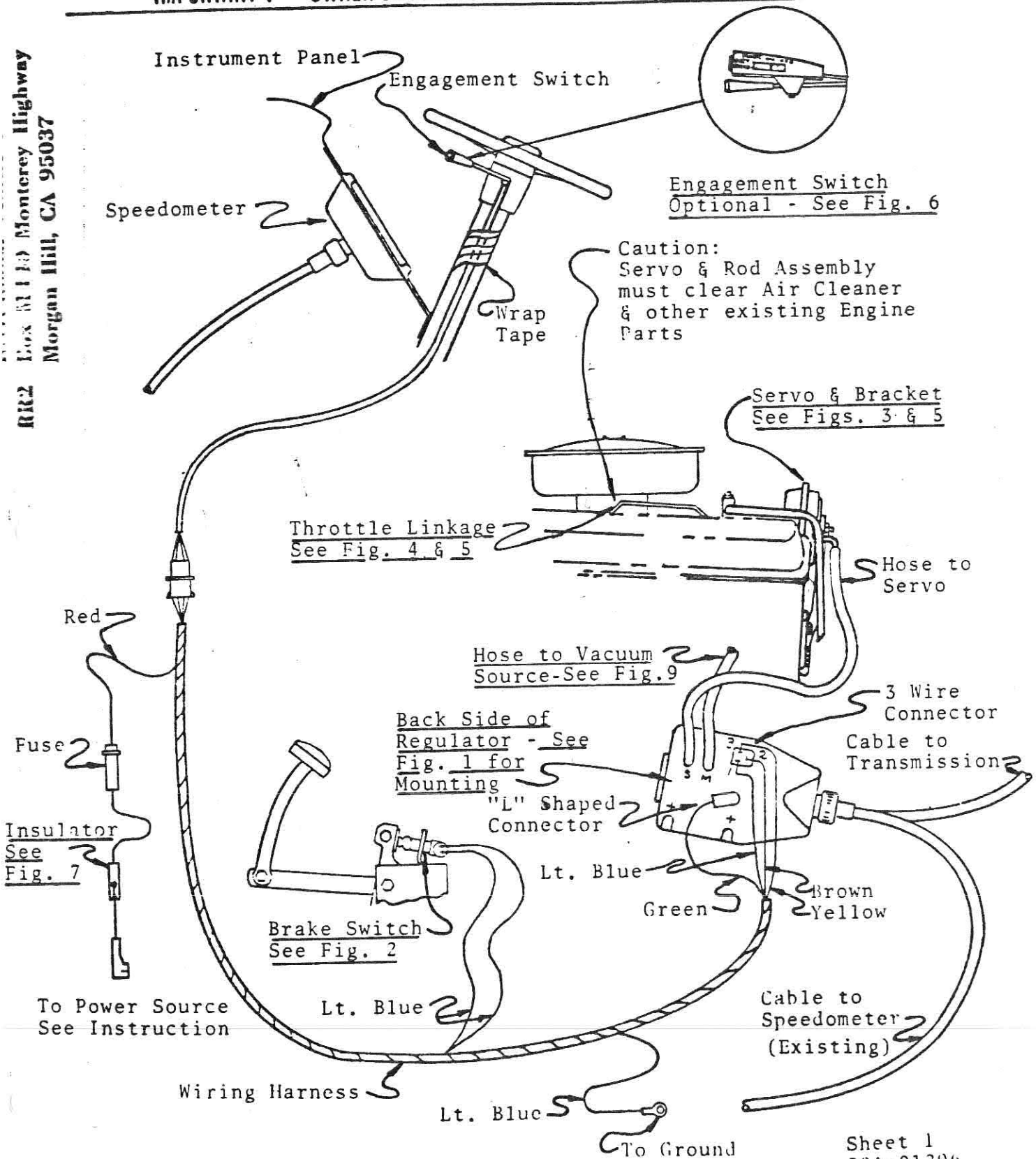
# INSTALLATION DIAGRAM

(J-MCRS SYSTEM)

DODGE CHASSIS MOTOR HOME - 440 ENGINE

**IMPORTANT ! - OWNER'S COPY - STORE IN VEHICLE FOR FUTURE REFERENCE**

RR2 Box 8119 Monterey Highway
Morgan Hill, CA 95037




Sheet 1
59A-01296
Rev. A

# Speedostat® INSTALLATION INSTRUCTIONS 4

## DODGE MOTOR HOME CHASSIS - 440 ENGINE

*********

Referring to the layout diagram and the various figures attached, note the location of each part. The regulator is mounted on the floorboard support near the left front shock. The brake release switch and brackets are located on the brake-light switch bracket and striker arm. The vacuum servo (bellows) and throttle linkage parts are mounted on the engine. The turn signal-engagement switch assembly replaces the existing turn signal lever or the lever mounted engagement switch assembly is clamped to the existing turn signal lever. The wiring harness, vacuum hoses and speedometer cables connect the various parts together.

Step No. 1 -

Raise left front of vehicle and support. Remove left front wheel.

Step No. 2 -

Disconnect existing speedometer cable at transmission and route to the proximity of the left front shock. (To be connected to the regulator).

Step No. 3 -

Attach regulator drive cable (included in kit) to the transmission and route to the proximity of the left front shock. (To be connected to the regulator).

Step No. 4 -

Attach cables to regulator and tighten nuts.

Step No. 5 -

a) Place regulator on floorboard support angle iron forward of left front shock with cables sloped downward as shown. See Fig. 1.

Note: Cables must be free of kinks and sharp bends (Minimum six (6) inch radius for all bends).

b) Locate, mark, and drill two (2) 9/32" diameter mounting holes. Fasten regulator in place with two (2) 1/4-20 x 1/2 hex head machine screws.

Step No. 6 -

Attach release switch striker to brake light switch striker arm with 3/8-16 x 1 1/8 hex bolt, lock washer and nut. See Fig. 2. Attach brake release switch bracket on front side of existing brake light switch bracket with the existing brake light switch and stamped nut. See Fig. 2.

Note: For proper adjustment of the existing brake light switch, it should be adjusted so the brake lights light when the brake pedal is depressed approximately 1/4 to 1/2 inch.

Step No. 7 -

a) Insert brake release switch tubular clip into brake release switch bracket. See Fig. 2.

b) Insert switch into tubular clip until switch body seats on tubular clip.

c) Pull brake pedal rearward. Switch will be moved in tubular clip providing proper adjustment.

Step No. 8 -

Replace left front wheel, remove support and lower vehicle.

Step No. 9 -

Remove air cleaner.

Step No. 10 -

Attach servo bracket to the back of the engine. See Fig. 3. The bracket is mounted to the back-left head of the engine using the two existing drilled and tapped holes. Use two (2) 3/8-16 x 1" hex head bolts and lock washers to fasten in place.

Note: The servo bracket should be mounted against the engine with the existing clamps mounted on top of the servo bracket. It is important that the 1" long hex bolts supplied be used in place of the existing bolts to insure proper thread engagement.

Step No. 11 -

Attach servo to mounting bracket using 1/4-20 hex nut and washer assembly. See Fig. 3.

Step No. 12 -

Attach servo rod to throttle linkage. See Figs. 4 and 5. Insert the straight end of the servo rod thru the nylon bushing on the front part of the servo assembly. Remove the hitch pin from the carburetor lever pin, install the servo rod between the legs of the throttle cable clevis and reinstall all existing parts as before.

Step No. 13 -

With the carburetor set on hot idle, install and adjust the servo rod clip so that there is about 1/16" clearance between the rod clip and the face of the plastic bushing on the servo assembly. See Fig. 5.

Caution: Carburetor must be in the hot idle position and off the fast idle cam.

Step No. 14 -

Attach 1/4" vacuum hose to servo-hose connector, route to regulator unit, cut to length and attach to "S" connector of regulator.

Step No. 15 -

For an adequate engine vacuum source, disconnect the power brake line from the intake manifold. Install the special adapter tee supplied and re-connect power brake line to the top of the tee. See Fig. 9. The special adapter tee should be installed so the 1/4" tube points toward the back-right side of the engine for proper hose routing.

For those model chassis which have a short adapter similar to the special adapter tee supplied, the existing adapter can be discarded and replaced by the special adapter tee.

Step No. 16 -

Important: See Fig. 9 for proper hose routing to the special adapter tee to eliminate interference problems with the servo rod and linkage parts.

Attach 1/4" vacuum hose to "M" connector of regulator, route to engine vacuum source, cut off any extra length and attach to the 1/4" tube of the previously installed special adapter tee.

Step No. 17 -

Replace air cleaner.

Caution: Make certain air cleaner, air conditioning brackets, etc., clear the servo and that there is no possibility of the linkage assembly becoming caught or entangled on any adjacent parts which would tend to hold the throttle open. Work foot throttle several times to check.

Step No. 18 -

Connect the wiring harness to the regulator (three-way connector - yellow, light blue and brown wires to the three terminal connection, and the "L" shaped connector - green wire to the threaded screw extending from back of regulator). Refer to the installation diagram (regulator portion) of this instruction.

Step No. 19 -

Ground wiring harness eyelet (blue wire) to any convenient chassis bolt, regulator mounting screw, etc.

Note: If mounting surface for regulator is not metal, an external grounding lead must be provided from the regulator to any convenient chassis screw, bolt, etc.

Step No. 20 -

Connect wiring harness brake release plug to the brake release switch (two-way connector, blue wires).

Step No. 21 -

Route remainder of wiring harness into the passenger compartment and up behind the instrument panel.

Step No. 22 -

If the combination engagement switch-turn signal lever assembly is to be installed, remove the steering wheel. Remove the existing turn signal lever and install the SPEEDOSTAT engagement switch-turn signal lever assembly. Re-install steering wheel. Route the engagement switch wiring thru the lever hole, down inside steering column bowl and on outside of steering column below bowl. Tape in place with black tape. Using the female connector body provided on the main wiring harness, insert the bullet nose terminals (4) of the engagement switch harness into the connector body matching the wire colors. It is important that the bullet nose terminals are fully engaged into the body connector.

If the clamp-on type engagement switch is to be installed, do not remove steering wheel or existing turn signal lever. Install the SPEEDOSTAT clamp-on switch with clamp provided and tighten socket set screw in clamp. See Fig. 6. Secure the engagement switch harness to the turn signal lever with the small plastic strap provided. Route the wiring on the outside of the steering column and hold in place with black tape. Plug the four-wire connector of the previously routed main harness (see Step No. 21) securely.

Note: Wire colors must match for both type engagement switch assemblies.

Step No. 23 -

Locate 12-volt power source when ignition key is in the "on" or "accessory" position. The two best sources are either the accessory side of the ignition switch, or at the fuse block. To find this 12-volt power source, make a tester as shown in Fig. 8. Connect one end of the tester to the wire in question, the other end to bare metal (ground). If the wire is "hot", the bulb will light. Then check to see if this wire is cold when the key is turned to the "off" position.
See NOTE: on next sheet.

Note: Correct selection of 12-volt power source wire is important! If the wire selected is "hot" with the ignition key in "off" position and the SPEEDOSTAT master switch is left in the "on" position, battery discharge may result when the vehicle is parked for an extended period. However, if the correct power source wire is selected, battery discharge cannot occur due to the SPEEDOSTAT.

Step No. 24 -

Securely crimp red wire of the wiring harness to the power source and slip nylon insulator over splice. See Fig. 7.

Step No. 25 -

The hoses and wiring harness may be tied together or out of the way with plastic straps to prevent damage on moving parts, hot manifold, etc.

INSTALLATION IS NOW COMPLETE

IMPORTANT! OWNER'S COPY - STORE IN VEHICLE FOR FUTURE REFERENCE

## OPERATIONAL CHECK PROCEDURE

CAUTION: SPEEDOSTAT should not be engaged on wet or slick roads.

Perform following checks after SPEEDOSTAT is completely installed. If problems are experienced during this operational check procedure, refer to the trouble shooting guide.

tion Switch-off

UNDER HOOD

1. Manually operate vehicle's throttle linkage through its full travel, thus allowing the speed control linkage to move its full travel. Check to see that there is no possibility of the linkage becoming caught or entangled on any adjacent parts which would tend to hold the throttle open.

2. Compress the servo and release. Servo must open completely without rubbing on the air cleaner, valve cover, throttle linkage, etc.

UNDER VEHICLE

Observe action of brake release switch by moving brake arm. Plunger on switch should move in and out with movement of arm. Plunger will be held in when arm is released.

Turn Ignition Switch On & Start Engine

(Engagement Switch in "off" position)

1. If engine accelerates, vacuum hoses are reversed at the regulator. Shut off ignition and correct.

2. Move engagement switch to "on" position and depress set button in end of lever. Unit should not engage. If unit does engage, immediately shut off ignition.

3. Disconnect vacuum hose at regulator from the "M" connector. Engine speed should increase somewhat. There should be vacuum available at the hose end. Reconnect vacuum hose and check all connections for leaks.

Vehicle Road Check

(Should be made on open or uncongested highway)

1. Drive at 10 miles per hour, switch in the "on" position, depress and release engagement button. The system should not engage. (Normally, system should engage at speeds above 30 mph.)

2. Drive at 45 mph. Depress the engagement switch and release. System should engage and hold on level road within ± 2 mph.

3. Depress brake pedal. System should disengage.

4. Move slide switch to "resume" position and release. Speed will resume back to pre-set speed.

5. Move slide switch to "off" position. System will be completely disengaged.

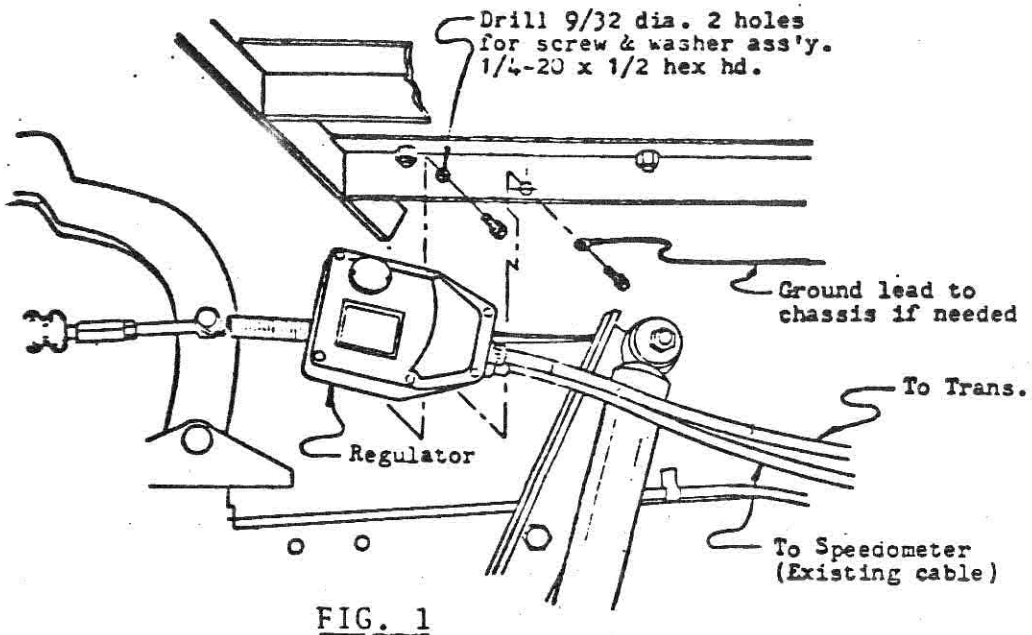



FIG. 1

BRAKE RELEASE SWITCH ASSEMBLY

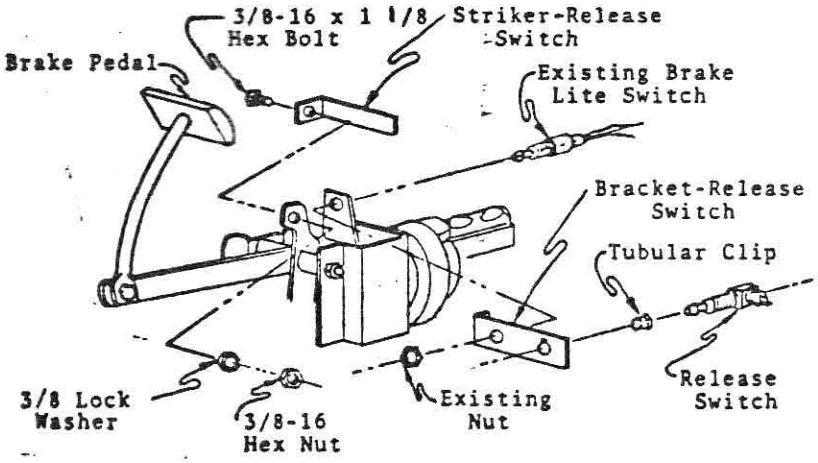



FIG. 2

SERVO MOUNTING

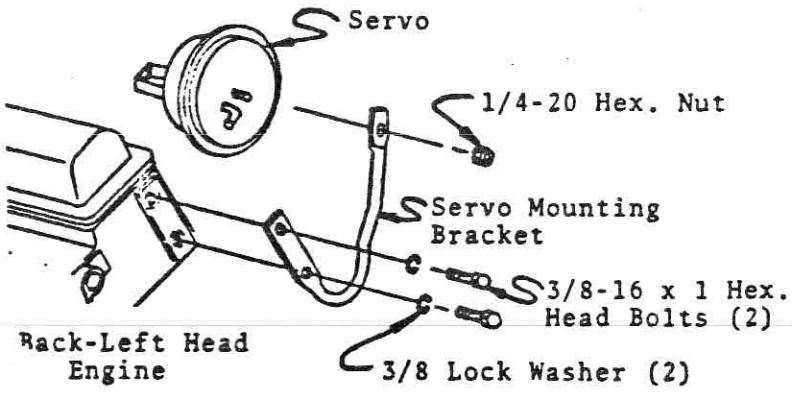



FIG. 3

SERVO ROD TO THROTTLE LINKAGE

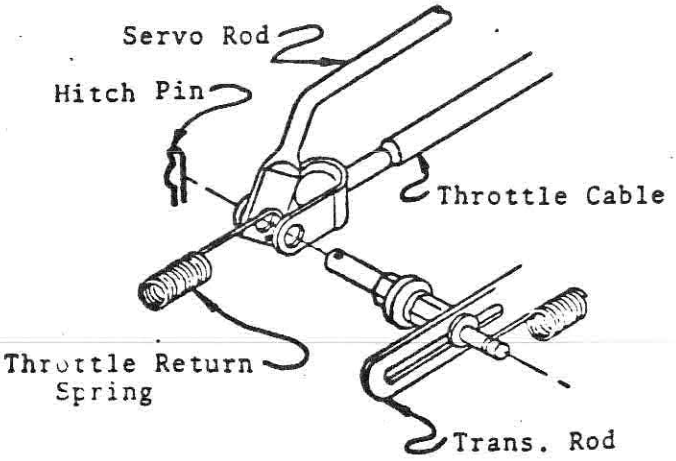



FIG. 4

## SERVO TO ROD ASSEMBLY

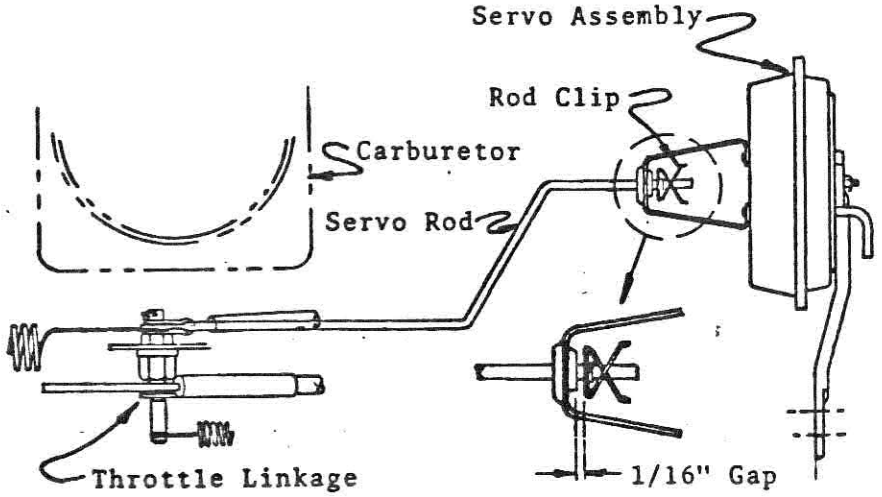



FIG. 5

## LEVER MOUNTED ENGAGEMENT SWITCH - OPTIONAL

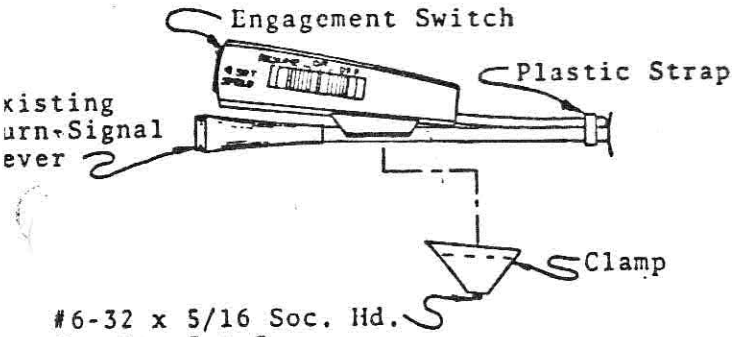



FIG. 6

## TYPICAL TEST LAMP

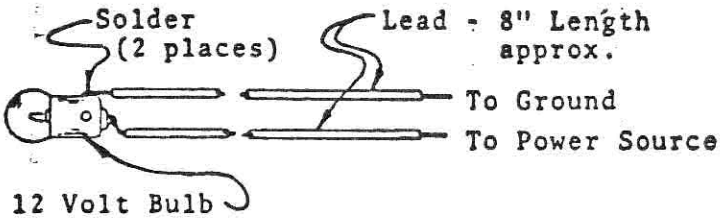



FIG. 8

## TAP SPLICE

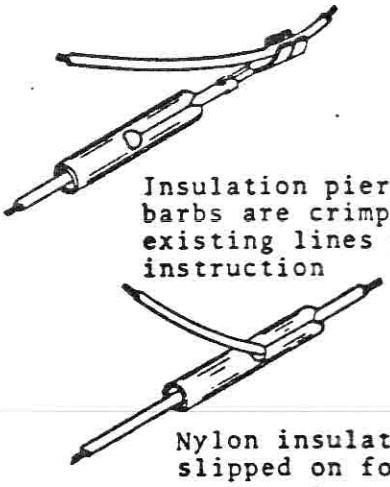



FIG. 7

## VACUUM SOURCE AND HOSE ROUTING

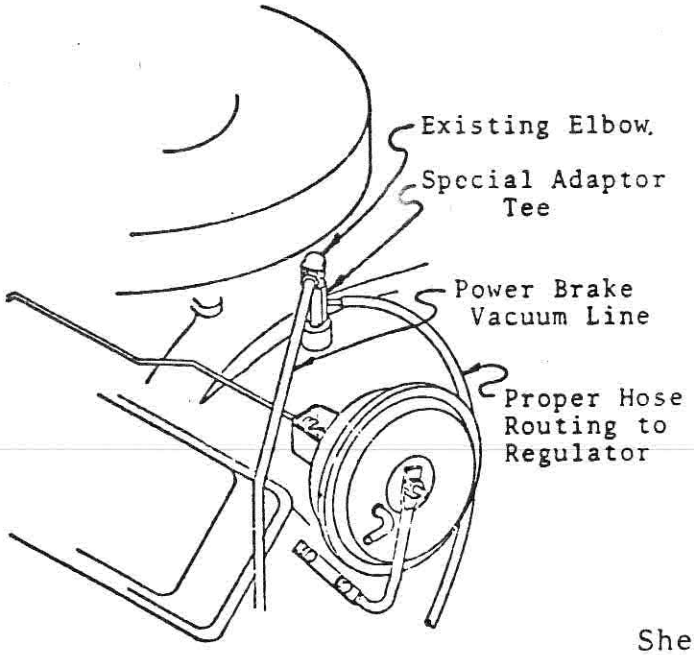



FIG. 9

4

# electrical systems

## *in the Dodge Truck Line*

## Electronic Ignition System

# II

**Foreword**

This publication covers the electronic ignition system in detail. It's purpose is to give you a working knowledge of electronic ignition, including trouble shooting and maintenance requirements.

Component testing or trouble shooting the electronic ignition system remains the same regardless of distributor model. You may be servicing a six cylinder or eight cylinder system, or a heavy duty truck with a Holley distributor. Refer to your service manual for complete specifications.

The booklet is divided into four sections as follows:

1. Introduction

2. Electronic Ignition System Components

3. Trouble Shooting the Electronic Ignition System using the Electronic Ignition Tester.

4. Trouble Shooting the Electronic Ignition System when the Electronic Ignition Tester is not available.

Chrysler Motors Corporation
U. S. Automotive Sales and Service

# INTRODUCTION



The Chrysler Electronic Ignition was first introduced in 1971 as a running change on model equipped with a 340 C.I.D. engine and a manual transmission.

By the end of the 1972 model year, electronic ignition was standard equipment on all eight cylinder models sold in California and available as an extra cost option in other states. Starting with 1973 production all North American built cars will be equipped with electronic ignition.

In January 1972, engines in light duty conventional cab and compact model trucks were equipped with electronic ignition as an option. In June 1972 electronic ignition was made available on 318-3 and 413-1 engines on Motor Home Chassis.

All Chrysler built truck engines in 1973 production will be equipped with electronic ignition.

It's a fact that a misfire in one cylinder can increase undesirable exhaust emissions as much as 4 times. Chrysler Engineers and others have found that an ignition system that has not been properly maintained is the most frequent cause of misfiring. Generally speaking, the breaker points have a shorter service life than any of the other ignition components. So, Chrysler Engineers have developed a new Electronic Ignition System that eliminates the breaker points and the service and performance problems associated with them. The new Electronic Ignition System that eliminates the breaker points and the service and performance problems associated with them. The new Electronic System controls ignition timing and dwell very accurately resulting in maximum exhaust emission control with minimum ignition system service.

**NOTES**

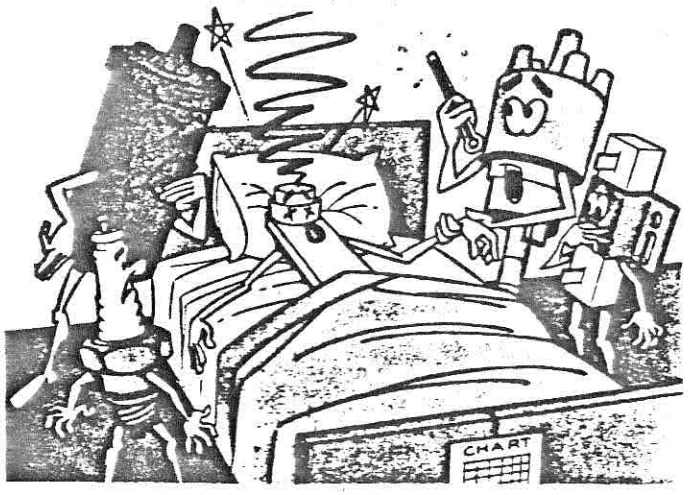



**Figure 1**

Before going any further with the electronic ignition system, let's review the periodic service required with breaker-point ignition. This will help you to appreciate the advantages of the new breakerless system. The breaker-point ignition has been steadily improved and is an excellent system. However, regular periodic service is required to maintain satisfactory ignition performance. Of all the breaker-point ignition components, the breaker-points have the shortest service life. Of course, spark plugs eventually wear out, but the coil, condenser and ballast resistor have been improved to the point that they should virtually last the life of the car.

1

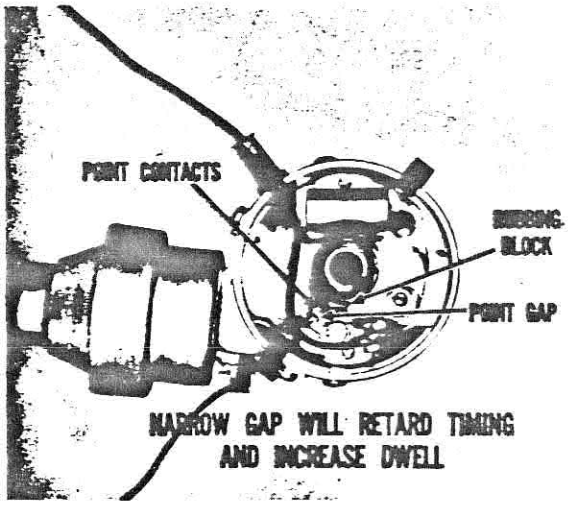



**Figure 2**

In an engine equipped with breaker-point ignition, there is a slight but continuous change in ignition timing over the life of the points.

That's because the contact gap closes and timing starts to retard as a result of rubbing-block wear. As the contact gap closes, the dwell in a breaker-point ignition system is also affected.

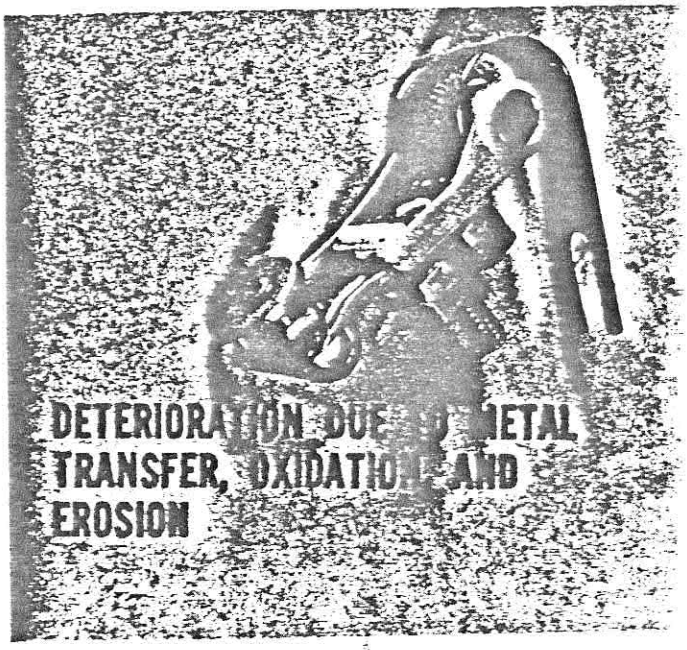



Figure 3

Engine performance can be maintained as the points wear by resetting the timing or readjusting the contact gap if the dwell is noticeably off. However, even when the breakerpoints are kept properly adjusted, they will deteriorate in normal usage due to metal transfer caused by arcing across the points, oxidation, and erosion. Eventually, this will cause misfiring.

NOTES


Figure 4

When the contacts deteriorate to the point where they cause misfiring, they should be replaced. When an engine begins to misfire, it also causes spark plug deterioration and shortens plug life considerably. Unfortunately, the average owner does not have a tune up performed often enough to prevent or for that matter, to correct misfiring.

With the electronic ignition system, periodic distributor service will be a thing of the past since the breaker-points have been replaced by electronic components and circuitry.

NOTES

# ELECTRONIC IGNITION C MPONENTS

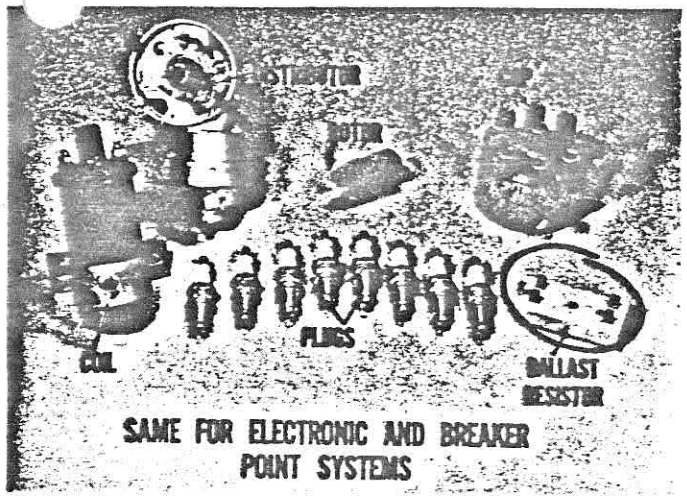



**Figure 5**

The distributor housing, the advance mechanism, the rotor and the distributor cap are the same for the new electronic ignition and the conventional breaker-point ignition. Both s ms use the same type ignition coil and spark pl A new dual ballast resistor is used. This wi e covered later. With the exception of the drive and advance mechanisms the components inside the electronic distributor are brand new. The pick-up unit and the reluctor have physically replaced the cam and breaker-points.

The word "physically" is used because although they do the same basic job, they actually do it quite differently. A condenser is no longer required and this will also be explained in later paragraphs.

**NOTES**

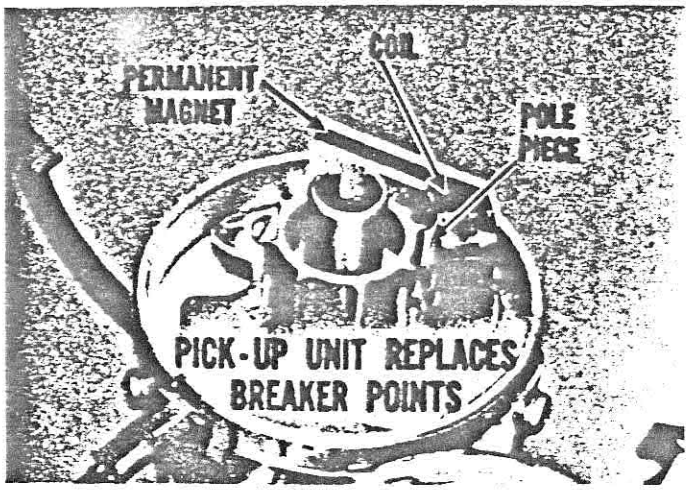



**Figure 6**

The pick-up unit consists of a permanent magnet and a coil that is wound around a pole piece. The pole piece is an extension of the mounting bracket and is attached to the permanent magnet. Because of the arrangement, the pick-up unit resembles a horseshoe type magnet with the reluctor end of the pole piece acting as one of the poles.

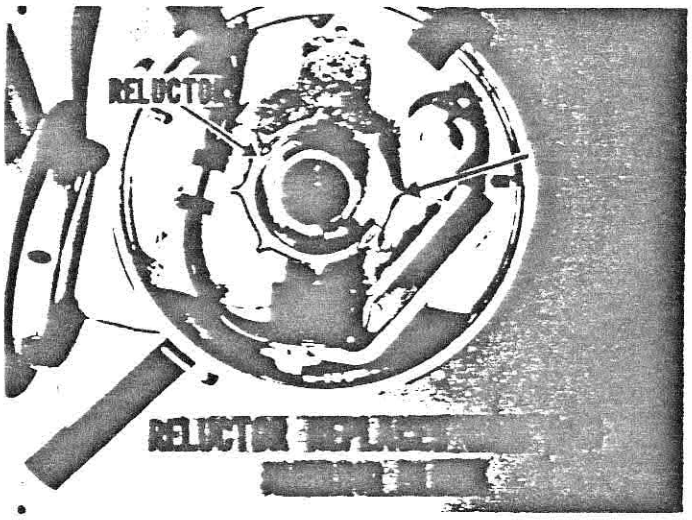



**Figure 7**

The reluctor is a gear like component that is attached to the distributor shaft in the same position as the cam in a breaker-point ignition. The reluctor is not a magnet but it does provide a better magnetic path than air. In other words, it is capable of reducing reluctance (resistance to magnetic flow) and that's why it is called a reluctor. More about this later.

In a very general way, the reluctor and the pick-up unit do electrically what the cam and rubbing block do mechanically in a breaker-point ignition. Although the electronic distributor components replace the cam and breaker-points, they operate quite differently. For one thing, the pick-up unit is not a set of points, and there must be no contact between the reluctor and the pick-up unit.

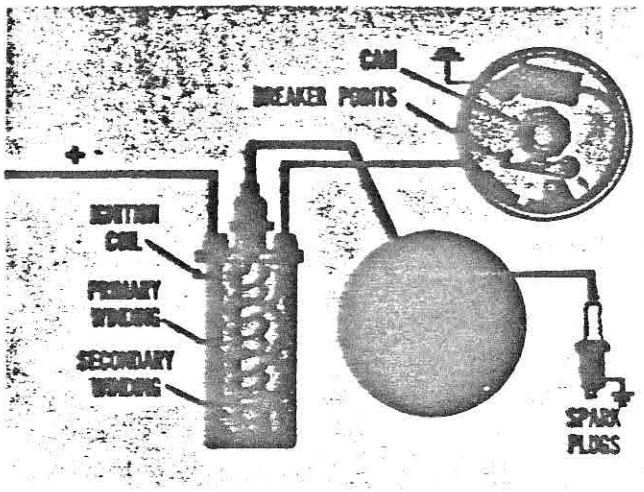



**Figure 8**

A short review of the breaker-point system will help you understand how the reluctor and pick-up unit work. In a breaker-point system, the current flowing through the primary winding of the ignition coil is interrupted when the breaker-points are opened by the rotating cam. The collapsing magnetic field in the ignition coil primary induces enough voltage in the ignition coil secondary to fire the plugs.

**NOTES**

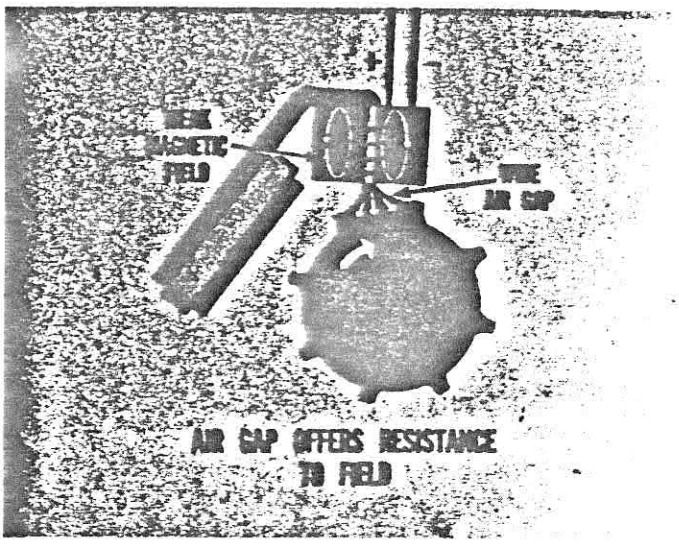



**Figure 9**

In the electronic ignition system a permanent magnet in the pick-up unit provides a magnetic field from the pole piece to the permanent magnet itself. This magnetic field passes through the coil that is wound around the pole piece. The magnetic field is relatively weak because the air gap between the pole piece and the magnet does not provide a good magnetic path between the two.

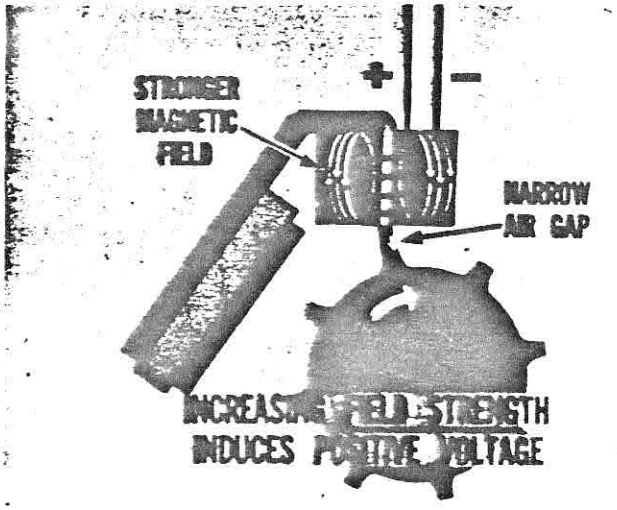



**Figure 10**

As a tooth of the reluctor approaches the pick-up, it provides a better path than the air gap and the strength of the magnetic field in the pick-up is increased. Increasing the field strength at the pick-up coil induces a positive voltage at one terminal of the coil. It should be understood that this voltage is induced as

a result of the changing (increasing) field strength and is not caused by physical movement of the field or the pick-up coil. The positive v ge continues to build until the reluctor tooth is ctly opposite the pole piece.

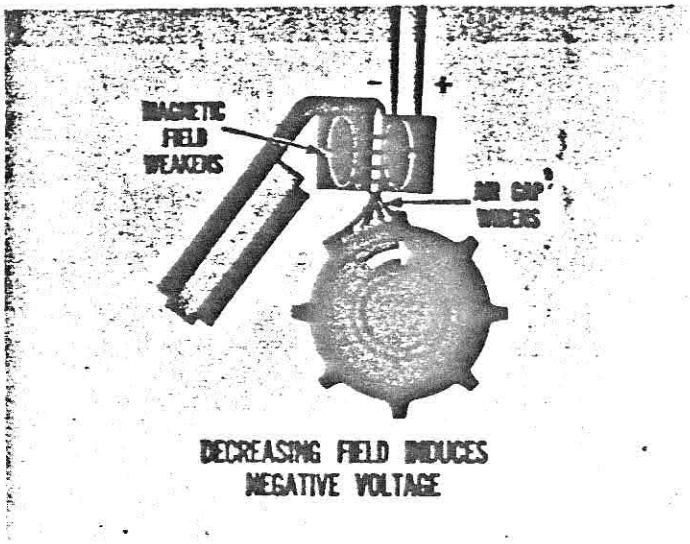



**Figure 11**

As soon as the reluctor tooth passes the pole piece, the air gap starts to increase and the field ı gth begins to decrease. The decreasing field s gth through the coil winding induces a negative voltage at the same terminal of the coil winding. Again, the voltage is induced by the change (reduction) in field strength. *No voltage is induced in the pick-up coil unless the reluctor is moving. The rapid increase and decrease of the magnetic field as the rotating reluctor teeth approach and pass the pole piece is what induces the positive then the negative voltage.*

The induced voltage is very small. It's just a tiny electrical signal that is fed into the electronic control unit. The function of the signal voltage induced in the pick-up unit is not the same as that of the contacts in a breaker-point ignition which open and interrupt the primary current in the ignition coil. The pick-up voltage is a precisely timed signal. It triggers the electronic circuitry in the control unit and in turn this controls the interruption of the current flowing t ıugh the primary windings of the ignition coil. let's consider primary current flow in greater detail.

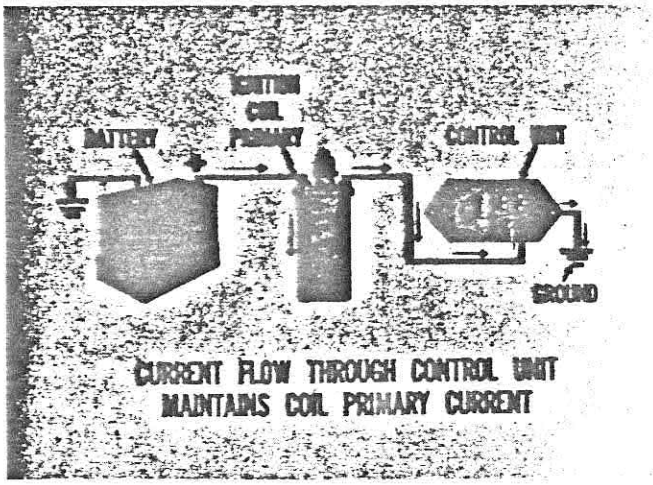



**Figure 12**

In the electronic ignition system, battery current flows through the primary winding of the ignition coil and then through the control unit which is grounded. This maintains current flow in the ignition coil primary winding pretty much the same as the closed contacts do in a breaker-point ignition. The control unit remains "on" or activated and current flows through the primary coil windings as long as a negative voltage from the pick-up is not applied to it.

5

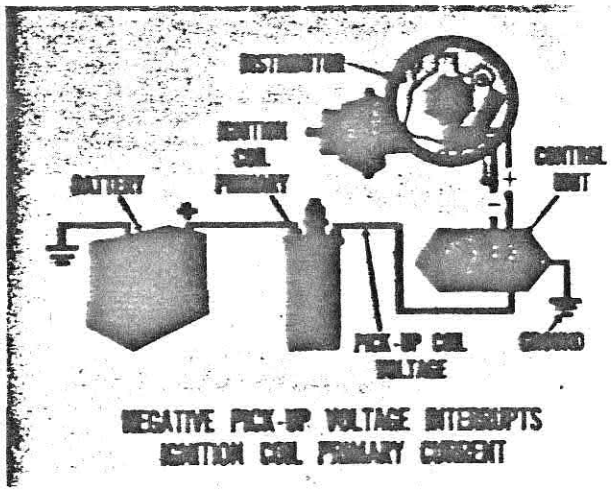



**Figure 13**

When the reluctor passes the pole piece, and the pick-up voltage turns negative, it deactivates or "turns off" the control unit circuitry. At this point, current cannot flow through the control unit to ground and therefore the current through the ignition coil primary windiing is interrupted. Like in all induction coil-ignition systems, this interruption of the current flow in the primary circuit induces enough voltage in the secondary

windings of the ignition coil to fire the spark plug.

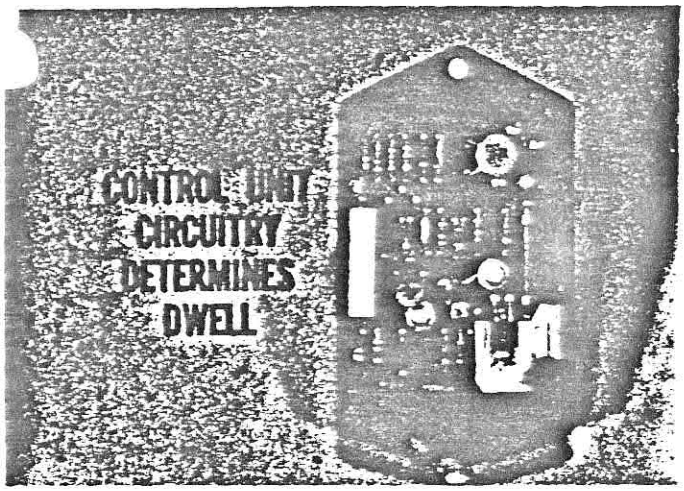



**Figure 14**

The control unit determines electronically how long the ignition coil primary current is allowed to flow before it is interrupted. In other words, it determines the dwell in the electronic system. Since the control unit circuitry is sealed and has no moving parts, the dwell cannot be changed. *The reluctor and the pick-up unit determine ignition timing. The control unit determines dwell.* However, it takes both of them working together to time the interruption of the ignition coil primary current and the firing of the plugs.

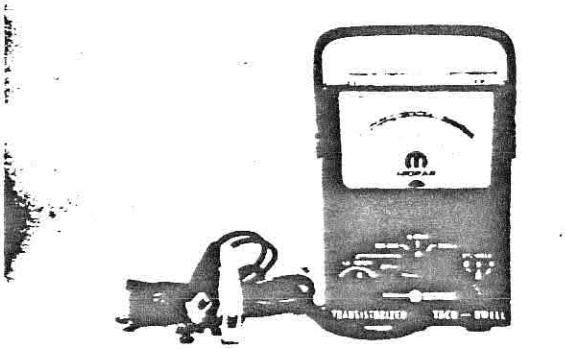



**Figure 15**

There is no reason to use a dwell meter when testing or checking an electronic ignition system. *Dwell will be correct unless the control unit has been damaged and this possibility can be easily and quickly checked out with your electronic ignition tester.* On the other hand, your tachometer and timing light will operate just as well with this system as they will with a breaker point system.

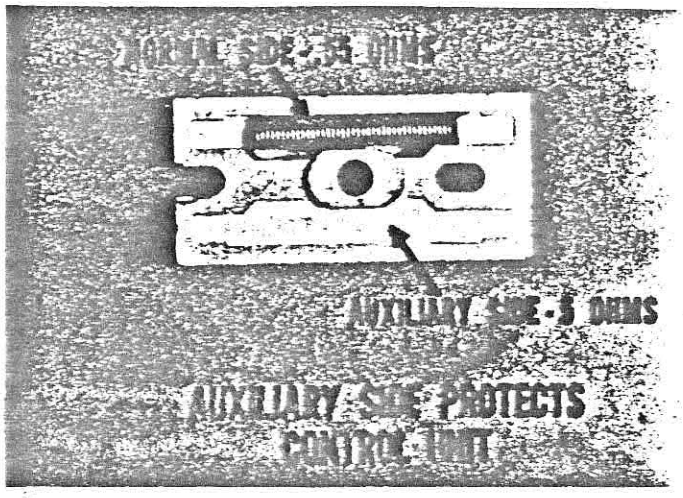



**Figure 16**

The ballast resistor for the electronic system plays a dual role. On the one side is the half-ohm ballast resistor that is the same as in a breaker-point system. It maintains constant primary current with variations in engine speed. This protects the ignition coil against high current flow at low engine speed. This ballast resistor is bypassed when cranking, to apply full battery voltage to the coil.

The other side of the dual unit is a five-ohm resistor. It protects the control unit by limiting current flow in the electronic part of the circuit. In a breaker-point ignition, the condenser helps the coil develop higher voltage because it speeds up the collapse of the magnetic field. It also increases ignition point life because it reduces arcing as the contacts open. The condenser is not needed in the electronic ignition because there are no points and the collapse of the field in the ignition coil primary is controlled by the electronic circuitry in the control unit.

# TROUBLESHOOTING With Electronic Ignition Tester

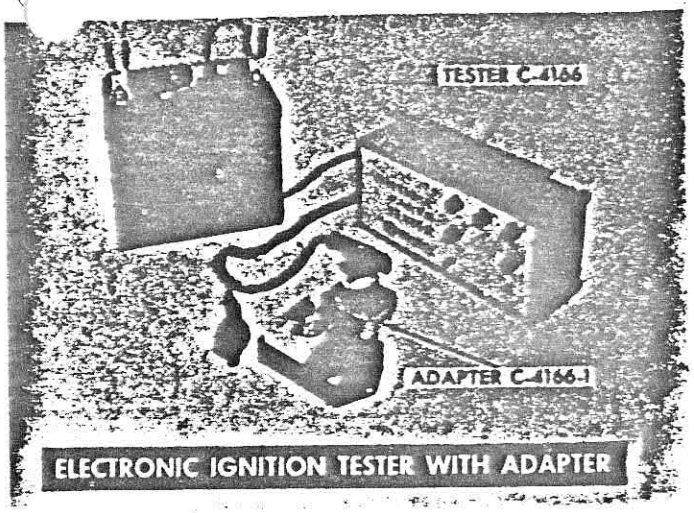



**Figure 17**

Because of design changes made in the new (1973) electronic control unit it was necessary to release an electronic adapter tester, that works with the present ignition tester C-4166. : adapter is number C-4166-1 and must be l when testing the 1973 control unit. It can also be used when testing earlier control units. The latest electronic ignition tester is numbered C-4166-A. It can be used to test all electronic ignition systems. *Learn to use the tester and you will find that it's a real time saver.* As you probably know, instructions for using the tester are included on the back panel of the instrument. Because of the limited space available, these instructions are quite condensed and a little extra explanation will help you get acquainted with this valuable diagnostic tool. The two leads with five-prong connectors are used to connect the test instrument into the car's ignition circuit, for on car testing. The test leads with the two alligator-type battery clips are not used for on-car testing—they are used only for bench-testing of electronic ignition components. Incidentally, the harness for the battery clip leads also includes a dual male-female connector which ` used for bench-testing the pick-up unit. It not used for on-car testing. There are two .s of instructions on the back of the instrument. The first set of instructions are for components or bench testing. Disregard them when troubleshooting the system on the car. The diagnosis chart at the right side of the panel does not apply to bench testing.

It is to be used only in connection with on-car testing. The 6-step system test instructions and the diagnosis chart are used for on-car troubleshooting. The chart is based on the condition of the lights on the front of the tester. When testing the system on the car the two green lights should come on as soon as the tester is connected into the system. This does not necessarily mean that everything is okay in the entire system but it does mean that you can proceed with the test. On the other hand, if both or either of the green lights do not come on, trouble exists which must be corrected before proceeding with the remainder of the test. The three red lights on the front of the tester are "trouble lights". If one or more of them comes "on" something is definitely wrong and the appropriate item indicated by an "x" on the chart should be checked. In other words an "off" condition in the green lights or an "on" condition with the red lights indicates trouble. Remember these thumb rules apply to on-car tests—they do not apply to bench testing which will be covered under a later heading. Although the instructions and chart on the back of the tester are complete, let's go through the on-car test procedure step-by-step.

**Figure 18**

If performance problems exist, the first thing to check on the ignition system is the rotor and distributor cap for cracks or corroded terminals. Hairline cracks are sometimes difficult to see, so look the cap and rotor over very carefully.

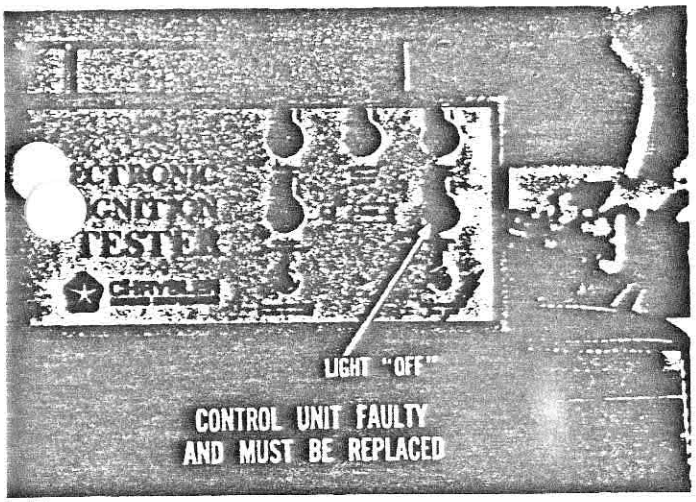



**Figure 23**

If the green light labeled "Control Unit" does not come on the control unit is faulty and must be replaced. Each test light is completely independent of the others, and if the control unit is good, this green light will be on even if there is a fault in the pick-up unit, the dual ballast resistor, or the remainder of the ignition primary circuit.

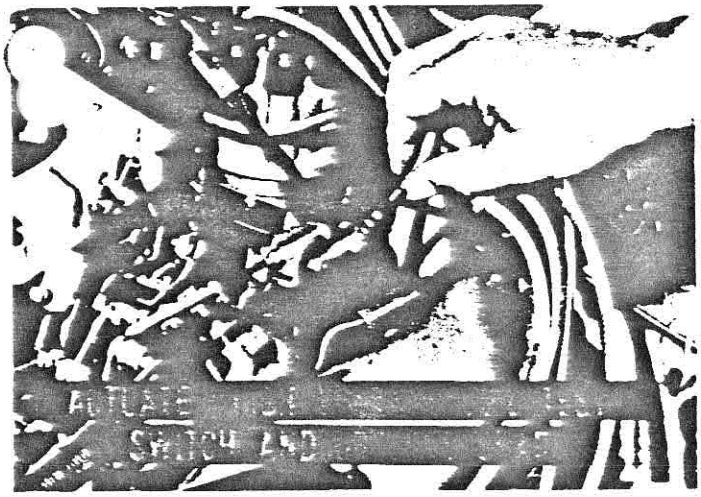


**Figure 24**

To complete checking the system, pull the ignition coil secondary wire from the distributor cap and hold it near the engine block. Actuate the "High Voltage Coil Test" switch and observe the length and intensity of the spark as you pull the wire slowly away from the block to increase spark gap. A long blue spark indicates that output is okay.

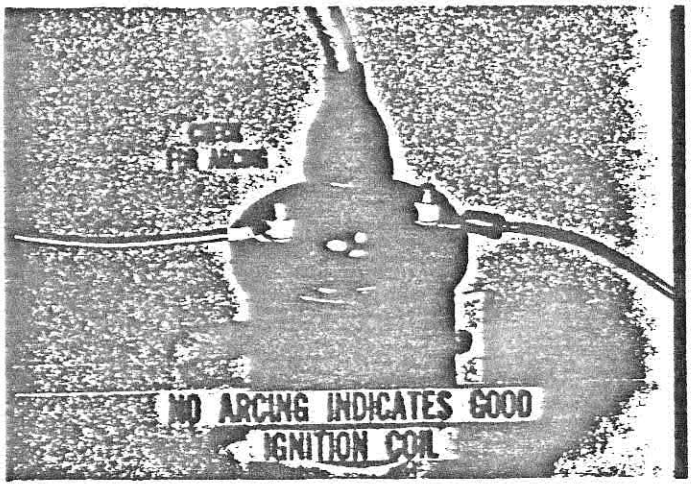



**Figure 25**

Move the coil wire away from the block until the spark no longer jumps to ground and closely observe the coil tower to make sure there is no arcing across the tower. If no arcing occurs, this completes the testing and indicates that the ignition coil is okay. If the primary circuit and the coil are okay but an ignition problem is evident. Check the spark plug cables with an ohmmeter or ignition oscilloscope and inspect spark plugs.

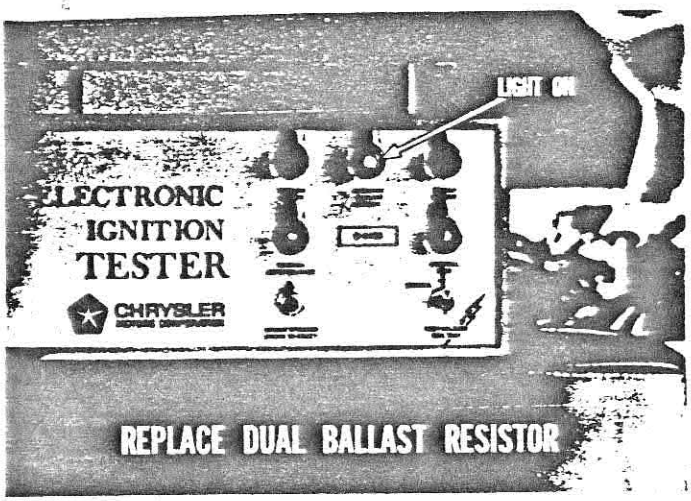



**Figure 26**

The red light labeled "Auxiliary Ballast Resistor" on the tester will light if the five-ohm side of the dual ballast resistor is bad. If the red light comes on, the dual ballast resistor must be replaced. The half-ohm (.5) side of the dual ballast resistor is checked with the rest of the primary circuit by the tester. When installing a new resistor make sure that the connectors are correctly installed.

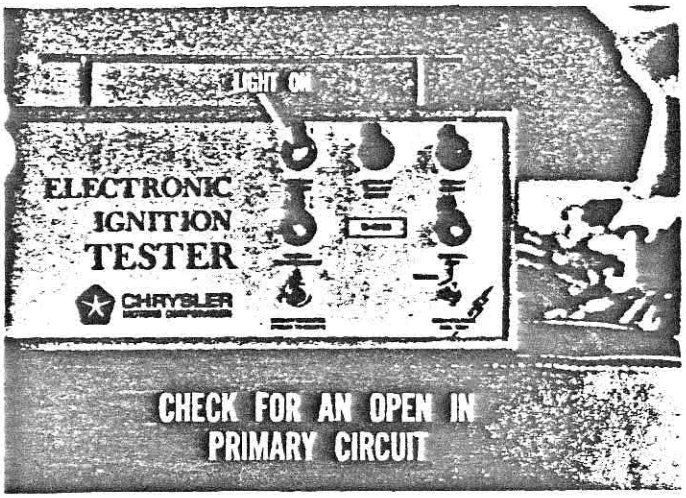



**Figure 27**

If the red light labeled "Primary Circuit" on the tester panel comes on, check the ignition coil primary, the suppression capacitor, the half-ohm side of the dual ballast resistor, and the wiring harness for an open in the circuit. Replace any parts that are faulty or do not meet specifications.

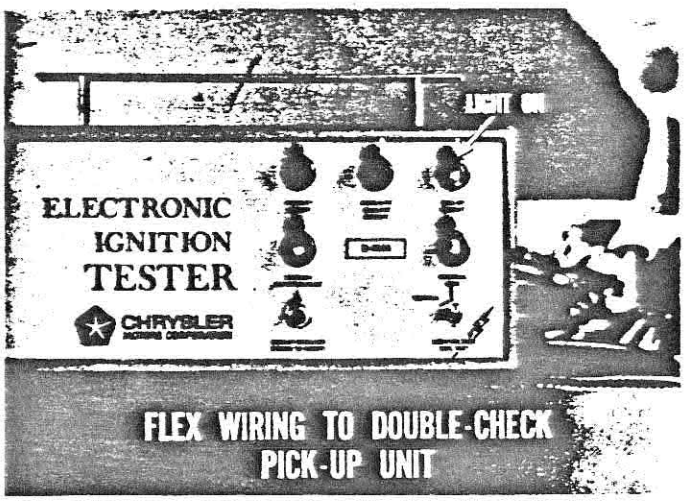



**Figure 28**

If the red light labeled "Pick-up Circuit" comes on the pick-up unit or its wiring is faulty and the pick-up unit must be replaced. Even if the light does not come on, it's a good idea to flex the wiring from the pick-up unit to double-check it. If the red light blinks while doing this, the pick-up unit wiring is bad and the unit should be replaced.

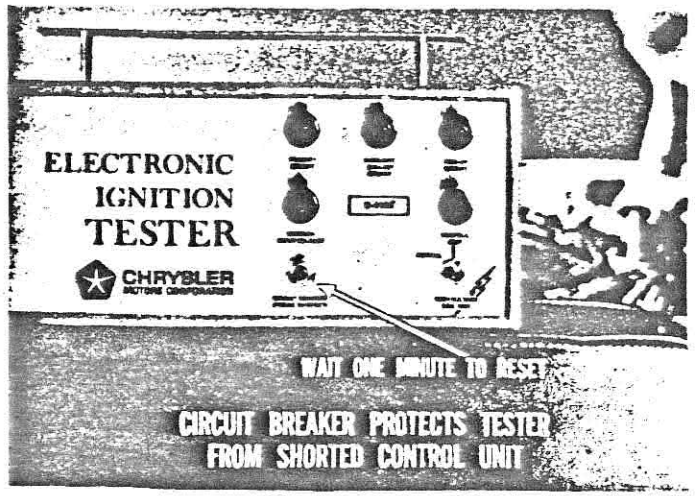



**Figure 29**

The electronic ignition tester is equipped with a circuit breaker to protect the tester from overloading when testing a shorted control unit. If the circuit breaker opens, the red button at the bottom of the panel will pop out. If it does, wait one full minute, then reset the circuit breaker by pushing the button in and continue testing.

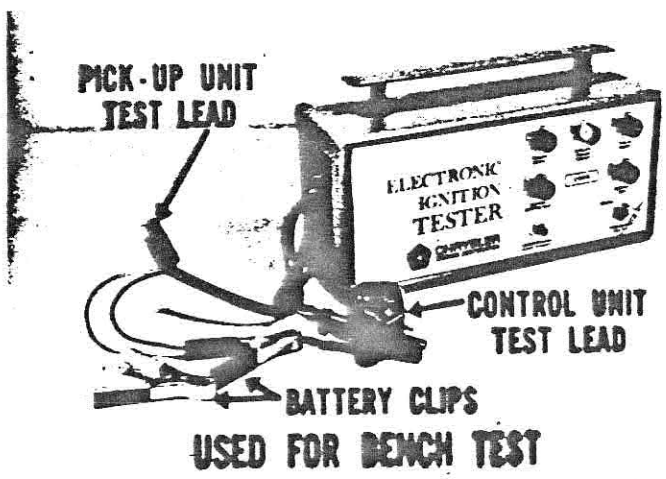



**Figure 30**

The tester can be used for bench testing the control unit and the pick-up unit independently. The test lead harness with the two battery clips and the pick-up unit connector is used for bench tests. A fully charged battery is also necessary for the bench tests. It is not necessary to ground the component being tested. Component tests are to be used to check new units prior to installation or to double-check units removed from the car.

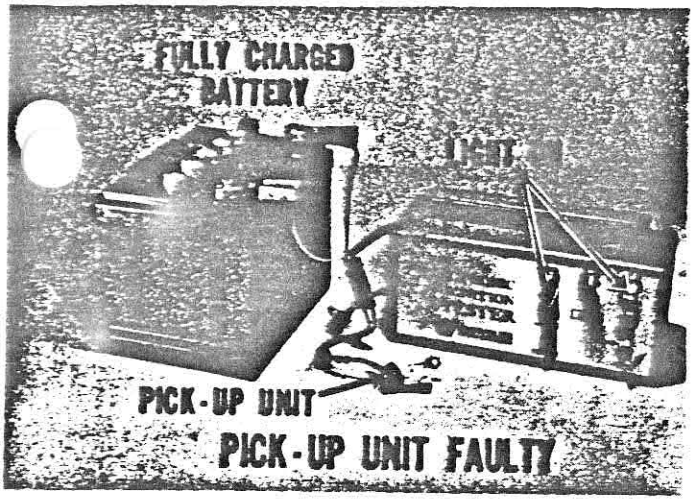



Figure 31

Hook the two battery clips to a fully charged battery. The red clip on the positive post and the black one on the negative post. To test the pick-up unit, mate the connector from the pick-up unit wiring with the pick-up connector test lead from the tester. If the red light labeled "Pick-up Circuit" comes on, the pick-up unit is faulty and must be replaced. If the light does not come on, double check the pick-up circuit by flexing the wiring from the pick-up unit. If the red light blinks when doing this, the wiring is bad and the pick-up unit cannot be used.

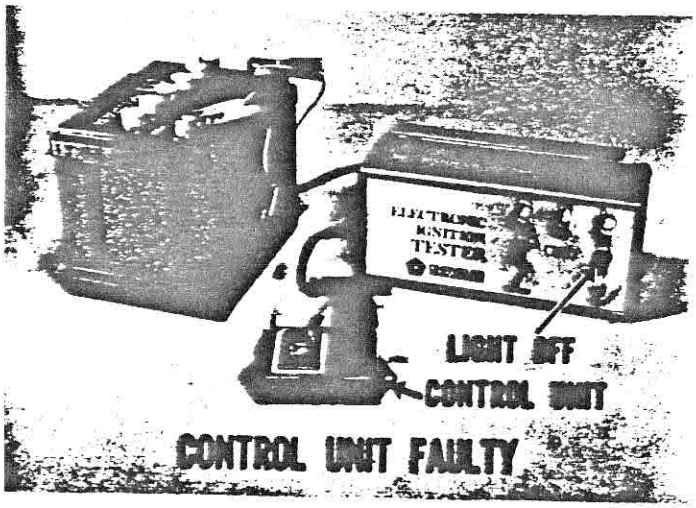



Figure 32

To bench test the control unit, simply plug the five pin female tester lead into the control unit with the clips still connected to the battery. If the green light labeled "Control Unit" does not come on, the control unit is faulty.

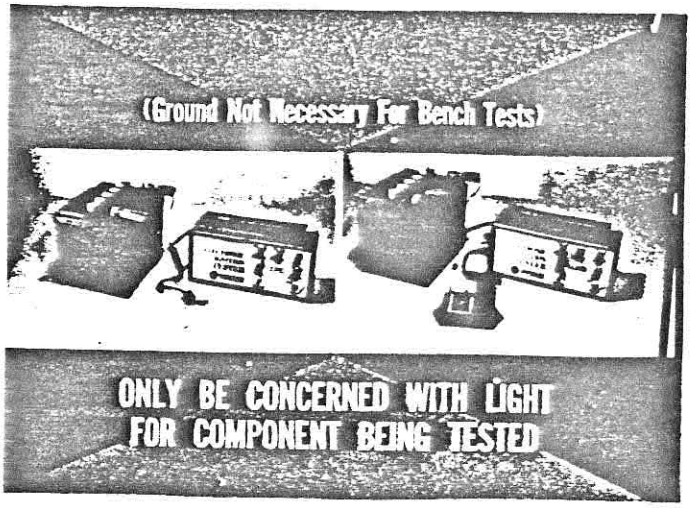



Figure 33

When bench testing the pick-up unit, the green "Control Unit" light will be off, and the red "Primary Circuit" and red ."Auxiliary Ballast Circuit" lights will be on. This is normal because there is no input for these components, when bench testing the pick-up unit. When bench testing the control unit, all three red lights will be on because the ballast reistor, pick-up unit and coil primary circuits are not connected into the tester circuit. So, when bench testing you need only be concerned with the green in-put voltage light-which must be on to indicate sufficient voltage and the green "Control Unit" light. All other can be ignored.

11

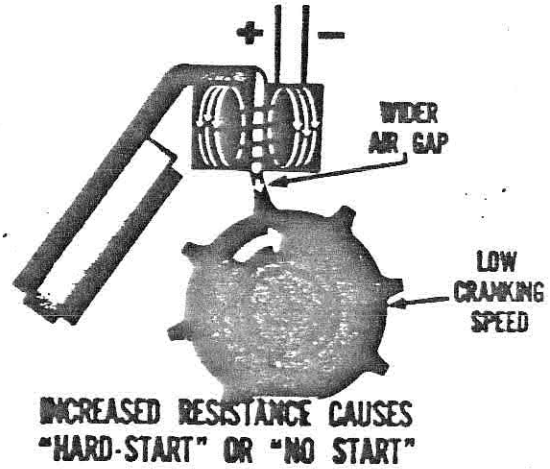



Figure 34

There is an adjusting slot on the distributor plate that can be used to change the air gap between the reluctor tooth and the pole piece of the coil. Unlike breaker-points reducing the air gap will

not retard the timing. Since dwell is determined by the control unit and is independent of the pick-up unit, changing the air gap will not affect timing or dwell. However, the gap between the pick-up and reluctor should be properly set. *One of the main advantages of the electronic ignition system is improved starting; because with no points, the possibility of arcing across the points at starting has been eliminated.* However, a pick-up gap that is too wide can cause starting problems. As the air gap between the reluctor and the pole piece is increased, field strength decreases. In addition, low cranking means low reluctor speed. The combination of weak field and slow changes in field strength results in very low voltage in the pick-up unit. This "weak signal" condition can cause hard starting. In fact there may even be a "no start" condition if the gap is too wide. If you get a "hard-start" condition, don't immediately blame the pick-up gap and change the adjustment. Make sure that the fuel system and the rest of the ignition system are okay. Although setting the pick-up gap correctly is a must when installing a new pick-up unit, the gap does not change or increase in service and does not require periodic adjustment. The main reason for the minimum air gap specification is to make sure the reluctor doesn't contact the pole piece as the vacuum plate moves.

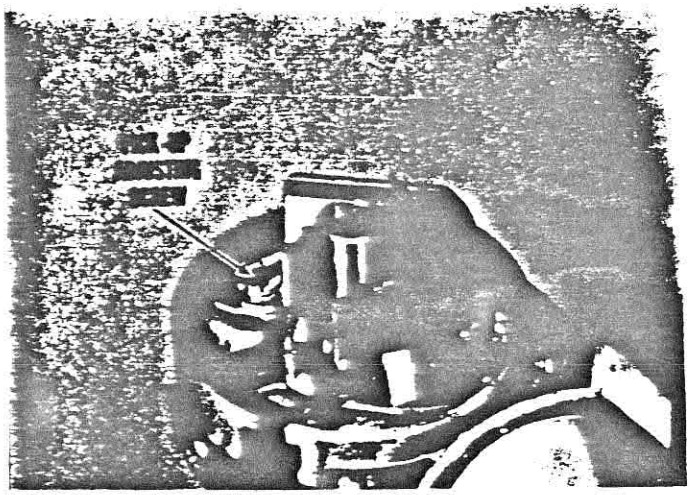


**Figure 35**

When checking the pick-up gap, a .010" feeler gauge should not slip between the end of the pick-up coil core and an aligned reluctor tooth. *Caution:* - A feeler gauge can be forced between the pick-up coil and reluctor tooth when the air gap is properly adjusted, so do not use force when checking with a .010" feeler. If it is necessary to set pick-up air gap, loosen the pick-up adjusting screw, align a reluctor tooth with the pick-up core and insert an .008" feeler between the reluctor tooth and pick-up core. Tighten the pick-up adjusting screw with the .008" feeler in place.

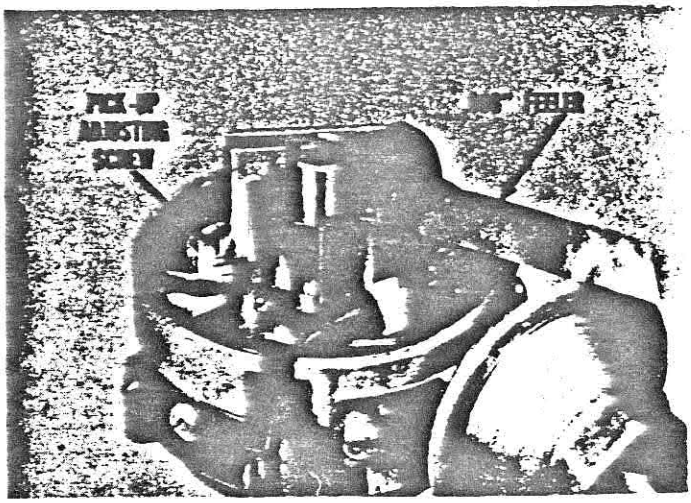



**Figure 36**

It will be necessary to use nonmagnetic feeler gauge because a feeler gauge that is attracted to the magnetism of the pole piece will give a false "feel" or drag. If nonmagnetic feeler gauges are not available, brass shim stock of the proper thickness can be used.

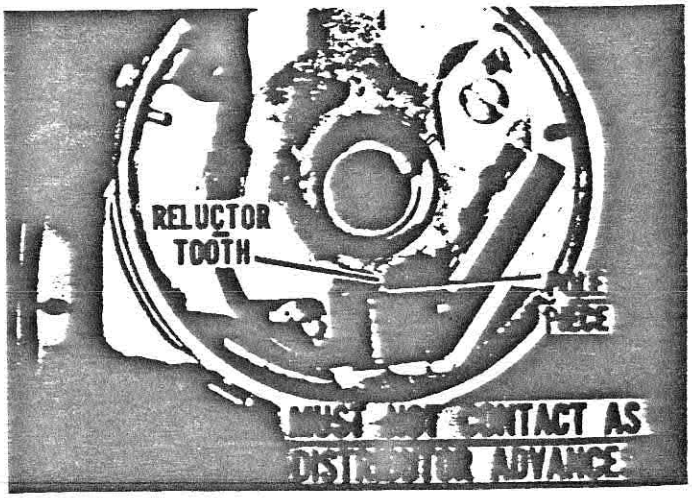



**Figure 37**

After setting the air gap, run the distributor on a test stand and apply vacuum to make sure

hat the reluctor teeth do not strike the pick-up core during vacuum advance check.

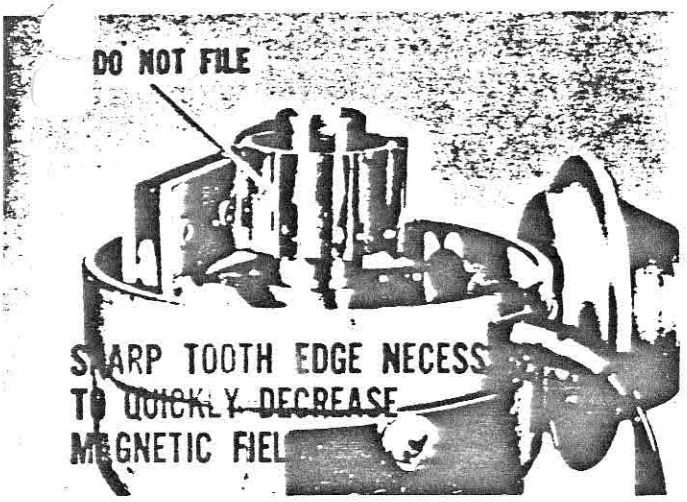



Figure 38

The reluctor teeth may appear to you to be a little rough at the edges. Do not try to clean them up by filing the edges. You may file too much and round the edges of the teeth. A sharp edge is needed to quickly decrease the magnetic field and induce the negative voltage in the pick-up coil. If the teeth are rounded, the voltage signal to the control unit will be erratic.

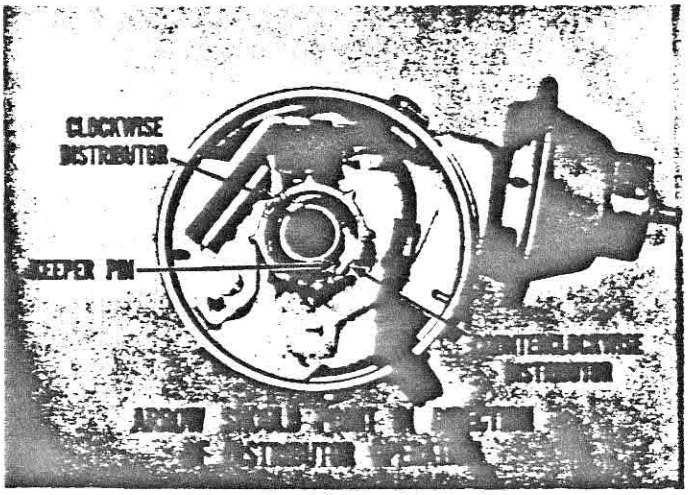



Figure 39

There are two small arrows on the reluctor that point in opposite directions. In a clockwise distributor, the arrow at the keeper pin that holds the reluctor in place should point clockwise. In a counter clockwise distributor, the arrow at the keeper pin should point counter-clockwise. If the arrow at the keeper does not point in the direction of distributor rotation, remove the reluctor, turn it one-hundred-eighty degrees, and reinstall it. When removing the reluctor, be careful not to lose the keeper pin.

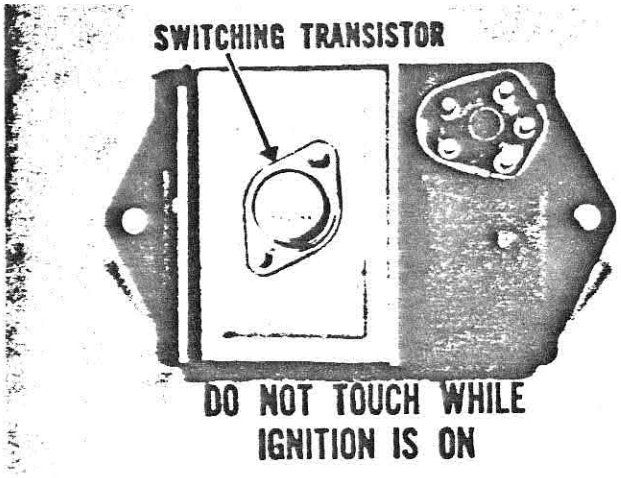
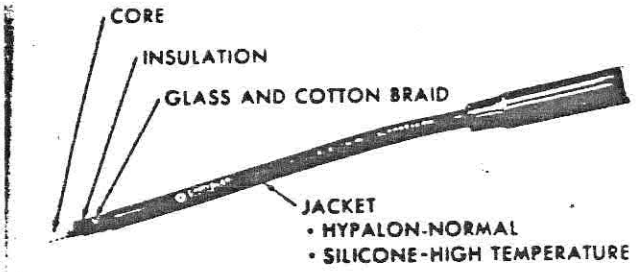



Figure 40

A new improved control unit will be used in 1973. Some internal changes have been made to give better cold starting characteristics under very cold temperatures. The new control unit will have a new part number so check parts book before ordering. One control unit will be used on all model engines. The control units equipped with a speed limiter have been discontinued. Remember, this switching transistor will still give you a shock when the ignition is on.

13




## SPARK PLUG CABLES

Figure 41

The new silicone ignition cables are equipped with a silicone-rubber outer covering that is highly flexible and is extremely heat resistant.

A fiberglass jacket has also been added which increases the strength and durability over the standard neoprene cables. This cable will be used on the rear four cylinders of the 400 and 440 Cubic Inch engines.

The hypalon Cable is used on all 225, 318, 360, 361 and 413 cubic inch engines. It will also be found on the front four cylinders of the 400 and 440 Cubic Inch engines.

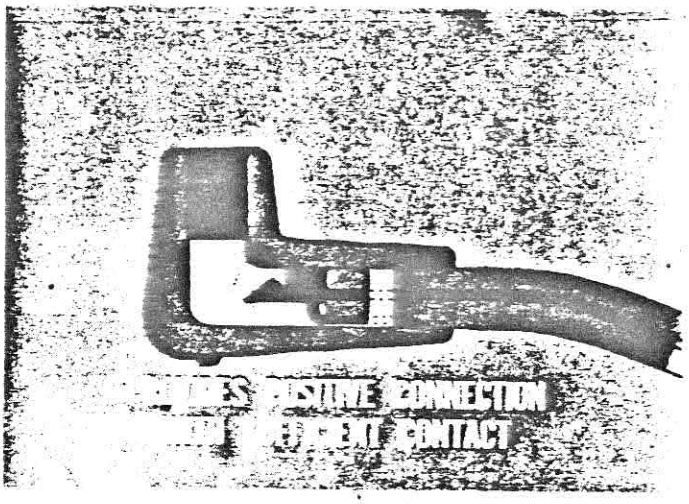


Figure 42

At the terminals, the conductor has been wrapped back over the outer covering and the clip installed. This new construction provides a positive connection with sufficient contact for a good strong spark.

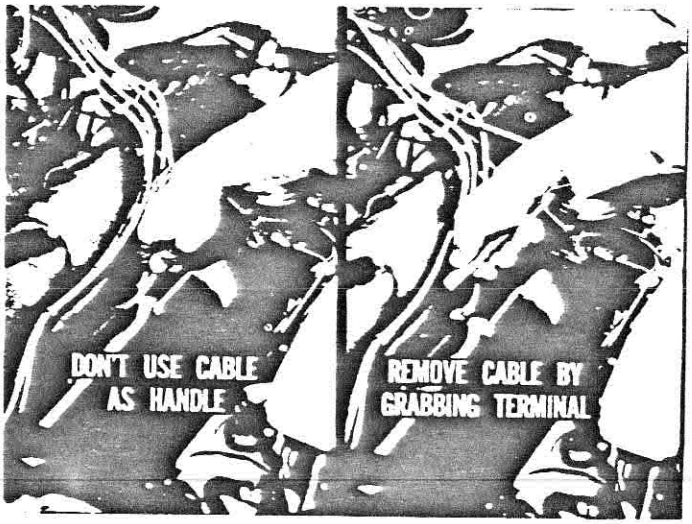
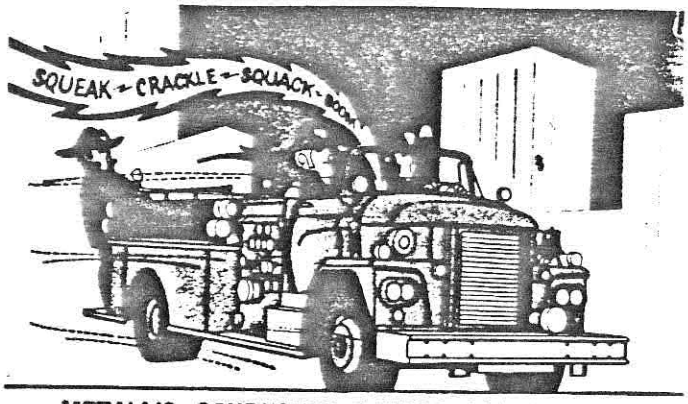



Figure 43

The increased strength and improved terminal construction of the new cables does not mean that you can use the cable as a handle and pull it from the spark plug or the distributor cap. That's the easiest way in the world to disconnect the cable from the terminal and ruin the cable. Always remove the cable from the plug by firmly grabbing the terminal itself. The cover at the terminal is very flexible so this can be done quite easily.




METALLIC CONDUCTOR CABLES CONTRIBUTE TO RADIO FREQUENCY INTERFERENCE

Figure 44

Metallic conductor ignition cables contribute substantially to what is known as "radio frequency interference," commonly referred to as R. F. I. In simple terms, this means that it can interfere with the other forms of communication equipment. The greatest danger from this interference lies in the fact that it can interfere with an even interrupt communication between community service vehicles such as police cars, fire trucks, ambulances and the like.

NOTES

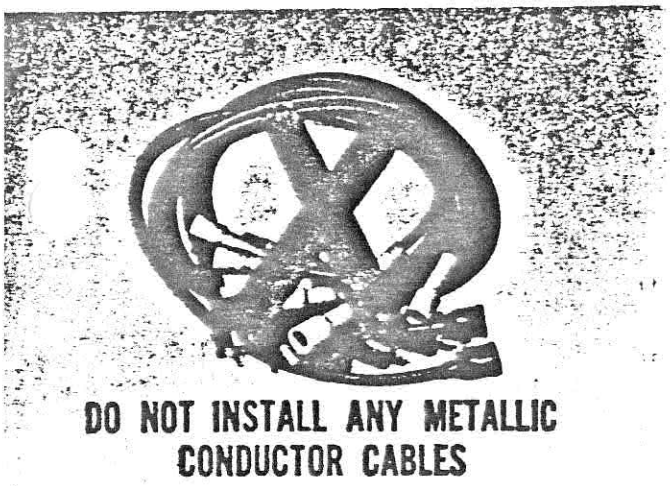



Figure 45

Chrysler Corporation hasn't used ignition cables with metallic conductors for about ten years. In addition, the Corporation has complied with the Federal Communications Commission and has removed all metallic conductor cables from their parts stack. You technicians can help out by refraining from installing any type of metallic conductor secondary cables on any car.

N ES

# TROUBLESHOOTING
## Without Electronic Ignition Tester

*To properly test the Electronic Ignition System, the tester C-4166 should be used. In 1973, adapter C-4166-1. must be used with tester C-4166.* But in the event they are not available, the system may be tested using a voltmeter and an ohmmeter. When ignition problems are suspected, the following procedure should be followed. Check battery and battery connections.

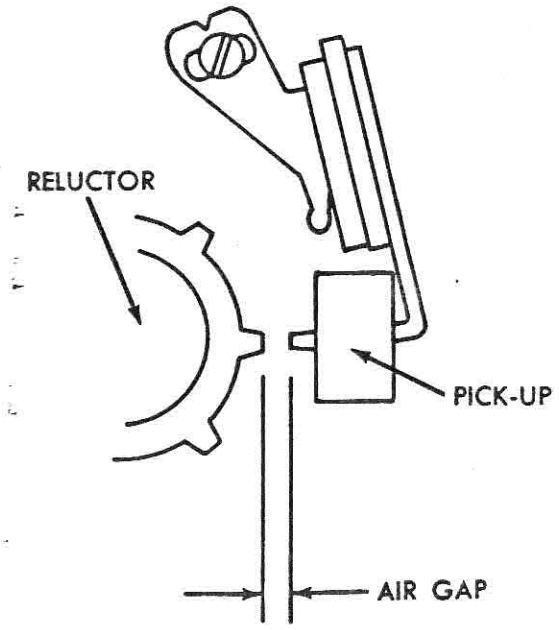
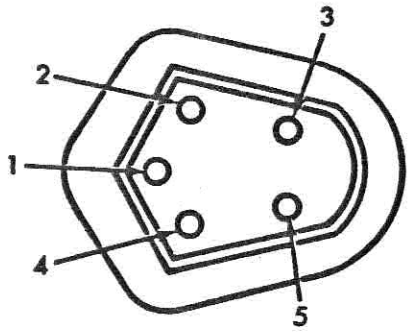



Figure 46

Check the air gap between the reluctor tooth and the pick-up coil. To set the air gap, loosen the pick-up coil hold down screw. Insert a .008'' *nonmagnetic feeler gauge* between the reluctor tooth and the pick-up coil. Adjust the pick-up coil. Adjust the pick-up so that the .008'' feeler gauge is snug. Tighten hold down screw. Visually inspect all secondary cables at the coil, distributor and spark plugs for cracks and tightness. Check primary wires at the ignition coil and ballast resistor for tightness. If the above checks do not determine the problem, the following steps will determine if a *component* is faulty.

**Figure 47**




Remove the multi-wiring connector form the control unit Figure 47 shows the connector cavities. (Female pins) Turn the ignition switch "on". Connect the negative lead of a voltmeter to a good ground.

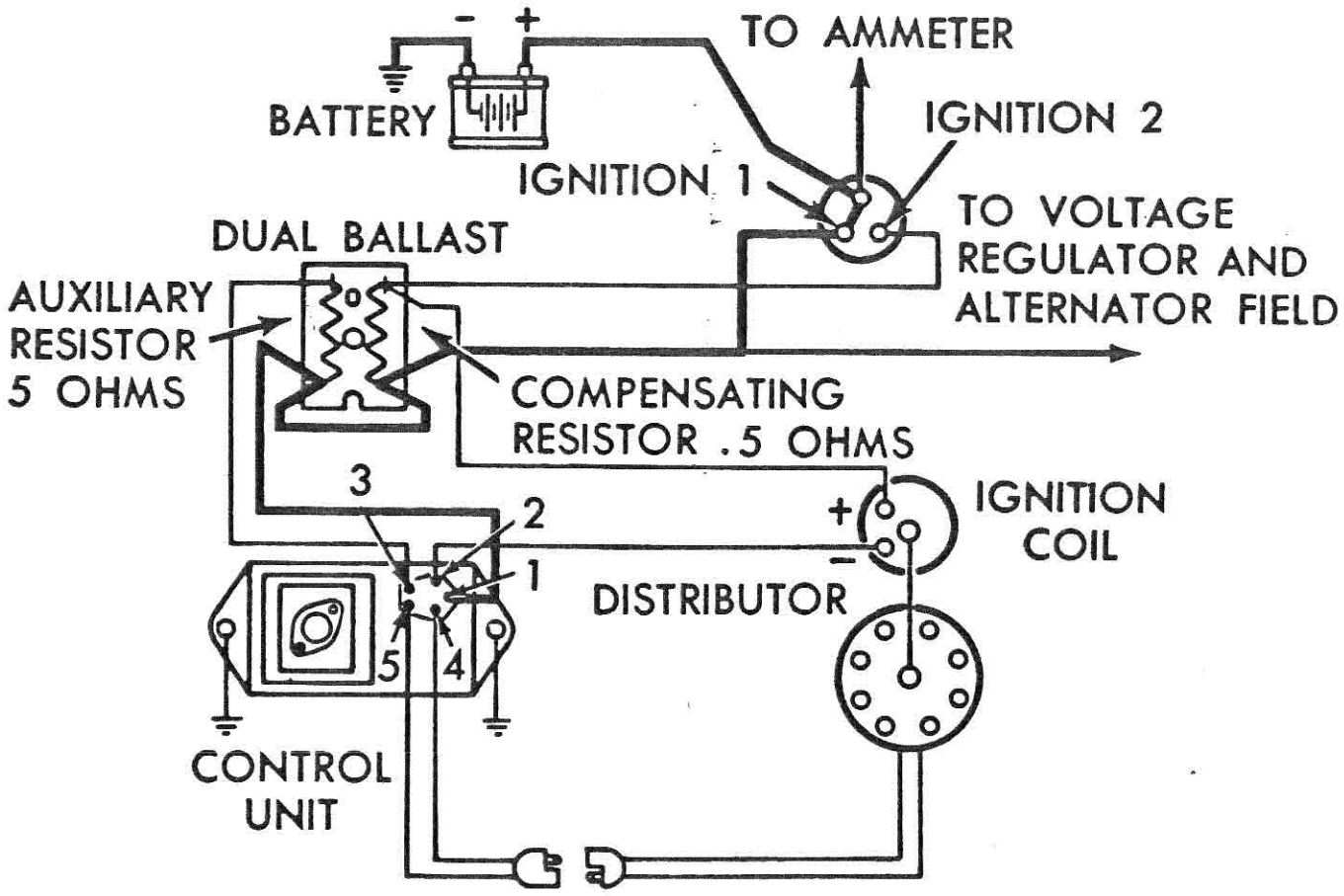



**Figure 48**

Connect the positive lead of the voltmeter to the wiring harness connector cavity No. 1 (Figure 47). Available voltage at cavity No. 1 should be within one volt of battery voltage with all accessories off. If there is more than a one volt difference, Figure 48 shows the circuit that must be checked.

*NOTE:* See wiring diagrams in appropriate service manual for *correct* wiring color codes.

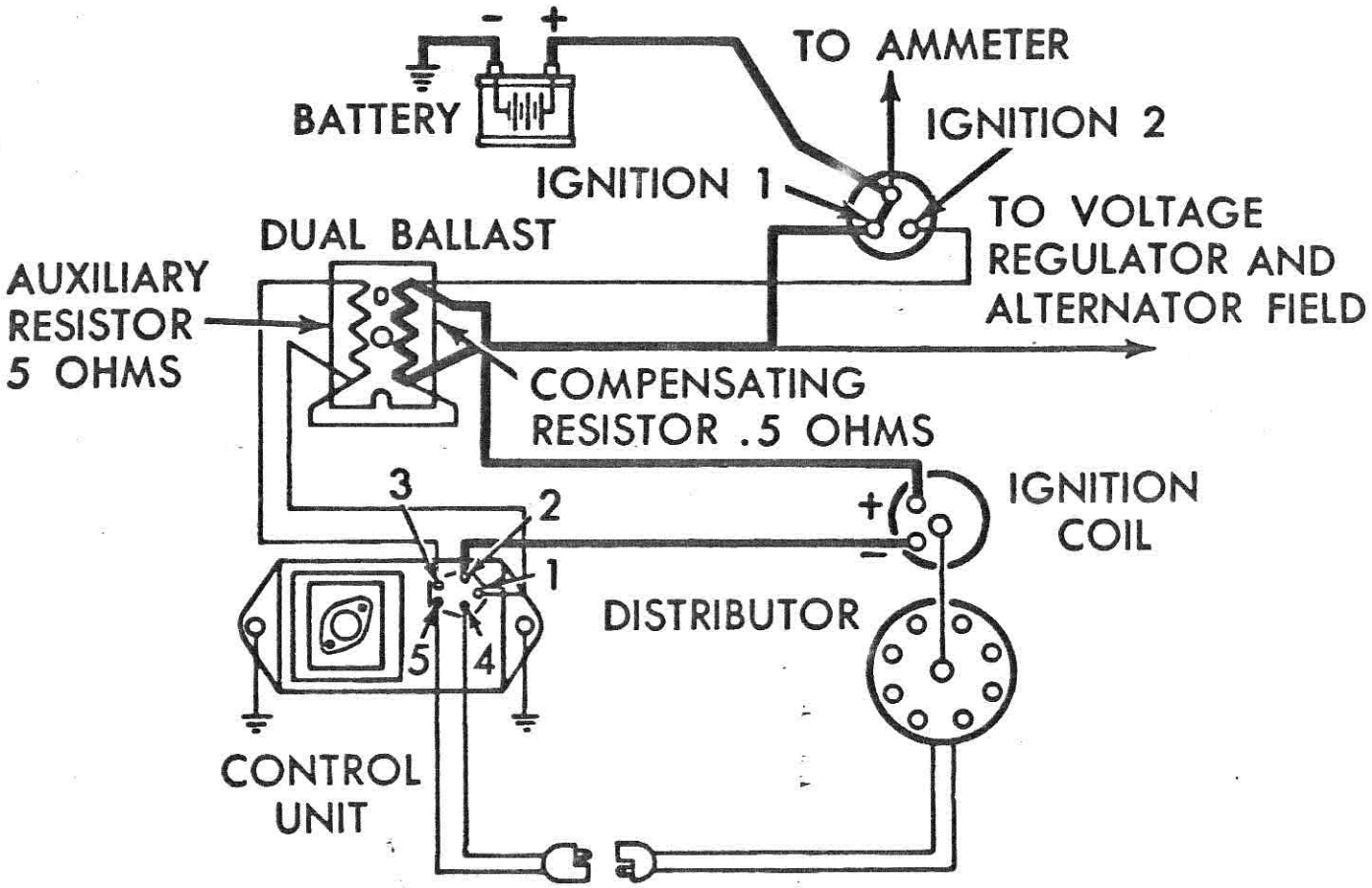





Figure 49

Connect the positive lead of the voltmeter to the wiring harness connector cavity No. 2 (Figure 47). Available voltage at cavity No. 2 should be within one volt of battery voltage, with all accessories off. If there is more than a one volt difference, Figure 49 shows the circuit that must be checked.

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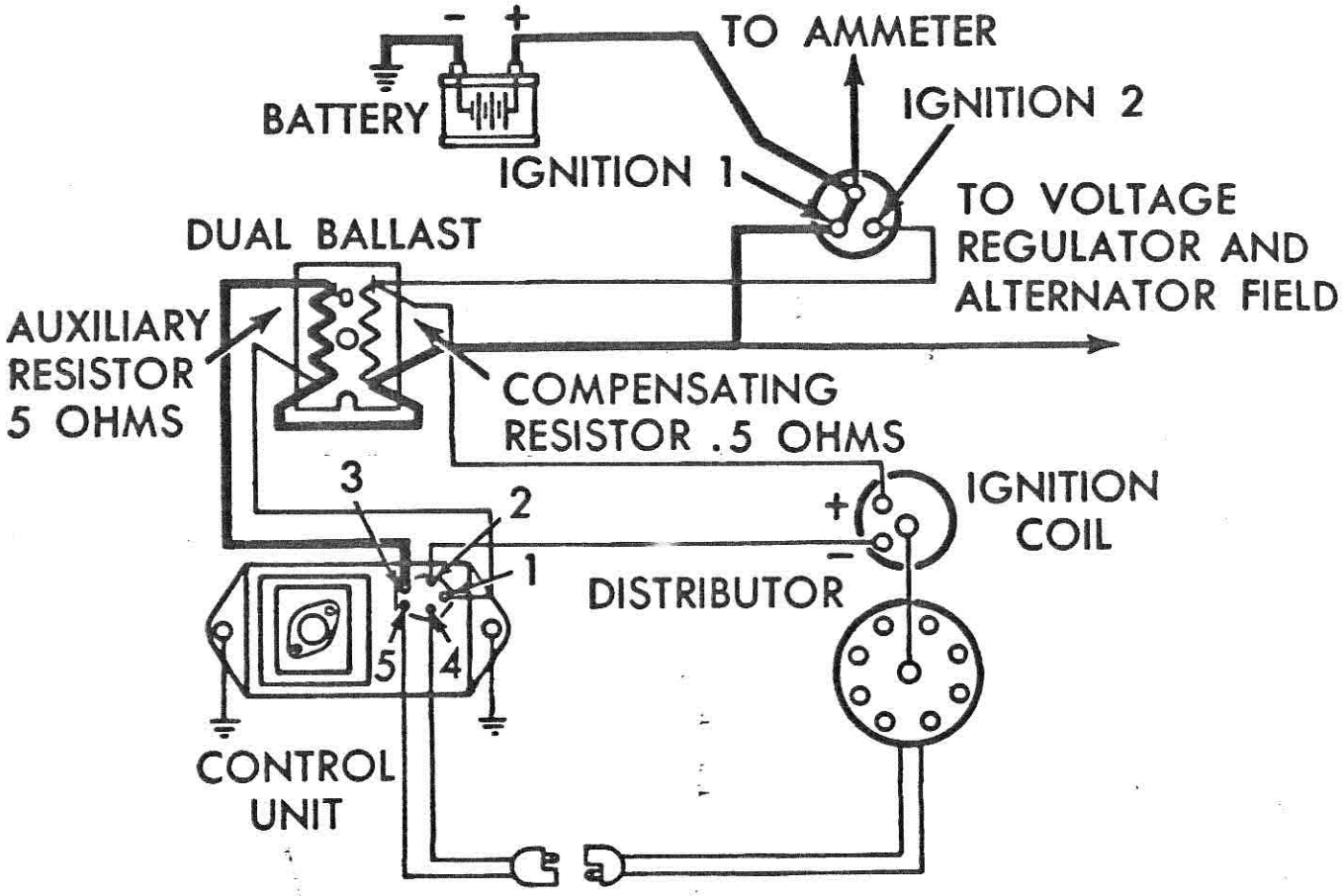


**Figure 50**

NOTES

Connect the positive lead of the voltmeter to the wiring harness connector cavity No. 3 (Figure 47). Available voltage at cavity No. 3 should be within one volt of battery voltage, with all accessories off. If there is more than a one volt difference, Figure 50 shows the circuit that must be checked. Turn ignition switch "off".

NOTES

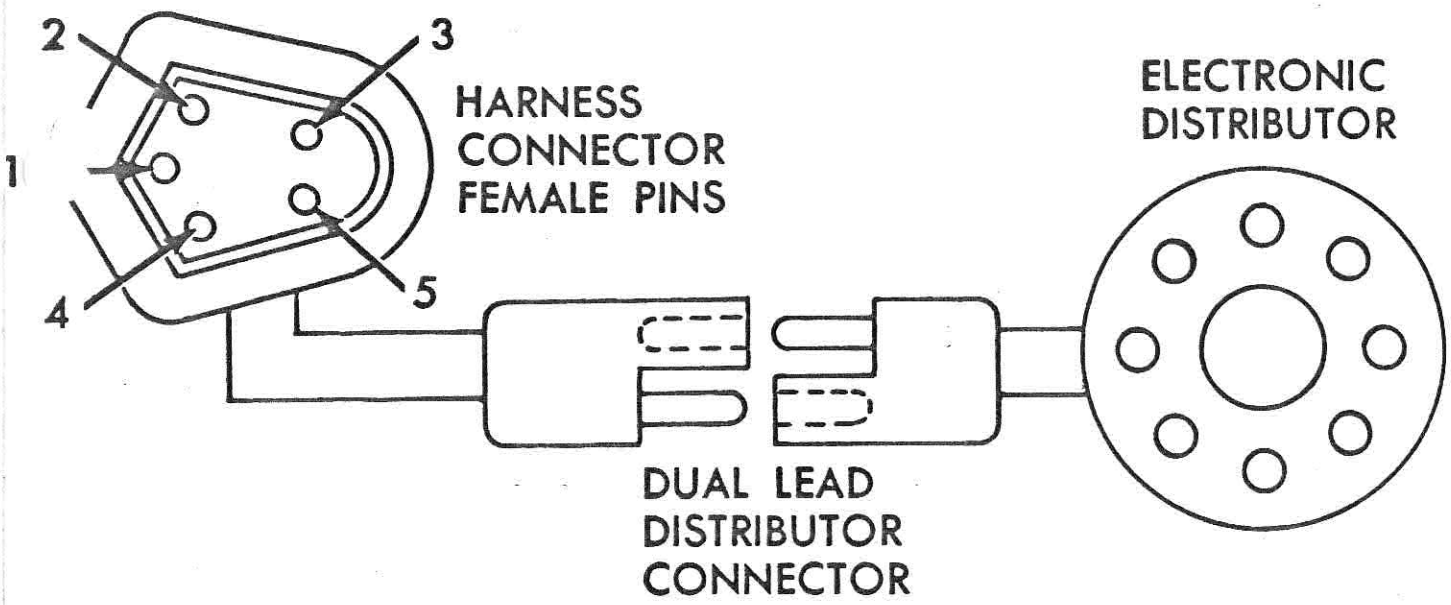


**Figure 51**

Connect an ohmmeter to wiring harness connector cavities No. 4 and No. 5. The ohmmeter resistance reading should be between 350 to 550 ohms. If reading is higher or lower than specified, disconnect the dual lead connector co[illegible]g from distributor. Using the ohmmeter, [illegible] the resistance at the dual lead connector [illegible]ing from the distributor. If the reading is not between 350 and 550 ohms, replace the pick-up coil assembly in the distributor. If the reading is within specs, check the wiring harness from the dual lead connector back to the control unit. Connect one ohmmeter lead to a good ground and the other lead to either dual lead connector pin of the distributor harness. Ohmmeter should show an open circuit. If the ohmmeter shows continuity, the pick-up coil in the distributor must be replaced.

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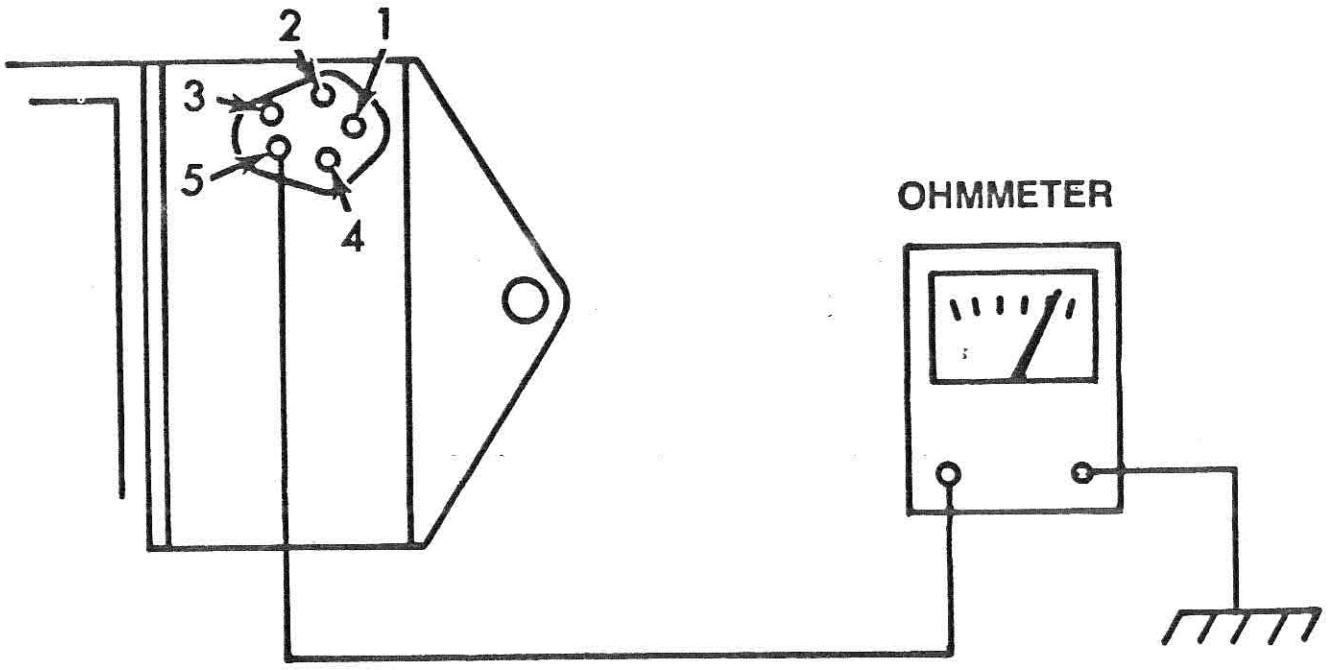


Figure 52

Connect one ohmmeter lead to a good ground and the other lead to the control unit connector in No. 5. The ohmmeter should show continuity between ground and the connector pin. If continuity does not exist, tighten the bolts holding the control unit to the firewall. Then recheck, if continuity does not exist, the control unit must be replaced.

Reconnect wiring harness at control unit and distributor. *NOTE: Whenever removing or installing the wiring harness connector at the control unit, the ignition switch must be "off". Otherwise the control unit could be damaged.* Remove the high voltage cable from the center tower of the distributor. Hold the cable approximately 3 16" from the ground. Crank engine. If arcing does not occur, replace the control unit. Crank the engine again. If arcing still does not occur, replace the ignition coil.

**Summary; Figures 46 through 52**

*REMEMBER:* The electronic ignition tester does a complete job of testing *circuits and components.* If a problem does not show up when making the checks in figures 46 through 52, it means that the control unit or ignition coil is faulty. It is very unlikely that both units would fail at the same time. It then becomes a matter of trying a new control unit and, or, an ignition coil to see which one restores secondary voltage.