CAUTION: To prevent severe electrical shock extreme care must be taken when working on or near the electronic ignition system as dangerous high tension voltages are produced in both the primary and secondary circuits.

SPECIFICATIONS

BATTERY

Type	12 volt lead acid
Polarity to earth	Negative (–)
* Specific gravity:	
Fully charged	Above 1.260 at 20 deg C
Fully discharged	Below 1.130 at 20 deg C

*Electrolyte specific gravity varies 0.007 for every 10 deg C rise or fall in temperature above or below 20 deg C; for above temperature add, for below temperature subtract.

ALTERNATOR

Type	14 volt AC
Make	Bosch
Maximum output	55 amps
Polarity to earth	Negative
Stator windings	Star connected
Regulator type	Integral
Brush length:	
New	8.9 mm
Wear limit	3.8 mm
Slip ring diameter (minimum)	32 mm

STARTER MOTOR

Make	Nippon Denso
Drive	Magnetic switch operated pinion with overrunning clutch
Commutator mica undercut:	
Standard	0.5–0.8 mm
Wear limit	0.2 mm
Commutator diameter:	
Standard	30 mm
Wear limit	29 mm
Commutator run out	0.05 mm
Brush length:	
Standard	13.0 mm
Wear limit	8.5 mm
Brush spring tension:	
Standard	1450–1950g
Wear limit	1200g

IGNITION ASSEMBLY

Make	Nippon Denso
Distributor control	Vacuum and centrifugal advance
Rotation of rotor	Clockwise (as viewed from top)
Firing order	1–3–4–2
Ignition coil:	
Primary resistance	0.38–0.46 ohms
Secondary resistance	7.7–10.4 kohms
Pick up coil resistance	140–180 ohms
Air gap	0.2–0.4 mm

NOTE: See Engine Tune-up section for tuning Specifications.

1. BATTERY AND CHARGING SYSTEM TROUBLE SHOOTING

BATTERY UNDERCHARGED

(1) Loose or broken fan belt: Adjust or renew fan belt.

(2) Faulty alternator regulator: Renew regulator unit.

(3) Faulty battery: Instal a new battery of the recommended type and capacity.

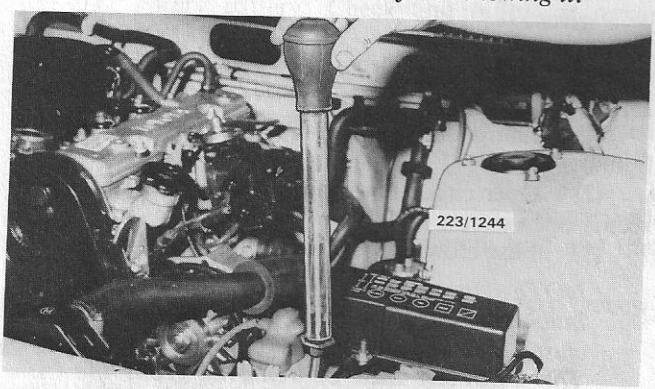
(4) Faulty alternator: Overhaul or renew alternator.

(5) Fault in charging system wiring: Check and renew or repair wiring harness.

(6) Faulty connections in charging system: Check and renew or repair components.

NOTE: The first thing to do is to test the state of charge of the battery with a hydrometer. As specific gravity varies with temperature it is advisable to use a hydrometer with an inbuilt thermometer so that the necessary variation can be calculated. Also an accurate hydrometer reading cannot be taken if distilled water has recently been added to the electrolyte. If the electrolyte level is below the battery plates it will be necessary to add water and charge the battery before testing with a hydrometer.

The specific gravity should not vary more than 0.030 between cells. If the variation is more than this then the serviceability of the battery is questionable and the battery should be recharged and retested before renewing it.



Check the specific gravity in each cell with a hydrometer.

If all readings are above 1.225 and uniform the battery can be considered to be serviceable. However, it may require recharging depending on the reading. See the following chart showing charge condition for the various specific gravity readings.

1.110–1.130 ..... Dead flat
1.140–1.160 ..... Nearly flat
1.170–1.190 .... About one quarter charged
1.200–1.225 ..... Half charged
1.230–1.250 ..... About three quarters charged
1.260–1.280 ..... Fully charged

If the battery is undercharged but serviceable seek out the cause by checking out the possible causes in the order given.

BATTERY OVERCHARGED

(1) Faulty alternator regulator: Renew regulator.
(2) Faulty battery: Renew or repair battery.
(3) Faulty alternator: Overhaul or renew alternator.
(4) Faulty charging system wiring or connections: Check and renew or repair faulty components.

NOTE: An overcharged battery is indicated by continual loss of water through boiling. This is usually accompanied by discoloration of the electrolyte.

CHARGE INDICATOR LAMP REMAINS ON

(1) Loose or broken fan belt: Adjust or renew fan belt.
(2) Faulty alternator regulator: Renew regulator.
(3) Faulty alternator: Overhaul or renew alternator.
(4) Short to earth in warning lamp circuit: Check and repair circuit.
(5) Warning lamp off when engine ignition switched on but comes on when engine started: Check fuse holder and fuse.

NOTE: Check out the no charge condition by checking out the possible causes in the order given.

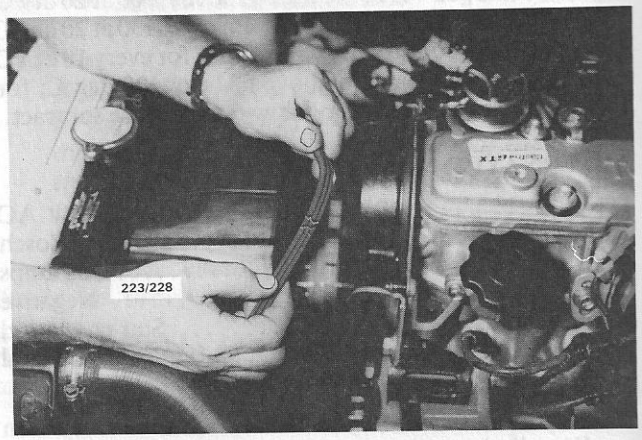
CHARGE INDICATOR LAMP DOES NOT OPERATE

(1) Lamp bulb blown: Check and renew faulty bulb.
(2) Open circuit in wiring or bulb holder:Check and rectify open circuit.
(3) Fuse blown: Locate cause and renew fuse.

NOTE: Access to the charge indicator lamp bulb can be gained by removing the instrument cluster and withdrawing the bulb and holder. The bulb can then be removed from the holder. If the bulb is serviceable check the circuit.

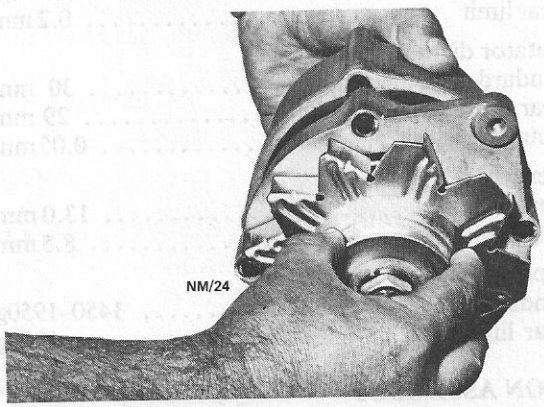
NOISE IN FAN BELT OR ALTERNATOR

(1) Fan belt frayed or out of alignment with pulleys: Renew fan belt and/or align pulleys.
(2) Loose alternator mounting bolts or worn bearings: Tighten mounting bolts or renew bearings.
(3) Loose alternator pulley: Tighten pulley retaining nut.
(4) Faulty alternator: Overhaul or renew alternator.
(5) Faulty diodes in alternator: Overhaul alternator, fit new heat sink.



Check the fan belt for fraying, cracking and deterioration.

NOTE: To check if the noise is in the alternator or fan belt loosen off the alternator mounting bolts and remove the fan belt. If the noise is gone when the engine is run for a short time, check the serviceability of the belt and alternator components.



Spin the alternator pulley over by hand to check bearings for noise.

2. BATTERY AND STARTING SYSTEM TROUBLE SHOOTING

STARTER LACKS POWER TO CRANK ENGINE

(1) Battery undercharged: Check the charging system and rectify as necessary.

(2) Battery faulty, will not hold charge: Check and renew battery.

(3) Battery terminals loose or corroded: Clean and tighten terminals.

(4) Faulty starter motor: Check and overhaul starter motor.

(5) Faulty starter magnetic switch: Check and renew the magnetic switch as necessary.

NOTE: Check the state of charge of the battery and check all terminals for cleanliness and security. If necessary test and overhaul the starter motor as described in this section.

STARTER WILL NOT ATTEMPT TO CRANK ENGINE

(1) Open circuit in starting system: Check for dirty or loose terminals, dirty commutator, faulty magnetic switch or faulty ignition switch.

(2) Discharged battery: Check for fault or short circuit in system.

(3) Battery fully charged but will not crank engine: Check for locked drive and ring gear, internal starter fault or seized engine.

NOTE: Turn engine over by hand to ensure that the starter drive is not locked with the flywheel ring gear and that the engine is not seized. Ensure that the ignition is switched off before turning the engine.

3. LIGHTING SYSTEM TROUBLE SHOOTING

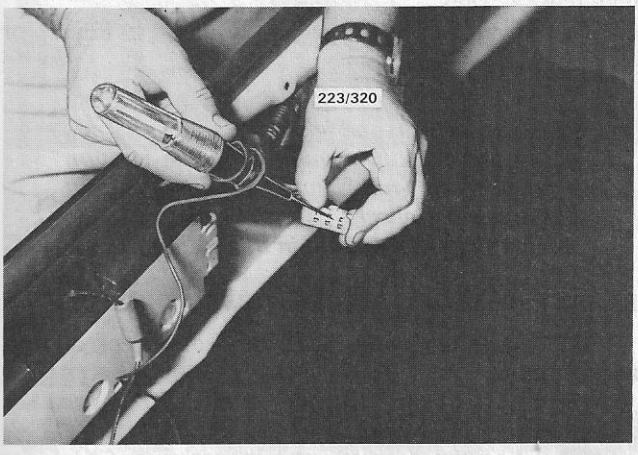
LAMP OR LAMPS FAIL TO LIGHT

(1) Faulty sealed beam or bulb unit/s: Check and renew faulty sealed beam or bulb unit/s.

(2) Open circuit in wiring or connections: Check out lamp circuit and rectify as necessary.

(3) Faulty lamp switch: Check and if necessary renew lamp switch.

(4) Faulty fuse or fuse holder: Rectify fuse holder or renew fuse.



To check if the lamp circuit is operating, start at the bulb and work back to the power source.

NOTE: Switch on the lamps concerned and using a test lamp, check that the lamp circuits are operating. This is best done by starting at the lamp wiring connector or bulb holder and working back to the power source.

LAMP OR LAMPS INCORRECTLY ILLUMINATED

(1) Lamp or lamps incorrectly earthed: Check lamp earth for looseness or clean contact, either at the lamp body or wire and repair as necesary.

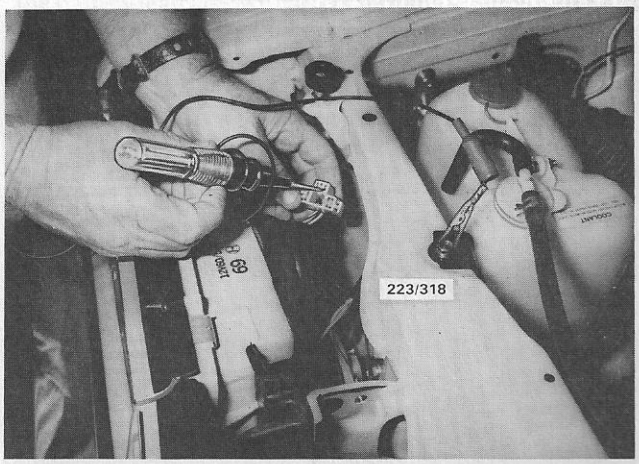
(2) Incorrect sealed beams or bulbs fitted: Check sealed beams or bulbs for correct wattage and voltage and renew with correct type if necessary.

(3) Dirty or damaged lamp reflector: Clean or renew lamp reflector.

(4) Faulty sealed beam or bulb: Check out with a known serviceable unit and renew if necessary.

(5) Dirty sealed beam or lamp lens: Clean or renew sealed beam or lamp lens.

NOTE: The most common cause for this condition is incorrect lamp earthing. Check the lamps at their earthing points.



Using a test lamp, check that the headlamp circuits are operating.

LAMPS FLARE WITH ENGINE SPEED INCREASE

(1) Faulty battery: Check and renew or repair battery.

(2) Battery in low state of charge: Charge battery and check charging system.

(3) High resistance or faulty connections between alternator and battery: Check circuit and rectify condition.

(4) Poor earth connection between battery and engine or alternator: Check battery earth lead and the strap between engine and body.

(5) Voltage regulator faulty: Check and renew regulator.

NOTE: The most common cause of this condition is dirty terminals on the earth leads. Check all earth leads at their earthing points.

4. TURN SIGNAL LAMP TROUBLE SHOOTING

TURN SIGNAL WARNING LAMP DOES NOT BURN AND NO AUDIBLE CLICKING FROM FLASHER UNIT

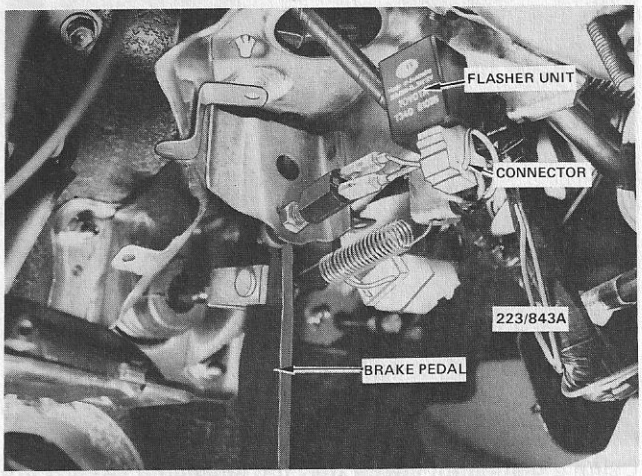
(1) Fuse blown: Rectify fault and renew fuse.
(2) Faulty flasher unit: Renew flasher unit.
(3) Faulty turn signal switch: Renew or repair switch.
(4) Fault in wiring circuit: Check and repair fault.

NOTE: If the fuse is functional check the flasher unit for serviceability by replacing with a known serviceable unit.

TURN SIGNAL WARNING LAMP DOES NOT FLASH BUT AUDIBLE CLICKING FROM FLASHER UNIT

(1) Warning lamp bulb blown: Check and renew bulb.
(2) Fault in warning lamp wiring: Check and repair fault.

NOTE: When renewing bulbs ensure that a new bulb of the correct wattage is used.



Installed view of the flasher unit.

BOTH WARNING LAMPS FLASH WEAKLY AND AT GREATER THAN NORMAL SPEED

(1) Faulty flasher unit: Check and renew flasher unit.
(2) Front bulb blown on turn side: Check and renew bulb.
(3) Rear bulb blown on turn side: Check and renew bulb.

NOTE: If one lamp unit is constantly blowing bulbs check for high resistance in circuit.

BOTH TURN SIGNAL WARNING LAMPS BURN CONSTANTLY

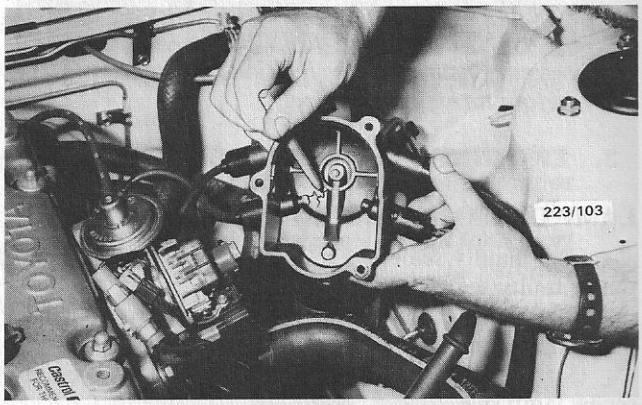
(1) Faulty turn signal switch: Check and renew switch.
(2) Fault in turn signal switch wiring: Check and repair fault.
(3) Faulty flasher unit: Check and renew flasher unit.

NOTE: If the flasher unit is to be renewed always try to obtain a genuine replacement part.

5. IGNITION SYSTEM TROUBLE SHOOTING

ENGINE WILL NOT START

(1) Fault in ignition primary circuit wiring: Check ignition primary circuit and repair as necessary.
(2) Faulty ignition switch: Renew ignition switch.
(3) Faulty coil primary or secondary winding: Renew ignition coil.
(4) Faulty ignition igniter: Check and renew igniter.
(5) Faulty capacitor or capacitor lead: Check and renew capacitor.
(6) Faulty signal rotor or pick up coil: Renew parts as necessary.
(7) Cracks in distributor cap: Renew distributor cap.
(8) Cracks in distributor rotor arm: Renew rotor arm.



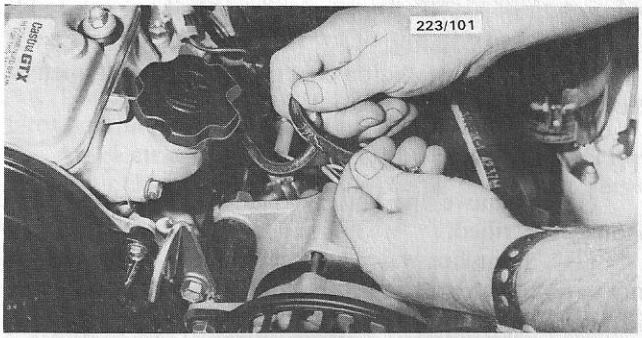
Check the distributor cap for cracks and tracking.

(9) Faulty high tension leads: Check and renew high tension leads.
(10) Faulty or incorrectly spark plugs: Renew or clean and adjust spark plugs.

NOTE: Refer to the Roadside Trouble Shooting section and make the necessary tests to ensure that the trouble is in the ignition system. If the fault is in the ignition, perform the electrical checks as described under the heading Ignition System in this section.

ENGINE RUNS BUT LACKS POWER

(1) Ignition timing incorrectly set: Check and re-adjust timing.
(2) Centrifugal advance mechanism seized or excessively worn: Overhaul distributor.
(3) Vacuum advance unit inoperative: Check for broken vacuum hose or faulty unit.



Check the high tension leads for cracks and deterioration.

(4) Vacuum advance unit operates but ineffective: Advance unit link disconnected or broken.

(5) Faulty, dirty or incorrectly adjusted spark plugs: Renew or clean and adjust spark plugs.

(6) Condensation moisture in distributor cap: Check, dry out and examine cap for cracks.

(7) Cracked spark plug insulator/s: Renew faulty spark plugs.

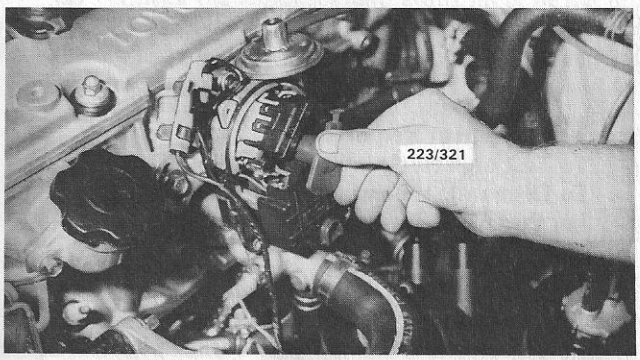
(8) Faulty ignition coil: Check and renew ignition coil.

(9) Defective high tension leads: Renew high tension leads.

(10) Faulty capacitor: Check and renew capacitor.

NOTE: Check out the possible causes in the order given.

To check if the centrifugal advance mechanism is operating correctly, remove the distributor cap and twist the rotor arm in the direction of normal rotation. When released it should spring back to its original static position.



To check if the centrifugal advance mechanism is operating, twist the rotor in the direction of normal rotation. It should spring back to its original position.

6. TEST EQUIPMENT AND SOME APPLICATIONS

TO MAKE A TEST LAMP

When working on the electrical system, a test lamp will be found to be most helpful for checking the continuity of live circuits. A simple test lamp can be made from two suitable lengths of 4 millimetre wire, two small alligator type clips, a double contact bulb holder and a 12 volt single filament double contact bulb.

(1) Bare both ends of the two lengths of 4 millimetre wire.

(2) Solder an alligator clip to one end of each wire lead.

(3) Connect the other ends of the leads to the double contact bulb holder terminals and ensure that they are insulated from each other and from the bulb holder base.

(4) Instal the bulb in the bulb holder.

(5) To test the unit, connect it across a 12 volt battery, the bulb should light if the wiring is correct and the bulb serviceable.

TO MAKE A JUMPER LEAD

When testing components of the electrical system a jumper lead is very handy.

(1) Bare both ends of a suitable length of 4 millimetre wire.

(2) Connect a small alligator clip to each end of the wire. Solder and tape the connections.

(3) Test the jumper lead for continuity by removing one battery lead and connecting the jumper lead between the battery lead and the battery terminal. Turn the ignition key to 'On' and the dash warning lamps should operate indicating a complete circuit through the jumper lead.

(4) Remove the jumper lead from the circuit and connect the battery.

NOTE: Make a few test leads of various length using different sizes and types of alligator and battery clips.

TO TEST SWITCHES

If a switch is suspected of being faulty, remove the wires from the switch and using a test lamp, test each lead to find the power wire. It may be necessary to turn the ignition switch 'On' as the switch may be wired through the ignition circuit.

After noting the colour/position of the wire, disconnect the test lamp and using a suitable jumper lead, connect the jumper lead from the power wire of the switch to the other side of the switch. If the circuit functions, the switch is faulty and should be renewed. See Switches and Controls.

TO TEST BULBS

If a bulb is suspected of being faulty, remove the bulb from the bulb holder and using a small jumper lead connect one end of the jumper lead to the power terminal of a serviceable battery and the other end of the jumper lead to a lug on the side of the bulb.

Connect one end of a second jumper lead to the earth terminal of the battery and with the other end of the jumper lead touch the bulb contact. The bulb should light.

If the bulb has two filaments, touch the other bulb contact with the end of the jumper lead. The bulb should light. If the bulb should fail to light, the bulb should be replaced with a bulb of the correct voltage and wattage.

TO TEST CIRCUITS

If a circuit is suspected of being faulty, turn the switch on in the normal manner so as to supply power to the circuit.

Where connections are in the circuit, disconnect the connection and connect one lead of a test lamp to the power or switch side of the disconnected circuit and the other lead of the test lamp to a clean earth (e.g. bolt or screw). If the lamp does not light, check the circuit towards the power or switch end of the circuit.

If the lamp lights, continue checking towards the motor or bulb in the circuit.

NOTE: A fuse or its associated connection is always a good starting point, but reconnect each connector or fuse after testing that particular connector or fuse.

7. BATTERY

Special Equipment Required:
To Test - Hydrometer

MAINTENANCE

Maintenance consists mainly of regular inspection and servicing.

(1) Keep the battery and its surroundings clean and dry. Give the top of the battery particular attention to prevent electrical leakage between the cell terminals.

(2) Remove the vent plugs and check that the vent holes are clear.

(3) Check the electrolyte level and top up as necessary. The correct level is just over the top of the separators. Do not overfill or acid will escape through the vent holes with detrimental effect to the connections and to adjacent parts of the vehicle.

(4) Use only distilled water for topping up.

NOTE: Never use a naked light when examining the battery as the gases given off by the battery can be dangerously explosive.

(5) If the battery requires an excessive amount of topping up, the cause should be sought. If overcharging is suspected then check the output of the alternator.

If one cell in particular is at fault, check the case for cracks. Never transfer electrolyte from one cell to another.

(6) Keep the terminals clean and apply a small amount of petroluem jelly to the terminals to prevent corrosion.

TO REMOVE AND INSTAL

(1) Loosen the clamp nut and remove the negative terminal from the battery post.

(2) Remove the positive terminal in the same manner.

(3) Undo the retaining nut and bolt, remove the battery holding clamp and lift the battery from the vehicle.

Installation is a reversal of the removal procedure with attention to the following points:

(1) Do not overtighten the clamp nuts and make sure of correct polarity.

(2) After installation coat the terminals with petroleum jelly to prevent corrosion.

TO CLEAN BATTERY CASE

(1) Remove the battery from the vehicle as previously described.

(2) Pour hot water over the battery being careful not to pour water through the vent holes of the filler caps.

(3) Wipe the battery case clean.

(4) If there is a crack in the case or around the base of the terminal/s the faulty components should be reparied. Take the battery to an automotive electrical shop or battery agent for necessary servicing.

TO CLEAN BATTERY CARRIER

If the battery electrolyte has overflowed and contaminated the surrounding body panels it will be necessary to remove this contamination and repaint the surface where necessary. The contamination can be neutralised by using an alkaline solution consisting of two tablespoons of washing soda to a litre of boiling water. Cloudy ammonia can also be used in concentrated form. Both these items are readily available at grocery stores.

After neutralising the contaminated body panels allow them to dry. Clean off the old paint and repaint the surfaces with an anti-rust based paint.

TO TEST

Use a hydrometer to check the specific gravity of the battery electrolyte. Refer to Specifications for a fully charged and fully discharged battery.

If the battery is in a low state of charge or completely flat take it to an automative electrical shop to have it charged and load tested.

8. ALTERNATOR

Special Equipment Required:
To Test on Vehicle - 60-0-60 Ammeter, voltmeter
To Dismantle - Bearing puller, soldering iron
To Assemble - Press, soldering iron

DESCRIPTION

In the alternator the field and pole shoe assembly is the moving part and is shaped to form the rotor. Since only a low amperage current flows between the slip rings on the rotor shaft and the brushes, wear on brushes and slip rings is very slight and maintenance is reduced to a minimum.

The output current is generated in the field stator windings and is a three phase alternating current (AC). The stator windings are wound on a laminated soft iron former, are star connected and fitted between the end brackets.

As it is not possible to recharge a storage battery with alternating current, it is necessay to rectify the output of

the stator windings to direct current (DC). This is done by a bank of diodes mounted within the alternator slip ring end bracket.

The output of the alternator is governed by the regulator and built in characteristics of the alternator.

An electrical cutout unit is not necessary with the alternator charging system as the diodes prevent a reverse current flow through the alternator.

SERVICE PRECAUTIONS

(1) Ensure that the battery is connected with the correct polarity to earth. Refer to Specifications.

(2) Do not short out or ground any terminals common to the charging circuit.

(3) Always disconnect the battery before connecting a battery charger.

(4) If a booster battery is used always connect it in a parallel circuit, i.e. positive to positive (+ to +) and negative to negative (− to −) to maintain a 12 volt supply pressure.

(5) Never disconnect the battery or terminals in the charging circuit while the engine is running.

(6) Regularly check the fan belt tension.

(7) Keep the battery terminals clean and all electrical connections tight.

(8) Disconnect the battery and alternator before electric welding on the vehicle.

TO TEST ON VEHICLE

If the ignition warning lamp stays on after the engine has been started and run at approximately 1000 rpm, carry out the following tests and precautions.

(1) Stop the engine. Do not open circuit any parts of the charging system while the engine is running.

(2) Check the condition and adjustment of the fan belt.

(3) Clean the battery terminals, tighten all electrical connections, check the wiring for shorts to earth and/or bridged circuits and ensure that the battery is fully charged.

(4) Start the engine and allow it to run until normal operating temperature is reached.

(5) Stop the engine and disconnect the negative battery terminal.

(6) Remove the wing nut and washer from the positive battery terminal and disconnect the alternator output lead. Instal the wing nut and washer to the battery terminal.

(7) Connect one lead of a 60–0–60 ammeter to the positive battery terminal and the other lead of the ammeter to the lead removed from the positive battery terminal. Ensure the connections are secure and insulated.

(8) Connect the negative battery terminal and connect a 0–20 voltmeter across the battery terminals.

(9) Switch on all lamps and allow them to burn for approximately five minutes to reduce the charge in the battery and to apply a load to the circuit.

(10) Start the engine and gradually increase the engine speed to approximately 2500 rpm. The reading on the ammeter should be approximately 75 per cent of the rated output of the alternator. See Specifications.

(11) Switch off all lamps and run the engine at 1500–2000 rpm until the indicated charge is below 10 amps. The voltmeter should now read in excess of 12.5 volts.

NOTE: Should the alternator fail to reach the specified output, the unit will have to be removed and overhauled or a replacement unit fitted. Should the voltage reading be above 14.7 or below 12.5 volts, the regulator will have to be renewed.

TO REMOVE AND INSTAL

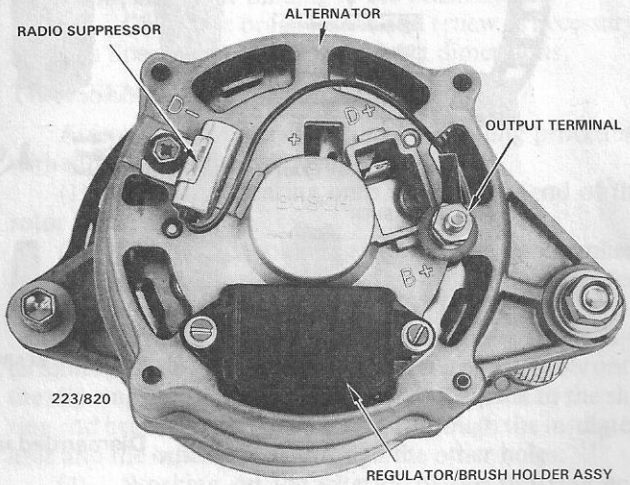
(1) Disconnect the negative battery terminal.

(2) Disconnect the terminal block from the alternator by pulling on the terminal block, not the wire.

(3) Pull back the rubber insulator, remove the nut and washer from the B+ terminal on the alternator and disconnect the output lead.

(4) Remove the bolt securing the alternator to the fan belt adjusting bar.

(5) Loosen the mounting bolt and nut, push the alternator towards the engine and slip the fan belt from the pulley.



Rear view of assembled alternator.

(6) Remove the mounting nut and bolt whilst supporting the alternator with the other hand. Remove the alternator.

Installation is a reversal of the removal procedure with attention to the following points:

(1) Do not overtighten the fan belt and only apply pressure to the mounting end bracket when adjusting the fan belt.

(2) Check the wiring where soldered to the terminals.

TO DISMANTLE

(1) Remove the alternator from the vehicle as previously described.

(2) Loosen the radio suppressor retaining screw and remove the suppressor from the alternator.

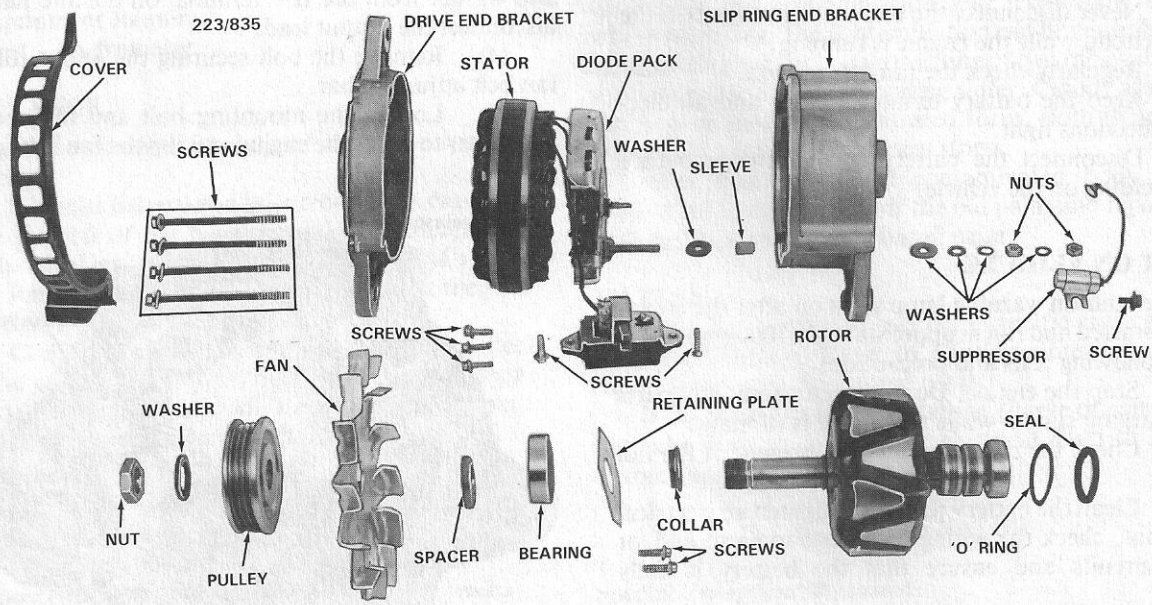
(3) Scribe a mark across the drive end bracket, stator and slip ring end bracket to facilitate correct alignment during assembly.

(4) Remove the two screws and washers securing the regulator and brush holder assembly. Withdraw the regulator and brush holder assembly sufficiently to disconnect the lead from the assembly.

(5) Remove the through screws securing the drive end bracket to the slip ring end bracket. Withdraw the drive end bracket, rotor and pulley. Collect the 'O' ring and seal behind the rear bearing.

(6) Holding the rotor in a vice with suitable protection between the vice jaws and the rotor, unscrew and remove the drive pulley retaining nut and spring washer.

(7) Withdraw the drive pulley, fan and spacer from the rotor shaft.



Dismantled view of alternator.

(8) Using a soft faced hammer, drive the rotor and shaft assembly out of the drive end bracket and where necessary withdraw the collar from the shaft.

(9) If the drive end bracket bearing is to be renewed, take out the securing screws, remove the bearing retaining plate and withdraw the bearing from the drive end bracket.

(10) Remove the nut, spring washer, flat washer and insulating washer from the B + terminal on the outside of the slip ring end bracket.

(11) Working inside the slip ring end bracket, remove the screws securing the diode pack to the bracket and withdraw the stator and diode pack as an assembly. Take the insulating sleeve and washer from the B + terminal.

NOTE: The diode pack is supplied as an integral unit and in the event of a component failure the diode pack must be replaced as a complete unit.

(12) Where it is necessary to remove the diode pack from the stator for testing or renewal proceed as follows:

(a) Tag and mark all wiring connections prior to removal to avoid incorrect connections during assembly.

(b) Using a very hot soldering iron and a pair of long nosed pliers as a heat sink, unsolder the stator lead from the connector terminals to separate the diode pack.

NOTE: Do not apply undue heat to the connections as damage may result to the terminal insulator and/or diodes.

(13) Using a suitable puller, remove the bearing from the slip ring end of the rotor shaft.

TO CLEAN PARTS

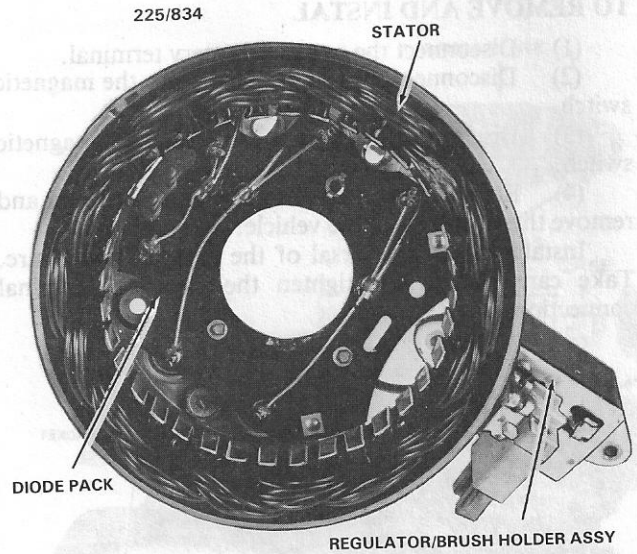
(1) Do not immerse units of the alternator in cleaning solvent as damage to the windings will result.

(2) The end brackets may be washed in a suitable cleaning solvent after they have been completely dismantled from the unit. They should be thoroughly dried after cleaning.

(3) Compressed air can be used to carefully blow out any dust from the stator windings and the field windings on the rotor.

(4) Slip rings that are burnt or scored should be polished using very fine glass paper.

(5) Clean the brushes and brush holder using a petrol damp rag and check and remove any burrs from the holder.



Dismantled view of the stator with diode pack and brush holder/regulator assembly.

(6) Check the sealed ball type bearings for wear, roughness and lack of lubrication and renew as necessary.

Unsealed type ball bearings if still serviceable may be lubricated with high melting point grease and installed for further service.

TO CHECK AND TEST COMPONENT PARTS

All parts being electrically tested should be resting on a non-conductive pad.

Field Windings and Rotor Assembly

(1) The insulation to earth test is done with an ohmmeter. Connect one of the test prods to one of the field wires or slip rings and the other test prod to one pole piece of the rotor.

(2) If the ohmmeter shows a reading and no visual earthing can be seen and rectified, a new rotor assembly will have to be fitted.

(3) To check for bridged or internal shorting of the field coils use an ohmmeter and check the resistance of the rotor windings. A zero reading indicates a bridged circuit internally, a high reading indicates an open circuit or high resistance in the windings. In both cases a new rotor assembly will have to be fitted.

Stator Windings

This stator test is carried out using an ohmmeter and a test lamp.

(1) The stator leads must be disconnected from the diode pack.

(2) Connect one test prod of the ohmmeter to one stator lead and the other test prod to another stator lead. Note the ohmmeter reading.

(3) Repeat the above procedure on the remaining leads alternatively to check each phase.

(4) If there is any variation in resistance between phases it will be necessary to renew the stator assembly.

(5) Connect a jumper lead from the negative terminal of a charged 12 volt battery to the stator winding frame. Connect one end of a test lamp to the battery positive terminal, the other end of the test lamp to the stator leads, one at a time.

(6) Should the test lamp light or burn dimly a short circuit is indicated and the stator assembly must be renewed.

Diodes

The diodes may be tested after their disconnection, testing can be done by using a 12 volt battery, a 1.5 watt test lamp and a jumper lead.

(1) Connect the jumper lead from the negative terminal of a charged battery to the carrier/bracket holding the diode to be tested.

(2) Connect one end of the test lamp to the battery positive terminal and the other end of the lamp to the diode lead. Note whether the lamp is illuminated and then reverse the connections of the battery.

(3) If the lamp was illuminated in both directions or was not illuminated at all, the diode is faulty and the diode pack must be renewed.

Brush Springs and Brushes

(1) Unsolder and remove the brushes.

(2) Check the brush springs for overheating and distortion, check for binding in the brush holder.

(3) Check the brush length and renew as necessary. Refer to Specifications for the correct dimensions.

TO ASSEMBLE

Assembly is a reversal of the dismantling procedure with attention to the following points:

(1) Fit a new bearing onto the slip ring end of the rotor shaft.

(2) Using a hot soldering iron and long nosed pliers as a heat sink, solder the stator leads to their respective terminals on the diode pack.

(3) Fit an insulating washer and sleeve to the B+ terminal post and place the diode and stator assembly onto the slip ring end bracket. Secure the diode pack to the slip ring end bracket with the long screw through the insulated hole and the other screws through the other holes.

(4) Working on the exterior of the slip ring end bracket, instal an insulating washer, flat washer and spring washer on the B+ terminal and secure it with the retaining nut.

(5) Fit a new bearing to the drive end bracket and secure the bearing with the retaining plate and screws.

(6) Hold the rotor in a vice with suitable protection and, where removed, place a small shouldered collar with the shoulder towards the bearing side onto the rotor shaft.

(7) Instal the drive end bracket to the rotor shaft.

(8) Instal the spacer, fan, pulley and lock washer and secure the assembly with the retaining nut.

(9) Position the 'O' ring and seal in the bearing recess of the slip ring end bracket and insert the rotor in the stator and end bracket assembly.

(10) Align the marks made on dismantling and instal and tighten the through screws.

9. STARTER MOTOR

Special Equipment Required:
To Check and Inspect - Ohmmeter and ammeter
To Renew Bearings - Suitable puller, press and press plates
To Renew Brushes - Soldering iron

DESCRIPTION

The starter motor is the induced pole type with four brushes and four shoes with field coils. A magnetic switch replaces the conventional solenoid which is attached to the drive end bracket. The drive pinion assembly incorporates two gears which reduce the revolutions and increase the torque of the starter drive pinion.

When the magnetic switch is energised by the key operated combination ignition/starter switch, the drive pinion assembly is pulled into mesh with the idler gear which is installed on the armature shaft. The drive is then transferred from the armature to the drive pinion assembly then to the flywheel.

As the engine fires the overrunning clutch of the drive pinion assembly prevents high speed rotation of and possible damage to the starter armature if the solenoid windings are not immediately de-energised by releasing the switch key.

TO TEST ON VEHICLE

Should the starter fail to operate when the switch is moved to the start position check the following points:

(1) Check the battery condition and state of charge, refer to the Battery heading in this section.

(2) Clean the battery terminals, taking particular care to remove the scale from the positive (+) terminal post and terminal.

(3) Check the earth connections for tightness and cleanliness.

(4) Switch on the headlamps and operate the starter control switch. If the lights go dim but the starter is not heard to operate, it could indicate that a short circuit or low resistance has developed in the starting system which could be either external or internal.

Also check that the engine is not 'seized' or 'locked up' as this condition would give the same indication as above.

(5) If the lamps do not dim and the starter does not operate this would indicate an open circuit such as a broken or disconnected wire or a switch not operating. If the vehicle is fitted with automatic transmission, operate the starter control switch and move the selector lever through all the gear selection range. If the starter operates in any position other than N or P, the neutral safety switch is faulty.

(6) Check all the external wiring to make sure the fault is not external, if the external circuit proves satisfactory, indicating that the problem is in the starter assembly, the unit will have to be removed and bench checked.

TO REMOVE AND INSTAL

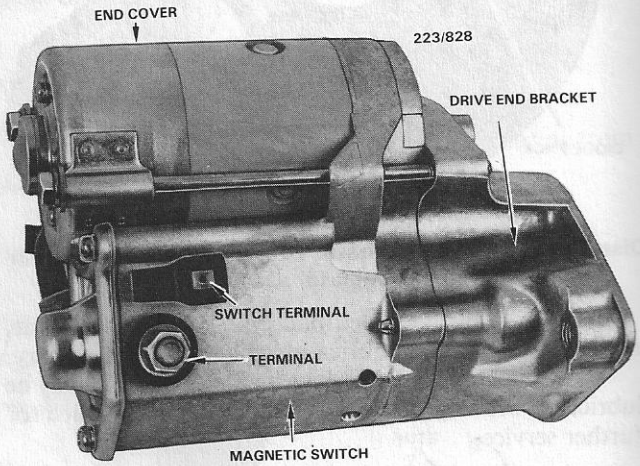
(1) Disconnect the negative battery terminal.

(2) Disconnect the battery lead from the magnetic switch.

(3) Disconnect the switch wire from the magnetic switch.

(4) Remove the bolts securing the starter motor and remove the starter from the vehicle.

Installation is a reversal of the removal procedure. Take care not to overtighten the electrical terminal connections.



Assembled view of starter motor.

TO TEST OFF VEHICLE

(1) Remove the starter motor from the vehicle as previously described.

(2) Mount the starter motor securely in a vice, connect the negative terminal of a fully charged 12 volt battery to a suitable earth point on the starter using a jumper lead.

(3) Connect a jumper lead with an ammeter in series to the starter battery terminal.

(4) When power from the starter battery terminal is supplied to the switch terminal via a jumper lead the starter should run smoothly and show a current draw of less than 90 amps.

NOTE: Only apply power to the switch terminal long enough to obtain an amperage reading as overheating of the magnetic switch could occur.

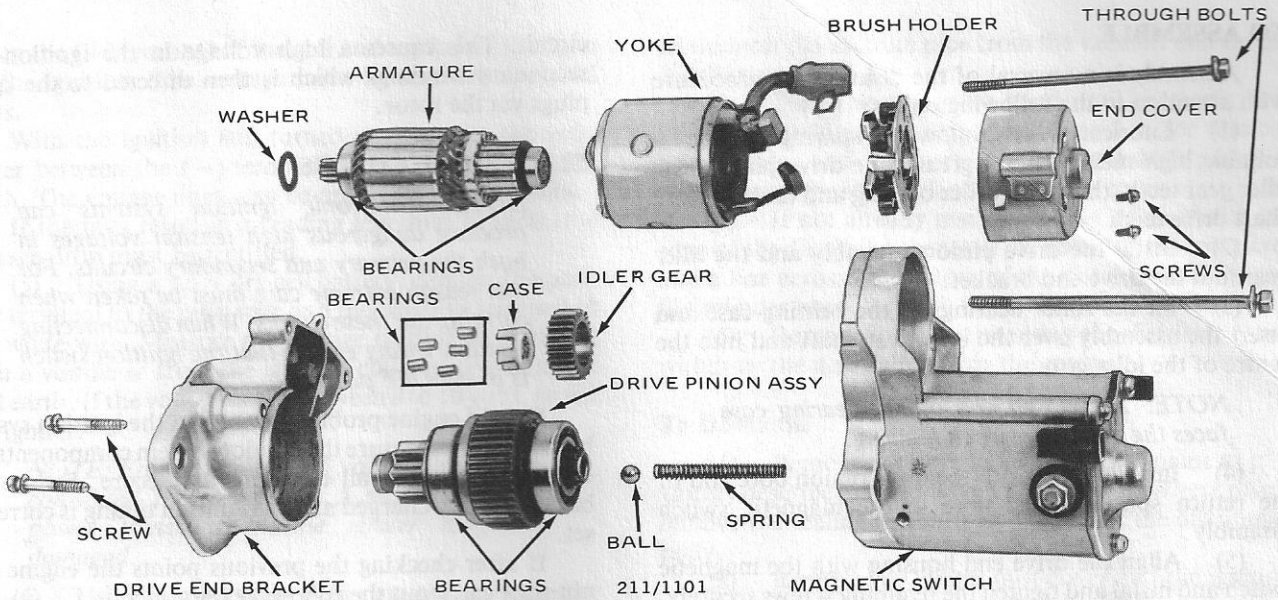
(5) During the above test the starter pinion should move freely to its engaged position on the shaft.

TO DISMANTLE

(1) Remove the starter motor as previously described.

(2) Fold back the insulator cover and remove the nut securing the wire to the magnetic switch assembly.

(3) Remove the through bolts and separate the yoke from the starter assembly ensuring to collect the felt washer from the magnetic switch housing.



Dismantled view of starter motor.

(4) Remove the recessed screws from the front of the drive end bracket and detach the bracket from the magnetic switch.

(5) Remove the drive pinion assembly from the drive end bracket and collect the ball from inside the pinion bore with the aid of a magnet.

(6) Remove the idler gear from the drive end bracket ensuring to collect the roller bearings and case.

(7) Remove the commutator end cover to brush holder retaining screws and remove the end cover from the yoke.

(8) Remove the two field brushes from the brush holder and remove the brush holder from the armature.

(9) Clean all the components thoroughly but do not immerse the magnetic switch, drive pinion assembly, yoke or armature in cleaning fluid.

(10) Visually inspect all components for wear and burnt insulation.

TO CHECK AND INSPECT

(1) With the starter motor dismantled check the brush holder insulation using an ohmmeter.

Connect one test lead on the brush holder positive side and the other lead on the negative side. If there is any indication of leakage the ohmmeter will show a reading other than infinite. Repair or renew the brush holder if a short circuit is evident.

(2) Check the brushes for adequate length. Brushes should be renewed when their length is below Specifications. They should be a free sliding fit in the brush holders.

(3) Check the brush springs for loss of tension and compare with Specifications.

(4) Check that the commutator is free from pitting and burning, clean with a petrol moistened cloth and polish with a strip of fine glass paper.

A badly worn commutator may be cleaned up by mounting in a lathe, spinning at high speed, and a light cut taken with a very sharp tool. After turning, undercut the insulation between the segments to Specifications.

(5) Check the armature for short circuit, using a ohmmeter.

Place one of the test leads on the armature shaft or core and move the other lead around the circumference of the commutator. If the ohmmeter shows a reading at any point the armature is faulty and should be renewed.

(6) Test the field coils for continuity by connecting the test leads in series with the field windings.

Failure of the ohmmeter to show a reading indicates an open circuit in the wiring of the field coils.

(7) Check the field coils for ground by placing one test lead on the field coil lead and the other lead on the yoke. If the ohmmeter shows a reading the field coils and yoke assembly are faulty and will have to be renewed.

(8) Check the drive pinion assembly and the idler gear for wear, scoring or chipping. A clutch in good condition should take up the drive in one direction only and it should rotate easily and smoothly in the non-drive direction.

NOTE: Do not wash the drive assembly or clutch in solvent as this will destroy the clutch lubricant and cause early failure of the unit.

(9) Check the armature shaft bearings for wear and renew as necessary. The old bearings must be removed using a suitable puller and the new bearings fitted using a suitable press and press plates.

(10) Check the magnetic switch pull in and hold in coils for continuity using an ohmmeter. There should be continuity between the switch terminal and the field coil terminal but no continuity between the switch terminal and the magnetic switch housing.

TO ASSEMBLE

Assembly is a reversal of the dismantling procedure with attention to the following points:

(1) Lubricate the following sparingly with a suitable high melting point grease; the drive pinion, the idler gear teeth, the caged roller bearing and the armature shaft drive teeth.

(2) Instal the drive pinion assembly and the idler gear into the drive end bracket.

(3) Fit the roller bearings to the bearing case and insert the assembly over the idler gear shaft and into the centre of the idler gear.

NOTE: The closed end of the bearing case faces the magnetic switch housing.

(4) Instal the ball into the drive pinion bore and fit the return spring to the bore in the magnetic switch assembly.

(5) Align the drive end housing with the magnetic switch and instal and tighten the retaining screws securely.

(6) Insert the armature into the yoke and instal the brush holder and brushes over the commutator.

To instal the brush holder with brushes fitted, it will be necessary to push the brushes against the spring tension into the holder and then slide the assembly onto the commutator.

(7) Instal the commutator end cover after ensuring the brush holder is correctly aligned with the yoke.

(8) Fit the commutator end cover to brush holder retaining screws and tighten securely. Instal the felt washer to the armature shaft.

(9) Align the locating lug on the yoke assembly with the groove in the magnetic switch housing ensuring that the bearing on the armature seats correctly and the teeth on the armature shaft are correctly meshed as the assemblies are engaged.

(10) Instal and tighten the through bolts evenly and securely.

(11) Connect the wire to the magnetic switch assembly and instal and tighten the retaining nut. Fit the insulator cover to the terminal.

(12) Test and instal the starter motor as previously described.

10. IGNITION ASSEMBLY

Special Equipment Required:

To Test – Ohmmeter, voltmeter

DESCRIPTION

The electronic ignition assembly is integrated with the distributor. It consists of a distributor with a signal rotor, pick up coil, igniter and ignition coil with vacuum and mechanical advance mechanisms.

A signal is given each time the vanes on the signal rotor pass the pick up coil.The electrical impulse is then directed to a diode in the igniter, causing it to open circuit and interupt the power supply to the ignition coil primary circuit. This causes a high voltage in the ignition coil secondary windings which is then directed to the spark plugs via the rotor.

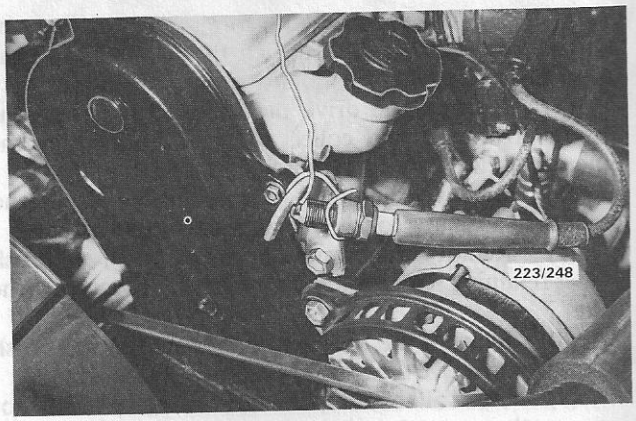
ELECTRICAL CHECKS

NOTE: Electronic ignition systems can produce dangerous high tension voltages in both the primary and secondary circuits. For this reason extreme care must be taken when carrying out these checks. When disconnecting ignition wiring ensure that the ignition switch is in the OFF position.

Should engine problems arise and the ignition system be suspect, first ensure the ignition system components are clean and dry and all terminals are secure. Ensure the battery is fully charged and the ignition timing is correctly set.

If after checking the previous points the engine will not start carry out the following tests:

NOTE: At the conclusion of each check ensure the ignition is switched OFF.



Securely earth the body of a test spark plug to check for spark at the spark plug leads.

(1) Remove a spark plug lead and connect it to an old spark plug. Open the gap to 6 mm, securely earth the body of the plug and have an assistant crank the engine. If no spark is evident, proceed with the following tests.

(2) Remove the distributor cap and using an ohmmeter, check the resistance from the distributor cap terminal to the spark plug terminal of the high tension lead. If the resistance exceeds 25 k ohms, check the high tension lead and distributor cap for deterioration and renew parts as necessary.

(3) Remove the rotor arm and the coil cover and disconnect the ignition coil leads.

Using an ohmmeter, check the coil primary resistance between the positive (+) and the negative (–) terminals. The coil secondary resistance test should be done by measuring from the positive (+) terminal and the high tension terminal.

Renew the ignition coil if the readings taken exceed Specifications.

(4) Connect the coil leads, connect a voltmeter be-

tween the (+) terminal of the coil and a good earth. Turn on the ignition. The voltage must be approximately 12 volts.

With the ignition still turned on, connect the voltmeter between the (−) terminal of the coil and a good earth. The voltage must also be approximately 12 volts.

If the tests result in a reading less than 12 volts, the voltage drop must be rectified.

(5) Using a 1.5 V dry cell battery, connect the positive terminal to the pink wire and the negative terminal to the white wire. Measure the voltage reading by checking with a voltmeter from the ignition coil negative terminal and earth. If the voltage is not between 8 to 10 volts, renew the igniter.

NOTE: Ensure that the 1.5 volt battery is not connected for more than 5 seconds or the power transistor in the igniter may be damaged.

(6) Using non magnetic feeler gauges, measure the air gap between the signal rotor and the pick up coil. If the air gap does not meet Specifications renew the signal rotor and/or the pick up coil assembly.

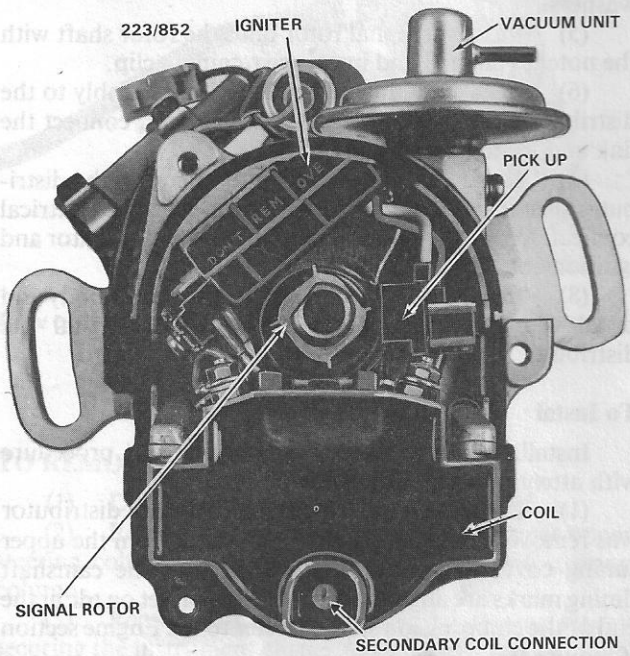
(7) Using an ohmmeter, measure the pick up coil resistance between the terminals of the pick up coil. Renew the pick up coil if the reading taken does not meet Specifications.

DISTRIBUTOR

To Remove

(1) Disconnect the negative battery terminal.

(2) Disconnect the distributor low tension leads from the distributor at the wiring connectors and remove the distributor cap and high tension leads from the engine.



View of the distributor showing the installed positions of the components.

Disconnect the vacuum pipe from the vacuum unit on the distributor.

(3) Turn the engine by hand until the rotor arm points to the high tension terminal position for number one cylinder and the mark on the crankshaft pulley is aligned with the tdc mark on the timing cover.

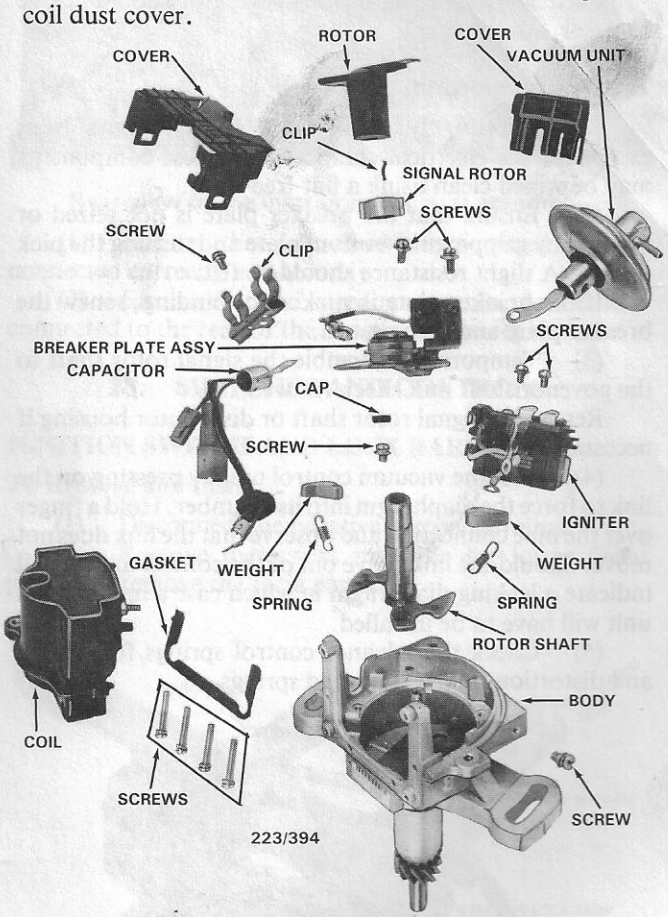
(4) If not already marked, scribe a line on the top edge of the distributor beneath the centre of the rotor arm and a line across the bottom of the distributor body and the cylinder head.

(5) Remove the bolts retaining the distributor and withdraw the distributor from the engine.

To Dismantle

(1) Remove the distributor from the engine as previously described and remove the rotor arm. Where fitted, remove the sealing gasket from the top of the distributor body.

(2) Remove the igniter dust cover and the ignition coil dust cover.



Dismantled view of the distributor.

(3) Remove the nuts securing the electrical connections to the ignition coil and disconnect the connections.

(4) Remove the screws securing the ignition coil to the distributor and remove the ignition coil and gasket.

(5) Loosen and remove the screws and nuts securing the wires to the igniter terminal and disconnect the wires. Remove the igniter retaining screws and lift the

igniter from the distributor. Remove the capacitor retaining screw and lift out the capacitor and wiring assembly.

(6) Remove the screw securing the vacuum advance unit to the distributor, disconnect the vacuum advance link and remove the vacuum advance unit from the distributor.

(7) Using a suitable screwdriver, prise out the retaining clip and withdraw the signal rotor off the shaft.

(8) Remove the screws and washers retaining the breaker plate and pick up coil and remove the assembly.

(9) Noting their installed positions, remove the centrifugal advance springs. Remove the grease cap from the centre of the rotor shaft, and remove the screw retaining the signal rotor shaft to the govenor shaft. Noting its installed position withdraw the signal rotor shaft from the distributor.

(10) Remove the snap rings from the centrifugal weight pivots and, noting their installed position, remove the weights.

Further dismantling of the distributor should not be necessary.

To Clean and Inspect

(1) Thoroughly clean all parts with cleaning solvent except for the electrical components. These components may be wiped clean using a lint free cloth.

(2) Ensure that the breaker plate is not seized or binding by gripping the bottom plate and turning the pick up coil. A slight resistance should be felt.

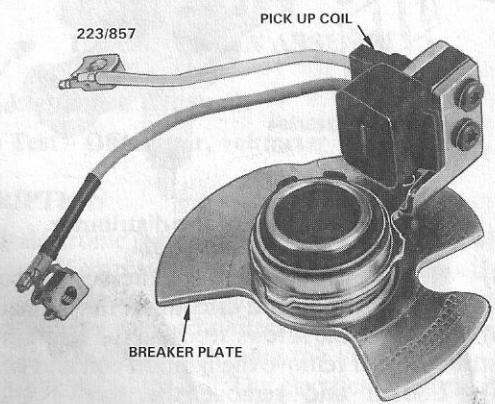
If the breaker plate is sticking or binding, renew the breaker plate and pick up coil.

(3) Temporarily assemble the signal rotor shaft to the govenor shaft and check for wear.

Renew the signal rotor shaft or distributor housing if necessary.

(4) Test the vacuum control unit by pressing on the link to force the diaphragm into its chamber. Hold a finger over the pipe connection and observe that the link does not move. Should the link move out of the control unit, it will indicate a leaking diaphragm in which case a new control unit will have to be installed.

(5) Check the advance control springs for stretch and distortion, renew damaged springs.



View of the breaker plate/pick up coil assembly.

(6) Using an ohmmeter check the resistance of the pick-up coil which should be between Specifications. Check that the coil leads are not open circuited.

(7) Check the teeth or poles of the reluctor and the core for damage and wear which can be caused by the air gap or clearance being below Specifications.

NOTE: Never file or dress the teeth or poles of the signal rotor or pick up coil, a sharp edge must be present at all times on these units to obtain an instant break off of the magnetic field for the maximum induced voltage to be created in the pick-up coil.

(8) Using an ohmmeter check the primary and secondary ignition coil resistance.

The primary resistance is measured between the positive and negative terminals.

The secondary resistance is measured between the positive terminal and the high tension terminal.

Renew the ignition coil if the resistance measured does not meet Specifications.

To Assemble

Assembly is a reversal of the dismantling procedure with attention to the following points:

(1) Instal the centrifugal weights into the distributor and instal the snap rings.

(2) Smear the govenor shaft with high temperature grease. Instal the signal rotor shaft as noted during dismantling and instal the retaining screw. Fill the shaft with high temperature grease and instal the grease cap.

(3) Instal the centrifugal advance control springs.

(4) Instal the breaker plate and pick up coil assembly, aligning the cutout parts in the assembly and the housing. Instal and tighten the retaining screws and washers.

(5) Instal the signal rotor onto the rotor shaft with the notches aligned and instal the retaining clip.

(6) Instal the capacitor and wiring assembly to the distributor. Instal the vacuum advance unit, connect the link and instal the retaining screw.

(7) Instal the igniter and ignition coil to the distributor, instal the retaining screws and connect the electrical connections as noted on dismantling. Instal the ignitor and ignition coil covers.

(8) Instal a new 'O' ring to the distributor body and instal the rotor arm to the rotor shaft. Instal the distributor.

To Instal

Installation is a reversal of the removal procedure with attention to the following points:

(1) If the engine rotated while the distributor was removed, remove the inspection plug from the upper timing cover and rotate the engine until the camshaft timing marks are aligned with No. 1 piston set on tdc at the end of the compression stroke. Refer to the Engine section if required.

(2) Instal the distributor to the engine, aligning the

marks made on dismantling. Instal the distributor retaining bolts, connect the electrical wiring and adjust the ignition timing as described in the Engine Tune-up section.

11. SPEEDOMETER CABLE

TO REMOVE AND INSTAL

(1) Working beneath the dashboard, depress the retaining clip on the speedometer outer cable and disconnect the cable from the speedometer.

(2) Prise the rubber grommet from the bulkhead and pull the cable into the engine compartment.

(3) Raise the front of the vehicle and support it on chassis stands.

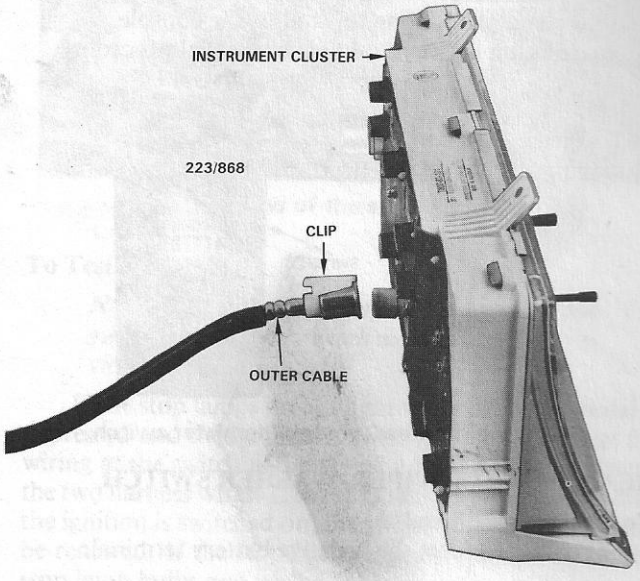
(4) Loosen the knurled end of the speedometer cable at the transmission end of the cable and disconnect the cable from the speedometer drive housing.

(5) Release the cable from the underbody retaining clips and remove it from the vehicle.

Installation is a reversal of the removal procedure with attention to the following points:

(1) Ensure that there are no kinks in the cable assembly when installed.

(2) Ensure that the outer cable is fully engaged on the speedometer.



View of the instrument cluster showing the speedometer cable connection.

12. INSTRUMENT CLUSTER

TO REMOVE AND INSTAL

(1) Disconnect the negative battery terminal.

(2) Remove the lower trim panel, remove the upper steering column mounting bolts and lower the steering column.

(3) Remove the upper and lower retaining screws securing the instrument cluster facia panel.

(4) Manoeuvre the facia panel away from the instrument cluster far enough to disconnect the various electrical connectors from the rear of the switches. Place the facia panel aside.

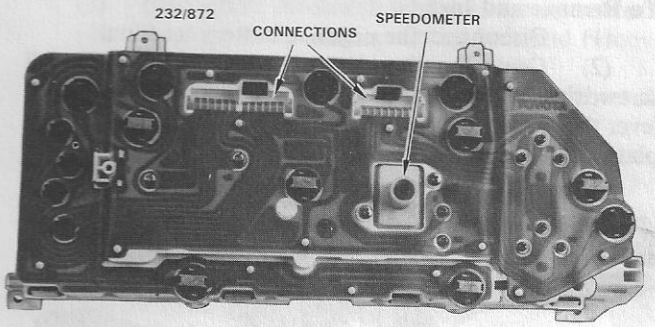
(5) Remove the screws retaining the instrument cluster to the body panel.

(6) Working behind the instrument cluster disconnect the speedometer cable from the rear of the instrument cluster.

(7) Remove the instrument cluster sufficiently to enable the electrical connectors to be disconnected.

(8) Disconnect all the electrical connectors and remove the instrument cluster from the vehicle.

Installation is a reversal of the removal procedure with the attention to the following points:



Rear view of the instrument cluster assembly.

(1) Ensure that all electrical connections are connected correctly and securely.

(2) Ensure that the speedometer cable is securely connected to the rear of the instrument cluster.

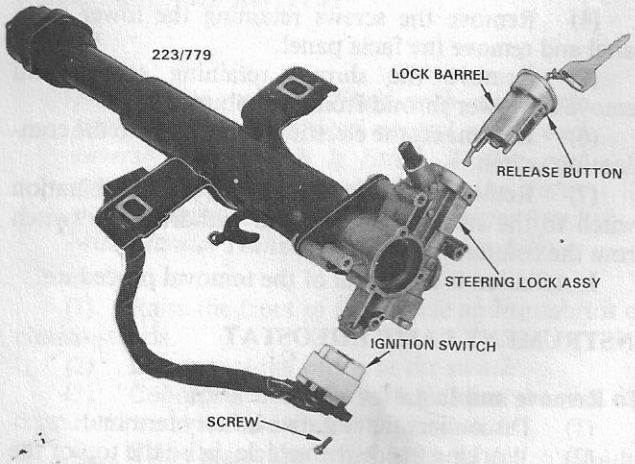
13. SWITCHES AND CONTROLS

IGNITION SWITCH AND LOCK BARREL

To Remove and Instal

(1) Disconnect the negative battery terminal.

(2) Remove the screws retaining the lower facia panel and remove the facia panel.



View of the steering column showing ignition switch components.

(3) Remove the screws retaining the lower steering column shroud, remove the lower shroud and manoeuvre the upper shroud to give access to the ignition switch and lock barrel.

(4) Turn the ignition switch to the ACC position and using a suitable pin punch, depress the barrel retaining button in the side of the lock barrel housing and withdraw the lock barrel.

(5) Disconnect the ignition switch wiring at the connector.

(6) Remove the ignition switch retaining screw and remove the ignition switch.

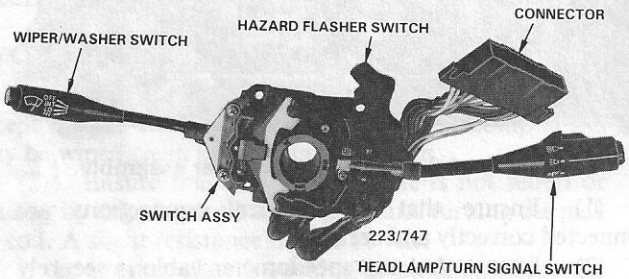
Installation is a reversal of the removal procedure.

COMBINATION SWITCH

To Remove and Instal

(1) Disconnect the negative battery terminal.

(2) Centralise the steering wheel. Insert a small screwdriver at the base of the steering wheel escutcheon, lever the escutcheon upwards and remove the escutcheon plate from the steering wheel.



View of the combination switch removed from the vehicle.

(3) Remove the steering wheel retaining nut and washer. Suitably mark the steering shaft and the steering wheel boss with quick drying paint to aid assembly and using a puller, remove the steering wheel.

NOTE: It is imperative that a puller be used, as a sharp blow can cause irrepairable damage to the steering column.

(4) Remove the screws retaining the lower facia panel and remove the facia panel.

(5) Remove the shroud retaining screws and remove the lower shroud from the column.

(6) Disconnect the electrical connectors to the combination switch.

(7) Remove the screws retaining the combination switch to the steering column and withdraw the switch from the column.

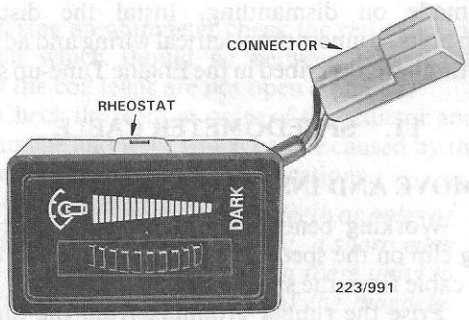
Installation is a reversal of the removal procedure.

INSTRUMENT LAMP RHEOSTAT

To Remove and Instal

(1) Disconnect the negative battery terminal.

(2) Working inside the vehicle, prise the top of the instrument lamp rheostat away from the instrument cluster facia panel with a small screwdriver.



View of the instrument lamp rheostat.

(3) Withdraw the instrument lamp rheostat far enough to disconnect the electrical connector.

(4) Disconnect the electrical connector and remove the rheostat.

Installation is a reversal of the removal procedure.

REAR WINDOW DEMISTER SWITCH

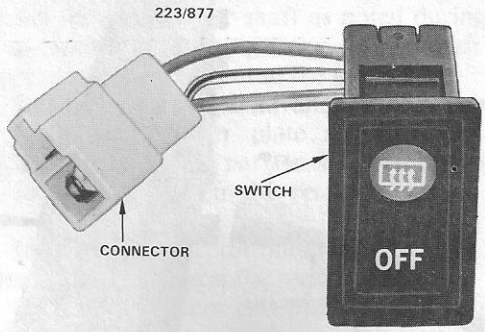
To Remove and Instal

(1) Disconnect the negative battery terminal.

(2) Remove the rear section of the centre console as described in the Body section.

(3) Disconnect the rear window demister electrical connector and push the switch out of the console.

Installation is a reversal of the removal procedure.

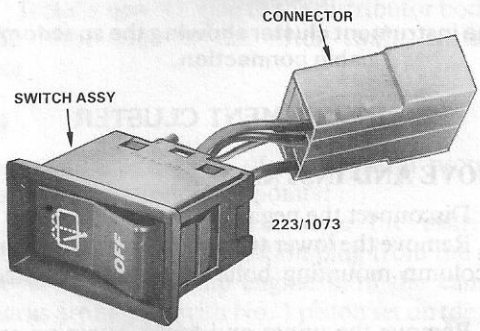


View of the rear window demister switch.

REAR WINDOW WIPER/WASHER SWITCH

To Remove and Instal

(1) Disconnect the negative battery terminal.



View of the rear window wiper/washer switch. Station Wagon.

(2) Remove the rear section of the centre console as described in the Body section.

(3) Disconnect the electrical connector and push the wiper/washer switch out of the console.

Installation is a reversal of the removal procedure.

STOP LAMP SWITCH

To Adjust

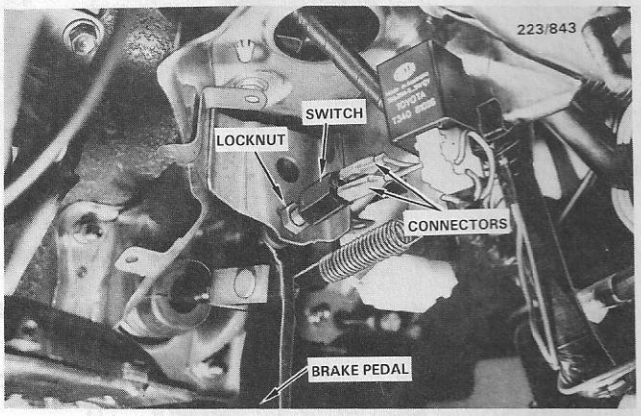
(1) Disconnect the switch wiring at the switch.

(2) Loosen the locknut and back off the switch a few turns to ensure that the brake pedal is fully released.

(3) Turn the switch until the plunger is fully depressed and tighten the locknut.

(4) Depress the brake pedal and ensure that there is a gap between the pedal and the switch plunger.

(5) Connect the wiring to the switch and test the operation of the stop lamps.



Installed view of the stop lamp switch.

To Test

NOTE: Before any attempt is made to test the switch, check the switch adjustment as previously described

If the stop lamps do not light when the brake pedal is depressed and the ignition is switched on, disconnect the wiring at the switch and connect a bridging wire between the two harness wires. If the stop lamps now operate when the ignition is switched on, the switch is faulty and should be renewed. If the stop lamps do not operate, check the stop lamp bulbs and wiring.

To Renew

(1) Disconnect the wiring at the switch.

(2) Loosen the locknut and unscrew the switch from the mounting bracket.

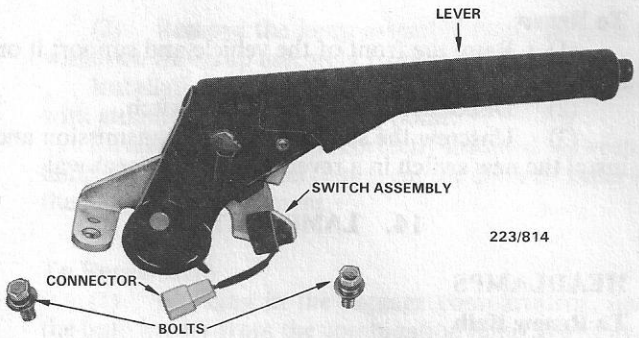
(3) Instal the new switch and adjust it as previously described.

HANDBRAKE WARNING LAMP SWITCH

To Renew

(1) Disconnect the negative battery terminal.

(2) Remove the rear section of the centre console as described in the Body section.



Dismantled view of the handbrake lever assembly showing the warning lamp switch.

(3) Disconnect the switch wiring at the connector.

(4) Remove the switch retaining bolt and remove the switch.

Instal the new switch in a reverse manner to removal.

COURTESY LAMP DOOR SWITCH

To Test

(1) Ensure that the switch on the courtesy lamp is in the DOOR position.

(2) Prise the rubber stop from the door pillar and unscrew the door switch from the pillar.

(3) Check that the switch button slides freely in and out of the switch body.

(4) Connect the switch wire to a suitable body earth. If the lamp lights, the switch is faulty and should be renewed.

To Renew

(1) Ensure that the switch on the courtesy lamp is in the OFF position.

(2) Prise the rubber stop from the door pillar and unscrew the door switch from the pillar.

(3) Disconnect the wiring from the switch.

Installation of the new switch is a reversal of the removal procedure.

REVERSE LAMP SWITCH

To Test

NOTE: On vehicles fitted with automatic transmission a combined neutral safety and reverse lamp switch is fitted. Testing and renewal procedures are detailed in the Automatic Transmission section. On vehicles fitted with Manual Transmission proceed as follow:

(1) Raise the front of the vehicle and support it on chassis stands.

(2) Disconnect the wiring at the switch.

(3) Connect a bridging wire between the two disconnected wires and switch on the ignition.

(4) If the reverse lamps now light the switch is faulty and should be renewed. If the reverse lamps do not light, check the wiring and the reverse lamp bulbs.

To Renew

(1) Raise the front of the vehicle and support it on chassis stand.

(2) Disconnect the wiring at the switch.

(3) Unscrew the switch from the transmission and instal the new switch in a reverse manner to removal.

14. LAMP UNITS

HEADLAMPS

To Renew Bulb

(1) Working behind the headlamp, pull back the rubber boot and disconnect the bulb retaining clip.

(2) Withdraw the headlamp bulb and carefully disconnect the headlamp wiring connector.

NOTE: Care must be taken not to handle the glass portion of the headlamp bulb as this will shorten the life of the bulb. Any accidental marks placed on the bulb may be removed by applying methylated spirits on the bulb and drying with a clean tissue or cloth.

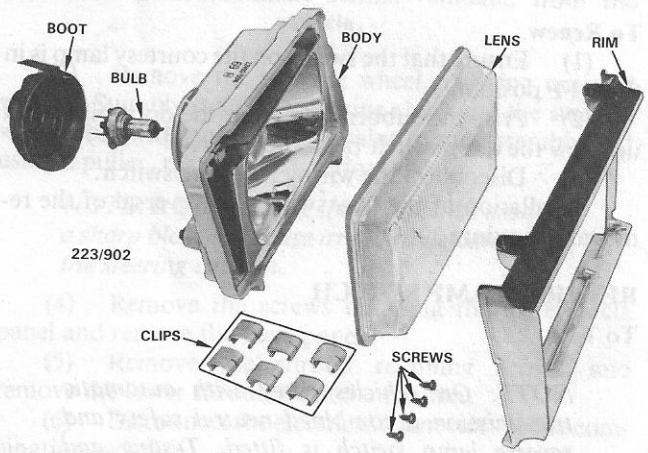
Installation is a reversal of the removal procedure.

To Remove and Instal

(1) Remove the headlamp bulb as previously described.

(2) Remove the bolts retaining the headlamp to the mounting brackets and remove the headlamp assembly.

(3) Remove the headlamp rim retaining screws and remove the headlamp rim.



Dismantled view of the headlamp assembly.

(4) Noting their installed positions, remove the retaining clips securing the headlamp lens to the headlamp body and remove the lens if required.

Installation is a reversal of the removal procedure.

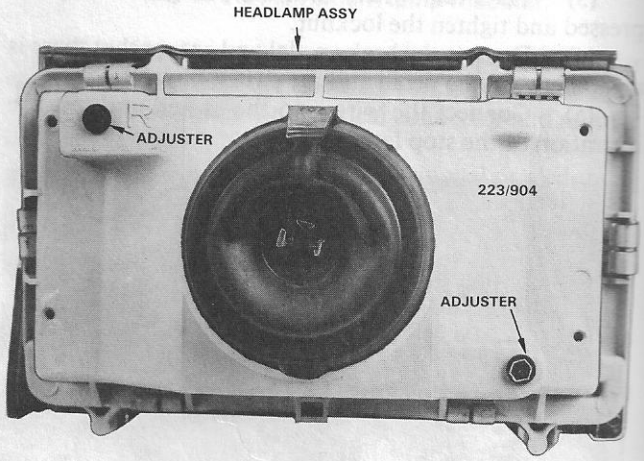
To Adjust

(1) Check that the tyre pressures are correct and that there is no undue weight in the rear of the vehicle, unless of course you are going on a trip and the vehicle lamps need to be lowered in order to make allowances for the added weight in the rear of the vehicle.

(2) Position the vehicle in relation to the testing equipment being used, i.e. headlamp tester or aiming board, paying particular attention to the equipment instructions.

(3) Turn on the headlamps, ensuring that they are on high beam.

NOTE: If a headlamp aiming board is being used, cover one headlamp while adjusting the other so that the beam pattern from the lamp being adjusted will not be confused with that of the other lamp.



Rear view of headlamp assembly showing adjustment points.

(4) To raise or lower the headlamp beam the top adjusting screw is used.

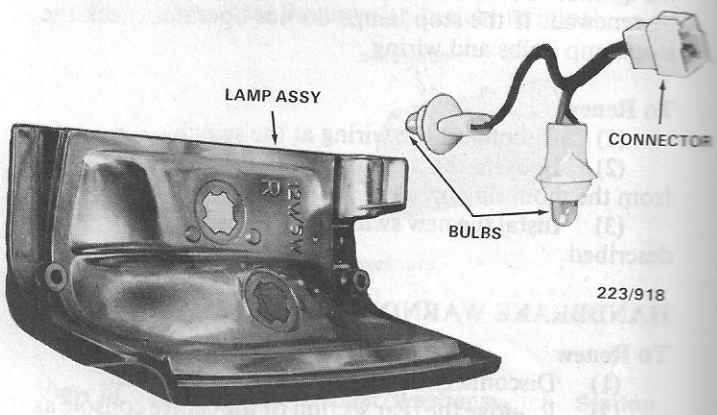
(5) To move the beam to the right or left, the lower adjusting screw is used.

NOTE: Reference should be made to the local regulations governing headlamp focus and the lamps should be focused accordingly.

FRONT COMBINATION LAMP

To Remove and Instal

(1) Working behind the front combination lamp, disconnect the electrical wiring at the connector.



Dismantled view of the front combination lamp.

(2) Remove the combination lamp retaining screws and withdraw the combination lamp.

Installation is a reversal of the removal procedure.

To Renew Bulb

(1) Remove the combination lamp as previously described.

(2) Twist the bulb holder and remove the bulb holder. Grip and pull the bulb from the bulb holder.

Installation is a reversal of the removal procedure.

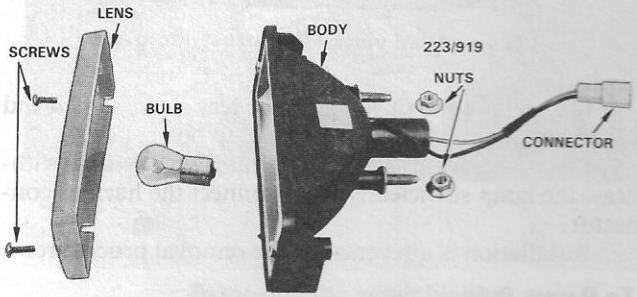
FRONT TURN SIGNAL LAMP

To Remove and Instal

(1) Working behind the lamp, disconnect the electrical wiring at the connector.

(2) Remove the turn signal lamp retaining nuts and withdraw the lamp.

Installation is a reversal of the removal procedure.



Dismantled view of the front turn signal lamp.

To Renew Bulb

(1) Remove the screws retaining the turn signal lamp lens.

(2) Grip and turn the bulb holder anticlockwise and remove the bulb holder from the lamp assembly.

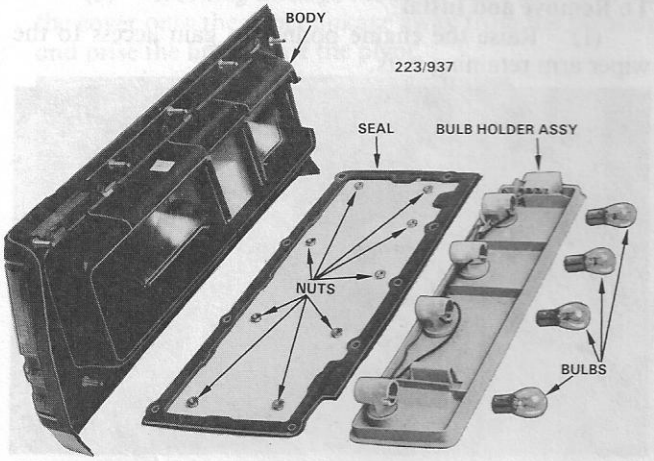
(3) Grip the bulb and pull it from the bulb holder.

Installation is a reversal of the removal procedure.

REAR COMBINATION LAMP — SEDAN

To Remove and Instal

(1) Working in the luggage compartment, disconnet the wiring at the connector.



Dismantled view of the rear combination lamp. Sedan.

(2) Remove the lamp assembly retaining nuts and withdraw the lamp assembly from the vehicle.

Installation is a reversal of the removal procedure with attention to the following point:

Ensure that the seal is correctly installed between the lamp and the rear panel to prevent the entry of water into the luggage compartment.

To Renew Bulb

(1) Working in the luggage compartment, unclip the bulb holder from the combination lamp assembly.

(2) Grip the relevant bulb, push it in, turn it anticlockwise and withdraw it from the bulb holder.

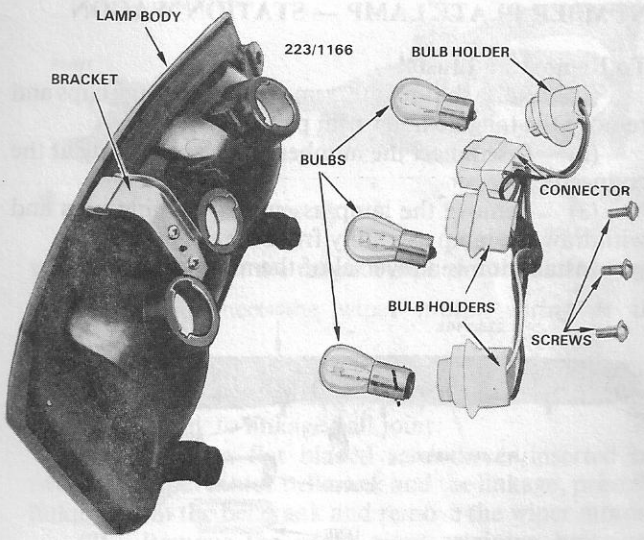
Installation is a reversal of the removal procedure.

REAR COMBINATION LAMP–STATION WAGON

To Remove and Instal

(1) Remove the combination lamp retaining screws.

(2) Withdraw the inner edge of the lamp unit away from the body sufficiently to gain access to the wiring connector and disconnect the connector.



Dismantled view of the rear combination lamp. Station Wagon.

(3) Loosen the screw securing the lamp retaining bracket to the lamp body and remove the lamp assembly.

Installation is a reversal of the removal procedure with attention to the following point:

Ensure that the seal between the body and the lamp is not damaged.

To Renew Bulb

(1) Remove the combination lamp retaining screws.

(2) Withdraw the inner edge of the lamp away from the body to gain access to the bulbs.

(3) Grip the relevant bulb, push it in, turn it anticlockwise and remove the bulb from the lamp assembly.

Installation is a reversal of the removal procedure.

NUMBER PLATE LAMP — SEDAN

To Remove and Instal

(1) Disconnect the number plate lamp wiring at the connector.

(2) Remove the retaining screws and withdraw the lamp from the bumper bar.

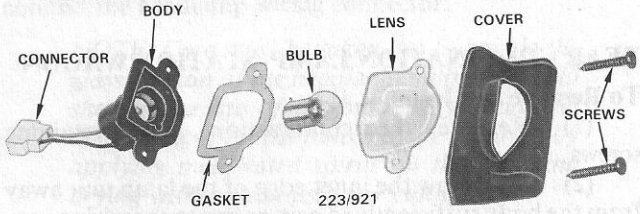
Installation is a reversal of the removal procedure.

To Renew Bulb

(1) Remove the retaining screws and remove the number plate lamp lens.

(2) Grip the bulb, push it in, turn it anticlockwise and withdraw the bulb from the bulb holder.

Installation is a reversal of the removal procedure.



Dismantled view of the number plate lamp. Sedan

NUMBER PLATE LAMP — STATION WAGON

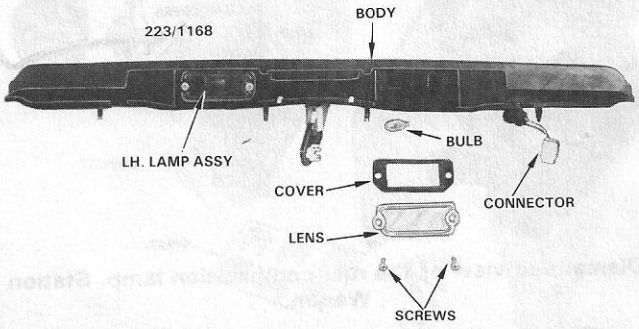
To Remove and Instal

(1) Raise the tailgate, remove the retaining clips and remove the tailgate inner trim panel.

(2) Disconnect the number plate lamp wiring at the connector.

(3) Remove the lamp assembly retaining nuts and withdraw the lamp assembly from the tailgate.

Installation is a reversal of the removal procedure.



Dismantled view of the number plate lamp. Station Wagon.

To Renew Bulb

(1) Remove the number plate lamp lens cover retaining screws and remove the lens cover and lens.

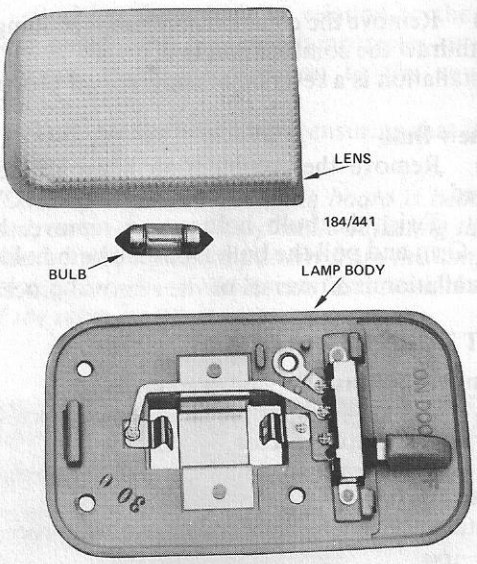
(2) Grip the bulb, push it in, turn it anticlockwise and remove it from the bulb holder.

(3) Ensure that the bulb holder is free from corrosion and instal the new bulb in a reverse manner to removal.

COURTESY LAMP

To Remove and Instal

(1) Ensure that the switch is in the OFF position.



Dismantled view of courtesy lamp.

(2) Using the fingers grip the lens at the switch end of the lamp and prise it from the lamp body.

(3) Remove the lamp retaining screws and withdraw the lamp sufficiently to disconnect the harness connector.

Installation is a reversal of the removal procedure.

To Renew Bulb

(1) Ensure that the switch is in the OFF position.

(2) Using the fingers grip the lens at the switch end of the lamp and prise it from the lamp body.

(3) Grip the bulb, push back one of the bulb contacts and remove the bulb.

(4) Instal the new bulb in a reverse manner to removal ensuring that the bulb contacts hold the bulb with enough tension to provide a good electrical contact.

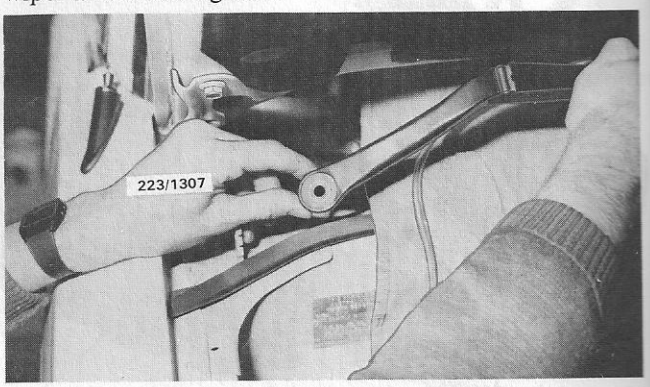
(5) Instal the lens to the lamp body.

15. WIPER MOTORS AND ARMS

WINDSCREEN WIPER ARMS

To Remove and Instal

(1) Raise the engine bonnet to gain access to the wiper arm retaining nuts.



Removing the wiper arm.

(2) Remove the nut retaining the arm to the pivot shaft.

(3) Carefully prise the wiper arm from the pivot shaft taking care not to damage the paintwork.

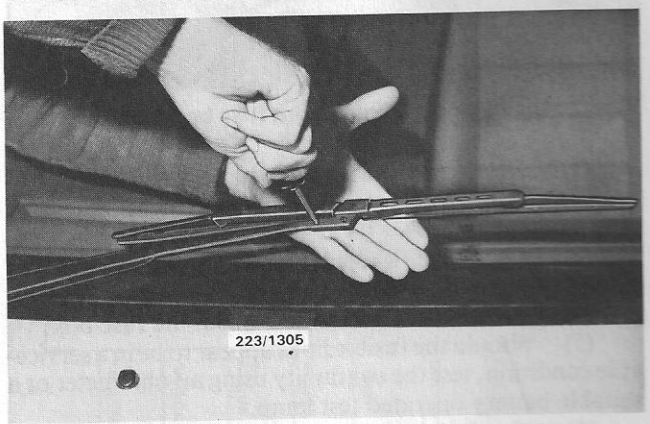
Installation is a reversal of the removal procedure with attention to the following point:

With the wipers in the park position the wiper blades should be 50 mm from the lower windscreen moulding.

WINDSCREEN WIPER BLADES

To Remove and Instal

(1) Pull the wiper arm and blade away from the windscreen until it locks in the vertical position.



Removing the wiper blade.

(2) Remove the screws retaining the wiper blade and withdraw the wiper blade from the wiper arm.

Installation is a reversal of the removal procedure ensuring that the blade is fully home before releasing the retaining clip.

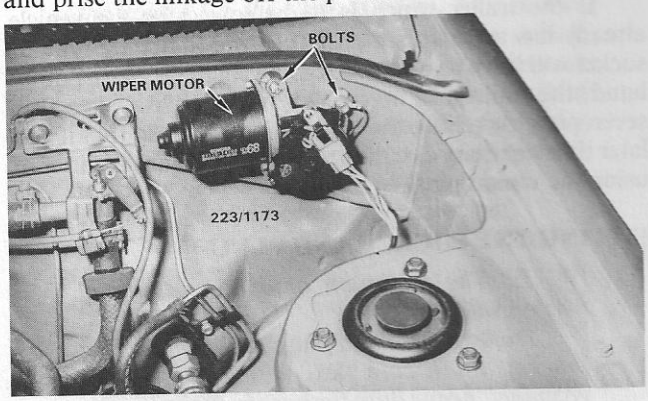
WINDSCREEN WIPER MOTOR AND LINKAGE

To Remove and Instal

(1) Remove the wiper arms as previously described.

(2) Remove the clips securing the cover plate situated near the left hand side wiper arm and remove the cover plate to gain access to the wiper linkage.

(3) Working through the cover plate aperture, slide the cover onto the wiper linkage away from the pivot ball and prise the linkage off the pivot.



Installed view of the wiper motor.

(4) Disconnect the wiper motor electrical wiring at the connector.

(5) Remove the wiper motor retaining bolts and manoevre the wiper motor and linkage from the aperture to gain access to the pivot. Slide the cover onto the wiper linkage, carefully prise the linkage from the pivot ball and remove the wiper motor from the vehicle.

(6) Withdraw the linkage from the aperture.

Installation is a reversal of the removal proceudre.

TAILGATE WIPER MOTOR AND LINKAGE

To Remove and Instal

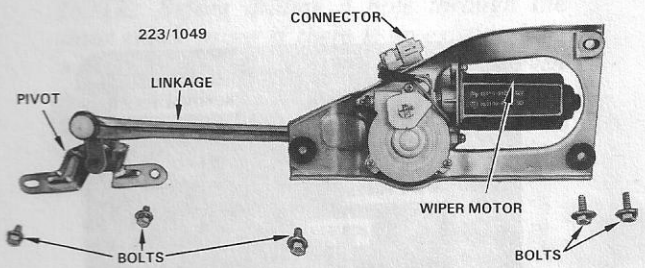
(1) Raise the cover on the wiper arm to gain access to the retaining nut.

(2) Remove the nut retaining the arm to the pivot shaft.

(3) Carefully prise the wiper arm from the pivot shaft taking care not to damage the paintwork.

(4) Remove the pivot shaft outer seal, retaining nut, washer and inner seal.

(5) Raise the tailgate, remove the inner trim panel retaining clips and remove the trim panel from the tailgate.



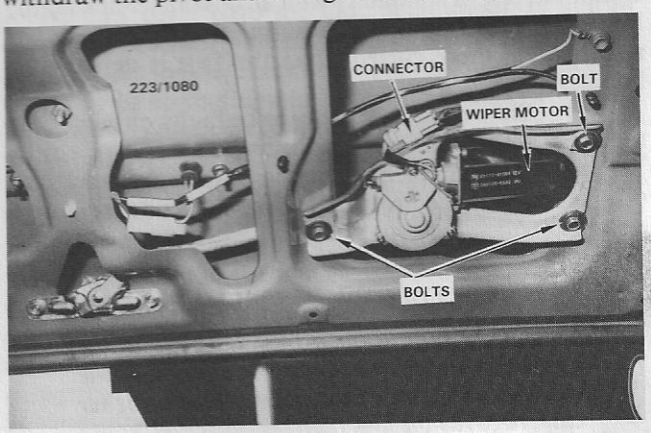
Dismantled view of the tailgate wiper motor and linkage.

(6) Disconnect the wiper motor wiring at the connector.

(7) Remove the wiper motor retaining bolts and withdraw the motor sufficiently to gain access to the wiper motor bellcrank to linkage ball joint.

(8) Using a flat bladed screwdriver inserted be tween the wiper motor bellcrank and the linkage, prise the linkage from the bellcrank and remove the wiper motor.

(9) Remove the wiper pivot retaining bolts and withdraw the pivot and linkage from the tailgate.



Installed view of the tailgate wiper motor.

Installation is a reversal of the removal procedure with attention to the following point:

With the wiper in the park position the wiper blade should be 25 mm from the rear window lower weatherseal.

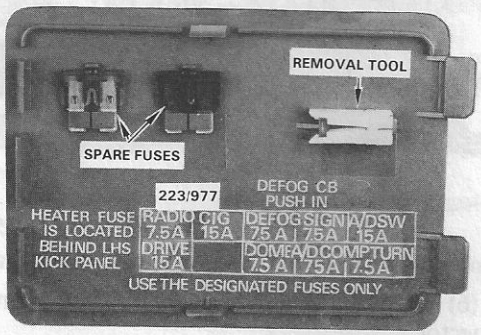
16. FUSES AND FUSIBLE LINKS

TO CHECK AND RENEW FUSE

NOTE: Two fuse boxes are fitted to this range of vehicles. One is located in the right hand side kick panel. The other is located in the engine compartment near the battery. If a fuse is found to be faulty or burnt out use a replacement fuse of the specified amperage only. The use of a higher amperage fuse than that specified could cause damage to the vehicle wiring harness.

(1) Remove the cover from the fuse box and using the chart printed on the cover locate the fuse protecting the circuit at fault.

(2) Prise the fuse from its terminals and visually inspect if for serviceability.



View of the right hand kick panel fuse box cover showing fuse locations.

NOTE: A fuse removal tool and spare fuses are attached to the fuse box cover in the right hand side kick panel.

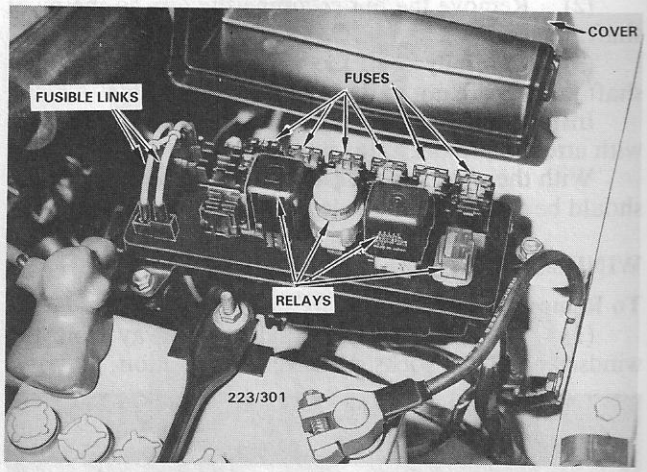
(3) Should the fuse appear to be in a serviceable condition, test its continuity with an ohmmeter or suitable battery operated test lamp, ensuring that the test lamp is not drawing more current than the fuse is designed to handle.

(4) Should the fuse prove to be faulty or burnt out, replace it with a fuse of the same amperage.

(5) If the circuit is still inoperative or the fuse burns out again, refer the problem to a competent automotive electrician.

TO CHECK AND RENEW FUSIBLE LINK

NOTE: If a fusible link is found to be faulty or burnt out, use a replacement fusible link of the specified amperage only. The use of a higher amperage fusible link than that specified could cause damage to the vehicle wiring harness.



View of the engine compartment fuse box with the cover removed.

(1) Disconnect the negative battery terminal.

(2) Remove the engine compartment fuse box cover.

(3) Check the fusible links visually for any signs of being burnt out.

(4) Remove the fusible links from the fuse box.

(5) Should the fusible links appear to be in a serviceable condition, test the continuity using an ohmmeter or a suitable battery operated test lamp.

(6) If a fusible link proves to be faulty, fit a new fusible link and have an assistant temporarily connect the battery while the circuit is checked for operation.

(7) If the circuit is still inoperative or the fusible link burns out again, refer the problem to a competent automotive electrician.

17. HOW TO WIRE UP A TRAILER

There are many different brands of trailer electrical combination plugs and sockets on the market. Some makes can even be obtained with a varying number of circuit pin connections. Most manufacturers however, now choose to market the seven pin variety only. The seven pin plug and socket provides for two auxiliary circuits and in caravan use these are usually used for the 12 volt interior lights and the electric brakes.

If the trailer which is to be towed by the vehicle already has a connector plug then the matching type of socket will have to be fitted to the vehicle. If on the other hand, the trailer has no plug then it is advisable to fit a seven pin type unit to the vehicle and trailer so that if at a later time auxiliary circuits are needed it is only a matter of using the vacant pins.

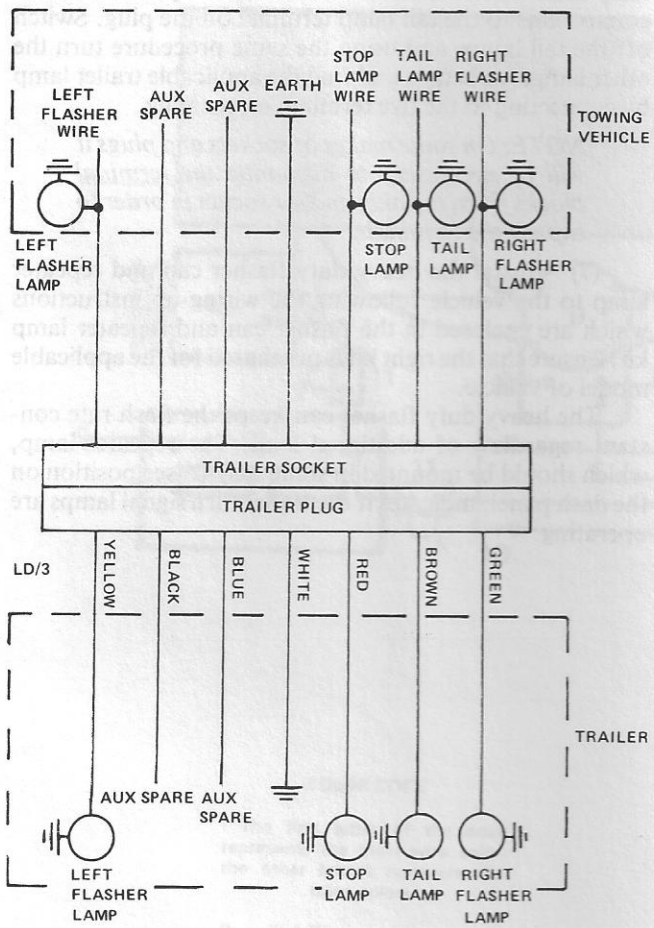
FITTING THE SOCKET AND PLUG

NOTE: The minimum amount of material needed will be:

Trailer socket and plug, socket mounting bracket, multi core flex, wiring connectors, grommet, heavy duty flasher can with repeater lamp.

(1) Disconnect the negative battery terminal.

(2) Locate the main wiring harness at the rear of the vehicle and using the length of multicore flex, cut if necessary and tap into the right flasher wire, left flasher wire, tail lamp, stop lamp wire and an earth wire. Use insulated connectors when tapping into the wires.



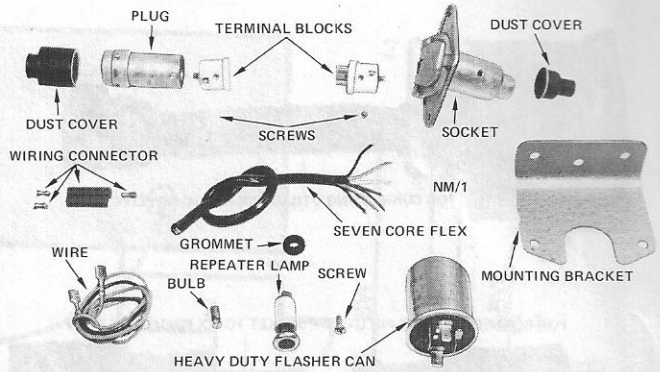
Typical diagram for wiring up a trailer.

NOTE: To determine which color wire on the vehicle is for each particular rear lamp refer to the wiring diagram in this section which shows the colors for the various wires. Ensure that the right diagram for the applicable vehicle model is used. When tapping into the rear wires on the vehicle conform to the standard caravan color coding by mating the right color wire of the multi core flex to its applicable lamp or earth wire on the vehicle. The standard caravan coding is as follows:

Left flasher ..... Yellow
Right flasher ..... Green
Stop lamp ..... Red
Tail lamp ..... Brown
Earth ..... White
Auxiliary spare ..... Blue
Auxiliary spare ..... Black

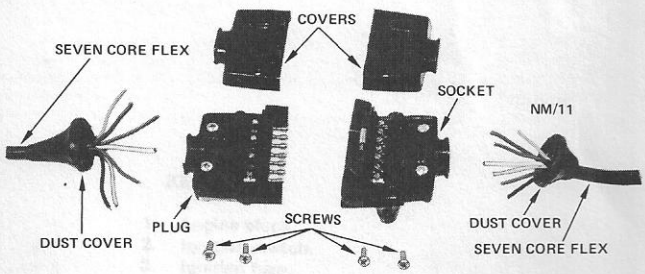
This color coding has nothing to do with the wiring on the vehicle. It is only for the caravan or trailer wiring.

(3) Drill a suitable sized hole through the vehicle floor, fit a rubber grommet and push through the multi core flex.



Minimum material needed for wiring up a trailer. Utilux trailer socket and plug shown.

NOTE: Before drilling a hole through the floor check to see if there is an existing hole which will take the multicore flex. It may even be convenient to use the number plate lamp wire hole. Whichever hole is used ensure that a rubber grommet is fitted to prevent the wires from chafing.



The Brylite seven pin trailer plug and socket.

(4) Cut the multicore flex to length and slide the socket dust cover onto the flex. Strip about 15 mm of covering from each wire and connect the wires to the terminals of the socket. Ensure that each colored wire is connected to its correct terminal. On the brands of sockets where the terminals are only numbered it will be necessary to refer to the instruction sheet which comes with the unit to find out the correct circuit connection for each pin number.

(5) After wiring up and reassembling the socket mount the socket to the rear of the vehicle. Try to mount the socket as near as possible to the tow bar ball and high enough to prevent damage to the socket if the rear of the vehicle happens to scrape on driveways, etc. On brands of socket that do not have an in-built mounting bracket it will be necessary to make up a mounting bracket or use the optional mounting bracket for that particular socket.