PULSAR

N13 Series

ASTRA

LD Series

1.6 and 1.8 Liter

1987 – 1991

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INTRODUCTION

This Service and Repair Manual covers the Australian manufactured Nissan Pulsar (hatchback) and Vector (sedan) N13 Series 1987 - 91 and the Holden Astra LD Series 1987 - 89.

Two engines were available: a 1.8 liter engine with multi-point fuel injection, and a 1.6 liter throttle body injected engine. The engines are similar having single overhead camshafts and computer controlled fuel injection and ignition control. There was a choice of three speed automatic or five speed manual transaxles.

A viscous coupling limited slip differential was introduced from July 1989 to the five speed manual transaxle models of the Pulsar Q and Vector SSS.

Disc brakes are fitted at the front of all models, while the rear brakes are either discs or drums.

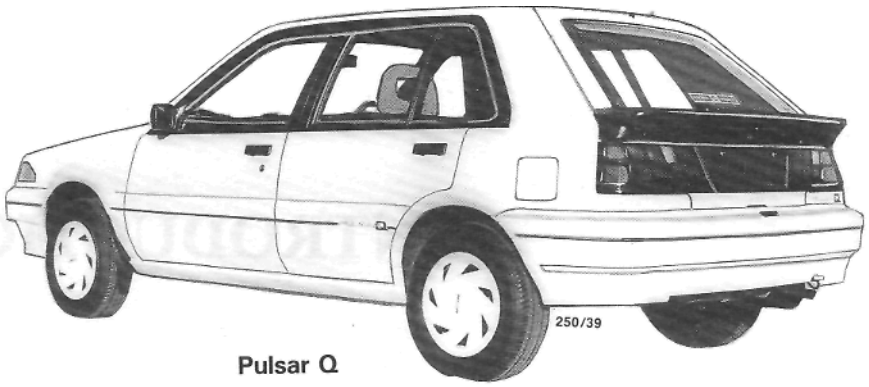
All models are equipped with independent coil spring suspension. Steering can be by either manual or power assisted rack and pinion.

This manual includes information on trouble shooting, lubrication and maintenance, specifications and the removal, installation and overhaul of components which are considered to be within the scope of the average, well equipped home mechanic.

Certain repair jobs covered in this manual require the use of special equipment not normally found in a home tool kit. When such equipment is required, the equipment and its function is brought to the users attention underneath the heading for that component. Some jobs, such as automatic transmission overhaul, should he left to an authorized dealer or a specialist who has the extensive knowledge and equipment required. In these cases, the removal and installation procedures are fully covered, enabling the unit to be removed for repair or a reconditioned unit to be installed.

Reference in the manual to the left and right hand sides of the vehicle are from the point of view of someone standing at the back of the vehicle and looking forward.

Inexperienced operators should not attempt a service or repair operation before completely reading the appropriate section (or other sections which may be referred to) in the manual.



Pulsar Q

Pulsar Q

Vector GL

Vector GL

VEHICLE IDENTIFICATION AND GENERAL SPECIFICATIONS

1. VEHICLE IDENTIFICATION

When purchasing spare parts or when registering or insuring a vehicle, it may be necessary to quote various vehicle identification codes. The location of these codes are as follows:

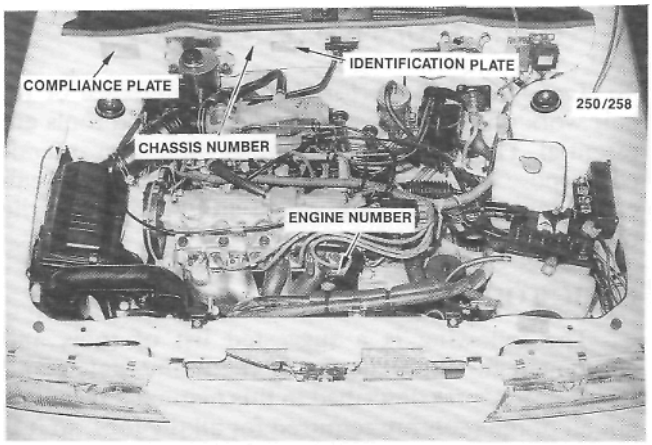
The Engine Number is stamped on the front face of the engine block below No. 4 spark plug.

The Chassis Number is stamped on the bulkhead above and to the right of the brake booster.

The Vehicle Identification Plate is located on the bulkhead to the left of the MAP sensor and contains codings relating to body style, engine capacity, model, transaxle type, engine number, paint, trim and build date.

The Compliance Plate contains information on the vehicle make, model, month and year of manufacture, chassis number, seating, capacity and the Australian Design Rules (ADR) with which the vehicle complies. This plate is affixed to the bulkhead above and to the left of the brake booster.

The Tire Placard, which is located on the inside of the glove compartment, contains information on the tire size, rim size, tire pressure and load ratings.



View of the engine compartment showing the location of various vehicle identification information.

2. GENERAL VEHICLE SPECIFICATIONS

Length:	
Pulsar	4 030 mm
Astra hatchback	4 035 mm
Vector	4215 mm
Astra sedan	4 255 mm
Width:	
Nissan	1 640 mm
Holden	1 655 mm
Height	1 380 mm
Wheelbase	2 430 mm
Wheel track:	
Front	1 435 mm
Rear	I 430 mm
Minimum ground clearance:	
Nissan	128 mm
Holden	110 mm
Turning circle kerb to kerb	10.8 m
Fuel tank capacity:	
Nissan	47 liters
Holden	50 liters
Towing capacity:	
Without trailer brakes	400 kg
With trailer brakes	900 kg

*Fuel consumption:

	L/100km (City)	L/100km (Highway)
Manual transaxle	8.5	6.6
Automatic transaxle	9.0	7.2

*The fuel consumption information is based on tests made according to Australian Standard 2877. The actual fuel consumption will depend on many factors including driving habits, vehicle condition and equipment and the prevailing conditions.

GENERAL INFORMATION

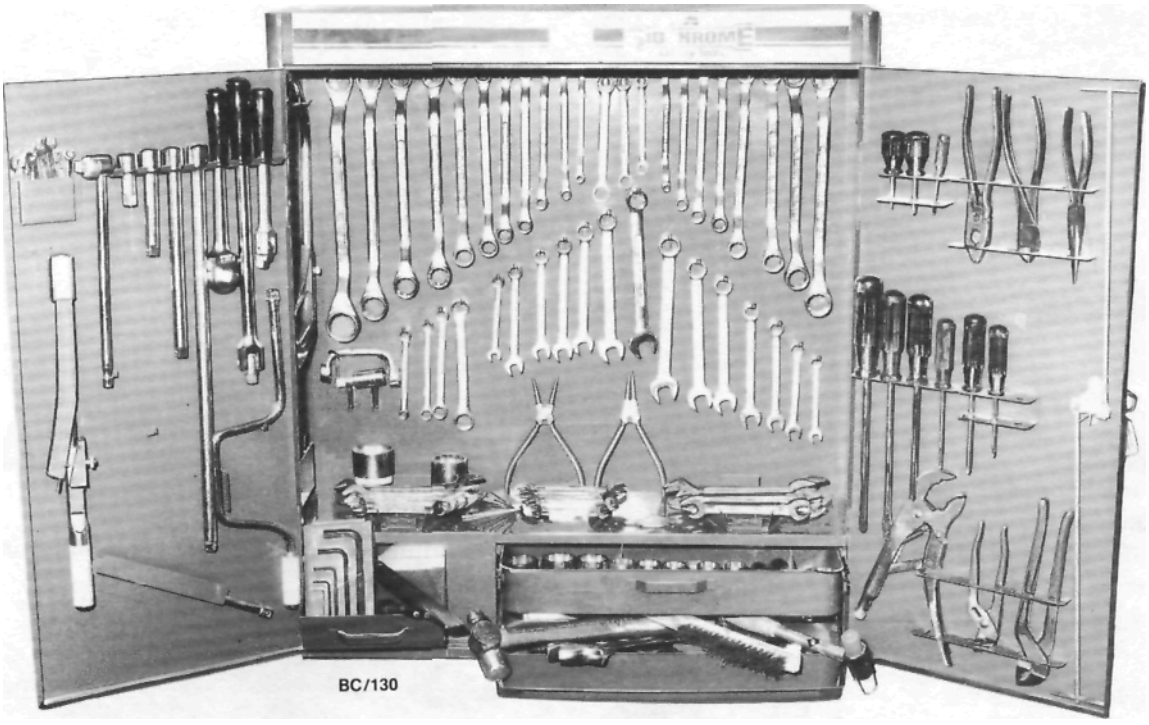
1. TOOLS AND EQUIPMENT

To successfully perform any maintenance or repair work on a motor vehicle, suitable hand tools are essential. The use of tools for other than their intended purpose or the use of incorrectly fitting tools can cause damage to the component and/or injury lo the operator.

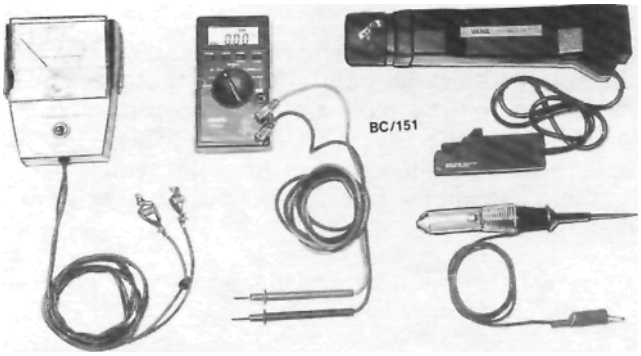
BASIC TOOL KIT

The following is a suggested list of tools and equipment for the majority of the maintenance and repair procedures described in this manual. Of course, not all of the tools are required for all the jobs, so it is wise to purchase tools on an 'as needed' basis.

Set of open ended spanners.
Set of ring spanners.
Set of socket spanners.
Spark plug spanner.
Assorted bladed screwdrivers.
Assorted Philips screwdrivers.
Assorted pliers — combination, long nose, multi-grip, vice grip, snap ring (internal and external).
Assorted adjustable spanners.
Ball pein hammer.
Cold chisels.
Pin punches and centre punch.
Assorted files.
Scraper.
Feeler gauges.
Torque wrench.
Hydraulic jack.
Chassis stands.
Car ramps.
Grease gun.
Oil can.
Oil gun.
Oil filter removal tool.
Funnel.
Containers for draining oil and washing components.



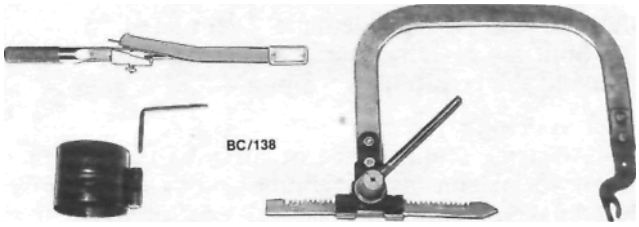
A comprehensive tool kit showing a wide range of general hand tools.



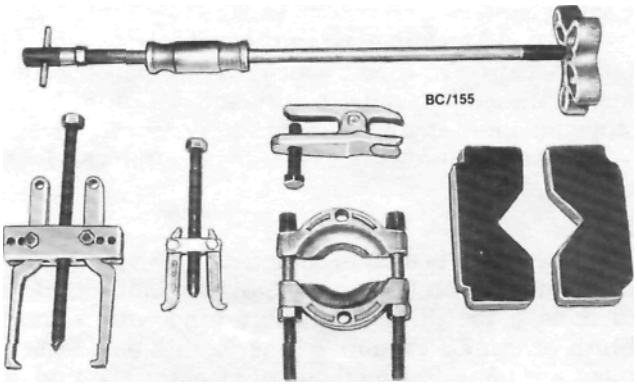
Assorted test equipment — dwell tachometer, digital multimeter, timing light and test lamp.

Inspection lamp.
Test lamp.
Tachometer.
Timing light.
Digital multimeter.
Piston ring compressor.
Valve spring compressor.
Micrometer — inside, outside, multi range.
Vernier calipers.
Assorted pullers.

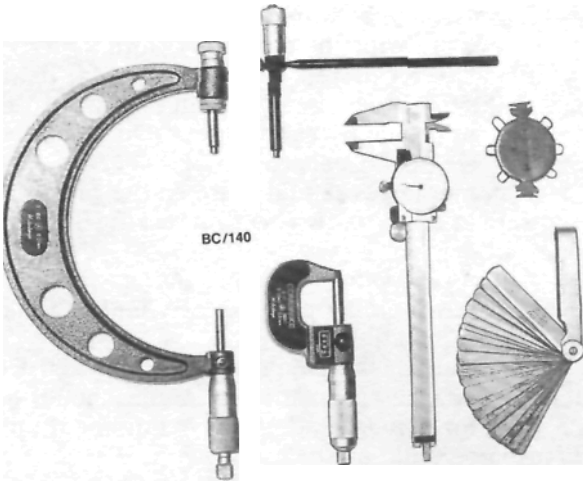
When purchasing tools, it is sound advice to select the highest quality that can be afforded, as the working life of cheaper tools is often very short.



Tension wrench, piston ring compressor and valve spring compressor.



Slide hammer, ball joint puller, assorted pullers and press plates.



Assorted measuring devices — inside and outside micrometers, vernier calipers, wire gauges and feeler gauges.

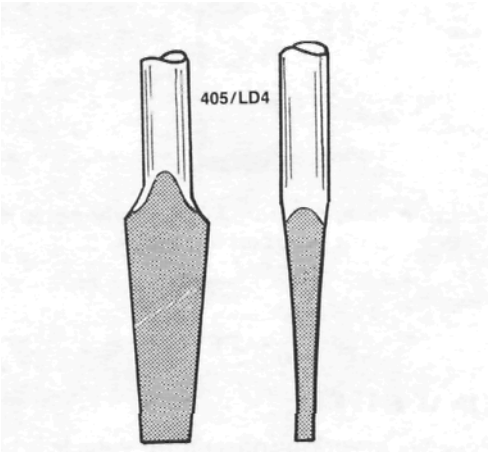
Ensure that the tools are suitable for the system of bolt and nut sizing on the vehicle. The range of vehicles covered by this manual use metric sizes.

TOOL CARE

To ensure the longest possible life for hand tools, it is important that time be spent maintaining them.

At the conclusion of each job. all tools used should be washed thoroughly in kerosene or similar cleaning solvent. Ensure that all dirt and grease is removed, particularly from tools with moving parts such as pliers and adjustable spanners. The tools should then be wiped dry with a clean cloth.

Measuring devices should be given particular attention as their accuracy can be affected if not properly maintained. Feeler gauges should be kept clean at all times and the blades should be wiped with an oily cloth after use to prevent rusting.



Views showing the correct tip profiles for a bladed screwdriver. Bladed screwdrivers should not be ground to a sharp point.

If tools are to be stored for any length of time, it is good policy to wipe them with an oily cloth.

Bladed screwdrivers should be checked for damage to the tip. If necessary, the tip can be returned to its original profile by careful grinding. Do not grind screwdriver tips to a sharp point.

Hammer heads should be secure on their handles and should be regularly checked for cracking or other damage.

Chisels and punches should be checked for damage or 'mushrooming' of the head. Any faults should be rectified by grinding.

Hydraulic jacks should be regularly checked for fluid leaks. Chassis stands and car ramps should be checked for damage and cracks. Any equipment that is suspect should not be used.

STORES

For routine maintenance, stores of automotive oils, greases and additives should be kept on hand. The following is a suggested list.

Engine oil.
Brake fluid.
Manual transmission or automatic transmission oil — automatic transmission oil is also used in the power steering system.
Rear axle oil.
Cooling system corrosion inhibitor/antifreeze.
Chassis grease.
High melting point grease, for hub bearings etc.
Penetrating oil or spray.
Kerosene or similar cleaning solvent.
Methylated spirits.

Oils and greases are available in handy pack size for do-it-yourself lube jobs.

2. SAFETY

PERSONAL SAFETY

Safety when working on a motor vehicle is basically a matter of commonsense. Some safety precautions to prevent personal injuries are as follows.

Raising a Vehicle

Always jack a vehicle on firm, level ground and at the specified jacking points. Ensure that the wheels remaining on the ground are fully chocked.

After raising the vehicle, place chassis stands underneath and allow the weight of the vehicle to rest on them. Do not use bricks, blocks of wood or similar material.

NOTE: Never work under a vehicle which is only supported by a jack.

Electrical System

Always disconnect the negative battery terminal when working on any electrical components. Avoid wearing metal watches, rings and chains which may short across live terminals.

As battery gases are explosive, keep naked flames and sparks clear of the work area. When connecting and disconnecting jumper leads, use extreme caution to avoid sparking.

Electronic Ignition Systems

Electronic ignition systems produce dangerous high tension voltages in both the primary and secondary circuits which can be fatal. Exercise extreme caution when working on or near any ignition system components. Do not disconnect high tension leads while the engine is running.

Work Area

Do not run the engine in a confined space. Ensure that the work area is adequately ventilated.

Spilt oil or water should be cleaned immediately to avoid the possibility of slipping.

Fuel System

Always disconnect the negative battery terminal when working on any fuel components. Do not smoke. Keep naked flames and sparks clear of the work area.

Do not siphon fuel using the mouth. Use a hand pump or suitable siphon.

Do not attempt to repair a fuel tank by welding it. This is an extremely hazardous procedure and should be entrusted to a specialist.

Cooling System

To avoid scalding, use caution when releasing the radiator cap on an engine which is at normal operating temperature. Turn the cap anti-clockwise to the first stop and allow any pressure in the system to release. When the pressure is released, remove the cap from the radiator.

Brakes

As asbestos is used in some brake lining material, avoid inhaling brake dust. Do not use compressed air to remove the dust. Gentle brushing with a small brush or using a vacuum cleaner with a hose attachment are the safest methods of cleaning the brakes. The above precautions also apply to the clutch plate lining material.

Lifting Equipment

When using lifting equipment to lift heavy components such as the engine and/or transmission, use metal slings or chain in preference to rope. If rope must be used, ensure that it is not placed against sharp edges on the component.

Automotive Lubricants and Solvents

Avoid prolonged skin contact with oils, greases and solvents as some can cause skin irritations and dermatitis.

Exercise caution when using cleaning solvents as many are inflammable. Do not smoke. Keep naked flames and sparks clear of the work area.

Compressed Air

Never point an air hose at another person or allow compressed air to blow onto your skin. High pressure air forced against the skin can enter the bloodstream and prove fatal.

Suspension and Steering Components

Damaged suspension and steering components should not be welded. Many of these components are fabricated from toughened metals. If welded they may lose their strength or become brittle. Damaged components should be renewed.

Air Conditioning

Avoid disconnecting air conditioning hoses as escaping refrigerant can cause frostbite. The refrigerant is highly flammable and when burnt, a poisonous gas is produced.

VEHICLE SAFETY

To prevent damage to the vehicle during servicing or repair work, note the following precautions.

Brake Fluid

If spilt on the vehicle paintwork, brake fluid should be immediately washed away with clean water and allowed to dry naturally, not wiped with a cloth.

Catalytic Converter

The following should be observed to prevent damage to the catalytic converter:

Do not operate the vehicle on leaded fuel.

Do not push or tow start the vehicle.

Do not allow the engine to idle for prolonged periods.

Do not switch the ignition off while the vehicle is in motion and the transmission is in gear.

Do not 'prime' the engine by pouring fuel into the inlet manifold.

Do not operate the vehicle if the engine is misfiring.

Avoid running the vehicle out of fuel.

Ensure that the engine oil is formulated to contain low phosphorus levels.

Electronic Components

The electronic components of the ignition and fuel injection systems can be damaged by the use of incorrect testing equipment.

It is essential in all tests where voltage or resistance is to be measured that a digital display multimeter with a minimum 10 megohm input impedance be used.

Some types of tachometers, timing lights and ignition system analyzers are not compatible with certain engine electronic systems. It is therefore recommended that the manufacturer of the test equipment be consulted before using the equipment.

Jump starting, or being jump started by another vehicle can cause damage to the electronic components of the vehicle. Refer to the Roadside Trouble shooting section for the correct jump starting procedure.

3. GENERAL REPAIR PROCEDURES

SEIZED FASTENERS

Seized bolts, nuts or screws should first have **a** liberal amount of penetrating oil applied. The fastener should be left for a period of time to allow the oil to penetrate and soften the corrosion which is causing the binding.

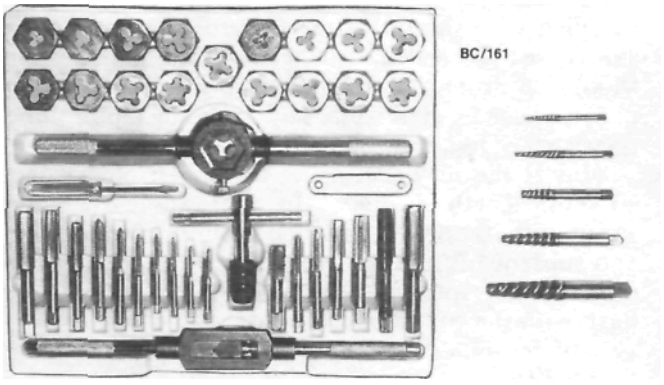
Often, a sharp hammer blow to the head of the fastener can dislodge the corrosion and permit it to be loosened.

An impact driver, which can be fitted with a socket or screwdriver bit, can be used to loosen a seized fastener.

Another method is to heat the component in which the fastener is seized. However, extreme caution should be exercised when heating aluminum alloy components as the melting point is much lower than that of steel.

If the above methods fail to free a seized **nut,** carefully hacksaw through one side of the nut until it can be split. Care should be taken that the threads of the bolt or stud are not damaged.

Should a bolt or stud break below the surface of the component, it will be necessary to use a screw extractor to remove the remaining part. Follow the screw extractor manufacturers instructions.



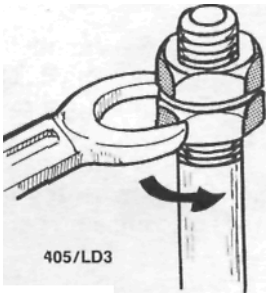
Tap and die set and assorted screw extractors.

Damaged threads can be repaired using a die nut on studs and bolts, and a tap on nuts and threaded holes in castings. If the threads of a threaded hole are damaged beyond repair, it will be necessary to drill and tap the hole to a larger size. Alternatively, a Helicoil insert can be used to Testore the hole to the original thread size.

STUDS

The simplest method for removing studs is to lock two nuts together on the threaded section. The stud should then be able to be removed by applying an unscrewing action to the lower nut.

Alternatively, there are various makes of stud extracting tools available.



Using two nuts locked together to remove a stud.

OIL SEALS

Oil seals can usually be removed by levering out with a flat screwdriver or other suitable lever. Care should be taken not to damage the surface of the component which the seal lip runs on.

Seals can also be removed by inserting a number of self tapping screws into the seal body. The seal can then be withdrawn using pliers gripping the self tapping screws.

Always apply a smear of grease or oil to the seal lip prior to installation to provide initial lubrication.

Unless otherwise stated, oil seals should always be installed with the lip facing inwards or towards the substance to be sealed. During installation, the seal lip should be protected from damage from sharp components such as shaft splines by wrapping tape around the sharp edges.

Install the new seal using a wooden block, or a socket or length of tube of the appropriate diameter. Ensure that the seal is installed squarely or distortion and subsequent leakage may occur. If an installation depth is not specified, the seal should be installed flush with the component surface.

GASKETS

When separating mating components (i.e. cylinder
head and cylinder block), do not insert screwdrivers or similar levers between the components in an attempt to lever them apart. This can cause severe damage to the sealing surfaces, particularly if the components are made of alloy compounds.

The components can be separated by tapping along the joint with a soft faced hammer or piece of wood. Before installing a new gasket, the mating surfaces should be cleaned of all traces of old gasket material and sealant.

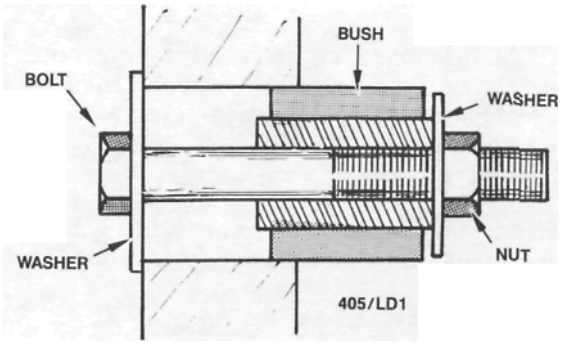
Check that the new gasket is correct by comparing the bolt holes and passages on the component face with the openings in the gasket.

Cork and paper gaskets which have been stored for some time may suffer from shrinkage. This can be rectified by soaking the gasket in water.

BEARINGS AND BUSHES

If the correct equipment is not available when removing and installing bearings and bushes, it is often possible to improvise.

Bearings can often be removed from shafts by tapping alternately on opposite sides with a hammer and drift.

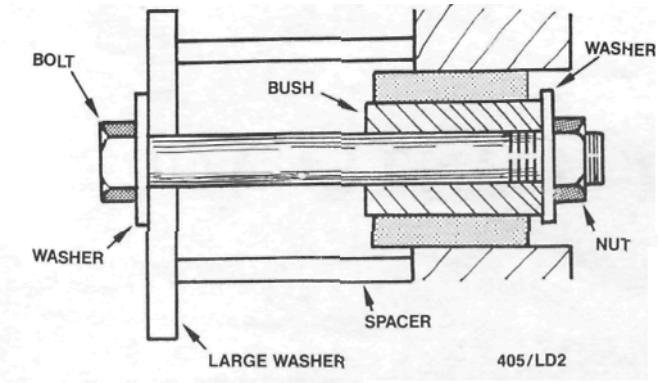


A simple bush installing tool using a bolt, nut and two washers.

If a press is unavailable, bushes can be installed by placing the bush and component between the jaws of a vice and screwing the jaws together until the bush is fully inserted. A vice can also be used to remove bushes by using suitably sized spacers against either vice jaw, one bearing on the bush and the other on the component. This method can also be used with a G clamp.

A simple removing and installing tool can be made using a long bolt, large and small washers, a nut and a tubular spacer. Refer to the illustrations for the method and applications.

Rubber bushes and bushes in blind holes can be removed using an expanding type masonry bolt (Rawlbolt Loxin). Install a neat fitting masonry bolt to the bush. Install and tighten the bolt until it grips the bush. The bolt and bush can then be removed using a slide hammer or levers.



A simple bush removing tool using a bolt, nut, suitable spacer and large and small washers.

Bushes in blind holes can also be removed using hydraulic force. With the hole packed with grease, insert a neat fitting drift and tap the drift into the hole. The pressure of the grease on the rear of the bush should force it from the hole.

ROTATING THE CRANKSHAFT

There are many occasions when it is necessary to rotate the crankshaft to a certain position. These include timing and valve adjustment and checking valve timing.

To make the engine easier to rotate, remove the spark plugs. This will relieve compression pressure.

The simplest method is to use a socket or ring spanner on the crankshaft pulley nut and turn the engine in the normal direction of rotation.

On vehicles with manual transmission, the engine can be turned by selecting top gear and rolling the vehicle forward. A variation of this method is to raise one of the driving wheels and, with top gear selected, rotate the driving wheel in a forward direction to turn the engine.

Alternatively, the engine can be brought to the desired position by briefly actuating the starter motor.

LUBRICATION AND MAINTENANCE

SPECIFICATIONS

CAPACITY AND GRADE

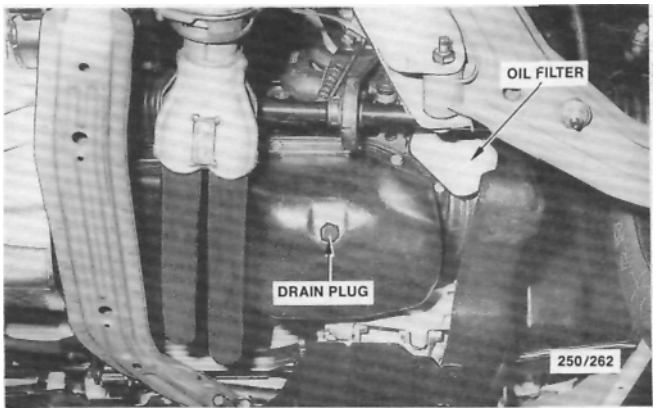
Engine:	
Lubricant	15W-50 SF
Sump capacity including filter	3.3 liters
Cooling system capacity	6.0 liters
Manual transaxle:	
Lubricant	80W-90 GL-4
Capacity	2.7 liters
Automatic transaxle:	
Lubricant	Dexron II
Capacity	6.0 liters
Power steering:	
Lubricant	Dexron II
Capacity	1.0 liters
Manual steering lubricant	Castrol EPLl grease
Brake fluid type	Dot 4

1. HOW TO GREASE AND OIL CHANGE

(1) Run the front of the vehicle onto car ramps and stop the engine. Chock the front wheels.

(2) Raise the rear of the vehicle and place chassis stands under the rear jacking points.

NOTE: It is best if the vehicle is kept as level as possible to avoid false readings when checking the lubricant levels.



Location of the engine sump drain plug.

(3) Clean around the engine sump drain plug.

(4) Place a drain tin under the engine sump, remove the engine sump drain plug and allow the engine sump to completely drain.

*NOTE: It is best to drain the engine sump **with** the oil at operating temperature. However, if the oil is hot take care to avoid scalding.*

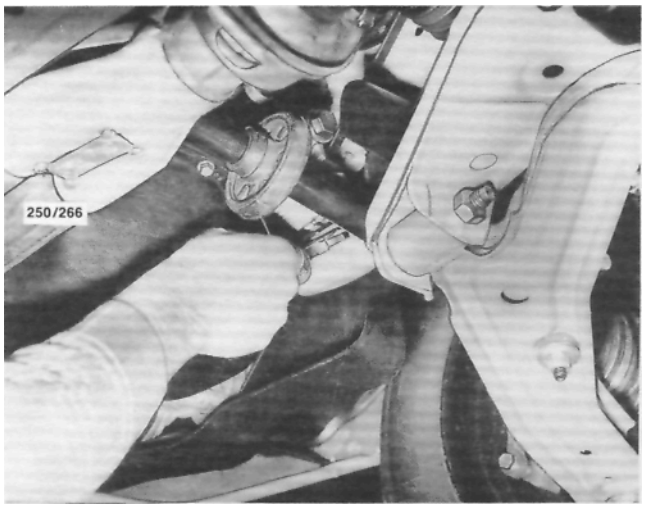
(5) Check that the sealing gasket on the sump plug is in a serviceable condition.

(6) When the engine sump has completely drained, install and firmly tighten the sump drain plug. Wipe around the plug after installation.

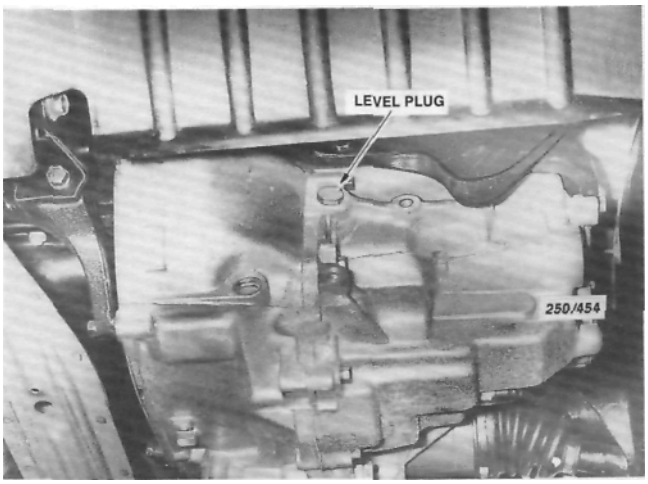
(7) Place the drain tin under the oil filler, remove the oil filter using a filter removal tool and allow the residual engine oil to drain. Smear the scaling ring of the new filter with engine oil and lighten the filter by hand as per the instructions supplied with the new filter.

NOTE: Before installing the new filter, ensure that the sealing gasket from the old filter has not adhered to the filter sealing surface on the engine.

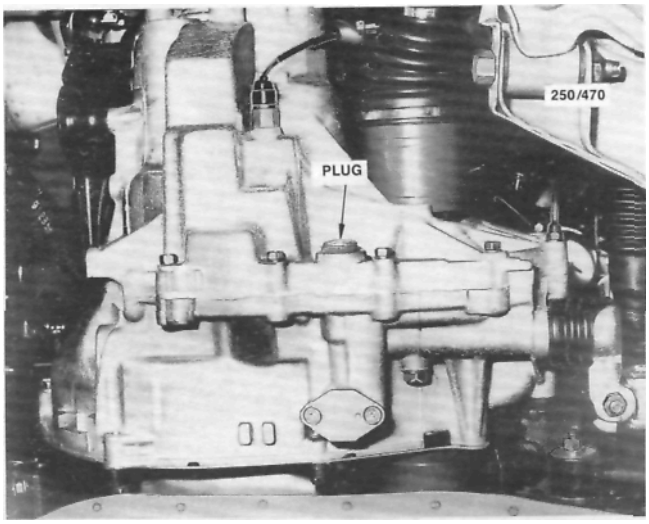
(8) Remove the level checking plug from the



Removing the engine oil filter using a filter removal tool.



Location of the manual transaxle level plug.



Location of the manual transaxle drain plug.

manual transaxle. Using a finger, check that the oil is level with the bottom of the plug hole. Overfilled units should be drained to the correct level.

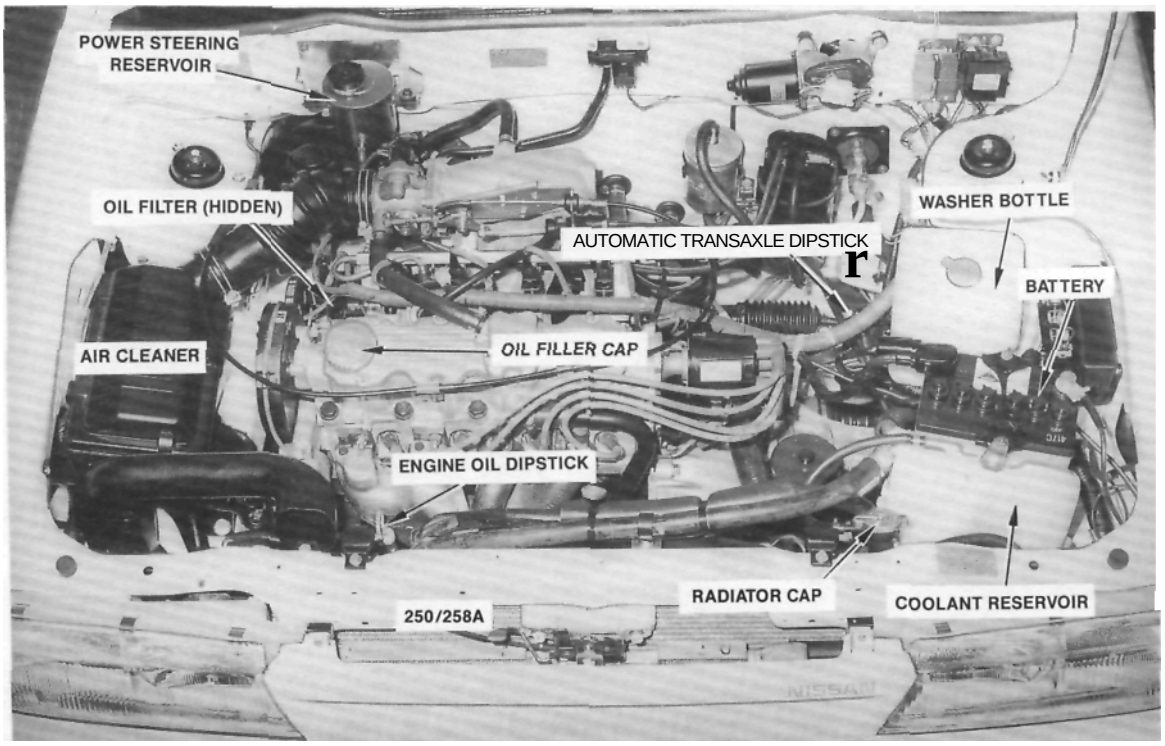
If the oil level is low, use an oil gun to fill the transaxle to the correct level.

When satisfied that the oil level is correct, install the plug and tighten firmly. Wipe around the plug after installation.

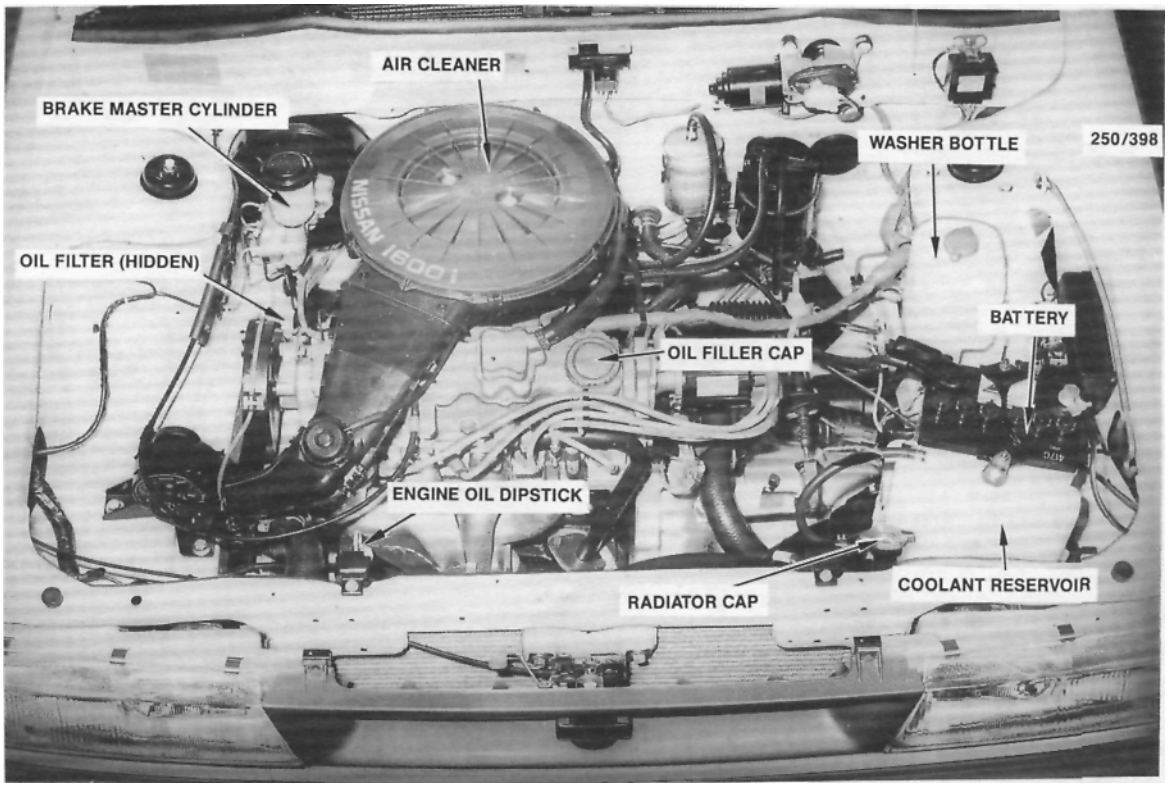
NOTE: On automatic transaxle vehicles, refer to the Automatic Transaxle section for the checking and topping up procedure.

(9) Using a funnel, fill the engine with the specified amount and grade of engine oil. start the engine and run it for a few minutes. Ensure that the oil light goes out. Stop the engine, wait for a few minutes and check the engine oil on the dipstick. If necessary add oil to bring the level to the full mark on the dipstick.

NOTE: To prevent overfilling the engine initially, it is good policy not to pour all the



Underbonnet view of the 1.8 liter engine. Automatic transaxle model.



Underbonnet view of the 1.6 liter engine. Manual transaxle model.

oil into the engine in one go as sometimes the amounts specified are only approximate. If is best to hold back at least half a liter and top up the level after the engine has been run for a few minutes.

(10) Check thoroughly for oil leaks at the engine sump drain plug and oil filter if a new filter was installed.

(11) Referring to the service schedule, lubricate and check all other items which coincide with the grease and oil change intervals.

(12) Lower the vehicle to the ground.

2. SERVICE SCHEDULE

This Section Removed

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WHEELS AND TYRES

SPECIFICATIONS

TYRES PRESSURES

Front:
Normal load ..... 200 kPa
Heavy load or high speed .....230 kPa
Rear:
Normal load ..... 180 kPa
Heavy load or high speed ..... 210 kPa

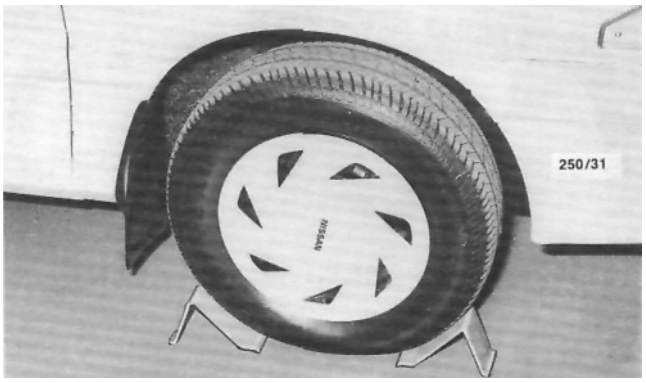
NOTE: The above pressures are measured cold and are meant as a guide only. Always refer to the tire placard positioned on the inside of the glove compartment lid and the tire manufacturers recommendations first.

TORQUE WRENCH SETTINGS

Wheel nut torque .....98 Nm

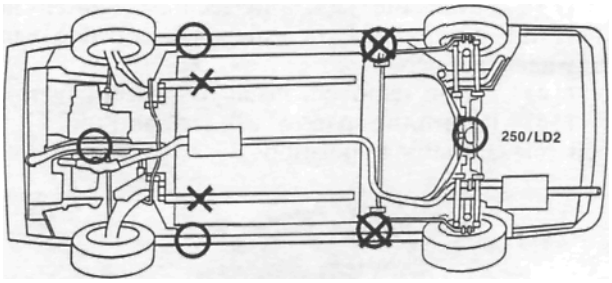
1. HOW TO CHANGE A ROAD WHEEL

(1) Ensure that the vehicle is on level firm ground and clear of any passing traffic.
(2) If necessary, switch on the hazard flashers.
(3) Switch off the engine and place the transaxle in the (P) Park position on automatic transaxle models or in reverse gear on manual transaxle models.

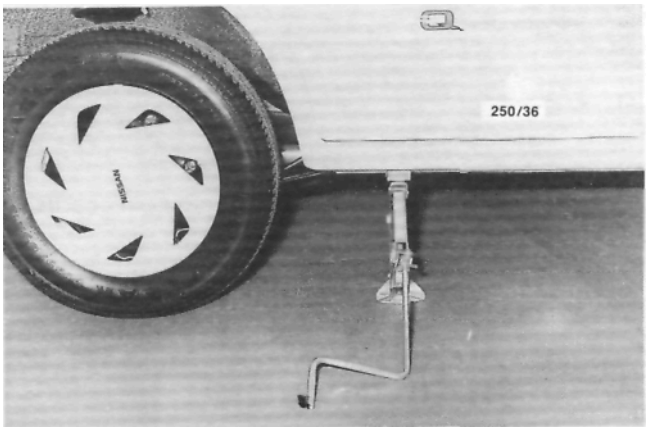


Chock the front and rear of the wheel diagonally opposite the wheel being changed.

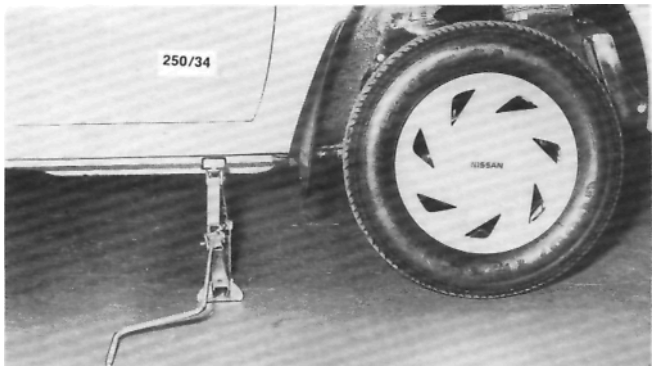
(4) Apply the handbrake firmly and chock the front and rear of the wheel diagonally opposite the wheel being changed.
(5) Remove the spare wheel, tool kit and jack located in the luggage compartment.
(6) On vehicles equipped with full wheel covers, remove the trim from the wheel.
(7) Using the wheel spanner, loosen the wheel nuts progressively in a diagonal sequence half a turn.
(8) Position the jack under the jacking point closest to the wheel being removed and raise the jack until the head of the jack contacts the jacking point.
(9) Raise the vehicle slightly and check that the jack is stable and vertical.



Underbody view showing the jacking and supporting points. O indicates the jacking points and X indicates the supporting points.



View of the jack correctly installed to the rear jacking point.



View of the jack correctly installed to the front jacking point.

(10) Continue to raise the jack until the tire clears the ground sufficiently to allow the spare wheel to be installed.

(11) Remove the wheel nuts and lift the wheel off the hub.

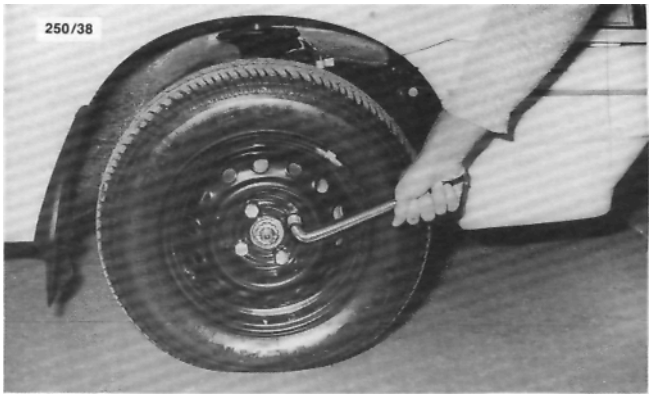
NOTE: Under no circumstances get under the vehicle while the jack is the only means of support.

(12) Install the spare wheel and install the wheel nuts with the chamfered ends contacting the wheels. Tighten the wheel nuts as much as possible by hand.

(13) Lower the jack and securely tighten the wheel nuts progressively in a diagonal sequence using the wheel spanner.

(14) Where removed, install the wheel cover.

(15) Return the spare wheel, jack and tool kit to their relevant storage positions.



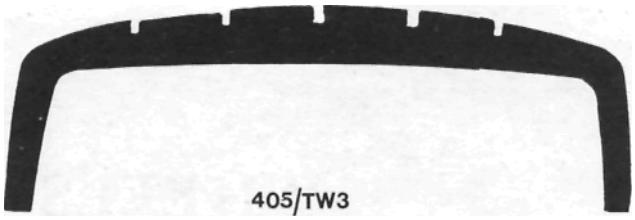
Tighten the wheel nuts in a diagonal sequence using the wheel spanner.

2. TYRE WEAR TROUBLE SHOOTING

ABNORMAL WEAR ON BOTH SIDES OF TREAD

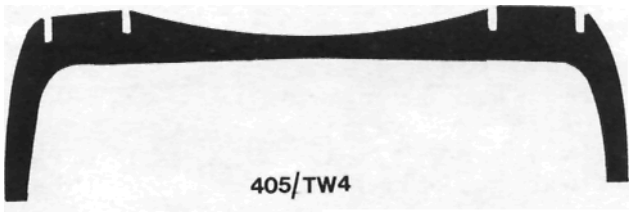
(1) Under inflation of tires: Check and inflate to the recommended pressure.

(2) Overloading: Reduce the maximum loading.



ABNORMAL WEAR ON CENTRE OF TREAD

(1) Over inflation of tires: Check and reduce to the recommended pressure.



ABNORMAL WEAR ON INSIDE OF TREAD

(1) Excessive negative camber angle: Check the wheel alignment.

(2) Sagging coil springs: Check and renew the coil springs as a pair.

(3) Loose or worn hub bearing assembly: Check and renew the hub bearing assembly.

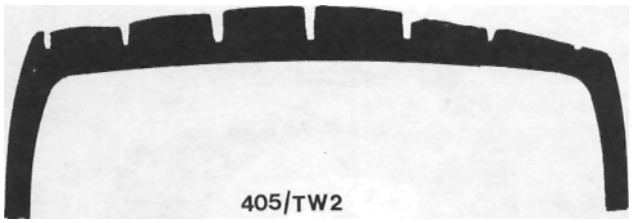
(4) Bent, loose or worn suspension components: Check and renew any faulty components.

ABNORMAL WEAR ON OUTSIDE OF TREAD

(1) Excessive positive camber: Check the front wheel alignment.

(2) Excessive speed when cornering: Revise driving habits.

(3) Bent, loose or worn suspension components: Check and renew any faulty components.



FLAT SPOTS ON TREAD OR IRREGULAR WEAR

(1) Static or dynamic unbalance of the wheel and tire assembly: Check the balance of the wheel and tire assembly.

(2) Lateral run out of the wheel: Check and (rue up or renew the wheel.

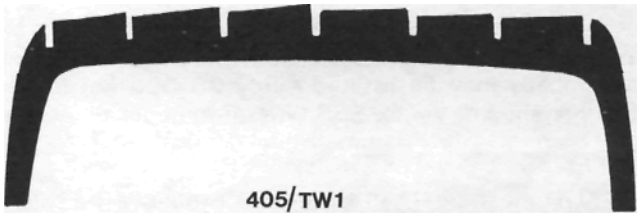
(3) Excessive play in the front suspension ball joints: Check and renew the ball joints.
(4) Excessive play in the hub bearing assembly: Check and renew the hub bearing assembly.

WORN SPOTS ON CENTRE OF TREAD

(1) Static unbalance of the wheel and tire asembly: Check the balance of the wheel and tire assembly
(2) Radial run out (eccentricity) of the wheel: Check and renew the wheel.

FEATHERED EDGES ON TREAD PATTERN

(1) Excessive speed when cornering: Revise driving habits.
(2) Excessive toe-in or toe-out: Check and adjust the wheel alignment.



(3) Bent, loose or worn suspension components: Check and renew any faulty components.

NOTE: To preserve tire life it is good policy to periodically have the front wheel balanced and the steering geometry checked on a reliable wheel alignment machine.

Under no circumstances mix radial ply and conventional ply tires. Install only tires of the same construction to all four wheels.

3. CARE AND MAINTENANCE

STEEL WHEELS

Steel wheels should be regularly cleaned of all foreign matter, such as dirt and mud. If foreign matter is allowed to build up it will affect the balance of the wheel and may cause vibrations and uneven tire wear. If the paint has been chipped or scratched it should be touched up as soon as possible to prevent rust.

Any minor damage to the wheel rim can usually be repaired using a suitable hammer after the wheel has been removed from the vehicle. However, any major rim damage or buckling of the wheel will necessitate the renewal of the wheel. It is good policy to occasionally remove the wheels from the vehicle and inspect them for damage, cracks or corrosion.

ALLOY WHEELS

Alloy wheels should be regularly cleaned of all foreign matter such as dirt and mud. If foreign matter is allowed to build up it will affect the balance of the wheel and may cause vibrations and uneven tire wear.

Wheels should be cleaned regularly of dirt and mud.

The alloy wheels are coated with a clear protective finish. Do not use abrasive cleaner, polishing compounds, steel wool etc. when cleaning the wheels. Only mild soap and warm water are recommended. Alloy wheels are particularly susceptible to corrosion damage particularly if exposed to salt water.

Alloy wheels being relatively soft in comparison to steel are easily scuffed, however, this will not affect the serviceability of the wheel. Where heavy damage has been sustained to the wheel it should be renewed. Buckling or cracking of an alloy wheel cannot be repaired.

TYRES

The depth of the tire tread grooves should never be allowed to be less than 1.5 mm before the tires are renewed. The tires should also be renewed when any damage, whether it be internal or external, is evident. Minor punctures or leaks should be properly repaired. Refer the tire to a tire specialist if there is any doubt about the serviceability of the tire.

The tread, tread grooves and sidewalls should be regularly inspected for foreign matter i.e. nails, stones etc. Where foreign matter is detected it should be removed from the tire and if necessary, the puncture repaired.

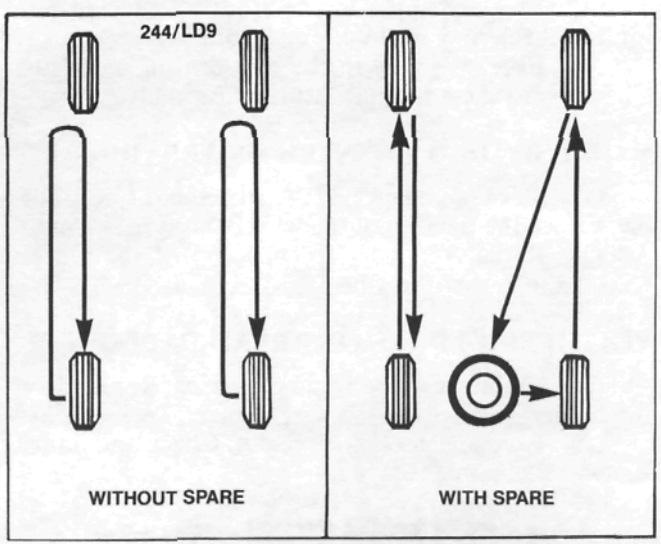
The tire valves should always have the caps installed, be regularly cleaned of dirt or dust and be inspected for leakage and damage every time the tire pressures are checked.

Regularly inspect the tread of the tires for signs of uneven wear. If uneven wear is apparent, refer to the heading Tire Wear Trouble Shooting in this section for possible causes and cures. If the uneven tire wear is noticed early enough, the cause correctly identified and the necessary cure carried out, the life of the tire should be extended.

When the tire tread groove depth is less than 1.5 mm, or when the tire is worn to the point where the tire wear indicators are level with the tread surface, the tire should be renewed.

To preserve tire life it is good policy to periodically have the front wheels balanced and the front end alignment checked on a reliable wheel alignment machine.

The wheel and tire assemblies may be rotated at 20 000 km if desired. Rotation of the wheels and tires will increase the period between tire renewal. Radial tires should not be cross changed, they should be changed from front to rear on the same side.



Tire rotation diagram. If desired, the wheel and tire assemblies may be rotated every 20 000 km in the manner shown. Vector SSS tire rotation not to include spare wheel.

The air pressure in the tire is probably the single most important aspect of tire care. Too little or too much pressure in the tire can cause rapid wear or complete failure through overheating. Where possible the tire pressures should be checked and adjusted when the tires are cold.

As a rule, different tire types, tread patterns or sizes should never be used on the vehicle at one time. All the tires on the vehicles, including the spare should be a matched set to prevent the vehicle behaving erratically under certain conditions. Under no circumstances mix radial ply and conventional ply tires.

ENGINE TUNE-UP

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. See the text for precautionary notes.

1. TUNE-UP SPECIFICATIONS

Firing order	1 -3-4-2
Spark plugs:	
Type	NGK BPR 6ES
Gap	1.1 mm
Tightening torque	20 Nm
Ignition timing with diagnostic link connector jumped	10 deg BTDC
Idle speed (ECU controlled):	
Manual transaxle 1.8 liter	850 ± 50 rpm
Manual transaxle 1.6 liter	800 ± 50 rpm
Automatic transaxle (Park or Neutral)	825 ± 50 rpm
Drive belt deflection:	
Alternator	14-16 mm
Power steering pump	14-16 mm
Air conditioner compressor	9-11 mm

*NOTE: When performing an engine tune-up, a/ways compare the above Specifications **with the** emission control information label inside the engine compartment.*

2. TUNE-UP OPERATIONS

Special Equipment Required:

To Test Compression — Compression gauge

TO SERVICE AIR CLEANER

The air cleaner is equipped with a paper element. The element should be regularly inspected but should not be cleaned in service.

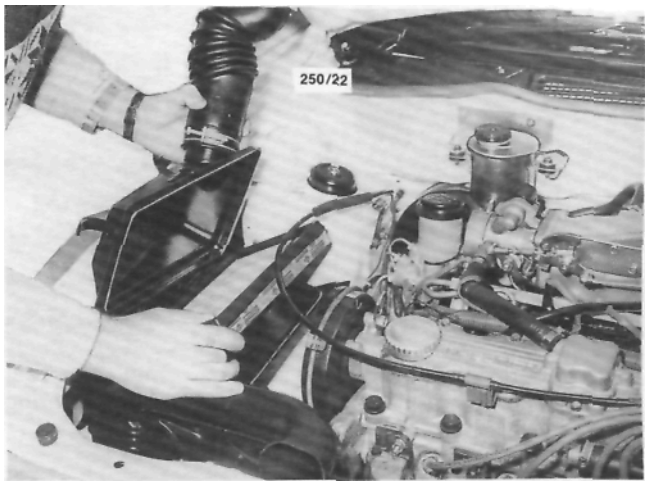
The element should be renewed every 40 000 km. This distance is only a guide for normal operating conditions and should be reduced accordingly if the vehicle is operating under extremely dusty conditions.

NOTE: Paper air cleaner elements should not be washed in petrol or any other type of cleaning solvent. If the element has been washed in solvent or has become oil soaked, it should be discarded and a new element installed.

1.8 Liter Engine

(1) Release the clamp securing the air intake hose to the throttle body and disconnect the throttle cable from the support bracket.

(2) Release the clips retaining the upper air cleaner housing to the lower air cleaner housing and raise the upper housing while disconnecting the air intake hose from the throttle body. Remove the air cleaner element.



The air cleaner element should be renewed at 40 000 km intervals. 1.8 liter engine.

(3) Clean the inside of the air cleaner housing using a damp rag to remove all traces of dust and check the upper housing and air inlet hose for cracks and air leaks. Renew if necessary.

(4) Install a new air cleaner element to the lower housing ensuring that the element is correctly seated around the edges.

(5) Install the upper housing and lock the clips, securing it to the lower housing. Connect the air intake hose to the throttle body and the throttle cable to the support bracket. Tighten the hose clamp securely.

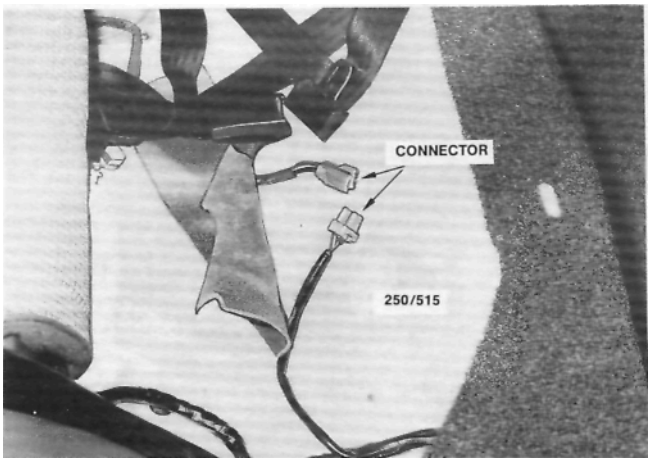
(6) Start the engine and check the air cleaner assembly for air leaks.

1.6 Liter Engine

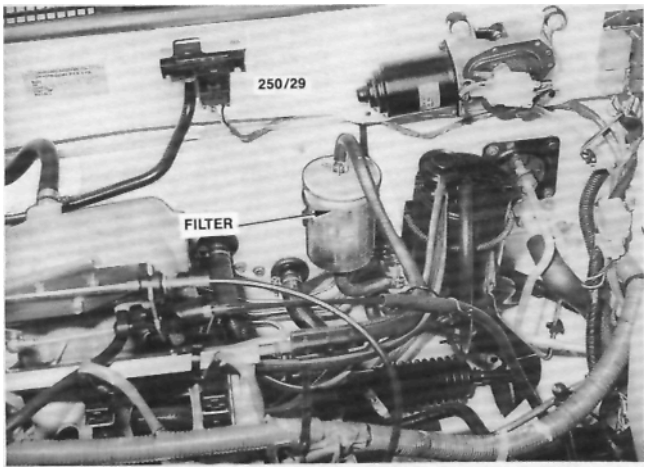
(1) Remove the nuts and washers securing the upper air cleaner housing to the lower air cleaner housing and release the retaining clips.
(2) Remove the air cleaner element.
(3) Clean the inside of the air cleaner housing using a damp rag to remove all traces of dust.
(4) Install a new air cleaner element ensuring that the element is correctly seated around the edges.
(5) Install the upper housing and secure the retaining clips. Tighten the retaining nuts securely.

TO RENEW FUEL FILTER

The fuel filter should be renewed every 40 000 km.
(1) Depressurize the fuel system using the following procedure:
(a) Lift the front edge of the rear seat cushion and remove the cushion from the vehicle.



When depressurizing the fuel system, remove the rear seat cushion and disconnect the fuel pump wiring connector.



Installed view of the fuel filter. Note the direction of the arrow on the filter prior to removal.

(b) Disconnect the fuel pump wiring connector.
(c) Start and run the engine until it stalls. Operate the starter motor for 10 seconds to ensure that the fuel pressure has dissipated.
(2) Disconnect the negative battery terminal.
(3) Release the hose clamps and disconnect the fuel hoses from the filter. Remove the filter from the retaining clamp noting the direction of the arrow on the filter body.

On some models it will be necessary to remove the screw from the side of the clamp to allow the filler to be removed.

Installation is a reversal of the removal procedure with attention to the following points:
(1) Install the fuel filter with the arrow facing the direction noted on removal, that is, in the direction of fuel flow.
(2) Ensure that the hose clamps are tightened securely.
(3) Connect the fuel pump wiring connector and install the rear seat cushion.
(4) Start the engine and check for fuel leaks. Rectify as necessary.

TO ADJUST DRIVE BELTS

It is essential that all drive belts are adjusted to the correct tension to prevent slippage or premature wear of the bearings in the alternator and, if equipped, the power steering pump and air conditioner compressor.

(1) Push down on the drive belt with a 10 kg force midway between the pulleys of the drive belt concerned.

On models with air conditioning, push down on the upper section of the drive belt between the compressor and crankshaft pulleys.

If the drive belt deflection is not within Specifications it will require adjustment as follows.

(2) Loosen the alternator and, if equipped, the power steering pump pivot and adjusting bolts and

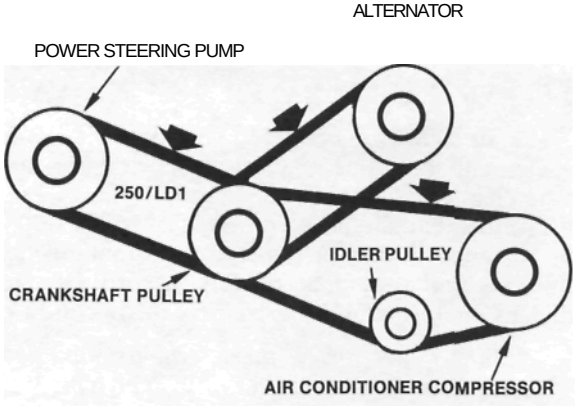


Illustration of the alternator, power steering pump and air conditioner compressor drive belts. The arrows indicate the deflection measuring points.

move the alternator or power steering pump as required until the drive belt concerned has the specified deflection.

On models with air conditioning, loosen the nut in the centre of the idler pulley and turn the adjusting bolt until the drive belt has the specified deflection.

(3) Tighten the alternator or power steering pump bolts securely and check the belt tension.

On models with air conditioning, tighten the idler pulley nut securely.

TO SERVICE SPARK PLUGS

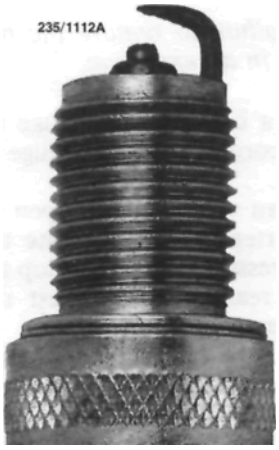
The spark plugs should be renewed at intervals of 40 000 km.

Before removing the spark plugs ensure that the area around each plug is clean to prevent foreign matter entering the cylinder when the plugs are removed.

Spark plugs removed from an engine in good mechanical condition should have a light powdery deposit ranging from light brown to grayish tan in color. After considerable service the electrodes will show signs of wear or normal burning. Spark plugs showing a thick black oily deposit indicate an engine in poor mechanical condition or possibly, that a plug with too low a heat range has been installed.

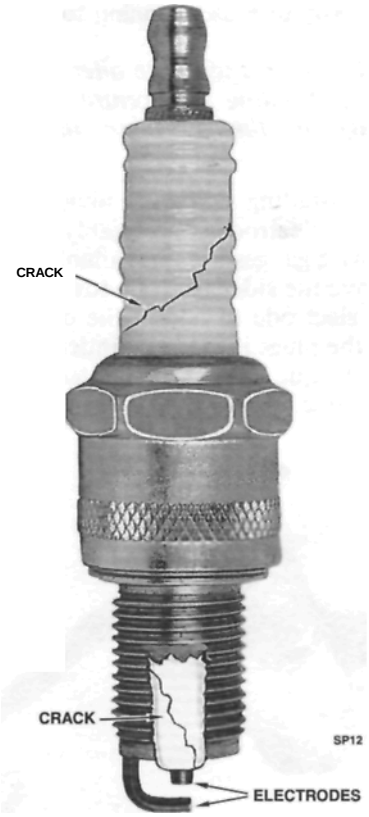
Spark plugs showing a white or yellowish deposit indicate sustained high speed driving or possibly that plugs with too high a heat range have been installed, particularly when these deposits are accompanied by blistering of the porcelain and burning of the electrodes.

If the spark plugs are to be cleaned, use a sandblasting machine and blow clean with compressed air. Ensure that all traces of abrasive grit are removed from the spark plug threads and from the well in the plug body. Carefully open the electrode gap a little, by bending the side electrode, and lightly file the electrodes flat with a points file.



When plug electrodes are eroded to this degree the spark can be considered worn out and should be renewed using a plug of the recommended heat range.

Black damp deposits can be caused by excessive oil consumption or incorrect plug type. Spark plugs in this condition are usually not firing.



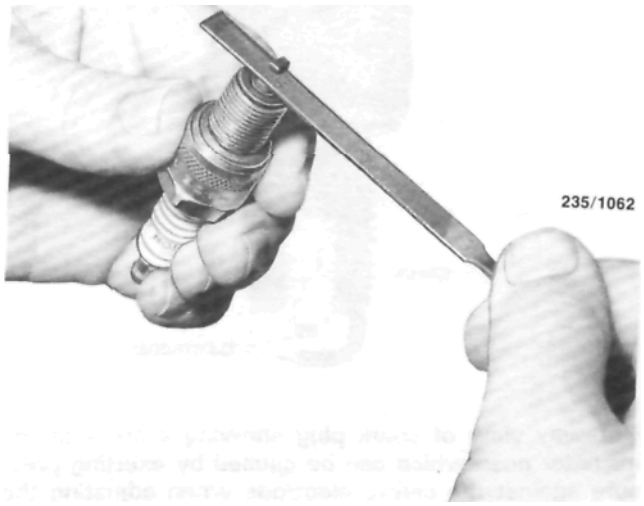
Cutaway view of spark plug showing a crack in the insulator nose which can be caused by exerting pressure against the centre electrode when adjusting the gap. The other crack shown on the insulator is caused by tilting the plug spanner.

Spark plug with burnt electrodes and white blistered appearance, possibly due to incorrect plug type, loose plug or motor running too hot.

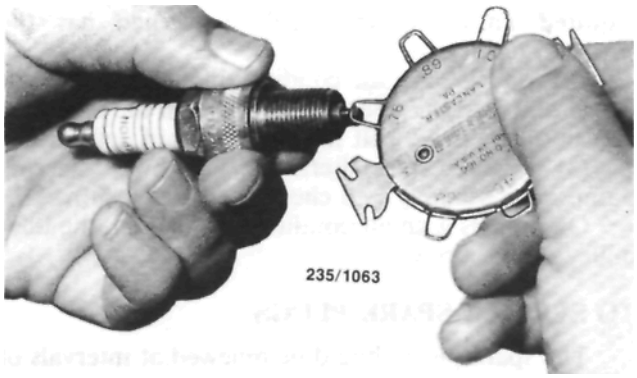
NOTE: Never attempt to alter the electrode gap by bending the centre electrode as damage to the porcelain insulator will result.

Before installing any spark plugs measure the gap between the electrodes, preferably with clean wire gauges. If wire gauges are unavailable, use clean feeler gauges. Move the side electrode towards or away from the centre electrode to obtain the correct gap-

Screw the plugs into the cylinder head ringer tight, then use a torque wrench to tighten the plugs lo the specified torque.



Lightly file the plug electrodes flat with a points file



Checking the spark plug electrode gap with a wire gauge.

NOTE: If a torque wrench is unavailable, extreme care must be taken when tightening the spark plugs as over tightening may lead to stripping of the thread from the cylinder head. If the plugs are tightened with the fingers and then taken up an additional 1/4 of a turn with a spark plug wrench, they will be tight enough.

TO TEST COMPRESSION

(1) With the engine at operating temperature. disconnect the high tension leads from the spark plugs.

(2) Ensure that the area around each spark plug is clean to prevent foreign matter entering the cylinders and remove the spark plugs.

(3) Remove the fusible link that is positioned third from the front of the fusible link connecting block, located at the rear of the battery. Disconnect the coil high tension lead from the coil.

NOTE: Failure to remove the fusible link can result in an explosion.

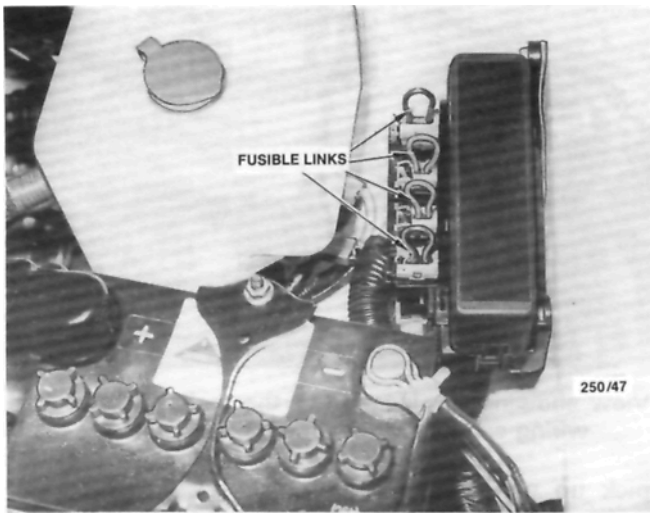
(4) Install a compression gauge to number one spark hole according to the gauge manufacturers instructions.

(5) Have an assistant fully open the throttle and operate the starter switch to rotate the engine. Observe the compression gauge and stop the engine when the gauge has reached the highest reading, usually after 3 or 4 compression strokes.

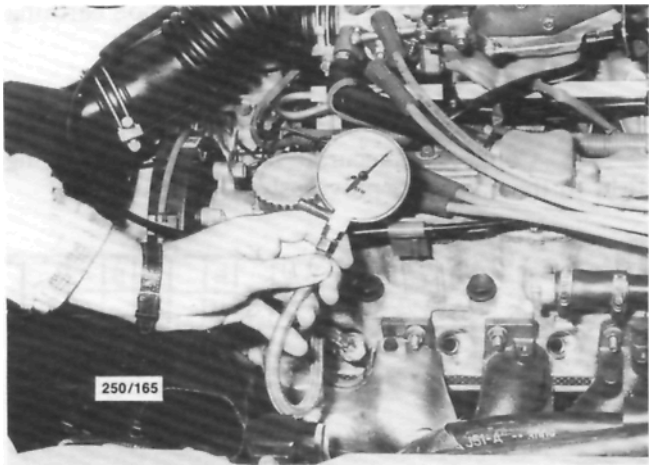
(6) Record the reading and check the compression of the remaining cylinders in the same manner.

(7) Compare all the readings taken. Variation between the highest and lowest reading cylinders should not exceed 100 kPa.

(8) If a low reading is recorded on one or more cylinders the trouble may be isolated as follows :



View showing the location of the fusible links.



Check the cylinder compressions using a compression gauge.

(a) Inject a small amount of engine oil into the spark plug hole of the cylinder concerned ensuring that the oil is evenly distributed within the cylinder by rotating the engine.

(b) Repeat the compression test on the cylinder concerned.

A substantial increase of compression pressure indicates faulty or worn piston rings, pistons or cylinder.

No increase of compression pressure indicates burnt, obstructed or sticking valves, or a leaking or blown cylinder head gasket.

(9) Install the fusible link and connect the high tension lead to the coil.

TO SERVICE THE DISTRIBUTOR

The electronic ignition system requires virtually no maintenance except for checking of the distributor cap. rotor and high tension leads as described below.

Refer to the Fuel and Engine Management section for Specifications and Trouble Shooting.

NOTE: When working on or near electronic ignition systems, care should be taken as dangerous high voltages are present in both the primary and secondary circuits.

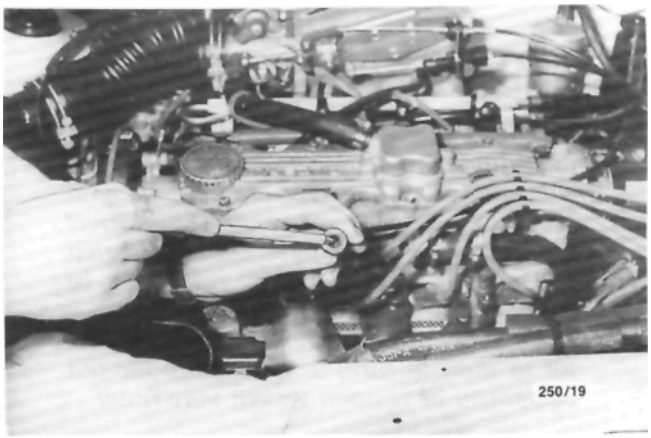
The ignition switch should be turned off before removing or installing any electrical connections otherwise damage to the ignition system as well as severe electrical shock could result.

TO SERVICE HIGH TENSION LEADS

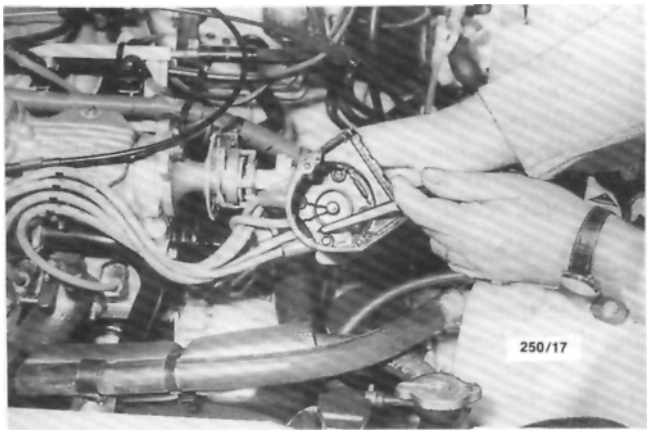
Check the leads for perishing or cracking and renew as required. Never attempt to repair defective carbon impregnated core leads.

The lead may be carefully cleaned, using cloth moistened with kerosene and then wiped completely dry.

If an ohmmeter is available the electrical resistance of the leads may be checked as follows:



Check the spark plug high tension leads for cracks and burnt or corroded terminals.



Check the distributor cap for cracks or tracking between the terminals.

(1) With the distributor cap and leads removed as an assembly, test one lead at a time, connecting the meter probes at the spark plug end of the lead and at the corresponding terminal inside the cap. Resistance should be less than 15 000 ohms.

(2) If the resistance is more than 15 000 ohms remove the lead from the distributor cap and check (he resistance in the lead only. The lead should be renewed if the resistance is still more than 15 000 ohms.

(3) High distributor cap resistance may be due to corrosion deposits on the cap terminals. These deposits should be removed with a small scraper or emery cloth.

Check the distributor cap for cracks or tracking between the high tension terminals on both the inside and outside of the cap. Renew the cap if cracks or tracking are evident.

Check the carbon brush in the centre of the distributor cap for evidence of arcing and renew as necessary.

Check the condition of the rotor and renew if arced excessively or cracked.

HOW TO CONNECT ELECTRICAL TEST EQUIPMENT

NOTE: Some types of tachometers, timing lights and ignition system analysers are not compatible with this type of electronic ignition system and may result in incorrect readings. It is therefore recommended that the manufacturer of the test equipment be consulted before using the equipment.

Do not allow the tachometer lead connector to short to earth as damage to the test equipment or ignition system may result.

Timing Light

(1) **Connect** the timing light to the engine following the instrument manufacturers instructions.

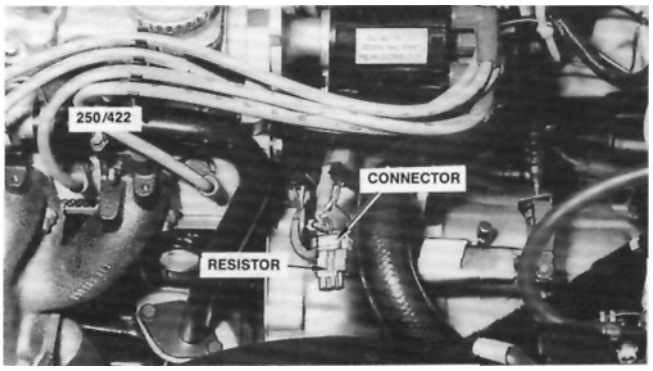
*NOTE: Do not connect or disconnect the timing light with the engine running **as** voltage surges could damage the alternator. Do not allow the high tension leads to open circuit as damage to the ignition system could result.*

(2) Where necessary, connect the power leads of the timing light to an external power source to prevent possible transient voltages in the timing light damaging the vehicle alternator.

Tachometer

(1) Ensure **that** the tachometer is compatible with the vehicle ignition system.

(2) Disconnect the resistor from the tachometer



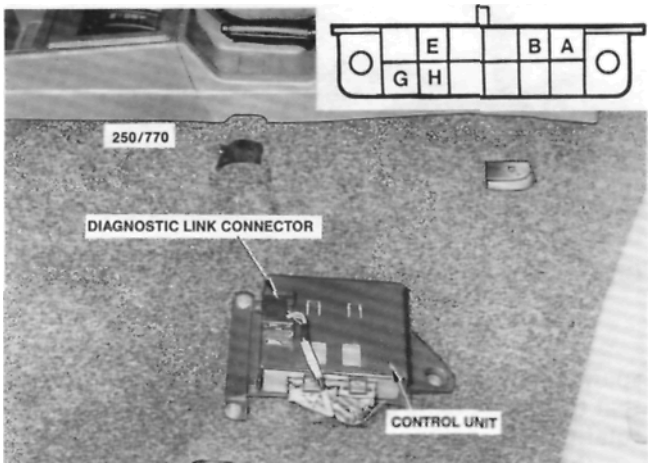
View showing the location of the tachometer pickup wiring connector with the resistor installed.

pick up wiring connector which is located on the ignition coil wiring harness, and connect the positive lead of an accurate tachometer to the brown wire terminal in the wiring connector.

(3) Connect the negative lead to a good earthing point.

TO CHECK AND ADJUST IGNITION TIMING

(1) Connect an accurate tachometer and timing light to the engine as previously described.



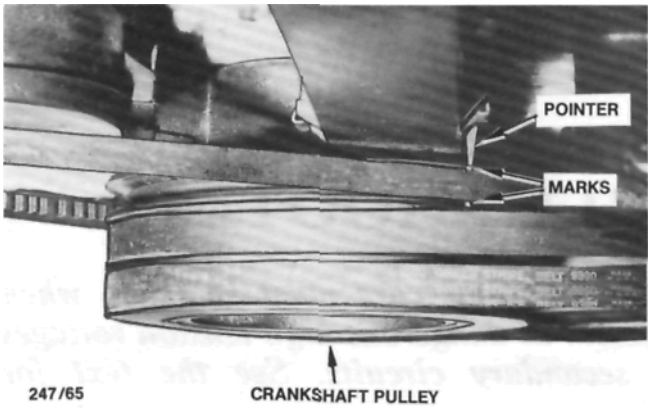
View showing the location of the diagnostic link connector. Passengers seat removed for clarity. Inset shows the diagnostic link connector terminal identification.

(2) Start the engine and allow it to reach normal operating temperature.

(3) Connect a jumper lead between terminals A and B on the diagnostic link connector.

(4) With the engine idling at the specified speed, check the ignition timing with the timing light.

Correct timing exists when the marks on the crankshaft pulley are aligned with the pointer on the inner timing cover.



View of the engine timing marks showing the 10 deg BTDC crankshaft notch aligned with the pointer on the front of the engine.

(5) If adjustment is necessary, loosen the distributor body retaining nuts and turn the distributor body until the correct setting is obtained.

(6) Tighten the distributor body retaining nuts and ensure that the timing is still correct.

(7) Remove the jumper lead from the diagnostic link connector.

(8) Disconnect the timing light from the engine.

TO ADJUST IDLE SPEED AND MIXTURE

The idle speed and mixture are not adjusted as normal service procedure. However, should the performace of the vehicle indicate that the mixture is incorrect, refer to the Fuel and Engine Management section for the procedures to test for faulty components in the engine management system.

ROADSIDE TROUBLE SHOOTING

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. See the text for precautionary notes.

This section deals with the common causes of engine failure to start, as inevitably there will come a time when every driver will experience this problem and will therefore need to call upon his own resources to rectify the trouble. Roadside breakdowns other than engine failure can be identified by reference to the Trouble Shooting section on the particular component affected.

1. TROUBLE SHOOTING

Trouble shooting is only a process of elimination and provided the procedure is carried out correctly and systematically an accurate diagnosis of the trouble can be made in the minimum amount of time.

For an internal combustion engine to run there are three basic requirements, these are ignition, fuel and compression. There are other factors of course but as a rule an engine's failure to start can be attributed to a fault in one of these three systems.

Reports from field engineers of motoring organisations prove that the biggest percentage of engine breakdowns are in the order of ignition or electrical failure first, followed by fuel, with mechanical or compression failure the least common.

Should the engine fail to start, first check that there is adequate fuel in the tank and if so. carry out the following checking procedures in the order described.

TO JUMP START A VEHICLE

NOTE: Jump starting a vehicle can be dangerous if the procedure described below is not performed correctly. If any doubt exists, it is recommended that the services of a competent mechanic be obtained.

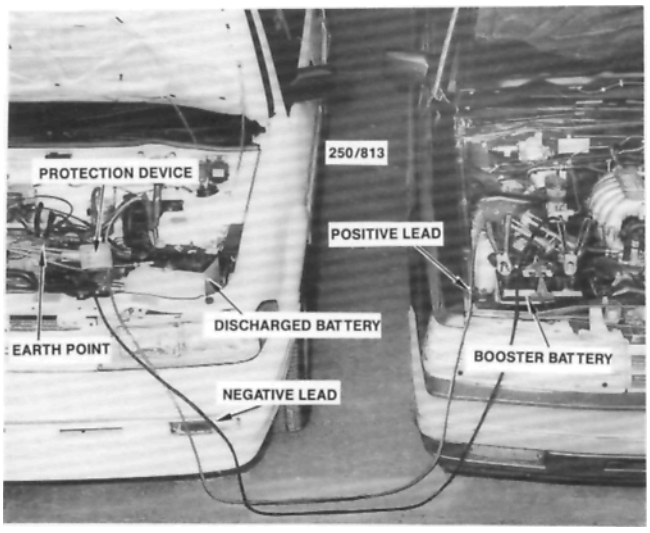
The vehicles covered by this manual are equipped with complex electronic circuitry which can be damaged by voltage surges. These voltage surges can be generated when jump starting, or being jump started by another vehicle. If available use jumper leads equipped with a surge protection device and follow the lead manufacturers instructions carefully, particularly regarding the connection and disconnection of the leads.

(1) Ensure that the booster battery is 12 volts and the negative terminal is earthed.

(2) Ensure that the vehicles are not touching and that the ignition and all accessories on both vehicles are switched Off.

(3) Ensure that the transmissions on both vehicles are in Park or Neutral and the handbrakes are firmly applied.

(4) Remove the vent caps from the battery and check the electrolyte level. Replenish with distilled water as necessary.



View showing the correct jumper lead connections for jump starting a vehicle. The leads shown are equipped with a surge protection device.

(5) Place the vent caps loosely over the cell apertures.

(6) Connect one end of the red jumper lead to the positive (+) battery terminal of the booster battery and the other end of the red lead to the positive (+) battery terminal of the discharged battery.

NOTE: The battery emits hydrogen gas which is explosive. Do not expose the battery to naked /lames or sparks.

Do not lean over the battery when connecting the jumper leads.

Do not allow the ends of the jumper leads to touch one another or any part of the engine.

(7) Connect one end of the black juniper lead to the negative (-) battery terminal of the booster battery and the other end of the black lead to a good earthing point on the engine of the vehicle with the discharged battery.

NOTE: Do not connect the jumper lead directly to the negative (-) battery terminal of the discharged battery.

(8) Start the engine on the vehicle with the booster battery and run the engine at a moderate speed.

(9) Start the engine on the vehicle with the discharged battery.

(10) If possible, leave the engines of both vehicles running for 10 minutes.

(11) Disconnect the jumper leads in the reverse order of the sequence in which they were connected.

2. TO CHECK IGNITION AND ELECTRICAL SYSTEM

(1) Switch on the ignition and check for warning lamp illumination on the dashboard.

(2) Operate the starter and check that the starter rotates the engine at a steady speed.

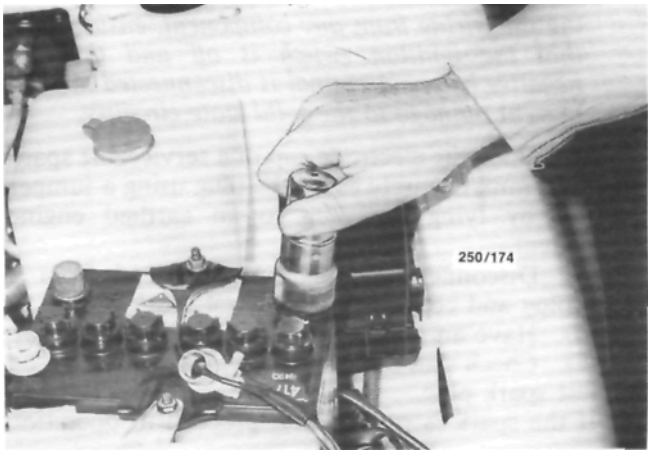
(3) Switch on the headlamps and check for good light intensity.

Should the lamps not illuminate or the starter motor not turn the engine, carry out the following steps:

(a) Remove the battery terminals and clean both terminals and posts. Connect the terminals and where applicable tighten firmly but not excessively.

(b) Check that the earth lead from the battery to the engine or body frame is not broken and that the connections are clean and secure.

. (c) Check that the lead from the battery to the starter motor or starter solenoid is intact and has a clean and secure connection.



Ensure that the battery posts and terminals are clean.

(d) Where necessary carry out repairs to (b) and (c).

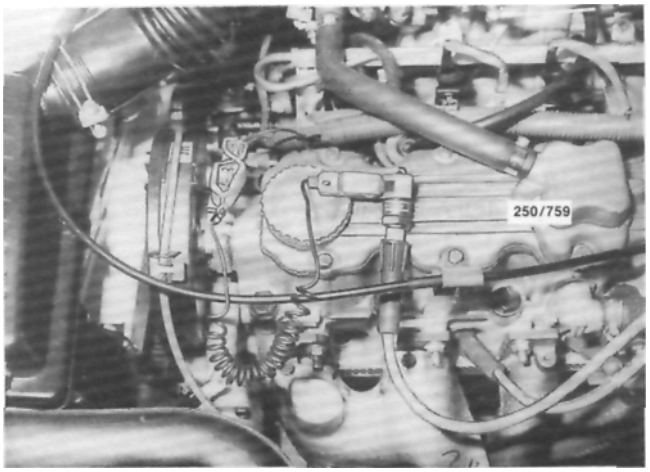
Repeat the check procedure. Should the starter motor still not operate, or the lamps not illuminate, one or more of the following faults may be the cause:

No starter motor operation or lamps: Battery flat or defective.

Lamps illuminate but no starter operation: Starter motor drive jammed in mesh with flywheel ring gear. Starter motor or solenoid defective. Ignition/starter switch faulty. On automatic transaxle models, faulty neutral safety switch.

Lamps dim and starter operation sluggish: Discharged battery or fault in starter motor. Battery flat due to broken fan belt or defective alternator. Faulty battery due to cell breakdown.

NOTE: Electronic ignition systems can produce dangerously high voltages in both the primary and secondary circuits. For this reason, extreme care must be taken when performing these checks. When disconnect-



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

ing the wiring from any component, ensure that the ignition switch is off and the negative battery terminal is disconnected to prevent damage to the solid state circuitry.

(4) Open the electrode gap of a serviceable spark plug to 6 mm. Securely earth the plug using a jumper lead or by tying the plug to an earthed engine component.

(5) Disconnect the high tension lead from a spark plug and connect it to the test spark plug.

(6) Have an assistant operate the starter motor.

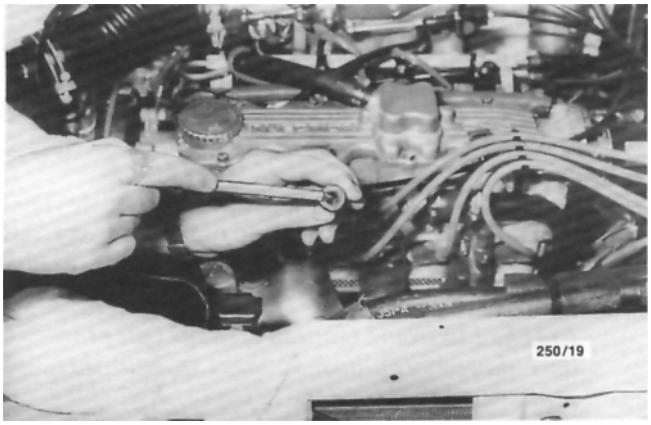
(7) Check that a spark, if any, jumps the gap on the test spark plug.

If the spark is satisfactory, proceed to operation (8).

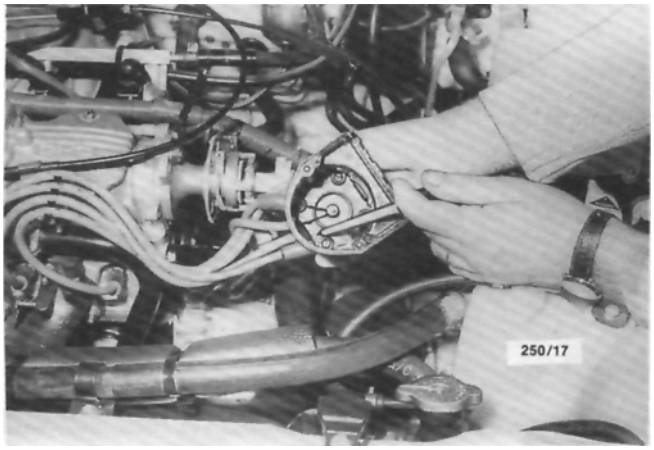
If there is no spark, proceed as follows:

(a) Check the high tension leads to ensure that they are dry and that the insulation is not cracked or perished. Check the ends of the leads for burning.

Using an ohmmeter, measure the resistance in each high tension lead. The resistance should be no more than 15 000 ohms per lead.



Check the spark plug high tension leads for cracks and burnt or corroded terminals.



Check the distributor cap for cracks or tracking between the terminals.

(b) Check the distributor cap to ensure that it is dry and clean. Examine both the inside and outside of the cap for cracks or tracking, particularly between the high tension lead segments.

Check that the carbon brush in the centre of the distributor cap interior face is clean and dry and ensure that the brush moves freely in and out of its locating hole.

(c) Check the rotor arm for cracks, deposits and burning on the metal arm.

(d) Ensure that the high tension leads have dry. clean and secure connections on the distributor cap.

(8) If the above checks result in a good spark at the spark plug high tension leads but the engine is still not operating satisfactorily, remove all the spark plugs and check the condition and electrode gap as described in the Engine Tune-up section under the appropriate heading.

3. TO CHECK FUEL SYSTEM

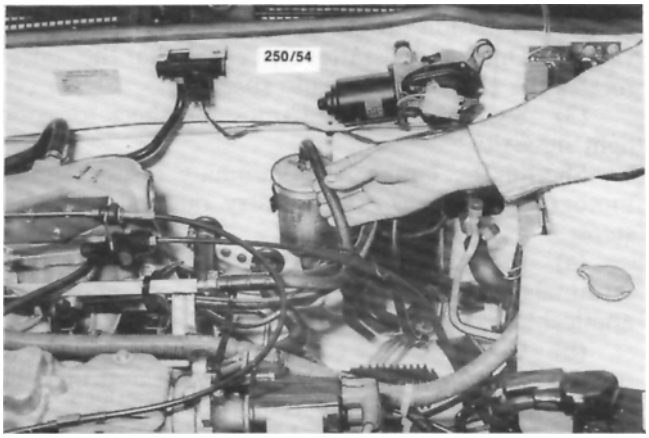
Due to the complex nature of the EFI system, it is recommended that should the following checks prove satisfactory but the engine fail to start, reference be made to the Fuel and Engine Management section of this manual or a Nissan workshop be consulted.

(1) Check that the fuel tank contains a reasonable amount of fuel.

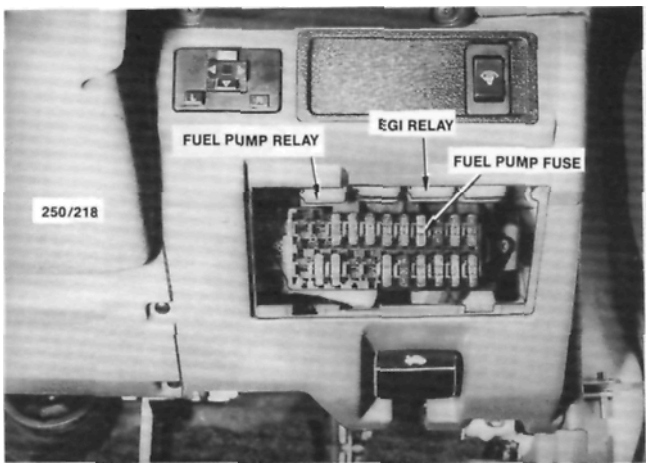
(2) Have an assistant switch the ignition on and off while squeezing the fuel supply hose with the fingers. If the fuel pump is operating it should be possible to feel the fuel pressure increase for approximately two seconds.

NOTE: When conducting the above test it should be possible to hear the fuel pump and ignition relays clicking when the ignition is switched on and off

If the fuel pump relay fails, power will be supplied to the fuel pump via the oil pressure



Squeeze the fuel supply hose while the ignition is switched On. An increase in pressure should be felt.



View showing the location of the fuel pump fuse and the EGI and fuel pump relays.

switch. When starting the engine, the fuel pump will not operate until the oil pressure is sufficient to extinguish the oil pressure warning lamp. Therefore it will be necessary to operate the starter motor for a longer period than usual to start the engine.

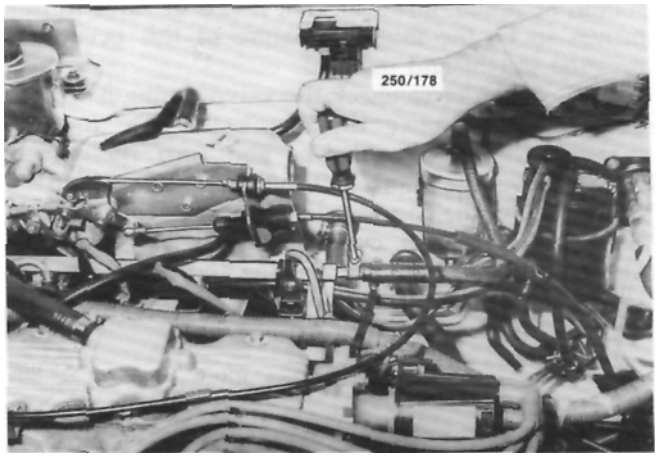
(3) If the fuel pump cannot be felt operating, check the fuel pump fuse located in the fuse panel adjacent to the steering column.

If the fuel pump fuse is serviceable, refer to the Fuel and Engine Management section for detailed tests on the fuel pump.

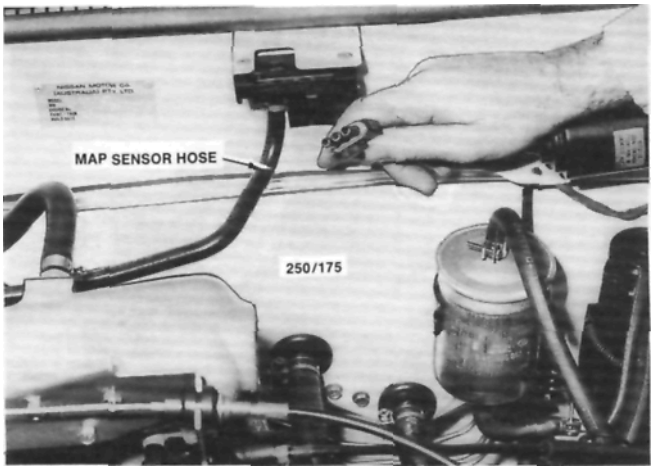
(4) Check that all fuel hose connections are secure.

(5) Remove the spark plugs and check for petrol saturation of the electrodes which indicates flooding. Thoroughly clean and dry the spark plugs before replacement.

Fully depress the throttle pedal and turn the ignition switch to the start position. If the engine does not start, proceed as follows.



Ensure that all fuel connections are securely tightened.



Check that the MAP sensor hose is not blocked or split and ensure that all electrical connections are clean and secure.

If flooding persists, refer to the Fuel and Engine Management section.

(6) Check that all EFI electrical wiring connectors are clean and secure.

(7) Check that the MAP sensor vacuum hose is securely connected at each end and is not split or blocked.

4. TO CHECK MECHANICAL SYSTEM

The following check procedure assumes that the starter motor will rotate the engine. If not, on manual transaxle models, depress the clutch pedal to disengage the engine from the transaxle in case the fault lies within the transaxle.

If the starter motor will not rotate the engine, it will be necessary to remove the starter motor and attempt to turn the engine over manually. This will establish whether the fault lies with the starter motor, which could be jammed or defective, or with the engine, which could be seized or have broken internal components such as connecting rods, pistons and crankshafts etc.

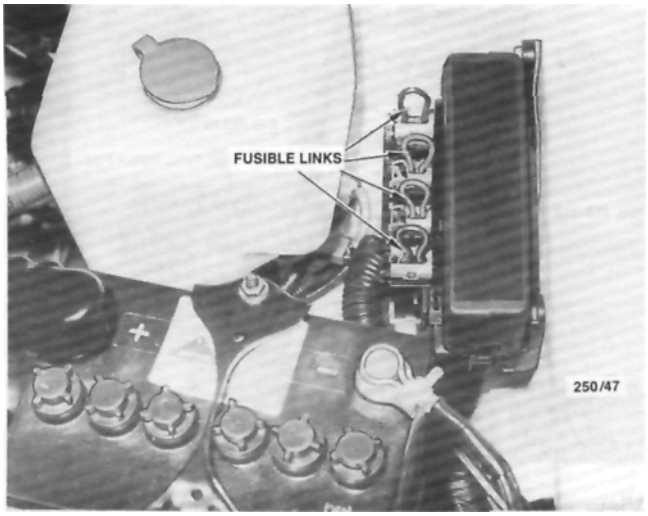
If the starter motor is not at fault and the engine will not rotate manually, refer to the Engine Mechanical Trouble Shooting heading in the Engine section.

It should be noted that the only way that cylinder compression can be accurately tested is with a compression gauge. The method described in the following procedure is only intended to give a rough indication when checking for causes of engine breakdown,

(I) When the engine is cool, check for loss of coolant from the cooling system.

If coolant loss is evident, check carefully for any indication of external leakage. Remove the engine oil dipstick and check for water contamination (emulsification) of the oil. When oil mixes with water it will

Check the engine oil for level and dilution on the dipstick.



View showing the location of the fusible links.

turn creamy. The oil level will also have increased. If the oil is emulsified, proceed to operation (5).

(2) Remove the fusible link that is positioned third from the front of the fusible link connection block, located at the rear of the battery. Disconnect the coil high tension lead from the coil.

(3) Remove all of the spark plugs except one.

(4) Have an assistant operate the ignition switch to rotate the engine and listen to the sound made by the engine as it is being turned over. Move the spark plug to a different cylinder and repeat the lest.

By performing the same test on all cylinders, a rough comparison can be made to determine if there is any loss of compression in any cylinder. This will be apparent by the different sound made by the engine as it is being turned over.

Normally, if the compression is satisfactory the cylinder with the spark plug installed will create a resistance to the rotating engine.

However, if the compression is low in a particular cylinder, the engine will turn over easily and smoothly when that spark plug is in place.

(5) If the above checks show a loss of coolant which is present in the engine oil or on the spark plug, one or more of the following faults may be the cause:

Blown cylinder head gasket.

Cracked cylinder or cylinder head.

If the compression check showed any weak or inconsistent compressions, in addition to the above faults any of the following could also be the cause:

Broken piston{s)

Burnt or broken valve(s).

Provided the previous checks do not indicate an internal leakage of coolant, proceed with the following:

(6) Remove the distributor cap and, with the aid of an assistant operating the starter motor, check that the rotor arm rotates as the engine turns over.

(7) Remove the camshaft housing top cover and. again with an assistant operating the ignition switch, check that all the valves open and close as the engine turns over.

If the rotor arm or valves do not operate with engine rotation, one of the following faults may be the cause:

Rotor arm does not turn but valves operate: Distributor drive shaft broken.

Rotor arm and valves do not operate: Broken camshaft drive belt. Sheared crankshaft timing gear drive key. Sheared camshaft liming gear drive dowel.

Provided that all the previous checks have been performed correctly and the operator is satisfied that none of the components are at fault, all that remains is for the ignition and valve timing to be checked. It should be noted, however, that if loss of valve timing proves to be the fault, the cause of this occurrence must be sought and rectified.

(8) In order to check the valve timing it will be necessary to remove the distributor cap and the camshaft housing top cover and turn the engine clockwise via the crankshaft pulley until No. 1 piston is at TDC on the compression stroke. In this position the valves of No. 1 cylinder should be closed, the valves of No. 4 should be rocking and the distributor rotor should be pointing to the No. 1 high tension lead segment in the distributor cap.

ENGINE

SPECIFICATIONS

ENGINE ASSEMBLY

Type ..... 4cyl OHC
Models ..... 1.6 liter, 1.8 liter
Capacity:
1.6 liter ..... 1 598 cc
1.8 liter ..... 1 796 cc
Firing order 1-3-4-2
Bore:
1.6 liter ..... 80.0 mm
1.8 liter ..... 84.8 mm
Stroke ..... 79.5 mm
Maximum compression pressure variation between cylinders ..... 100 kPa

NOTE: Specifications regarding engine tuning arc listed in the Engine Tune-up section.

CYLINDER BLOCK

Type ..... 4 cyl in line
Material ..... Cast iron
Bore diameter:
1.6 liter ..... 79.995-80.065 in three groups
1.8 liter ..... 84.755-84.905 in four groups
Bore taper limit ..... 0.013 mm
Bore ovality limit ..... 0.013 mm
Block face distortion limit ..... 0.10 mm
Maximum height of piston above block face at top dead centre:
1.6 liter ..... 0.00 mm
1.8 liter ..... 0.50 mm
Bore oversize ..... 0.50 mm

CYLINDER HEAD

Type ..... One piece, cross flow
Material ..... Aluminum alloy
Distortion limit ..... 0.025 mm
Machining limit ..... 0.25 mm
Minimum overall height after machining:
1.6 liter ..... 95.50 mm
1.8 liter ..... 94.80 mm
Valve seat angle ..... 45 degrees
Valve seat contact width:
Inlet ..... 1.0-1.5 mm
Exhaust ..... 1.7-2.2 mm
Valve stem protrusion ..... 18.4 mm from top of cylinder head
Valve guide height ..... 12.2-12.5 mm from top of cylinder head

VALVES AND SPRINGS

Valve length ..... 104.2 mm
Valve head diameter:
1.6 liter —
Inlet ..... 36.0 mm
Exhaust ..... 32.0 mm
1.8 liter -
Inlet ..... 41.8 mm
Exhaust ..... 36.5 mm
Valve stem diameter:
Inlet ..... 6.998-7.012 mm
Exhaust ..... 6.978-6.992 mm
Valve stem to guide clearance:
Inlet ..... 0.018-0.052 mm
Exhaust ..... 0.038-0.072 mm
Oversize valve system availability ..... 0.075, 0.150 and 0.250 mm
Valve face angle ..... 44 degrees
Valve spring tension:
Valve closed ..... 300 N at 37.5 mm
Valve open ..... 765 N at 26.5 mm

TAPPETS

Type ..... Hydraulic
Operating length ..... 63.26 mm
Diameter 21.392-21.405mm
Leak down rate ..... 2-10 seconds for 3.175 mm

PISTONS AND GUDGEON PINS

Piston type ..... Aluminum alloy
Diameter:
1.6 liter ..... 79.955-80.035 mm in 8 categories in increments of 0.01 mm
1.8 liter ..... 84.725-84.885 mm in 16 categories in increments of 0.01 mm

*Piston skirt to cylinder bore clearance:
1.6 liter .....0.020-0.040 mm
1.8 liter .....0.010-0.030 mm
Gudgeon pin length:
1.6 liter .....53 mm
1.8 liter ..... 61.5 mm
Gudgeon pin diameter.....20.990-20.995 mm
Gudgeon pin clearance in piston:
1.6 liter .....0.010-0.020 mm
1.8 liter .....0.0055-0.0115 mm
Gudgeon pin offset in piston:
1.6 liter ..... 0.35-0.65 mm towards thrust side
1.8 liter ..... 0.8 mm towards thrust side
*Measured 9 mm from the bottom of the piston skirt for 1.6 liter models and 6 mm from the bottom of the piston skirt for 1.8 liter models.

PISTON RINGS

Rings per piston:
Compression 2
Oil control 1
End gap:
Compression .....0.30-0.50 mm
Oil control —
1.6 liter .....0.33-1.10 mm
1.8 liter .....0.40-1.40 mm

CONNECTING RODS AND BEARINGS

Connecting rod side clearance..... 0.07-0.24 mm
Maximum connecting rod weight variation..8 grams
Crankpin bearing oil clearance.....0.019-0.063 mm

CRANKSHAFT AND MAIN BEARINGS

Number of bearings..... 5
End float taken at..... No. 3 main bearing
End float.....0.070-0.302 mm
Bend limit .....0.03 mm
Main bearing oil clearance.....0.015-0.040 mm
Main bearing journal diameter.. .57.982-57.995 mm
Crankpin diameter.....48.971-48.987 mm

FLYWHEEL

Ring gear run out limit..... 0.3 mm
Clutch face regrind limit ..... 0.3 mm

CAMSHAFT

Drive .....Toothed belt
End float.....0.04-0.14 mm
Bend limit ..... 0.03 mm
Bearings.....Direct in housing
Journal diameter:
Standard —
No. 1 .....42.455-42.470 mm
No. 2 .....42.705-42.720 mm
No. 3 .....42.955-42.970 mm
No. 4 .....43.205-43.220 mm
No. 5 .....43.455-43.470 mm
Undersize —
No. 1 .....42.355-42.370 mm
No. 2.....42.605-42.620 mm
No. 3 .....42.855-42.880 mm
No. 4.....43.105-43.120 mm
No. 5 .....43.355-43.370 mm
*An undersize camshaft can be identified by a violet flash between the inlet and exhaust lobes of No. 2 cylinder.
Housing diameter;
Standard —
No. 1 .....42.500-42.525 mm
No. 2 .....42.750-42.775 mm
No. 3 .....43.000-43.025 mm
No. 4.....43.250-43.275 mm
No. 5 .....43.500-43.525 mm
*Undersize —
No. 1 .....42.400-42.425 mm
No. 2 .....42.650-42.675 mm
No. 3 .....42.900-42.925 mm
No. 4.....43.150-43.175 mm
No. 5 .....43.400-43.425 mm
*An undersize camshaft housing can be identified by a violet flash on the centre camshaft bearing support.

LUBRICATION

Oil pump type .....Involute gear
Filter type..... Full flow disposable
Oil pressure at 4 000 rpm.....480-620 kPa
Rotor assembly end float..... 0.03-0.010 mm
Rotor teeth backlash..... 0.010-0.20 mm

TORQUE WRENCH SETTINGS

*Cylinder head bolts:
Initial torque..... 25 Nm
1st stage ..... + 60 degrees
2nd stage..... + 60 degrees
3rd stage..... + 60 degrees
4th stage, engine at operating temperature ..... + 30-50 degrees
Exhaust manifold nuts..... 22 Nm
Exhaust manifold flange nuts ..... 22 Nm
Inlet manifold nuts..... 22 Nm
Throttle body to inlet manifold nuts.....12 Nm
Camshaft liming gear bolt.....45 Nm
Camshaft retaining plate bolts .....7 Nm
Camshaft cover bolts.....8 Nm
Thermostat cover bolts.....15 Nm
*Main bearing bolts.....60 Nm + 45 degrees
Connecting rod bearing cap nuts..... 35 Nm + 45 degrees
* Crankshaft timing gear bolt.....145 Nm + 35 degrees
*Flywheel bolts (microencapsulated) ..... 60 Nm + 30 degrees
*Drive plate bolts (microencapsulated).....60 Nm
Water pump bolts..... 25 Nm

Oil pump cover plate screws..... 6 Nm
Oil pump mounting bolts..... 6 Nm
Oil pump pickup bolts
(coat with Loctite 242)..... 8 Nm
Sump bolts (coat with Loctite 242)..... 5 Nm
Sump drain plug .....35 Nm
*Use new bolts
Head bolts maximum torque 135 Nm

1. ENGINE MECHANICAL TROUBLE SHOOTING

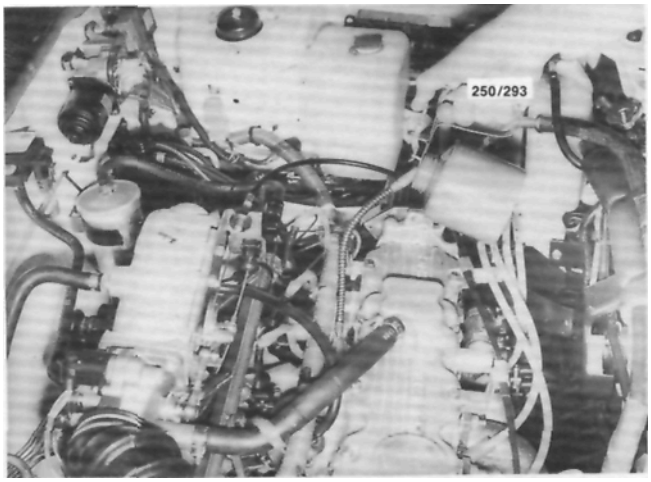
ENGINE MISSES AT IDLING SPEED

NOTE: For other causes of engine misfire, refer to the Fuel and Engine Management section.

(1) Blown head gasket: Check the cylinder compressions and renew the head gasket as necessary.
(2) Burnt valves or seats in the cylinder head: Check the cylinder compressions and overhaul the cylinder head as necessary.
(3) Broken or worn piston rings: Check the cylinder compressions and renew the piston rings as necessary.
(4) Weak or broken valve springs: Remove the camshaft housing top cover and check the condition of the valve springs.
(5) Air leak at the inlet manifold gasket; Check for air leaks by applying oil around the manifold joints. Renew the gasket if an air leak is evident.

NOTE: Use a compression gauge and check the compression pressure in each cylinder as described in the Engine Tune-up section. If a low pressure reading is indicated in one or more cylinders, remove the cylinder head for gasket and valve inspection. Should the gasket and valves prove satisfactory, inspect the cylinder bores, pistons and rings.

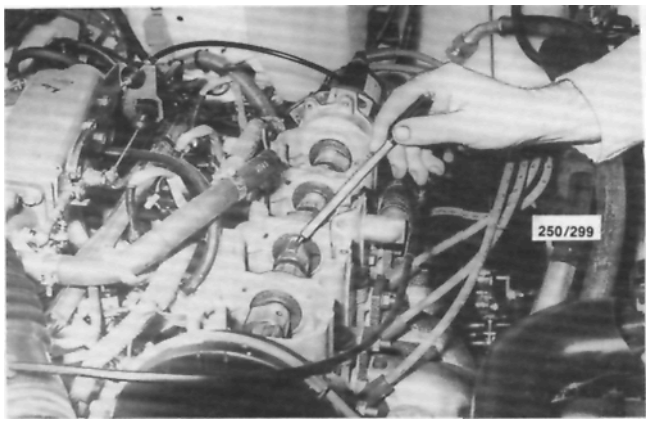
Check for air leaks at the inlet manifold by applying engine oil around the manifold joints. If the oil can be seen or heard sucking into the manifold or excessive smoke begins to issue from the exhaust system, there is an air leak at the inlet manifold.



Air leaks at the inlet manifold can be located by applying engine oil around the suspect joints.

NOISY VALVE OPERATION

(1) Faulty hydraulic tappets: Renew the faulty tappet assemblies.
(2) Weak or broken valve springs: Remove the camshaft housing top cover and check the condition of the valve springs.
(3) Worn valve guides: Overhaul the cylinder head as described in this section.
(4) Worn rocker gear: Remove (he rocker gear and check the components for wear.

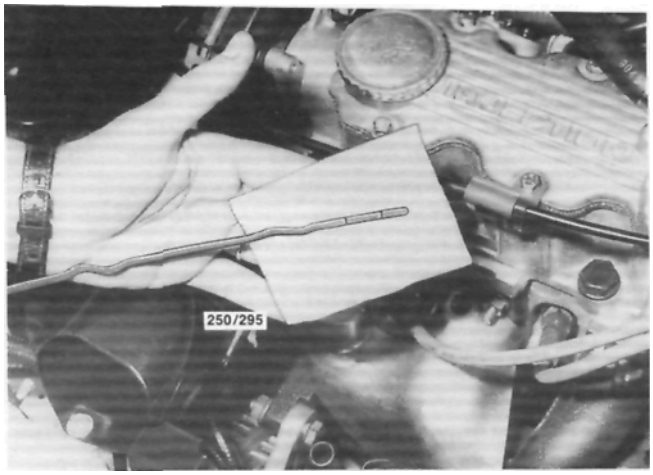


Camshaft lobe wear is also a cause of noisy valve operation.

BIG END BEARING NOISE

(1) Inadequate oil supply: Check the oil level in the sump and the condition of the oil pump and relief valve. Renew the oil filter.
(2) Excessive bearing clearance: Renew the bearing shells, check and regrind the big end journals if oval or tapered.
(3) Thin oil or oil diluted by petrol or water: Change to the correct oil grade. Check and rectify the cause of the oil dilution. Check that the engine is not operating in overheat conditions.
(4) Low oil pressure: Check the engine oil level. Check the pressure relief valve and spring and the oil filter bypass valve.
(5) Misaligned big end bearings: Align the connecting rods and renew the big end bearing shells.

NOTE: Big end bearing noise is indicated by a metallic knock which is usually loudest at approximately 60 km/h with the throttle



Check the engine oil for level and dilution on the dipstick.

dosed. Before dismantling the engine to inspect the big ends check the engine oil for correct level and dilution on the dipstick. Also, remove the oil pressure sender unit and connect an oil pressure gauge into the oil gallery to check the oil pressure readings.

MAIN BEARING NOISE (APPARENT)

(1) Loose flywheel: Tighten the flywheel securing bolls to the specified torque.

(2) Low oil pressure: Check the bearing to journal clearance. Check the condition of the oil pump and pressure relief valve. Recondition the oil pump as necessary.

(3) Excessive crankshaft end float: Renew the main bearings.

(4) Crankshaft journals out of round and excessive bearing to journal clearance: Regrind the journals and renew the bearings (undersize).

(5) Insufficient oil supply: Replenish the oil in the sump to the correct level.

NOTE: Main bearing noise is indicated by a heavy but dull knock when the engine is under load. A loose flywheel is indicated by a thud or dull click when the ignition is turned off. It is usually accompanied by vibration.

Crankshaft end float noise is indicated by a sharp rap at idle speed. The crankshaft can be readily checked for excessive end float by levering the crankshaft backwards and forwards.

If the oil pressure is not satisfactory, remove the main bearing caps and assess the bearing clearance using the Plastigage method as described in this section. Ovality and wear on the main bearing journals can only be checked with a micrometer after the crankshaft has been removed.

EXCESSIVE OIL CONSUMPTION

(1) Oil leaks: Check and renew the engine gaskets or seals as necessary.

(2) Damaged or worn valve stem oil seals: Dismantle the cylinder head and renew the damaged or worn oil seals.

(3) Excessive valve stem to valve guide clearance: Ream the valve guides and renew the valves as necessary.

(4) Worn or broken piston rings: Renew the piston rings on all pistons.

(5) Rings too tight or stuck in the grooves: Renew the rings and clean the ring grooves.

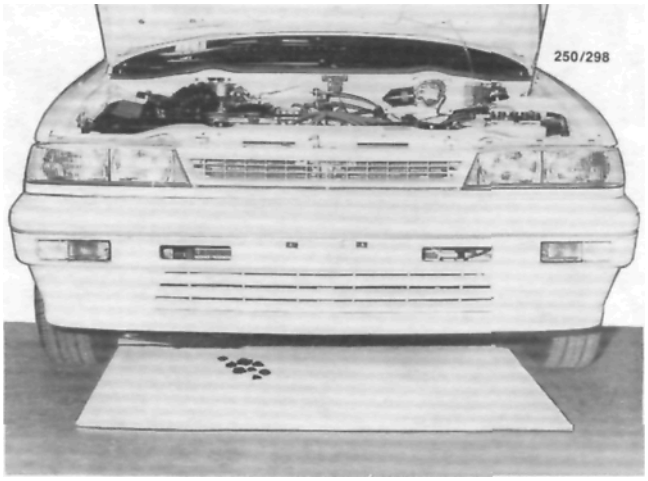
(6) Excessive wear in the cylinders, pistons and rings: Recondition the cylinders and renew the pistons and rings.

(7) Compression rings incorrectly installed. Oil rings clogged or broken: Renew the piston rings.

NOTE: Before checking the engine for oil leaks the engine should be completely degreased and cleaned. Run the engine at operating temperature for a period and visually check for oil leakage. By placing white paper on the floor directly beneath the engine any excessive leak can be readily pinpointed.

Damaged or worn valve stem oil seals which allow oil to be drawn down past the valve stems into the combustion chambers can be diagnosed by allowing the engine to idle for a few minutes and then opening the throttle. If oil is being drawn past the valve stems a heavy discharge of blue smoke will be seen at the tailpipe.

Piston, ring and cylinder bore troubles are normally accompanied by a loss of compression. Cylinder compression can only be accurately assessed by using a compression gauge.



Run the engine over white paper to check for oil leaks.

DROP IN OIL PRESSURE

(1) Oil level low in the sump: Check and replenish the oil to the full mark on the dipstick.

(2) Thin or diluted oil: Change to the correct oil grade and rectify the source of dilution.

(3) Oil pump relief valve stuck or spring broken; Free up the relief valve or renew the broken relief valve spring.

(4) Excessive bearing clearance: Renew the bearing shells or recondition the crankshaft journals as necessary.

(5) Excessive wear of the oil pump components: Renew or recondition the oil pump.

NOTE: If the vehicle is not equipped with an oil pressure gauge remove the oil sender unit and connect a pressure gauge into the oil gallery. Check the oil pressure with the engine cold and hot. If the oil pump or relief valve are faulty. low pressure will be indicated with the engine both hot and cold. However, if the bearings are at fault a fairly high oil pressure will be indicated when the engine is cold, but a marked drop in pressure will occur when the engine is hot.

ENGINE WILL NOT ROTATE

(1) Starter motor drive jammed: Remove the starter motor. Check and renew the damaged drive and/or flywheel ring gear.

(2) Engine overheated and seized: Remove and dismantle the engine. Check and renew any damaged components. See the following note.

(3) Water in the cylinder due to a blown head gasket or cracked cylinder block or head: Remove the cylinder head. If the gasket is blown, check for cylinder block and head distortion and reface if necessary. Renew the cylinder head and/or cylinder block if cracked.

(4) Broken crankshaft, connecting rod. piston etc. due to overheating, fatigue etc: Remove and dismantle the engine. Examine and renew any components as necessary.

(5) Valve head broken off due to overheating, fatigue etc: Remove the cylinder head and check the head, piston and cylinder bore for damage. Repair or renew as necessary.

NOTE: Invariably when an engine seizes because of overheating due to lack of oil and/or water, damage is done to the bearings, pistons etc. Although there may be instances where an engine will start and run after it has cooled down and the oil and water have been replenished, it will usually be found that oil consumption increases, oil pressure decreases and the engine will be noisier, depending on the degree of damage.

When a cylinder head gasket blows allowing water into the cylinders, or compression loss between the cylinders, it is essential to check the gasket faces on the cylinder block and head for distortion. Sufficient water can enter a cylinder because of a blown head gasket, cracked cylinder or head to prevent an engine from rotating.

This is normally preceded by difficult starting, misfiring, excessive steam from the exhaust and loss of water from the radiator.

Frequent jamming of the starter motor drive with the flywheel ring gear can be due to a bent starter armature shaft or damaged teeth on the drive and/or ring gear. With the starter motor removed, the flywheel ring gear teeth can be examined through the starter motor mounting aperture. Renewal of the ring gear requires removal of the transaxle, clutch and flywheel on manual transaxle models and the removal of the transaxle and drive plate on automatic transaxle models. To check for a bent armature shaft, rotate the shaft by hand while holding the end in close proximity to a fixed object.

2. DESCRIPTION

The 1.6 and 1.8 liter engines are basically identical in design.

Both engines share the same stroke. The 1.8 liter engine has a larger bore thus giving it increased capacity.

The engine is a four cylinder, inline, overhead camshaft design transversely mounted in the front of the vehicle.

The camshaft runs in five integral support bearings in the camshaft housing which in turn is mounted directly on to the cylinder head and retained by the cylinder head bolts.

Camshaft end float is controlled by a retaining plate engaged in a groove machined in the **rear** camshaft journal. The camshaft is driven by the crankshaft timing gear via a reinforced rubber belt.

The aluminum cross flow cylinder head houses the tappets, rocker arms and valve assemblies. An oil pressure relief valve is installed to the cylinder head to maintain oil pressure to the hydraulic tappets at a predetermined setting.

The exhaust valve springs are equipped with rotators mounted below the valve springs which rotate the exhaust valve assemblies. The rocker arms pivot on hydraulic tappet assemblies and locate in notched lash pads mounted on the valve stems. The camshaft lobes bear directly onto the rocker arms and due to the characteristics of the hydraulic tappet assemblies, no provision is made for tappet clearance adjustment.

The cylinder block is a cast iron alloy, deep skirt design and the crankshaft is supported in the cylinder block by five precision insert replaceable main bearings. Crankshaft end float is controlled by the flanged centre main bearing. Connecting rods are I section forgings equipped with precision insert replaceable big end bearings. The gudgeon pins are an interference fit in the connecting rod and a floating fit in the piston.

The cast aluminum pistons are equipped with two compression rings and one oil control ring.

The twin rotor, involute gear oil pump is mounted directly to the front face of the cylinder block. The inner rotor is internally driven by the crankshaft. The oil pump pressure relief valve is not adjustable, and consists of a plunger and spring mounted in the oil pump body.

The pump draws oil through a screen in the sump and delivers it, via a full flow replaceable oil filter, to the oil gallery from where it is distributed to the hydraulic tappets, camshaft and crankshaft bearings and to the overhead rocker and valve mechanism.

3. ENGINE AND TRANSAXLE ASSEMBLY

Special Equipment Required:
To Remove and Instill — Suitable lifting tackle, extra long chassis stands, suitable trolley

TO REMOVE

NOTE: Due to the high residual pressure within the fuel system, it will be necessary to depressurize the system before removing any fuel supply components. Refer to the Fuel and Engine Management section for the correct procedure.

(1) Disconnect the negative battery terminal.

(2) Mark around the bonnet hinges with a soft lead pencil Co facilitate correct installation. With the aid of an assistant, remove the bonnet retaining bolts and remove the bonnet from the vehicle.

(3) Drain the engine and transaxle lubricant.

(4) Open the coolant drain tap located on the lower radiator pipe and drain the coolant.

(5) Loosen the hose clips and disconnect the heater hoses from the heater pipes at the bulkhead.

NOTE: Do not use excessive force to remove the heater hoses from the heater pipes or the heater core will become dislodged from the heater unit. If necessary, cut the heater hoses from the pipes using a sharp knife.

(6) Loosen the hose clamps and disconnect the radiator hoses from the engine assembly.

(7) Disconnect the positive lead from the battery.

(8) On 1.8 liter models, disconnect the air inlet duct.

(9) On 1.6 liter models, remove the air cleaner assembly. Refer to the Fuel and Engine Management section if necessary.

(10) Disconnect the throttle cable from the throttle body and from the camshaft housing top cover bracket, if applicable.

(11) Disconnect the fuel supply and return hoses. Mark the hoses as an aid to installation.

(12) Suitably mark and disconnect the charcoal canister hoses.

(13) Disconnect the injector wires from the injectors. On 1.6 liter models, slide the wiring out from the throttle body.

(14) Disconnect the wiring from the throttle position sensor (TPS), idle air control (IAC) valve, oxygen (O_2) sensor wire, coolant temperature sensor, coolant sender and on 1.8 liter models, the manifold air temperature (MAT) sensor.

(15) Disconnect the wiring connector adjacent to the top heater hose, the wiring from the alternator and the two earth wires from underneath the cylinder head bolts.

(16) Lay the wiring loom over on the passenger side of the engine compartment, clear of the work area.

(17) On manual transaxle models, loosen the clutch cable adjusting nuts and remove the cable through the slot in the lever. Remove the clutch cable bracket from the transaxle after removing the retaining bolts and place the cable to one side.

(18) Disconnect the wiring from the starter motor, speedometer sender and on manual transaxle models, the reverse lamp switch wiring.

(19) If applicable, disconnect the power steering lines from the pump and drain the fluid into a container. Suitably plug the lines and the pump to prevent the entry of dirt.

(20) On automatic transaxle models, disconnect the selector cable and bracket from the transaxle assembly.

Disconnect the transaxle oil cooler lines from the transaxle. Plug the lines and fittings to prevent the entry of dirt etc.

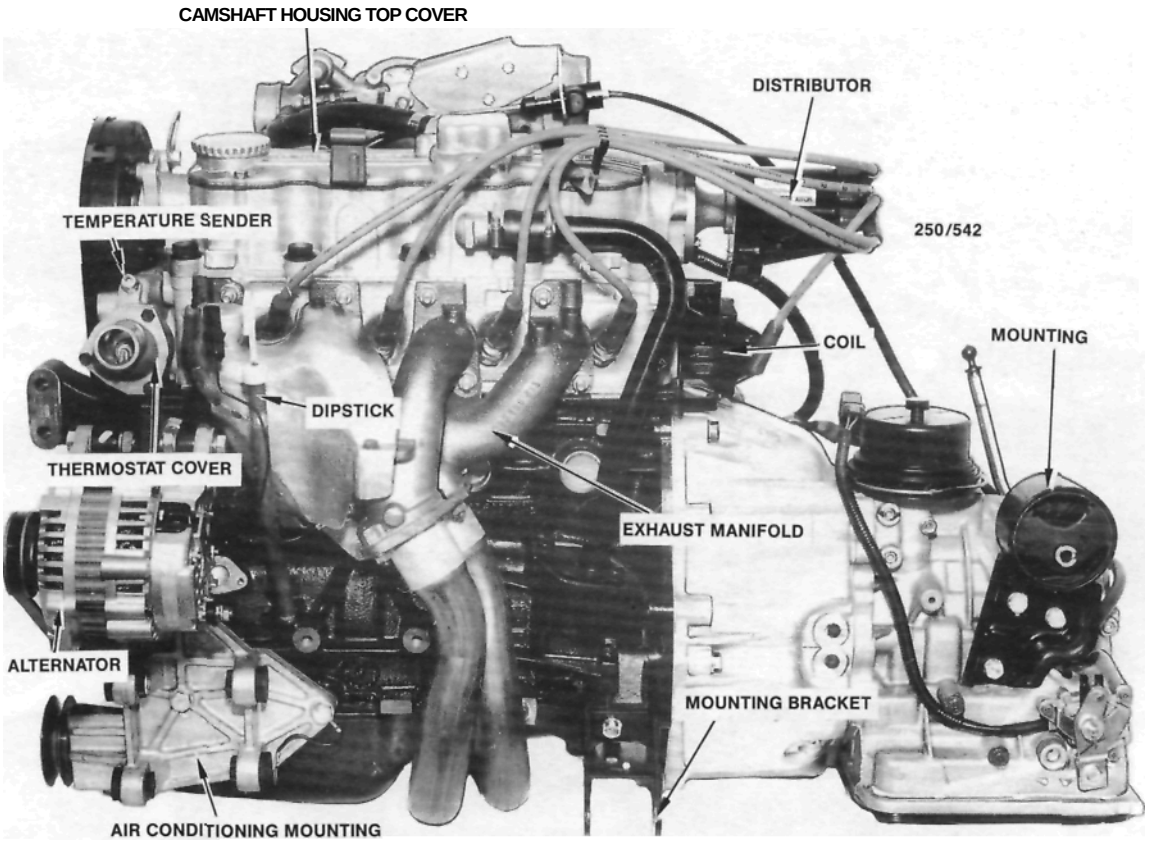
(21) Loosen the front wheel nuts, raise the front of the vehicle and support it on extra long chassis stands. Ensure that the vehicle is high enough to allow removal of the engine from underneath.

(22) Remove the front wheels and the engine splash guards from the vehicle.

(23) On manual transaxle models, remove the stay rod and control rod bolts and nuts and disconnect the rods from the transaxle.

(24) Remove the lower control arm to steering knuckle ball joint nuts and separate the ball joints from the steering knuckle by holding a dolly or a hammer against one side of the steering knuckle and hitting the other side with a hammer. The taper on the ball joint will release from the steering knuckle.

(25) Pull the steering knuckles outward swiftly to



Front view of the 1.8 liter engine and automatic transaxle assembly removed from the vehicle.

release the driveshafts from the transaxle. Tie the driveshafts to the underbody of the vehicle using wire and ensuring that excessive strain is not placed on the joints.

NOTE: If the driveshafts will not release from the transaxle, a lever can be used between the driveshaft and the transaxle. Care must be taken when using the lever not to damage the transaxle oil seals.

(26) Remove the engine pipe from the engine. Refer to the procedure at the end of this section if necessary.

(27) Remove the engine crossmember retaining bolts and nuts and remove the crossmember from beneath the vehicle.

(28) Attach the lifting tackle to the engine and raise the engine slightly to take the weight off the engine mountings.

(29) Remove the front, rear, left and right engine mounting bolts and nuts. Withdraw the mountings from the engine compartment.

(30) Slowly lower the engine and transaxle assembly from the engine compartment.

On air conditioned vehicles, remove the air conditioning compressor and hoses after the engine has been lowered slightly. Secure the compressor to one side, clear of the work area, with wire or similar.

NOTE: Do not disconnect the hoses from the air conditioning compressor. Escaping refrigerant can cause frostbite and eye damage.

(31) Lower the engine and transaxle assembly onto a suitable trolley and maneuver the engine from beneath the vehicle.

TO INSTAL

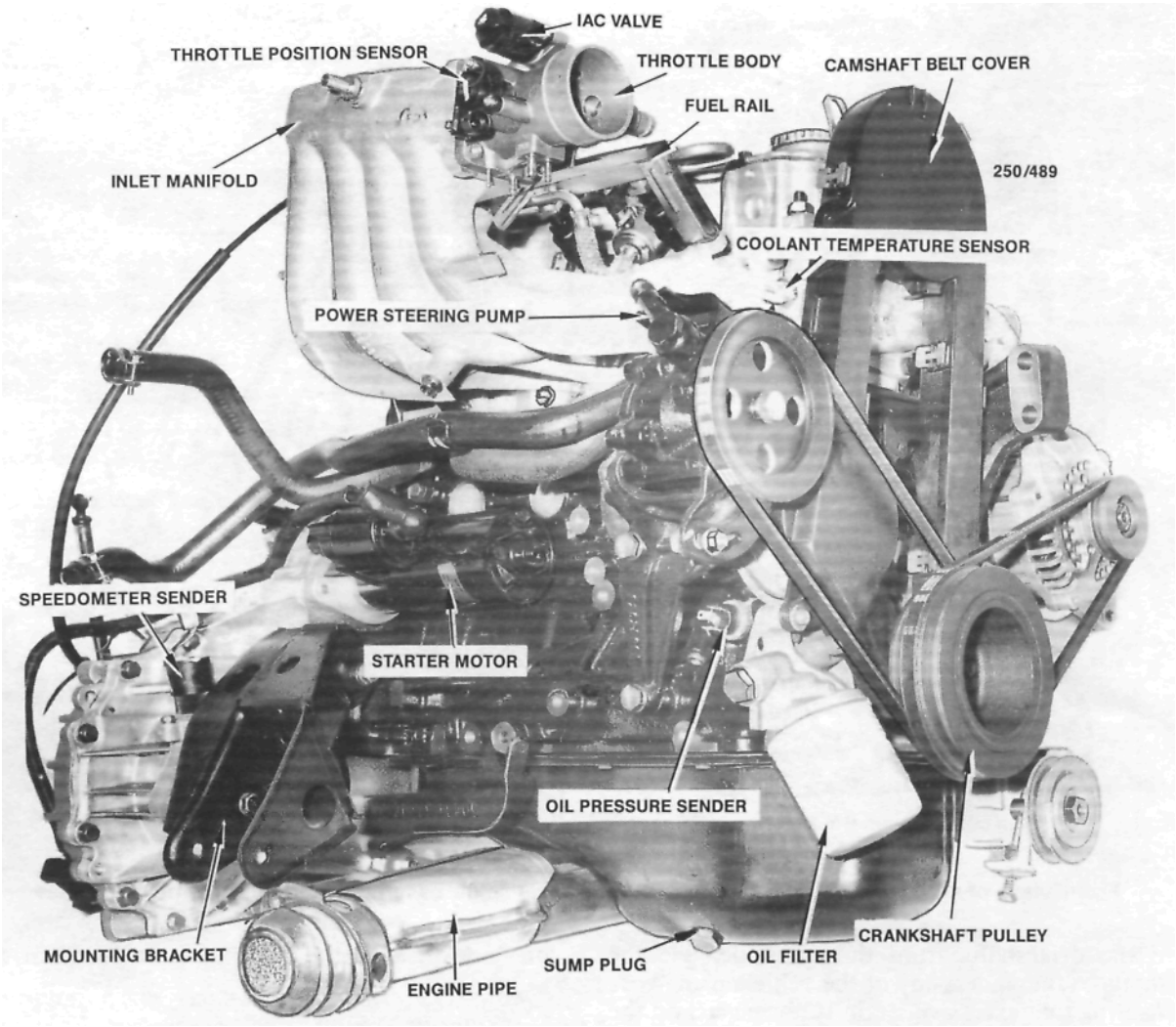
Installation is a reversal of the removal procedure with attention to the following points:

(1) Position the engine and transaxle assembly beneath the front of the vehicle.

(2) Install the lifting tackle and raise the engine assembly into position in the engine compartment.

NOTE: On air conditioned models, ensure that the air conditioning compressor is installed to the engine as the engine is installed to the engine compartment.

(3) Install the engine and transaxle assembly
mounting nuts, bolts and washers finger tight before the full weight of the assembly is taken by the



Rear three quarter view of the 1.8 liter engine and automatic transaxle assembly.

mountings. Lower the assembly onto the mountings and tighten the mounting nuts and bolts.

(4) Install a new exhaust flange gasket.

(5) Fill the engine and transaxle with the correct quantity and grade of lubricant.

(6) Fill the cooling system as described in the Cooling and Heating Systems section.

(7) On models with power steering, fill the power steering reservoir with the recommended fluid.

(8) Start and run the engine until it reaches the normal operating temperature and check for fuel, oil and coolant leaks.

4. MANIFOLDS

INLET MANIFOLD - 1.6 Liter Models

To Remove and Install

NOTE: Due to the high residual pressure within the fuel system, it will be necessary to depressurise the system before removing the fuel supply components. Refer to the Fuel and Engine Management section for the correct procedure.

(1) Disconnect the negative battery terminal.

(2) Remove the wingnuts retaining **the** air cleaner to the throttle body, lift the air cleaner upwards slightly and disconnect the vacuum hoses.

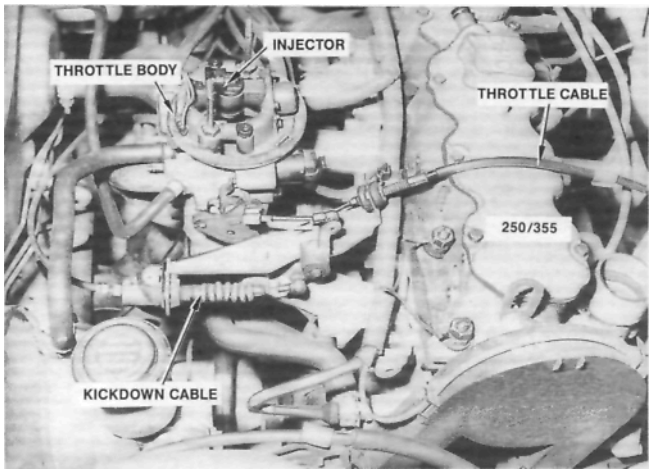
(3) Drain the cooling system as described in the Cooling and Heating Systems section.

(4) Loosen the hose clamps and disconnect the engine coolant hoses from the rear of the manifold.

(5) Disconnect the small branch of the engine ventilation hose from the rear of the inlet manifold.

(6) On automatic transaxle models, disconnect the kickdown cable from the throttle lever by releasing the wire spring clip and removing the cable end socket from the ball.

(7) Turn the throttle lever to the full throttle position. Using the slack in the throttle cable, release the throttle cable end through the slot provided.



Installed view of the inlet manifold. 1.6 liter models. Air cleaner removed.

(8) Remove the bolts retaining the throttle cable bracket to the inlet manifold and place the bracket with cable(s) attached to one side.

(9) Suitably mark the supply and return fuel hoses and disconnect them from the throttle body.

(10) Suitably mark and disconnect the air pre-heat, map sensor, charcoal canister and brake booster vacuum hoses from the throttle body.

(11) Disconnect the electrical connector from the throttle body.

(12) Remove the inlet manifold nuts and withdraw the inlet manifold assembly. Discard the gasket.

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

(1) Ensure that all the carbon and old gasket material is cleaned from the manifold and cylinder head faces.

(2) Check the face of the manifold for distortion using a straight edge and a feeler gauge.

(3) Use a new gasket and ensure that the manifold retaining nuts are tightened to the specified torque in a spiral pattern from the centre outwards.

(4) Connect the vacuum hoses, the throttle cable and where applicable, the kickdown cable. Adjust the throttle cable as outlined in the Fuel and Engine Management section and the kickdown cable as described in the Automatic Transaxle section.

(5) Fill the cooling system as described in the Cooling and Heating Systems section.

(6) Start the engine and check for air, fuel and water leaks.

INLET MANIFOLD - 1.8 Liter Models

To Remove and Install

NOTE: Due to the high residual pressure within the fuel system, it will be necessary to depressurise the system before removing any fuel supply components. Refer to the Fuel and Engine Management section for the correct procedure.

(1) Disconnect the negative battery terminal.

(2) Loosen the hose clamp and disconnect the air inlet duct from the throttle body.

(3) Suitably mark and disconnect the vacuum hoses from the throttle body.

(4) On automatic transaxle models disconnect the kickdown cable from the throttle lever by releasing the wire spring clip and removing the cable and socket from the ball.

(5) Turn the throttle lever to the full throttle position. Using the slack in the throttle cable, release the throttle cable end through the slot provided.

(6) Remove the bolts retaining the throttle cable bracket to the inlet manifold and place the bracket with cable(s) attached to one side.

(7) Disconnect the wiring connectors from the idle air control (IAC) valve and the throttle position sensor (TPS).

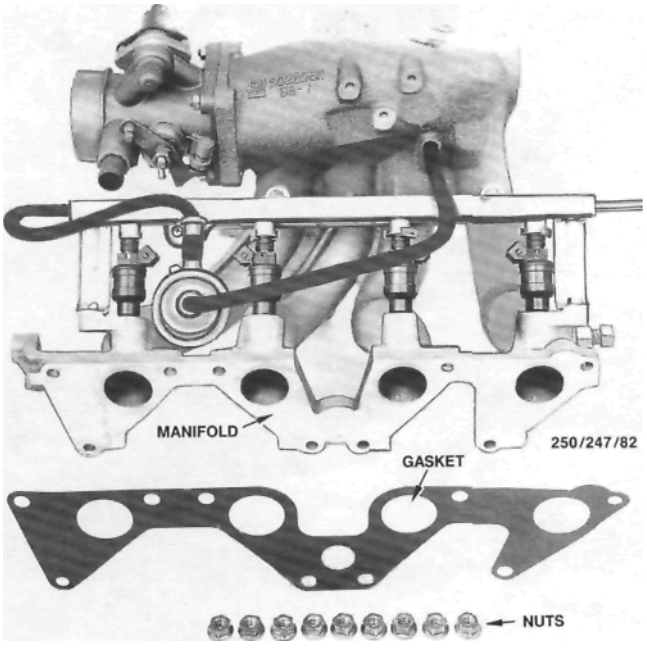
(8) Disconnect the wiring connectors from the fuel injectors and manifold air temperature (MAT) sensor.

NOTE: A small screwdriver or similar tool can be used to release the wire spring clips on the injector connectors.

(9) Suitably mark and disconnect the fuel supply and return lines from the fuel rail.

(10) Remove the inlet manifold nuts and withdraw the inlet manifold assembly. Discard the gasket.

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



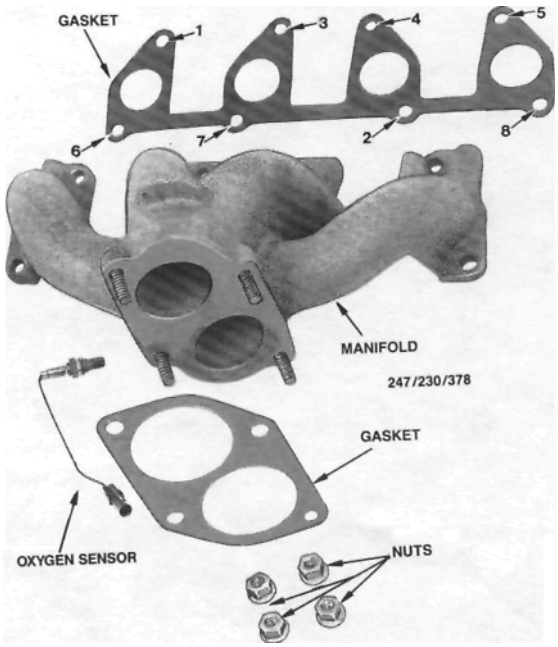
View of the inlet manifold removed from the engine.

(1) Ensure that all carbon and old gasket material is cleaned from the manifold and cylinder head faces.
(2) Check the face of the manifold for distortion using a straight edge and a feeler gauge.
(3) Use a new gasket and ensure that the manifold retaining nuts are tightened to the specified torque in a spiral pattern from the centre outwards.
(4) Adjust the throttle cable as described in the Fuel and Engine Management section and the kick-down cable as described in the Automatic Transaxle section.
(5) Start the engine and check for air, fuel and water leaks.

EXHAUST MANIFOLD

To Remove and Install

(1) Bring the engine to operating temperature and remove the oxygen sensor.
(2) Disconnect the negative battery terminal.
(3) On 1.6 liter models, remove the air cleaner nuts, disconnect the vacuum hose and withdraw the air cleaner from the vehicle.
(4) Remove the front exhaust pipe flange mounting nuts and separate the exhaust pipe from the manifold.
(5) Remove the heat shield retaining bolts and withdraw the heat shield from the exhaust manifold.
(6) Remove the exhaust manifold to cylinder head retaining nuts and remove the manifold from the engine. Discard the manifold gasket.



View of the exhaust manifold and components showing the correct tightening sequence.

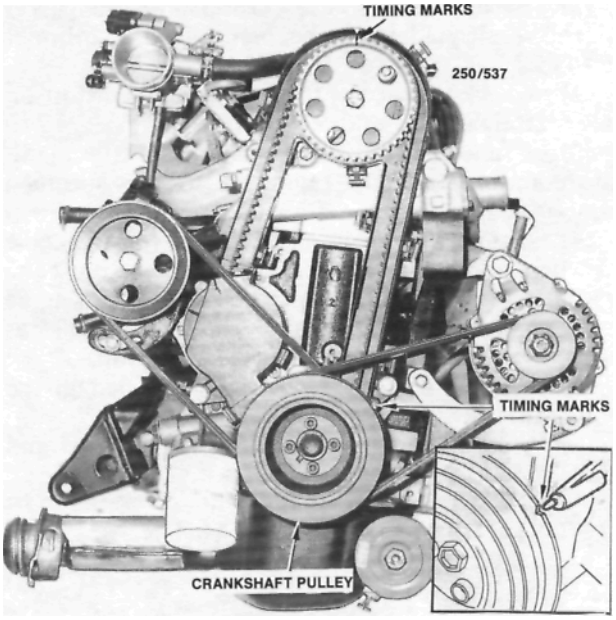
Installation is a reversal of the removal procedure with attention to the following points:
(1) Ensure that all carbon is cleaned from the manifold and cylinder head mating surfaces.
(2) Check the face of the manifold for distortion using a straight edge and feeler gauges.
(3) Use new gaskets on assembly.
(4) Tighten the exhaust manifold retaining nuts to the specified torque in the sequence shown in the illustration.
(5) Install the oxygen sensor. Refer to the Fuel and Engine Management section.
(6) Coat the threads of the front exhaust pipe to manifold retaining nuts with an anti-seize solution and tighten the nuts to the specified torque.

5. CAMSHAFT DRIVE BELT

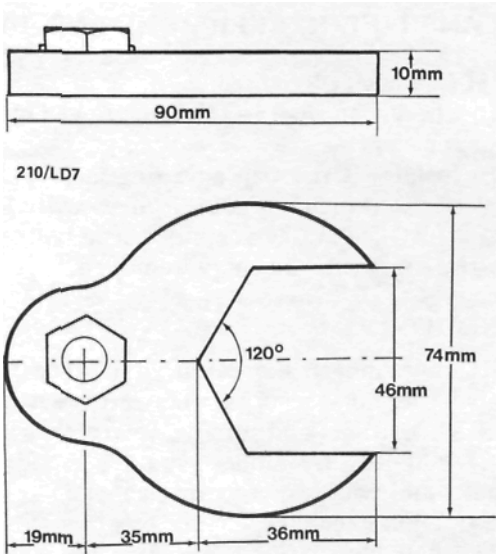
Special Equipment Required:
To Adjust — Drive belt adjusting tool

TO REMOVE

(1) Disconnect the negative battery terminal.
(2) Raise the front of the vehicle, support it on chassis stands and remove the right hand front wheel. Refer to the Wheels and Tires section.
(3) Remove the fasteners securing the engine splash guard to the right hand front inner mudguard and remove the splash guard.
(4) Loosen the alternator adjusting bolt and if equipped, the power steering and air conditioning adjusting bolts. Remove the drive belt(s).



View of the 1.8 liter engine with the upper timing belt cover removed showing the camshaft gear timing marks. Inset shows the crankshaft pulley timing marks.



Line drawing showing the dimensions for the fabrication of a camshaft drive belt adjusting tool.

(5) Release the clips securing the camshaft drive belt outer cover to the inner cover and remove the outer cover.

(6) Turn the engine in the direction of rotation until the timing marks on the camshaft gear and the inner cover are aligned and the timing marks on the crankshaft pulley and the pointer on the inner timing cover are also aligned.

(7) If the drive belt is to be reused, mark the drive belt with an arrow to ensure that it is installed in the original direction of rotation.

(8) Remove the Allen head bolts securing the crankshaft pulley to the crankshaft gear and remove the pulley.

(9) Loosen the water pump retaining bolts and using the adjusting tool, rotate the water pump housing to release the camshaft drive belt tension.

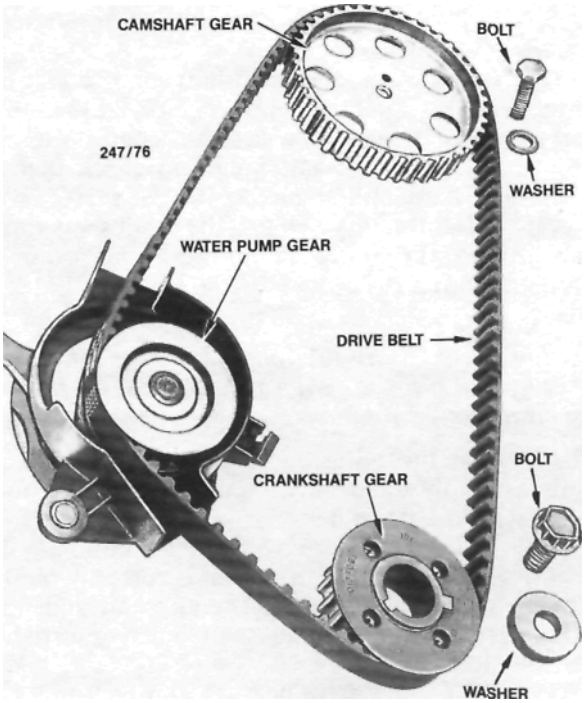
NOTE: A drive belt tension adjusting tool can be manufactured from a piece of 10 mm thick steel to the dimensions given in the illustration.

(10) Remove the inner cover lower retaining bolts and maneuver the camshaft drive belt from the camshaft and crankshaft gears. Do not rotate the crankshaft or camshaft.

TO CHECK AND INSPECT

(1) Inspect the drive belt for any signs of wear, damaged teeth or torn backing. Renew the belt if it is contaminated by oil. Do not wash or clean a drive belt in solvents. Any slight contamination may be wiped off using a dry cloth.

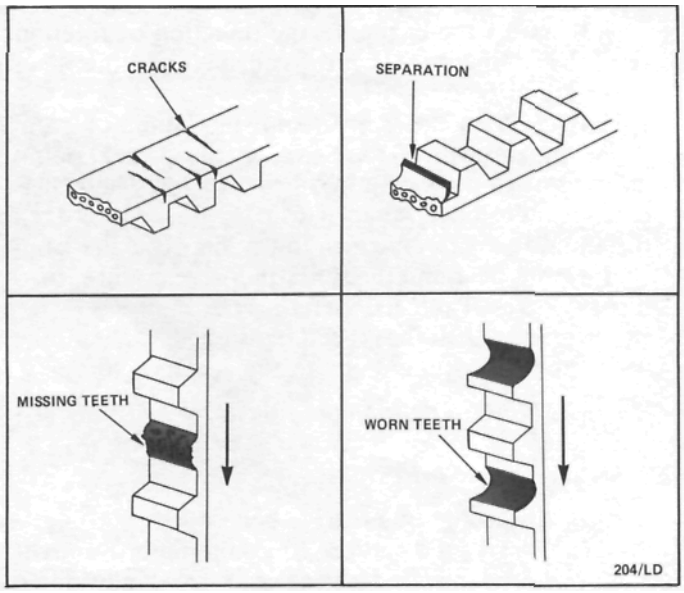
NOTE: If the drive belt is contaminated with oil, the crankshaft and camshaft oil seals must be checked and any oil leak rectified prior to installing a new drive belt.



Dismantled view of the camshaft drive belt components.

(2) Check the water pump for rough or excessively noisy operation. Ensure that the assembly slides smoothly in the cylinder block and that the seal is not leaking. Refer to the Cooling and Heating Systems section if it is necessary to renew the water pump assembly.

(3) Check the water pump, camshaft and crankshaft timing gears for any wear or damage.



Check the drive belt for the illustrated faults.

TO INSTAL

(1) Check that the camshaft and crankshaft timing gears have not been moved and that the timing marks are still aligned. It will be necessary to temporarily install the crankshaft pulley to check that the timing marks are still aligned.

(2) Install the drive belt to the crankshaft timing gear around the water pump gear and onto the camshaft timing gear.

NOTE: If the original drive belt is being installed, ensure that the arrow marked on the belt prior to removal is pointing in the direction of rotation.

(3) Use the adjusting tool to turn the water pump assembly sufficiently to engage the water pump pulley with the drive belt.

(4) Install the inner cover lower retaining bolt.

(5) Ensure that the drive belt is correctly meshed with the teeth of the camshaft, crankshaft and water pump gears. Install the crankshaft pulley and tighten the bolts to Specifications.

(6) Adjust the drive belt as described under the following heading.

(7) Install the drive belt outer cover and fasten the retaining clips.

(8) Install and adjust the alternator and if equipped, the power steering and air conditioning drive belts as described in the Engine Tune-up section.

TO ADJUST

(1) Remove the alternator drive belt and if equipped, the power steering and air conditioning drive belts.

(2) Release the clips securing the camshaft drive belt outer cover to the inner cover and remove the outer cover.

(3) Turn the engine in the direction of rotation until the timing marks on the camshaft and the inner cover are aligned.

(4) Loosen the water pump retaining bolts and using the adjusting tool, rotate the water pump housing to gain the required belt tension. The belt is correctly tensioned when it can be grasped between the thumb and forefinger midway between the camshaft timing gear and the water pump gear and turned ninety degrees from its operating position.

After the belt has been tensioned, tighten the water pump retaining bolts to the specified torque.

NOTE: Over tensioning of the drive belt will result in noisy operation and premature wear of the belt.

(6) Install the outer drive belt cover.

(7) Install and adjust the alternator, and if equipped, the power steering and air conditioning drive belts as described in the Engine Tune-up section.

6. CAMSHAFT. ROCKER ARMS AND TAPPETS

Special Equipment Required:

To Check Camshaft — Dial gauge, Vee blocks and micrometers

To Install — Drive belt adjusting tool

It is recommended that a new cylinder head gasket is installed and the cylinder head bolts renewed when the camshaft housing is removed.

TO REMOVE

(1) Disconnect the negative battery terminal. Remove the nuts securing the earth wires to the cylinder head bolts and remove the earth wires.

(2) On 1.6 liter models, remove the air cleaner wingnuts and withdraw the air cleaner.

(3) Disconnect the engine breather hoses from the camshaft housing and the camshaft housing top cover.

(4) Remove the camshaft housing top cover retaining bolts and remove the top cover. Discard the gasket.

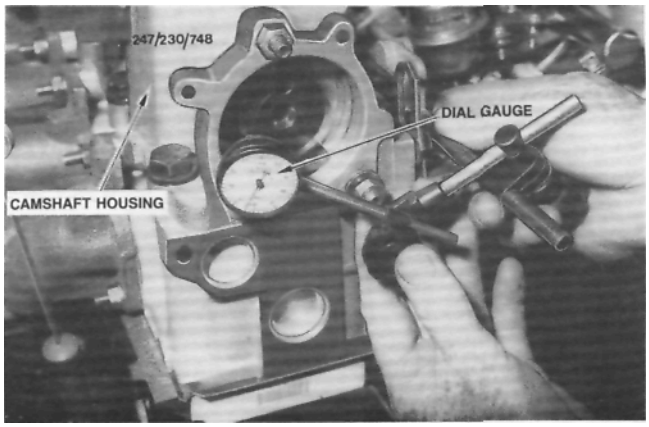
(5) Remove the camshaft drive belt as described under the previous heading.

(6) Using an open ended spanner, hold the camshaft between the inlet and exhaust lobes of number four cylinder and remove the camshaft timing gear retaining bolt and the camshaft timing gear.

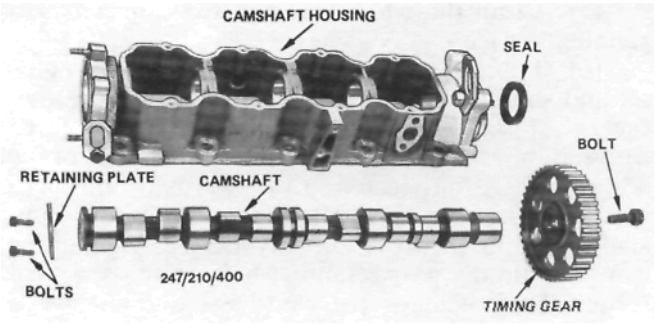
(7) Remove the distributor, distributor cap and high tension leads. If necessary refer to the Fuel and Engine Management section.

(8) Check the camshaft end float before removing the camshaft from the engine. Mount a dial gauge to the cylinder block with the plunger bearing on the distributor drive end of the camshaft.

(9) Lever the camshaft towards the dial gauge and zero the gauge. Move the camshaft in the opposite direction away from the dial gauge and note the reading obtained. Check this measurement against Specifications.



Checking the camshaft end float.



Dismantled view of the camshaft housing and components.

(10) If the measurement is not within Specifications, check the retaining plate and the retaining plate groove in the camshaft for wear or scoring after dismantling. Renew the defective parts as necessary on assembly.

(11) Disconnect the lower radiator hose and drain the cooling system.

NOTE: If the coolant is to be reused, drain the coolant into a clean container.

(12) Remove the bolts securing the camshaft drive belt inner cover to the camshaft housing.

(13) Remove the cylinder head bolts in the reverse order of the tightening sequence, backing off each bolt a quarter of a turn then half a turn at a time until the bolts are loose.

NOTE: Do not loosen the cylinder head bolts while the engine is warm as distortion of the cylinder head could result.

(14) Remove the cylinder head bolts and lift the camshaft housing from the cylinder head.

(15) The rocker arms, thrust pads and tappet assemblies can now be removed from the cylinder head. Number a rack from 1 to 8 and keep each assembly in order so that they can be returned to their original positions.

(16) From the distributor drive end of the camshaft housing, remove the bolts securing the camshaft retaining plate to the camshaft housing and remove the retaining plate.

(17) Withdraw the camshaft from the camshaft housing taking care to support the camshaft to avoid scoring the inner surfaces of the camshaft bearings.

(18) With a pointed drift, tap a small hole in the front face of the oil seal. Insert a self tapping screw in the hole and using a pair of pliers, pull on the screw to remove the oil seal from the housing. Discard the oil seal.

TO CLEAN AND INSPECT

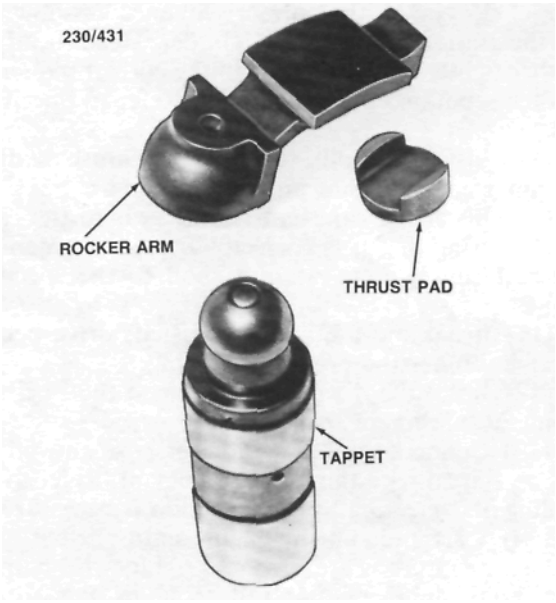
(1) Wash all parts in cleaning solvent and dry with compressed air. Ensure that all oil ways in the camshaft and rocker arms are free from obstruction.

(2) Check the camshaft lobes, the rocker arms. the thrust pads and the tappet assemblies for pitting and wear. The tappet assemblies are non-serviceable and should be renewed as an assembly if wear is apparent or internal damage is suspected.

(3) Support the camshaft at each end on Vee blocks and using a dial gauge with its plunger bearing on the centre journal, rotate the camshaft and check for bend.

(4) Using micrometers, measure the outside of each camshaft journal and the inside of each camshaft tunnel in the camshaft housing. Compare these measurements to Specifications and renew defective parts as necessary.

(5) Check the retaining plate and the retaining plate groove in the camshaft for wear and scoring. Renew defective parts as necessary.



Dismantled view of the valve operating components.

TO INSTAL

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

(1) Lubricate the lip of a new oil seal with engine oil and position the seal squarely in the camshaft housing. Ensure that the lip of the seal faces towards the inside of the camshaft housing. Tap around the edge of the seal with a soft faced hammer until the seal is fully seated in the recess in the camshaft housing.

(2) Apply clean engine oil to the camshaft bearings and camshaft journals. Insert the camshaft into position taking care not to damage the bearings with the edges of the cam lobes or journals.

(3) Apply engine oil to the camshaft retaining plate and position it in the groove in the camshaft. Install the retaining bolts and tension the bolts to the specified torque.

(4) Ensure that the tappet assemblies are full of clean engine oil and insert the tappets in their respective bores in the cylinder head. Install the thrust pads to the top of each valve assembly ensuring that they are returned to their original location.

(5) Coat the contact surfaces of the rocker arms with molybdenum disulphide grease and install the rocker arms to their original locations on the cylinder head.

(6) Clean the mating surfaces of the camshaft housing and cylinder head. Apply a bead of Loctite 515 to the cylinder head and camshaft housing mating surfaces. Take care that no sealant is forced into the oil passages and install the camshaft housing to the cylinder head.

(7) Install new cylinder head bolts and lubricate the bolts and washers with oil.

(8) Apply an initial torque to the cylinder head bolts of 25 Nm in the correct sequence as shown in the illustration under the Cylinder Head heading. Further tighten the head bolts in the correct sequence, in three separate 60 degree stages. Refer to Specifications.

(9) Install the bolts securing the camshaft drive
belt inner cover to the camshaft housing.

(10) Install the camshaft timing gear to the camshaft ensuring that it is correctly located. Tighten the camshaft timing gear retaining boll to the specified torque.

(11) Install and adjust the camshaft drive belt as described under the previous heading.

(12) Install the distributor. Refer to the Fuel and Engine Management section.

(13) Connect the lower radiator hose and fill the cooling system with the required coolant. Refer to the Cooling and Heating Systems section if necessary.

(14) Start and run the engine until normal operating temperature is attained and tighten the cylinder head bolts another 30-50 degrees in the correct sequence, ensuring that the tension does not exceed 135 Nm.

TO RENEW CAMSHAFT OIL SEAL, CAMSHAFT INSTALLED

(1) Remove the camshaft drive belt from the camshaft timing gear as described under the previous heading.

(2) Remove the camshaft housing top cover retaining bolts, remove the cover and discard the gasket.

(3) Use an open end spanner to hold the camshaft between the inlet and exhaust lobes of number four cylinder and remove the camshaft timing gear retaining bolt and the camshaft timing gear.

(4) With a pointed drift, tap a small hole in the front face of the oil seal. Insert a self tapping screw in the hole and using a pair of pliers, pull on the screw to remove the oil seal from the housing.

(5) Clean the seal recess and the camshaft sea! running surface.

(6) Lubricate the lip of a new oil seal with engine oil and slide the seal over the camshaft. Ensure that the lip of the seal faces towards the inside of the camshaft housing. Tap evenly around the edges of the seal until it is fully seated in the camshaft housing.

(7) Install the camshaft timing gear to the camshaft, ensuring that it is correctly located. Tighten the camshaft timing gear retaining bolt to the specified torque. Do not allow the camshaft to rotate while tightening the bolt.

(8) Install and adjust the drive belt as described under the previous heading. Ensure that the timing marks are aligned.

(9) Install the camshaft housing top cover using a new gasket. Tighten the retaining bolts to the specified torque.

7. CYLINDER HEAD

Special Equipment Required:

To Dismantle and Assemble — Valve spring compressor

To Inspect — Dial gauge and straight edge

To Install — Drive belt adjusting tool

TO REMOVE AND INSTAL

NOTE: Due to the high residua! pressure within the fuel system, it ***will*** *be necessary to depressurize the system before removing any* ***fuel*** *supply components. Refer to the Fuel and Engine Management section for the correct procedure.*

Allow the engine to cool prior to the removal of the cylinder head to prevent possible distortion of the cylinder head.

(1) Disconnect the negative battery terminal and remove the nuts securing the earth wires to the cylinder head bolts.

(2) Remove the camshaft drive belt as previously described.

(3) Disconnect the lower radiator hose and drain the cooling system. Refer to the Cooling and Heating Systems section if necessary.

(4) Remove the alternator adjusting bracket mounting bolt and insulating washers from the inlet manifold. Loosen the adjusting bolt at the alternator and slide the bracket away from the cylinder head.

(5) Disconnect the upper radiator hose, coolant by-pass hose and the heater hose from the thermostat housing and on 1.6 liter models, the coolant hoses from the inlet manifold.

(6) Disconnect the electrical connectors from the throttle body, fuel injectors, coil, distributor and on 1.8 liter models, the MAT sensor.

(7) Disconnect the oxygen sensor wiring connector and remove the wiring connectors from the

coolant temperature sensor and temperature sender switch located in the thermostat housing.

(8) Remove the bolt securing the wiring clamp to the rear of the manifold and maneuver the wiring away from the cylinder head and the inlet manifold.

(9) Disconnect the throttle cable and on automatic transaxle models, the kickdown cable from the throttle body linkage.

(10) Remove the bolls securing the throttle cable bracket to the inlet manifold and place the bracket and cable(s) to one side.

(11) Mark the fuel supply and return hoses to ensure correct installation and disconnect the hoses from the fuel rail or throttle body. Plug the hoses to prevent the loss of fuel or the entry of dirt.

(12) Mark the vacuum hoses connected to the inlet manifold and throttle body to ensure correct installation and disconnect the hoses.

(13) Remove the nuts securing the engine pipe to the exhaust manifold and separate the pipe from the manifold.

(14) Remove the oxygen sensor from the exhaust manifold. Refer to the Fuel and Engine Management section if necessary.

(15) Remove the distributor and coil as described in the Fuel and Engine Management section.

(16) Disconnect the engine breather hoses from the camshaft housing and camshaft housing top cover.

(17) Remove the bolts retaining the top cover to the camshaft housing and remove the top cover.

(18) Using an open end spanner, hold the camshaft between the inlet and exhaust lobes of number four cylinder and remove the camshaft timing gear retaining bolt and the camshaft timing gear.

(19) Remove the bolts securing the camshaft drive belt inner cover to the camshaft housing.

(20) Loosen the cylinder head bolts in the reverse order of the tightening sequence, backing off each bolt a quarter turn then half a turn at a time until the bolts are loose.

NOTE: Do not loosen the head bolts while the engine is warm as distortion of the cylinder head could result.

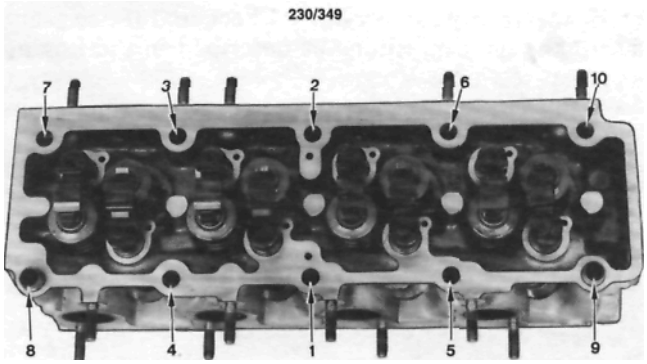
(21) Remove the cylinder head bolts and lift the camshaft housing from the cylinder head.

(22) Remove the cylinder head and gasket from the cylinder block.

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

(1) Thoroughly clean the gasket surfaces of the cylinder head, cylinder block and camshaft housing and check all mating surfaces with a straight edge. Ensure that all the oilways are clean and free of any foreign material and lightly oil all operating parts with engine oil.

(2) Install new gaskets throughout during assembly.



View of the cylinder head showing the bolt tightening sequence.

(3) Ensure that the cylinder head and gasket are located correctly on the dowels on the cylinder block face. The head gasket is marked TOP to aid in correct installation.

(4) With the cylinder head and gasket in position on the cylinder block, apply an even smear of Loctite 515 to the cylinder head and camshaft housing mating surfaces. Take care that no sealant is forced into the oil passages.

(5) Install new cylinder head bolts and lubricate the bolts and washers with engine oil,

(6) Apply an initial torque to the cylinder head bolts of 25 Nm in the sequence shown in the illustration. Further tighten the head bolts in the same sequence in three separate 60 degree stages. Refer to Specifications.

(7) Install the bolts securing the camshaft drive belt inner cover to the camshaft housing. Install the camshaft timing gear and tighten the retaining bolt to the specified torque.

(8) Install and adjust the camshaft drive belt as previously described.

(9) Install the distributor, coil and oxygen sensor as described in the Fuel and Engine Management section.

(10) Using a new gasket, connect the engine pipe to the exhaust manifold flange, coat the nuts with an anti-seize compound and install and tighten the nuts to
the specified torque.

(11) Connect all hoses and electrical wiring disconnected during the removal of the cylinder head. Ensure that all the hoses are returned to their original locations.

(12) Connect the throttle cable and where applicable, the kickdown cable. Adjust the cables as described in the Fuel and Engine Management section and the Automatic Transaxle section.

(13) Check the engine oil for correct level on the dipstick and for dilution. Change the engine oil and filter if necessary.

(14) Fill the cooling system as described in the Cooling and Heating Systems section.

(15) Start the engine and check for oil or water

leaks and rectify as necessary. Check and if necessary adjust the ignition timing as described in the Engine Tune-up section.

(16) When the engine has reached normal operating temperature, tighten the cylinder head bolts another 40-50 degrees in the correct sequence shown in the illustration, ensuring that the tension does not exceed 135 Nm.

TO DISMANTLE

(1) Remove the cylinder head as previously described.

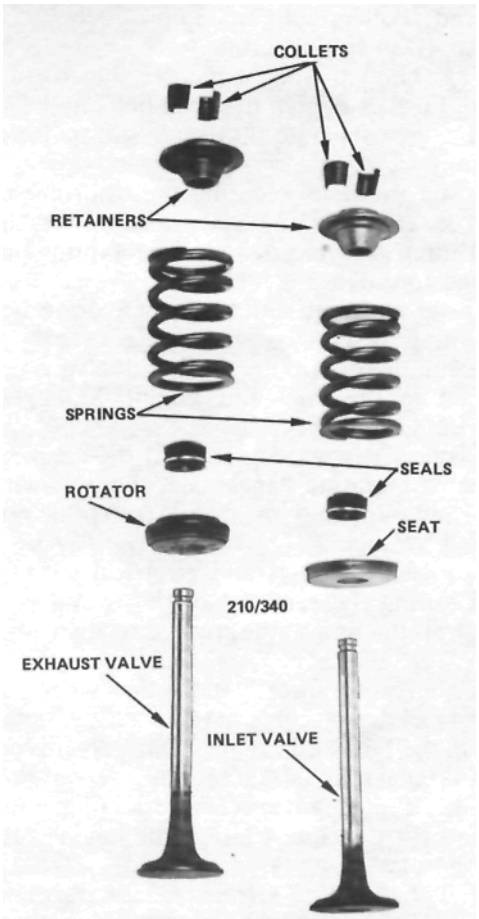
(2) Remove the thermostat housing and sealing ring from the cylinder head.

(3) Remove the nuts securing the inlet and exhaust manifolds to the cylinder head and remove the manifolds. Discard the gaskets.

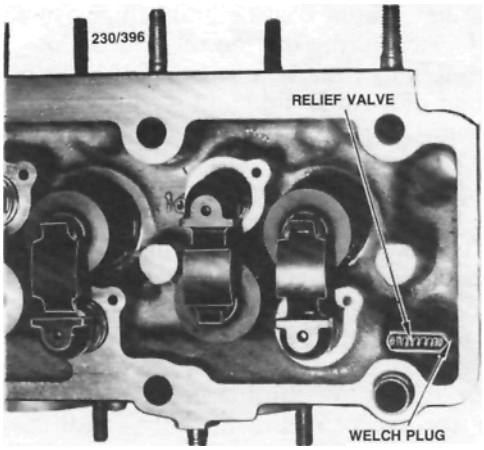
(4) Lift the rocker arm and thrust pad from the top of each valve assembly, keeping them in order for assembly to their original locations.

(5) Slide each hydraulic tappet from its bore in the cylinder head, also keeping them in order for assembly to their original locations.

(6) Before removing the valves the deposits in the combustion chambers should be removed. Care should be taken not to damage the cylinder head gasket face.



Dismantled view of the valve and spring components.



Installed view of the cylinder head oil pressure relief valve.

(7) Using a valve spring compressor, compress each spring in turn. Remove the split retaining collets and slowly release the compressor.

(8) Remove the valve spring retainers and valve springs.

(9) Remove the valve stem seals from the top of the valve guides and detach the exhaust valve rotators and the inlet valve spring seats, from the cylinder head.

(10) Remove any burrs from the valve stem grooves to prevent damage to the valve guides when the valves are removed from the cylinder head.

(11) Remove the valves, keeping them in order for assembly to their original locations.

NOTE: To keep the valve assemblies in order have a rack numbered from 1 to 8 and instill the components in this rack, starting from the front of the cylinder head.

(12) If the oil pressure relief valve in the cylinder head is to be renewed, proceed as follows:

(a) Using a drift, remove the welch plug from the distributor end of the cylinder head.

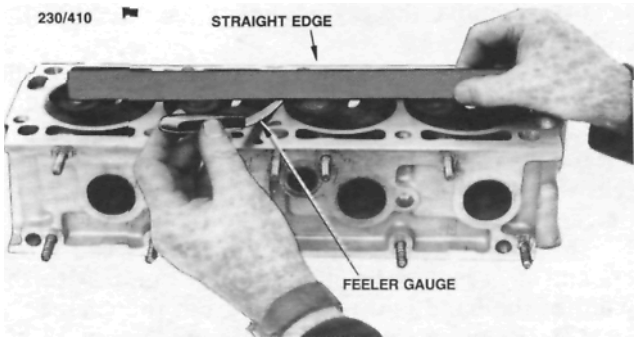
(b) Remove the recessed screw from the thermostat housing end of the cylinder head.

(c) Using a long brass drift inserted in the oilway through the tappet bores from the thermostat housing end. remove the oil pressure relief valve from the cylinder head. Discard the relief valve.

TO CLEAN AND INSPECT

(1) Clean the valves thoroughly and discard any burnt, warped or cracked valves.

(2) Have the valves refaced to the recommended angle on a valve refacing machine. The valve stem tips are specially hardened and should not be refaced.



Method of checking cylinder head for distortion.

(3) Carefully clean the deposits from the inlet and exhaust ports, the auxiliary passages, the valve guides and the manifolds, taking care not to damage any mating surfaces.

(4) Clean the cylinder head mounting faces, wash the cylinder head in solvent and dry with compressed air. Blow through all the oil holes with compressed air to ensure that they are not blocked.

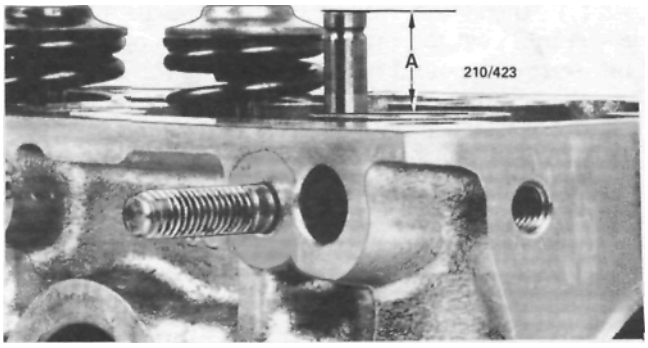
(5) Check the cylinder head for distortion diagonally and lengthwise using a straight edge and feeler gauges. Refer to Specifications for the distortion and machining limits.

(6) Check the cylinder head face and combustion chambers for cracks, burn marks and corrosion.

(7) Check the valve stem to guide clearance. If the clearance is in excess of the Specifications, the valve guide must be reamed and the appropriate oversize valve installed.

(8) Inspect the valve seats for pitting or burning and if necessary, recut the seats with a valve seat cutter to the recommended angle. When the seats are correctly finished, the seat widths should conform to the Specifications.

(9) Lap the valves to the valve seats with a fine lapping compound. Apply a smear of Prussian blue to the valves or their respective seats to ensure that true and concentric seating has been gained.



Dimension A is the correct position to measure the valve stem installed height. Dimension A = 18.4 mm.

(10) Install each valve in its respective port and check the valve stem height above the cylinder head. Refer to the illustration. The extended height must not exceed 18.4 mm. If the height exceeds the Specifications, the valve or the cylinder head must be renewed. Do not remove any material from the valve stem tip.

(11) Check the valve spring tensions and compare with the Specifications.

Check that the springs are not bent or distorted.

If a spring tester is not available, check the springs by comparison with new springs. This can be done using a surface plate and straight edge for checking the free length and using a new spring and a used spring loaded in a vice end on end, with a plate in between. Measure from the plate to the vice jaw adjacent to both the new and used springs. A used spring is serviceable if it does not show collapse in excess of five percent when subjected to this comparison test.

(12) Check the exhaust valve rotators for wear and ensure that the rotators turn freely.

(13) Clean the cylinder block face of all carbon and rust deposits and ensure that all old gaskets are removed. Do not allow the waste deposits to enter the oil or water galleries.

Clean all waste materials from the cylinder bores.

TO ASSEMBLE

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

(1) Lubricate all component wear surfaces with engine oil before assembly to ensure adequate lubrication when starting.

(2) If the oil pressure relief valve was removed from the cylinder head, proceed as follows:

(a) Using a brass tube inserted in the welch plug hole at the distributor end of the cylinder head, tap the relief valve into position.

(b) Install the welch plug and the recessed screw in their respective positions, after coating the plug and the screw with Loctite 242 or equivalent.

(3) Install the inlet valve spring seats and the exhaust valve rotators over the valve guides before installing the valve stem seals onto the valve guides.

(4) Install the valve stem seals, ensuring that the rib of the moulding on the inside of the seal is correctly positioned in the groove of the valve guide and that the spring clip retainer is correctly positioned.

NOTE: The valve stem seals can be positioned correctly and without damage using an upturned valve spring retainer.

(5) Install the valves to their original location in the cylinder head. Use care when installing the valves to prevent damage to the seals.

(6) Install the valve springs, retainers and collets.

Ensure that the valve retaining collets are fully seated

in the valve stem groove before releasing the spring compressor. A sharp tap to the top of the valve stem with a soft faced hammer will ensure that the collets are correctly seated.

(7) Install the inlet and exhaust manifolds using new gaskets and tighten the mounting nuts to the specified torque as previously described.

(8) Install a new sealing ring to the thermostat housing, install the housing to the cylinder head and tighten the mounting bolts to the specified torque.

(9) Ensure that the lappet assemblies are filled with clean engine oil and install the tappets in their respective bores in the cylinder head.

(10) Install the thrust pads to the top of each valve assembly, ensuring that they are returned to their original locations.

(11) Coat the contact surfaces of the rocker arms with molybdenum disulphide grease and install the rocker arms to their original locations on the cylinder head.

(12) Install the cylinder head to the engine as previously described.

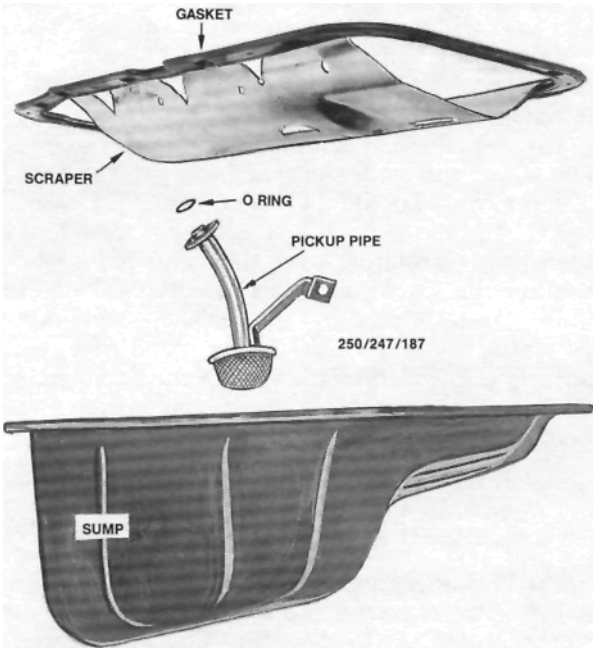
8. ENGINE SUMP AND OIL PUMP PICKUP . PIPE

TO REMOVE

(1) Disconnect the negative battery terminal.

(2) Raise the front of the vehicle and support it on chassis stands. Refer to the Wheels and Tires section for the correct procedure.

(3) Remove the sump plug and drain the engine oil into a container. Install and tighten the plug after the oil has been drained.



View of the sump, oil pump pickup, gasket and scraper removed from the engine.

(4) Remove the engine pipe as described at the end of this section.

(5) Remove the nuts and bolts retaining the engine crossmember to the vehicle underbody and withdraw the crossmember from the vehicle. On automatic transaxle models, it will be necessary to release the selector cable from the crossmember bracket.

(6) Remove the sump retaining bolts and washers and if necessary firmly bump the sump with the palm of the hand and remove it from the engine.

(7) Remove the bolts retaining the oil pump pickup pipe to the oil pump and disconnect the pickup pipe from the support bracket. Remove the pickup pipe and discard the O ring seal.

(8) Remove the scraper and gasket from the engine.

(9) Clean the gasket material from the sump, engine block and the scraper.

NOTE: If the scraper assembly is damaged it should be renewed.

TO INSTAL

(1) Wash the inside of the sump to remove carbon and sludge deposits. Check for any metal deposits which may indicate an imminent component failure.

(2) Inspect the sump for dents and cracks. Ensure that the gasket sealing face is not distorted or damaged.

(3) Clean the pickup pipe screen with solvent and a brush.

(4) Using a new O ring seal, install the pickup pipe. Coat the pipe retaining bolts with Loctite 242 and tighten to the specified torque.

(5) Apply a bead of KP510-00150 sealer or equivalent to the oil pump to cylinder block mating joint area.

(6) Ensure that the sump gasket is correctly located on the scraper and install the sump to the engine. Apply Loctite 242 to the threads of the sump bolts and tighten the bolts to the specified torque.

(7) Install the front exhaust pipe using a new gasket and coat the threads of the flange nuts with an anti-seize compound before tightening the nuts to the specified torque.

(8) Install the engine crossmember and tighten the nuts and bolts securely. If applicable, connect the automatic transaxle selector cable to the crossmember bracket.

(9) Ensure that the sump drain plug is secure and lower the vehicle to the ground.

(10) Fill the engine with the specified amount and grade of engine oil. Refer to the Lubrication and Maintenance section if necessary.

(11) Start and run the engine and check for oil leaks.

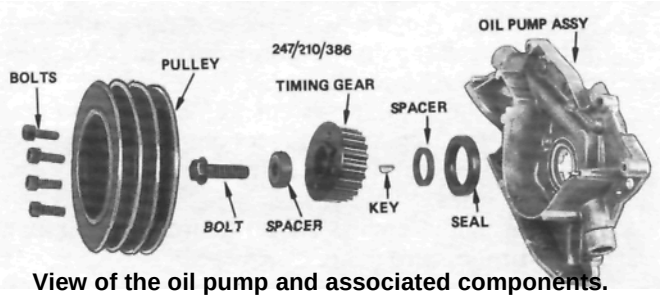
9. OIL PUMP

TO REMOVE AND DISMANTLE

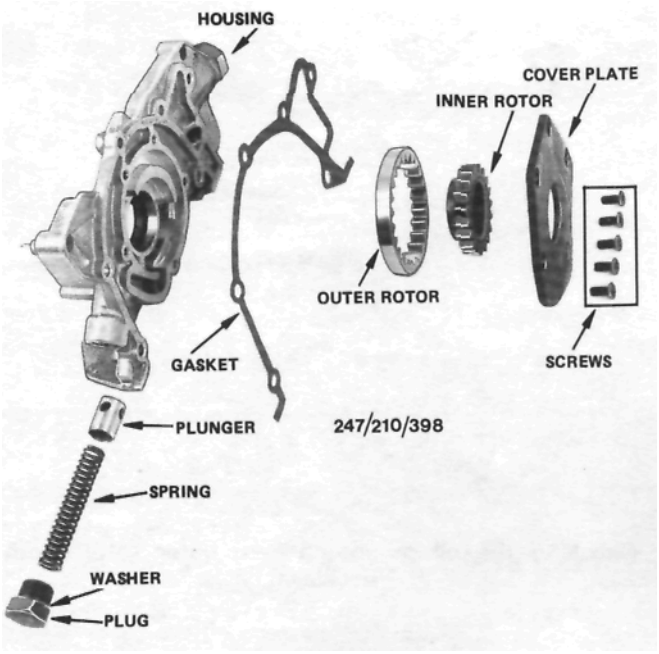
(1) Disconnect the negative battery terminal.
(2) Disconnect the lower radiator hose and drain the cooling system.
(3) Raise the front of the vehicle and support it on chassis stands. Refer to the Wheels and Tires section if necessary.
(4) Remove the right hand front wheel.
(5) Remove the fasteners securing the engine splash guard to the right hand front inner mudguard and remove the splash guard.
(6) Remove the engine sump and oil pump pickup pipe as previously described. Remove the oil filter.
(7) Remove the camshaft timing belt as described previously.
(8) Disconnect the oil pressure sender electrical connector.
(9) Using a socket and bar, remove the bolt and spacer retaining the crankshaft timing gear to the crankshaft. Discard the bolt.

NOTE: It may be necessary to lock the crankshaft when removing the crankshaft timing gear retaining bolt. If necessary, insert a piece of timber between the crankcase and the crankshaft to prevent the crankshaft turning.

(10) Remove the crankshaft timing gear from the crankshaft. It may be necessary to lever the gear from the crankshaft using two screwdrivers. Remove the key and spacer from the crankshaft.
(11) Remove the camshaft housing top cover.
(12) Using an open ended spanner, hold the camshaft between the inlet and exhaust lobes of number four cylinder and remove the camshaft timing gear retaining bolt and the camshaft timing gear.
(13) Remove the bolts securing the water pump to the cylinder block and remove the water pump. If necessary- refer to the Cooling and Heating Systems section.
(14) Remove the camshaft drive belt inner cover retaining bolts and remove the inner cover.
(15) Remove the bolts securing the oil pump to the cylinder block and remove the oil pump from the engine. Discard the gasket.



View of the oil pump and associated components.

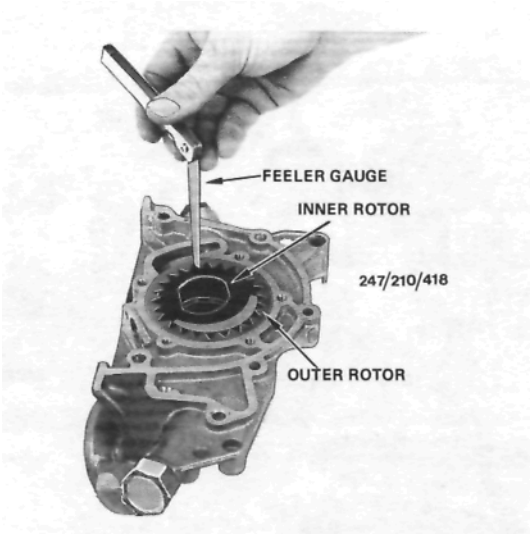


Dismantled view of the oil pump assembly.

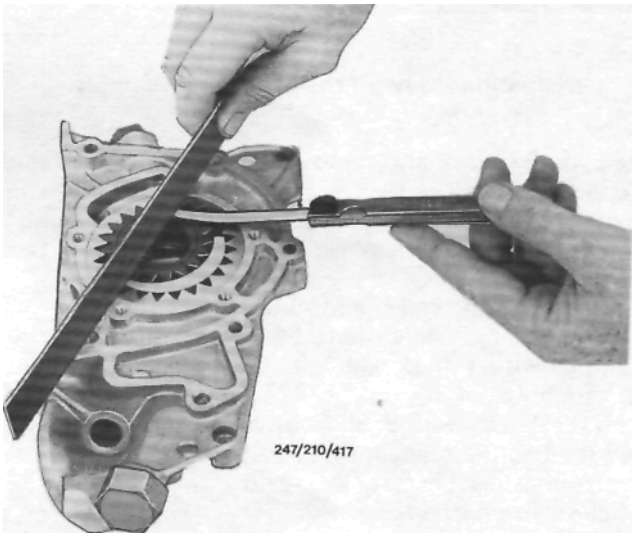
(16) Remove the screws retaining the oil pump cover plate and lift the cover plate from the rear of the oil pump.
(17) Lift the inner and outer rotors from the oil pump housing. Note that the outer rotor may be stamped with a mark which must face the cover plate on assembly.
(18) Unscrew the oil pressure relief valve plug and remove the relief spring and plunger from the oil pump housing. Discard the sealing washer from the relief valve plug.
(19) If necessary, remove the oil pressure gauge sender unit.
(20) Remove the crankshaft oil seal from the pump housing.

TO CHECK AND INSPECT

(1) Wash all the pump components thoroughly in cleaning solvent and allow to dry.
(2) Inspect the inner and outer rotors and the cover plate for scoring or wear. Renew the rotors and/or the cover plate if these faults are evident.
(3) Temporarily install the rotors into the oil pump housing. Check the backlash between the teeth of the inner and outer rotors at the point where the rotor teeth are most closely meshed. If the clearance at this point exceeds the Specifications, check the rotors and housing for wear and renew as necessary.
(4) Check the rotor end float by placing a straight edge across the oil pump housing and measure the clearance between the straight edge and the rotors



Checking the oil pump inner to outer rotor teeth backlash.



Checking the oil pump rotor end float.

with a feeler gauge. Renew the oil pump if this clearance exceeds the Specifications.

(5) Check the cover plate for wear and scoring and renew as necessary.

(6) Check the relief valve plunger and spring for wear or damage. Renew any faulty components as necessary.

TO ASSEMBLE AND INSTAL

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

(1) Liberally lubricate all components with clean engine oil before assembly.

(2) Install the relief valve plunger and spring into the pump housing and install the relief valve plug
using a new sealing washer. Tighten the plug securely.

(3) Install the outer rotor into the pump housing with the F mark on the rotor facing towards the cover plate, if applicable. Install the inner rotor ensuring that it is correctly meshed with the teeth of the outer rotor.

(4) Install the cover plate to the oil pump housing and tighten the retaining screws to the specified torque.

(5) Install a new oil seal to the front of the oil pump housing. Ensure that the lip of the oil seal faces the inside of the oil pump housing.

(6) If necessary, install the oil pressure gauge sender unit.

(7) Turn the inner rotor in the oil pump housing. Ensure that the oil pump rotates freely.

(8) Ensure that the mating surfaces of the oil pump and cylinder block are thoroughly clean. Coat the oil pump gasket with an oil resistant sealer and install the oil pump and gasket to the cylinder block. It may be necessary to turn the oil pump slightly to align the inner rotor and crankshaft. Tighten the retaining bolts to the specified torque.

NOTE: Ensure that the oil seal installed to the oil pump is not damaged when the oil pump is positioned on the crankshaft.

(9) Install the camshaft drive belt inner cover.

(10) Install the water pump using a new O ring. Coat the water pump and the engine block mating surfaces with Dow Corning silicone grease or equivalent. Do not fully tighten the water pump retaining bolls at this stage.

(11) Install the camshaft timing gear and tighten the retaining bolt to the specified torque.

(12) Install the crankshaft timing gear spacer, key and timing gear to the crankshaft.

(13) Using a new crankshaft timing gear retaining bolt, install the spacer and tighten the retaining bolt to the specified torque.

(14) Ensure that the oil pump pickup pipe and screen are clean and free of foreign material. Install a new O ring to the pipe and position the pickup pipe and screen in position on the oil pump. Coat the threads of the mounting bolts with Loctite 242 and torque the bolts to the specified torque.

(15) Fill a new oil filter with the correct grade of engine oil and install the oil filter.

(16) Install the sump as previously described.

(17) Install and adjust the camshaft drive belt as described under the Camshaft Drive Belt heading.

(18) Fill the engine with the correct grade and quantity of oil. Refer to the Lubrication and Maintenance section.

(19) Fill the cooling system as described in the Cooling and Heating Systems section.

(20) Start and run the engine and check for oil and coolant leaks.

(21) Install the engine splash guard to the inner
right hand mudguard.

(22) Install the right hand wheel and tighten the wheel nuts as much as possible.

(23) Lower the vehicle to the ground and securely tighten the wheel nuts.

10. PISTONS, CONNECTING RODS AND CYLINDER BORES

Special Equipment Required:

To Inspect — Micrometer, cylinder measuring gauge
To Remove Ridge from Bores — Ridge removal tool
To Deglaze Cylinder Bores — Cylinder surfacing hone
To Install — Piston ring compressor

TO REMOVE

(1) Remove the engine sump and oil pump pickup pipe as previously described.

(2) Remove the cylinder head as previously described.

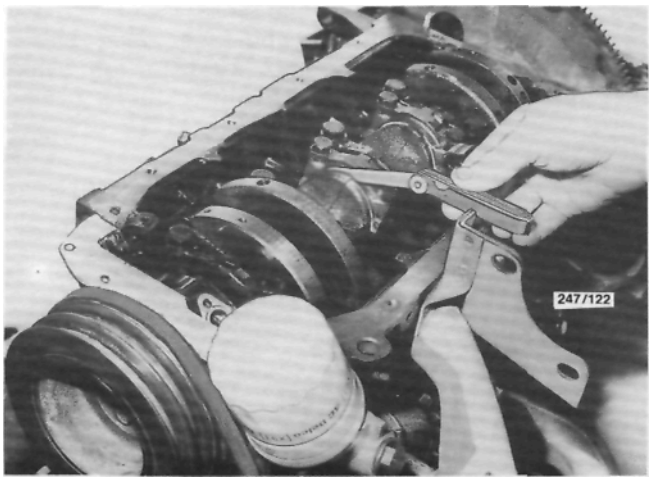
(3) Mark the relationship of the pistons to their respective cylinders and the bearing caps to their respective connecting rods by letter stamps or centre punch marks.

(4) Measure each connecting rod for side clearance on the crankpin. Refer to the illustration. If the clearance exceeds the Specifications a new connecting rod will have to be installed on assembly.

(5) With number one cylinder on the bottom of its stroke, remove the bearing cap bolts and the bearing cap.

Wipe the bearing shell and the exposed part of the journal with a piece of clean lint free cloth, insert a piece of Plastigage across the journal, install the bearing cap and tighten the bolts to the specified torque.

Remove the bolts and cap and measure (with the scale on the packet) the spread width of the Plastigage to determine the bearing clearance.

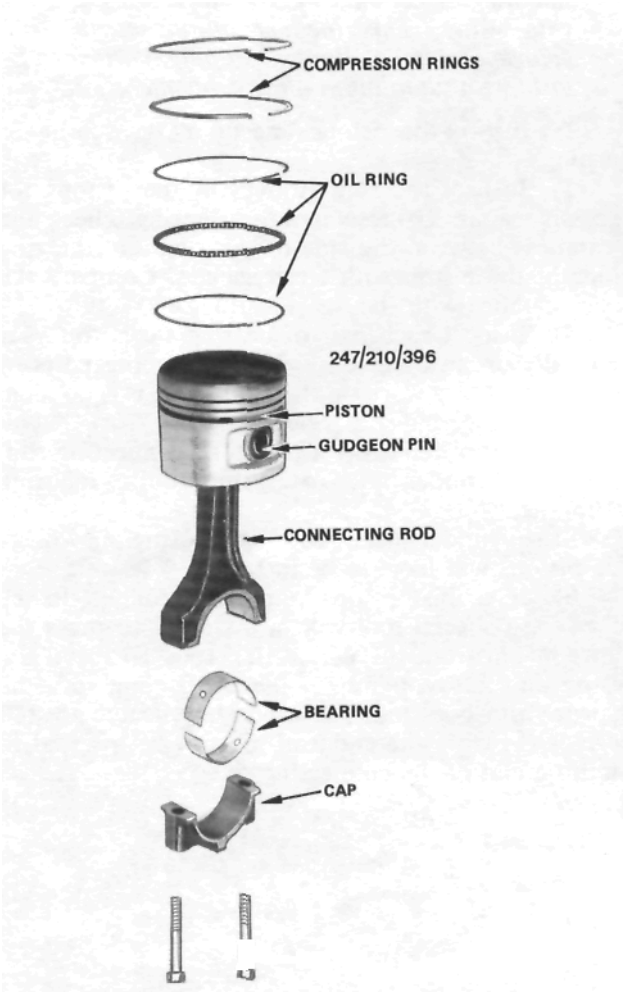


Checking the connecting rod side clearance using feeler gauges.

Compare the measurement to the Specifications and if the bearing clearance exceeds the limit, install a new bearing on assembly.

Repeat the procedure on the remaining cylinders and note each individual bearing clearance for assembly purposes.

NOTE: Do not rotate the engine while the Plastigage is in position or false readings will result.



Dismantled view of the piston and connecting rod components.

(6) Remove each bearing cap in turn, keeping them in order, and using a wooden hammer shaft, push each piston assembly from the cylinder block and install its respective bearing cap.

NOTE: Before removing the pistons, remove the ridge from the top of the cylinder bore using a ridge removal tool.

(7) Remove the piston rings over the top of the piston and discard the piston rings.

TO INSPECT PISTONS AND CONNECTING RODS

(1) Remove all carbon deposits from the bottom of the ring grooves with a ring groove cleaning tool or a broken ring. Use caution to avoid scoring the bottom and sides of the ring groove.

NOTE; An ideal method of removing carbon deposits from pistons is to immerse the piston in a tank of chemical cleaner. After soaking, the carbon can be readily hosed off with water. This method minimizes the chance of damage through scraping, particularly with aluminum alloy components.

(2) Inspect the pistons for scuff marks, scoring or burning.

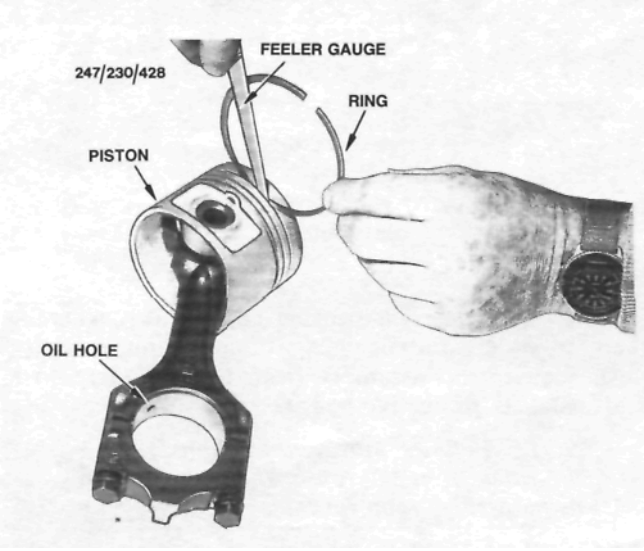
(3) Inspect the ring grooves of the pistons for excessive wear. Using a new piston ring, check the clearances between the side of the ring and the ring lands of the piston with feeler gauges. Compare the side clearance with the Specifications.

(4) Inspect each pair of bearing shells for wear especially on an outer edge. If one or more pairs of bearing shells are worn on the outer edge it is possible that the connecting rod is bent.

(5) Before renewing a piston or connecting rod, inspect the cylinder block to see if it requires reboring or honing.

If the cylinder block requires reboring, new oversize pistons will have to be installed.

(6) If a piston or connecting rod is to be renewed, a special tool will be required to press the gudgeon pin from the connecting rod. To install the piston and gudgeon pin to the connecting rod, the gudgeon pin boss must be accurately heated to 280 degrees C before the gudgeon pin can be inserted in the little end of the connecting rod.



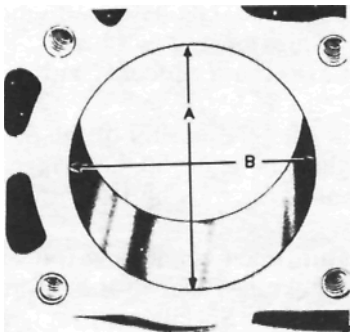
Measuring the piston ring side clearance.

Replacement connecting rods are supplied only at their highest production weight and must be matched to the weight of the remaining connecting rods by filing the big end boss. For these reasons it is recommended that the work be entrusted to a reputable engine reconditioner who will have the specialised equipment and knowledge to carry out this work.

TO INSPECT CYLINDER BLOCK AND BORES

With the pistons removed as previously described, carry out the following checks and measuring procedures:

(1) Check the cylinder bores for cracks, scores or scuffs.

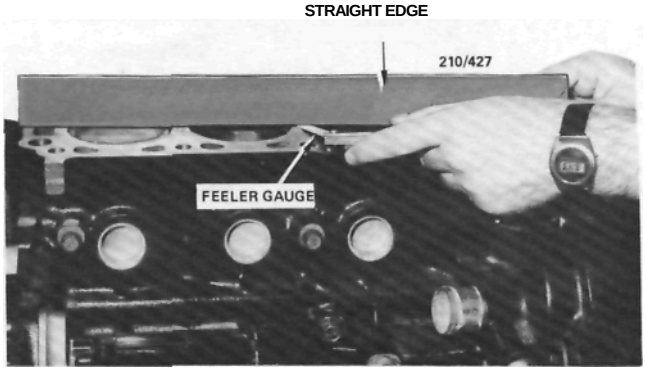


Check for cylinder bore wear. Difference between A and B measurement at top of piston travel is out of round dimension. Difference between A at top and at bottom of piston travel is cylinder taper.

(2) Using an accurate cylinder gauge, measure each cylinder bore for wear. Take the measurements, at the upper and lower sections of the bore in two directions — along and across the cylinder block. Refer to the illustration.

(3) If the wear in any cylinder exceeds the specified limit, rebore and hone all the cylinders to the nearest oversize for pistons and rings.

(4) With a straight edge and feeler gauge, check the top face of the cylinder block for distortion, using the same procedure described for the cylinder head.



Checking the cylinder block face for distortion.

(5) If the engine is completely dismantled, thoroughly clean the cylinder block with solvent and compressed air paying particular attention to the oilways. Inspect the block for cracks and damage.

TO CHECK PISTON CLEARANCE

(1) Using an accurate cylinder measuring gauge, measure and note the diameter of each bore as previously described.

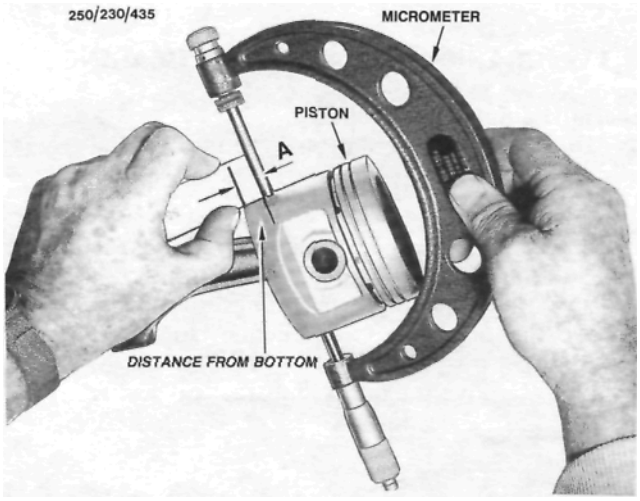
(2) Measure each piston skirt using a micrometer as follows:

(a) On 1.6 liter models, measure each piston skirt at a point 9 mm above the bottom skirt edge and at right angles to the gudgeon pin axis.

(b) On 1.8 liter models, measure each piston skirt at a point 6 mm above the bottom skirt edge and at right angles to the gudgeon pin axis.

(3) The difference between the bore and the piston measurement is the piston clearance. If the clearance exceeds the Specifications, renew the pistons and rebore all the cylinders.

(4) Cylinders that have had new pistons installed or that have been rebored should have the piston clearance checked again.



Measuring the piston diameter using a micrometer. On 1.6 liter models, dimension A = 9 mm. On 1.8 liter models, dimension A - 6 mm.

TO INSPECT AND DEGLAZE CYLINDER BORES

Cylinder bores that are fit for further service with the original pistons, but require re-ringing, should be deglazed with a hone. Before honing the cylinder bores with crankshaft installed, place plenty of clean rag over the crankshaft to keep the abrasive materials from entering the crankcase area.

(1) Deglaze the cylinder walls using a cylinder surfacing hone equipped with suitable stones. Inspect the cylinder walls after each 20 strokes. Use honing oil and not engine or transmission oil, mineral spirits or kerosene.

(2) Honing should be carried out by moving the hone up and down fast enough to obtain a cross hatch pattern. When hone marks intersect at 60 degrees, the pattern is most satisfactory for correct seating of rings.

(3) After honing it is necessary that the block be cleaned again to remove all traces of abrasives.

> *NOTE: When deglazing, the cylinder should be honed only sufficiently to eliminate the glazed condition. Excessive honing will increase the bore size and alter the piston clearance.*

(4) When honing is complete, ensure that the cylinder bore, crankcase area and oilways are thoroughly cleaned.

(5) After the cylinder block has been cleaned and dried, wipe the bores with a lint free cloth and smear them with engine oil to prevent rusting.

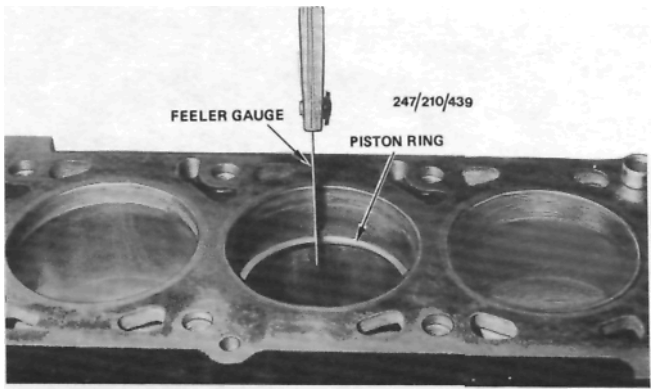
> *NOTE: All abrasives must be removed from the engine components after honing. A solution of soap and water should be used with a brush and the components thoroughly dried. A bore can be considered clean when it can be wiped clean with a white cloth and the cloth remains clean. Oil the bores after cleaning to prevent rusting.*

TO FIT NEW PISTON RINGS AND INSTAL PISTONS

Once the correct piston and the bore relationship has been determined and the pistons cleaned or renewed as necessary, proceed as follows:

(1) Place a ring into number one cylinder bore and using an inverted piston push the ring down 50 mm into the cylinder bore.

(2) Withdraw the piston and measure the gap in the ring with feeler gauges. Adjust the end gap of the ring by filing as necessary. See the Specifications for the ring end gap.



Checking the piston ring end gap.

NOTE: Should the ring end gap be greater than the specified gap, another ring set should be obtained and the ring end gaps checked and compared with the Specifications.

(3) Treat each ring and cylinder bore individually and ensure that the rings are assembled to the respective piston for the cylinder bore in which they were installed to check the end gap.

(4) Assemble each oil control ring to its respective piston bottom groove as follows:

(a) Install the oil ring expander to the piston groove, ensuring that the ends of the expander are bulled together and not overlapped.

(b) Position one end of the lower side rail in the groove and peel the ring over the piston and into the groove.

(c) Similarly install the upper side rail.

(5) Install the lower compression ring into the lower piston groove.

NOTE: The compression rings should be installed with the manufacturers mark facing the top of the piston. To minimize the possibility of ring breakage the rings can be immersed in hot water prior to installation.

(6) Install the upper compression ring into the upper piston groove.

(7) Space the compression ring gaps 120 degrees apart, and ensure that the oil ring gaps and the join in the oil ring expander are not aligned.

(8) With the rings correctly installed and gapped, remove the bearing cap from the connecting rod.

(9) Liberally lubricate the piston assembly and install the piston ring compressor to number one piston.

NOTE: When installing the pistons to the cylinder ensure that the front marking on the piston is towards the front of the engine.

(10) Turn the crankshaft until number one crankpin is at the bottom of its stroke.

(11) Install number one piston and connecting rod assembly into its bore. Push the assembly down the bore until the connecting rod can be aligned with number one crankpin.

NOTE: The bearing shells should be lubricated with engine oil before installation.

(12) Install the connecting rod cap and tighten the retaining bolts to the specified torque.

NOTE: If new bearing shells were installed, check the bearing clearance with Plastigage as previously described.

(13) With the bearing clearance as specified, instal the remaining pistons in the same manner.

(14) Ensure that the crankshaft turns without binding.

(15) With all connecting rod bolts tightened to the specified torque, install the associated components by referring to the relevant headings in this section.

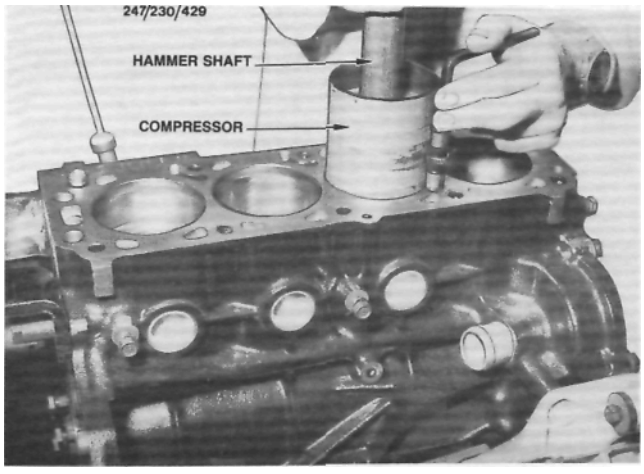
11. CRANKSHAFT AND MAIN BEARINGS

Special Equipment Required:
To Inspect — Micrometer, Vee blocks, dial gauge

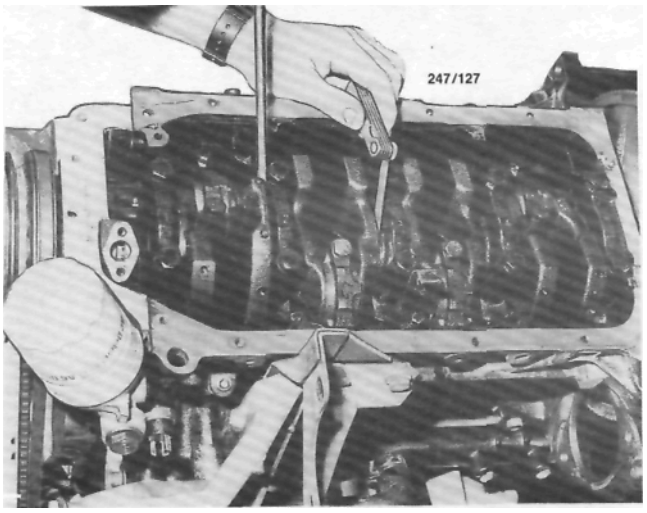
TO REMOVE

(1) With the engine assembly removed from the vehicle and the transaxle separated from the engine, refer to the appropriate headings or sections and remove the following components: sump, oil pump pickup pipe, oil pump, and flywheel or drive plate.

(2) Remove the crankshaft rear oil seal from the



Using a ring compressor to install the piston.



Checking the crankshaft end float using feeler gauges.

rear main bearing cap and engine block. Discard the oil seal.

(3) Ensure that all main bearing and connecting rod bearing caps are numbered to ensure correct assembly.

(4) Remove the connecting rod bolts and caps, keeping them in order. Push each piston and connecting rod slightly up into the bore without pushing the piston beyond its upper limit.

(5) Check the crankshaft end float by inserting a feeler gauge between the shaft and the centre main bearing, or by mounting a dial gauge with its plunger against one end of the shaft.

(6) Push the crankshaft into contact with the front edge of the centre main bearing, then lever the shaft forward to determine the end float.

(7) If the end float exceeds the Specifications, renew the centre main bearing on assembly.

(8) Check the main bearing clearance by the Plastigage method as follows:

(a) Remove one bearing cap and with a piece of rag wipe the journal and bearing clean.

(b) Position a piece of Plastigage, the approximate length of the bearing width and slightly off centre, on the bearing surface of the crankshaft journal.

(c) Install the bearing cap and tighten the cap bolts to the specified torque.

NOTE: Do not rotate the crankshaft while the Plastigage is in position.

(d) Remove the cap bolts and carefully detach the cap and lower half bearing.

(e) With the Plastigage scale, measure the compressed Plastigage strip to determine the clearance.

(f) The widest point of the strip will indicate the minimum clearance and the narrowest point the maximum clearance.

(g) The remaining bearings can be checked in turn using the same procedure.

(9) Lift the crankshaft from the crankcase using care not to dislodge or damage the upper halves of the main bearing shells if they are to be used again.

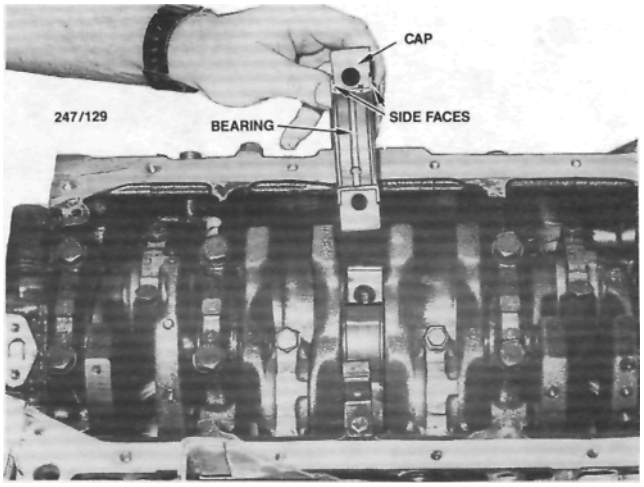
(10) If new bearing shells are to be installed, remove the upper halves of the bearings from the crankcase.

TO CHECK AND INSPECT

After thoroughly cleaning the crankshaft in solvent and drying it with compressed air, blow out all the oilways and make the following checks:

(1) Check and measure the main bearing journals and crankpins for wear, taper and scoring. If wear is excessive, the journals and/or crankpins should be ground to accommodate the nearest underside bearing shells.

One worn or damaged journal or crankpin will necessitate the grinding of all the journals or crankpins and the installation of new undersize bearing shells.



View of the centre main bearing showing the side faces which control crankshaft end float.

If wear or damage is such that the journals or crankpins cannot be reground to take any one range of the available undersize bearings, the crankshaft will have to be renewed.

(2) Support the crankshaft at each end in Vee blocks and with a dial gauge, check the crankshaft for bend at the centre main journal. Renew the crankshaft if the bend is in excess of the allowable limit. Refer to the Specifications.

(3) Check the centre main bearing side faces for pitting or wear. If pitting or wear is evident, renew the main bearing shells as a set which should restore the crankshaft end float to the Specifications.

(4) Even when the main bearing clearance has been found to be satisfactory, inspect the bearing shells for scores, flaking and pitting. Renew the main bearing shells as a set if necessary.

TO INSTAL

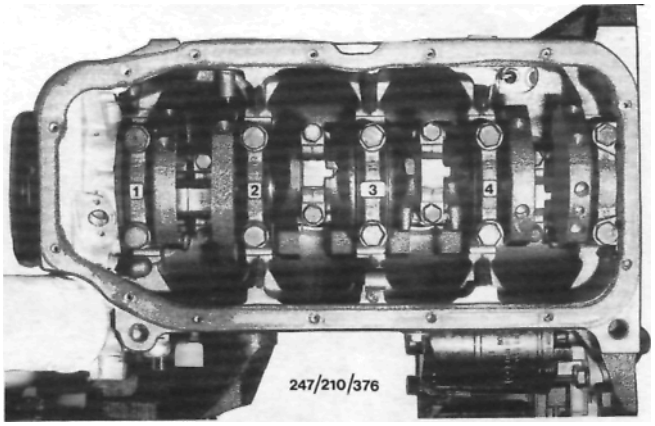
Installation is a reversal of the removal procedure with attention to the following points:

(1) Ensure that all of the oilways are clear and that all the journals and crankpins have been thoroughly cleaned. Ensure that the bearing shells have been cleaned and smeared with new engine oil and that they are correctly positioned in their respective web, connecting rod or cap.

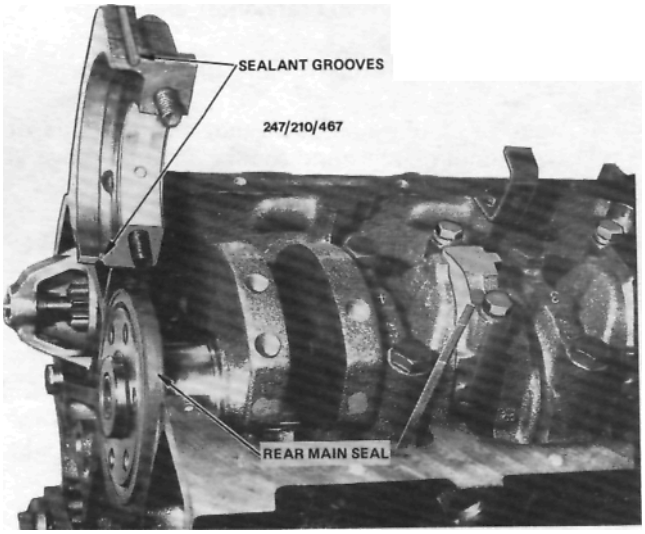
(2) Carefully place the crankshaft in position in the cylinder block and guide the connecting rods to their respective crankpins.

(3) If new bearing shells were installed, check the bearing clearance using the Plastigage method as previously described.

(4) Install the rear main bearing cap and inject Permatex Ultra Grey or equivalent sealer into the grooves in the side of the rear bearing cap. Fill the grooves.



View showing the numbering and correct location of the main bearing caps.



Main bearing cap removed showing the location of the rear seal and sealant grooves.

until the sealant appears at the inner, lower edge of the bearing cap to cylinder block joint. Install the bearing cap bolts and tighten to the specified torque.

(5) Tighten the remaining main bearing cap bolts and the connecting rod cap bolts to their respective tensions and rotate the crankshaft to check for binding.

(6) Install the crankshaft oil seal to the end of the crankshaft after applying lithium grease to the lip of the oil seal. Ensure that the lip of the seal is facing towards the engine.

(7) Install the remainder of the engine components by referring to the relevant headings in this section.

TO RENEW MAIN BEARINGS - CRANKSHAFT INSTALLED

(1) Remove the automatic transaxle or manual transaxle as described in the appropriate section.

(2) Remove the flywheel/drive plate as outlined under the Flywheel/Drive Plate heading.

(3) Remove the engine sump and oil pump pickup pipe as previously described.

(4) Ensure that the main bearing caps are numbered to ensure correct assembly.

(5) Remove the main bearing cap bolts and remove the bearing cap and half shell of the bearing to be renewed. Thoroughly clean the bearing cap in solvent.

(6) Where necessary, use the Plastigage method to measure the bearing clearance.

(7) Position a piece of Plastigage the approximate length of the bearing width, across the bearing shell in the cap and tighten the cap bolts to the specified torque. Do not rotate the crankshaft.

(8) Remove the bearing cap and measure the spread width of the Plastigage with the scale on the packet to determine the main bearing clearance. Compare the measurement to the Specifications and if the bearing clearance exceeds the limit, install a new set of bearing shells.

NOTE: Renew one bearing at a time, leaving the others securely attached.

(9) Install a brass rivet in the crankshaft journal oil drilling and rotate the crankshaft in a clockwise direction until the head of the rivet contacts the plain edge of the upper bearing shell.

(10) Continue to rotate the crankshaft to carry the upper half of the bearing shell out of the crankcase.

(11) Select a half shell of the required thickness (standard or undersize), coat it liberally with clean engine oil and start it, plain edge first, into position on the crankshaft. Rotate the crankshaft anti-clockwise so that the rivet contacts the locating lug edge of the bearing shell, carrying it into position in the crankcase above the main bearing journal. Slightly reverse the rotation of the crankshaft and remove the rivet from the oil drilling in the crankshaft.

(12) Place the other half shell of the selected bearing shells in the bearing cap. checking the clearance as detailed in operations (7) and (8).

NOTE: By checking the taper on the plastigage any taper of the bearing journal can be calculated.

(13) When the bearing has been correctly selected to give the specified clearance, tighten the cap bolts to the specified torque.

(14) Use the same method to renew the other main bearings.

(15) When renewing the rear main bearings, remove and discard the rear crankshaft oil seal.

(16) Install the rear main bearing cap into position and inject KP510-00150 sealant or equivalent into the grooves in the sides of the rear bearing cap. Fill the grooves until the sealant appears at the inner lower

edge of the bearing cap to cylinder block joint. Install the bearing cap bolts and tighten to the specified torque.

(17) Lubricate the lip of the new oil seal with lithium grease and carefully install the seal into position over the crankshaft. Insert the seal as far as possible using finger pressure and then fully install the sea! using a tubular drift. Ensure that the seal is not damaged during installation and that the seal is mounted square to the block face.

(18) Install the remainder of the engine components by referring to the relevant headings in this section.

TO RENEW CRANKSHAFT OIL SEALS

Front

(1) Remove the camshaft drive belt as previously described.

(2) Disconnect the lower radiator hose and drain the cooling system.

(3) Select fifth gear on manual transaxle models and firmly apply the handbrake.

(4) On automatic transaxle models, remove the torque converter inspection cover to allow access to the ring gear. Have an assistant hold the ring gear using a suitable lever.

(5) Remove the crankshaft timing gear retaining bolt and discard.

(6) Remove the crankshaft timing gear from the crankshaft. It may be necessary to lever the gear from the crankshaft using two screwdrivers. Remove the key and spacer from the crankshaft.

(7) Using a centre punch, tap a small hole in the front face of the oil seal.

(8) Insert a self tapping screw into the hole.

(9) Remove the seal from the oil pump by gripping and pulling the end of the screw with a pair of pliers.

(10) Coat the lip of a new seal with multi-purpose grease.

(11) Install the oil seal to the oil pump using a tubular drift. Ensure that the lip of the oil seal faces the inside of the housing.

(12) Install the remaining components in the reverse order of removal, using a new crankshaft timing gear retaining bolt and referring to the relevant headings in this section as necessary.

Rear

(1) Remove the automatic transaxle or manual transaxle as described in the appropriate section.

(2) Remove the flywheel/drive plate as described under the following heading.

(3) Lever the oil seal from the rear of the crankcase being careful not to damage the crankshaft.

(4) Coat the lip of a new seal with Lithium grease.

(5) Install the oil seal over the crankshaft. Ensure that the lip of the oil seal faces towards the engine.

(6) Insert the seal as far as possible using finger pressure, and then fully seat the seal using a tubular drift.

(7) Install the remaining components in the reverse order of removal, referring to the relevant headings in this section as necessary.

12. FLYWHEEL/DRIVE PLATE

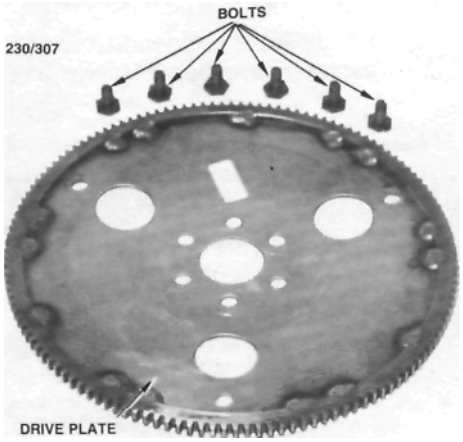
Special Equipment Required:

To Renew Ring Gear — Suitable heat source

TO REMOVE

(1) Remove the transaxle from the vehicle as described in the Manual or Automatic Transaxle sections, whichever is applicable.

(2) On manual transaxle models, mark the flywheel and the clutch pressure plate cover to ensure correct assembly.



View of the drive plate and retaining bolts.

Progressively loosen and remove the pressure plate retaining bolts.

Using a dial gauge, check the runout of the clutch face contacting surface of the flywheel. If the runout exceeds 0.3 mm have the flywheel face surfaced by a clutch specialist or authorized dealer.

(3) Suitably mark the flywheel or drive plate so that the unit can be installed in the original position on the crankshaft. Remove the retaining bolts.

(4) Lift the flywheel or drive plate from the engine.

TO CHECK AND INSPECT

Inspect the clutch face contacting surface of the flywheel for cracks or excessive scoring.

(2) Inspect the ring gear teeth for damage, cracks or wear. The ring gear on manual transaxle models can be renewed separately from the flywheel, but on

automatic transaxle models the complete drive plate must be renewed.

(3) Inspect the drive plate bolt holes for elongation which is caused by loose retaining bolts.

(4) Inspect the drive plate for cracks.

(5) Repair or renew the flywheel if necessary.

TO INSTAL

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

(1) The flywheel and drive plate retaining bolts are special micro-encapsulated fasteners.

Install new micro-encapsulated bolts of the correct
strength classification on assembly.

(2) Thoroughly clean the crankshaft threads with a thread tap. Clean the threads with solvent and dry before installing the flywheel or drive plate retaining bolts.

(3) Tighten the flywheel or drive plate retaining bolts to the specified torque and on manual transaxle models, align the clutch plate as described in the Clutch section.

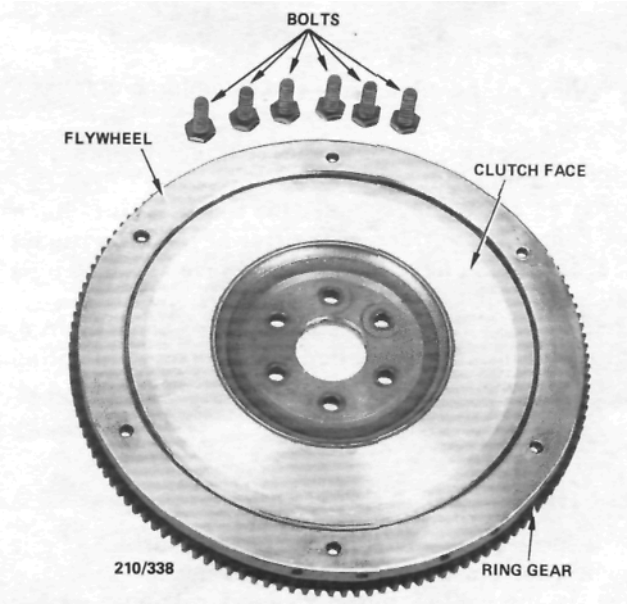
TO RENEW FLYWHEEL RING GEAR

(1) With the flywheel removed from the vehicle, drill a 6 mm diameter hole between two teeth of the ring gear.

NOTE: Do not drill right through the ring gear as this will damage the flange on the flywheel.

(2) Secure the flywheel, with the drilled hole uppermost in a soft jawed vice.

(3) Place a cold chisel above the hole in the ring gear and hit it sharply to split the ring gear.



View of the flywheel and retaining bolts.

(4) Check the direction of the chamfered face of the old ring gear. The new ring gear must be installed to the flywheel with the chamfer in the same direction.

(5) Remove the ring gear, clean the mounting face on the flywheel and remove any burrs.

(6) Polish a few spots of the ring gear with emery cloth and heat the ring gear evenly until the polished spots turn dark blue.

NOTE; Do not heat the ring gear past the point required to achieve a dark blue color or the tempering of the ring gear teeth will be impaired.

(7) With the flywheel suitably supported, pick the ring gear up using pliers, and place it evenly onto the flywheel. Use a hammer and a brass drift to ensure that the ring gear seats against the flywheel flange.

NOTE: Allow the ring gear to cool slowly. Do not quench it in water.

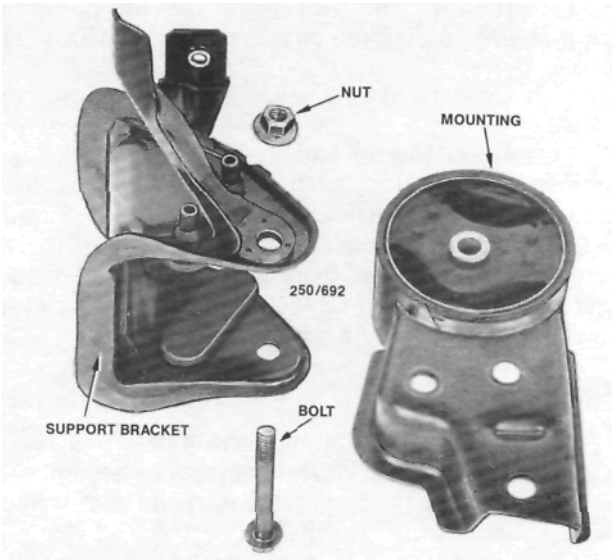
13. ENGINE MOUNTINGS

TO RENEW LEFT HAND SIDE MOUNTING

(1) Disconnect the positive and negative battery terminals, loosen the battery clamp nuts and withdraw the battery from the engine compartment.

(2) Remove the bolts retaining the battery carrier to the inner mudguard and remove the battery carrier and associated components from the engine compartment.

(3) Support the transaxle using a jack. Interpose a block of wood between the head of the jack and the transaxle to prevent damage to the transaxle.

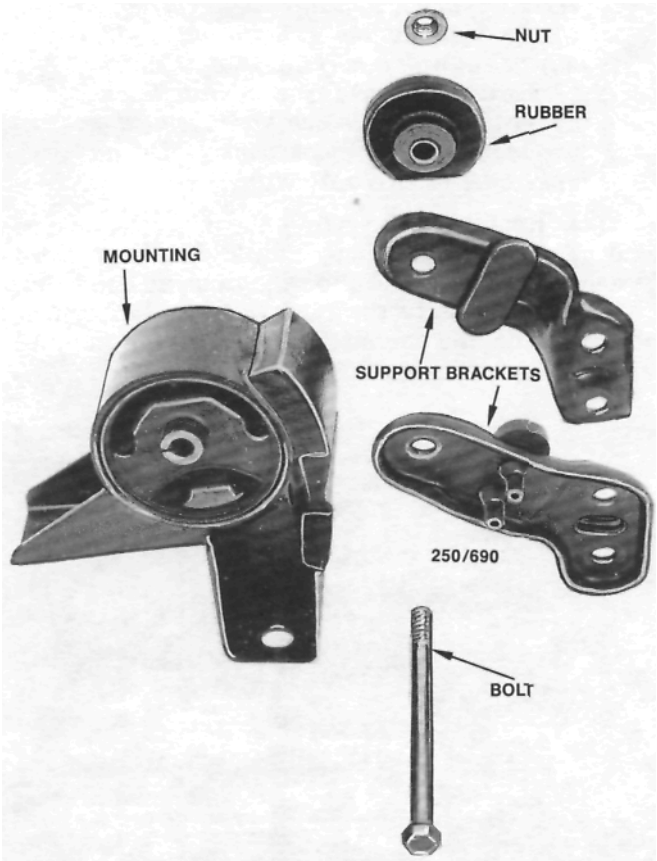


Dismantled view of the left hand side engine mounting assembly installed to vehicles with an automatic transaxle.

(4) Hold the nut and remove the mounting through bolt.
(5) Remove the bolts retaining the mounting to the transaxle and maneuver the mounting from the engine compartment.
(6) If necessary remove the bolts retaining the support bracket to the inner mudguard and withdraw the support bracket.
Installation is a reversal of the removal procedure ensuring that the weight of the engine is bearing on the engine mounting before tightening the through bolt securely.

TO RENEW RIGHT HAND SIDE MOUNTING

(1) Disconnect the negative battery terminal.
(2) On 1.8 liter models, remove the air cleaner assembly. Refer to the Fuel and Engine Management section if necessary.
(3) Support the engine under the sump using a jack. Interpose a block of wood between the head of the jack and the sump to prevent damage.
(4) Hold the nut and remove the mounting through bolt and rubber.
(5) Remove the bolts retaining the mounting to the inner mudguard and maneuver the mounting from the engine compartment.



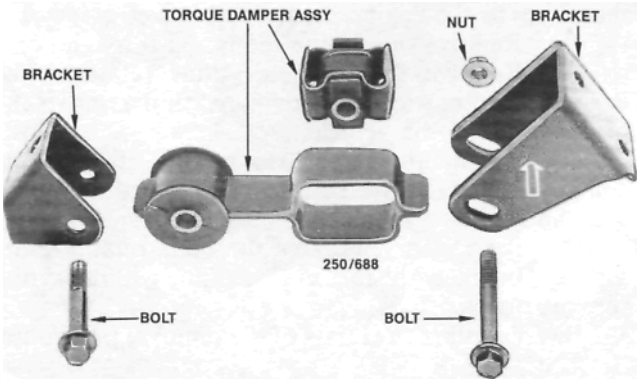
Dismantled view of the right hand side engine mounting assembly.

(6) If necessary, remove the nuts and bolts retaining the support brackets to the engine assembly and withdraw the support brackets.
Installation is a reversal of the removal procedure ensuring that the weight of the engine is bearing on the engine mounting before tightening the through bolt securely.

TO RENEW FRONT TORQUE DAMPER

(1) Raise the front of the vehicle, remove the splash guard fasteners and remove the splash guard(s) from the front of the vehicle.
(2) Remove the through bolts and nuts from the torque damper.

NOTE: It may be necessary to unclip the wiring harness from the lower radiator support panel to gain access to the front through bolt.

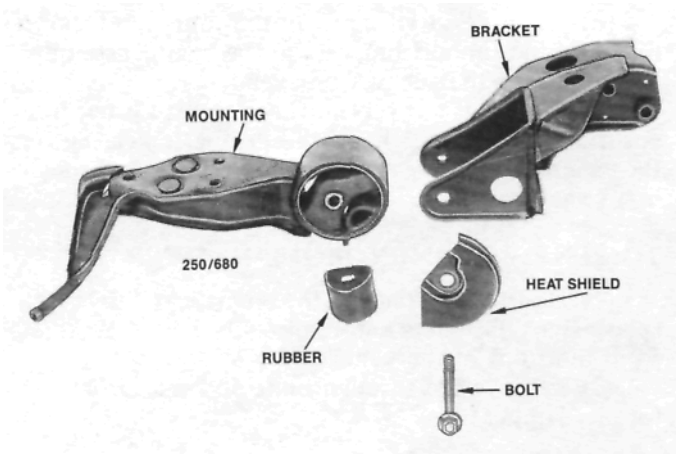


Dismantled view of the front torque damper. The arrow of the engine bracket must face upwards.

(3) Withdraw the torque damper from the engine.
(4) If necessary the support brackets can be removed.
Installation is a reversal of the removal procedure ensuring that the arrow on the engine bracket faces upwards.

TO RENEW REAR ENGINE MOUNTING AND TORQUE DAMPER

Automatic and manual transaxle models both use a similar rear engine mounting with different support brackets. Manual transaxle models use a rear torque damper.
(1) Raise the front of the vehicle and support it on chassis stands.
(2) Remove the stabilizer bar mounting bracket bolts and allow the rear of the stabilizer bar to hang down slightly.
(3) Remove the nuts and bolts retaining the engine crossmember to the vehicle underbody and withdraw the crossmember from the vehicle.



View of the rear engine mounting. Automatic transaxle models.

(4) Remove the bolt retaining the exhaust mounting to the engine mounting bracket.
(5) Remove the engine mounting through bolt.
(6) Remove the bolts and nuts retaining the engine mounting to the floor panel and remove the mounting from the vehicle.
(7) On manual transaxle models, the torque damper can be removed after removal of the through bolts and nuts.
(8) If necessary, remove the bolts retaining the support bracket to the engine and withdraw the support bracket.

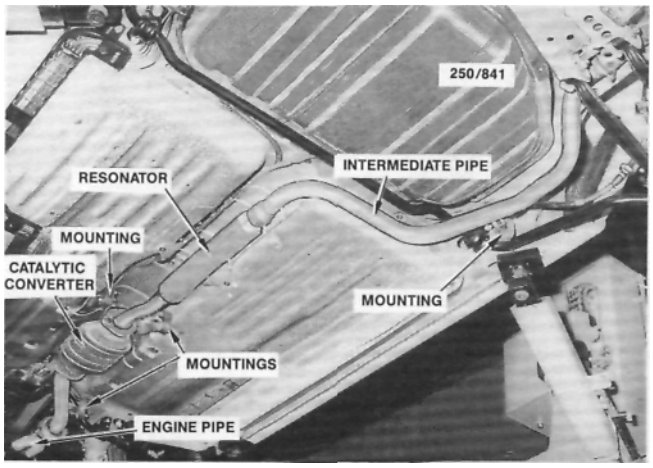
Installation is a reversal of the removal procedure.

14. EXHAUST SYSTEM

TO REMOVE AND INSTAL

Engine Pipe

(1) Raise the front of the vehicle and support it on chassis stands.
(2) Remove the nuts retaining the engine pipe to the exhaust manifold flange.



Underbody view of the exhaust system.

NOTE: It is advisable to soak all exhaust system nuts and bolts with penetrating oil to prevent breakage when removing.

(3) Remove the bolts from the flexible joint and withdraw the engine pipe from the vehicle. Discard the gasket.

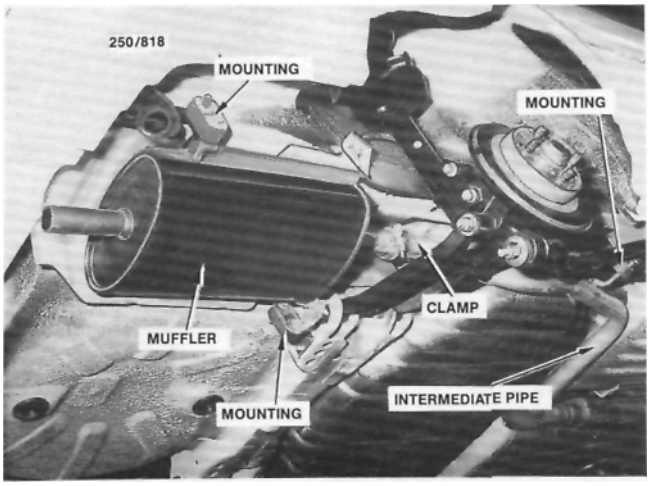
Installation is a reversal of the removal procedure with attention to the following points:
(1) Clean any carbon build up from the exhaust flange and pipe joints.
(2) Inspect the condition of the flexible joint spring. Renew the engine pipe assembly if necessary.
(3) Use a new exhaust manifold flange gasket and coat the manifold studs with anti-seize compound.
(4) Ensure that all nuts and bolts are tightened securely.

Rear System

(1) Raise the front and rear of the vehicle and support it on chassis stands.
(2) Loosen the clamp securing the tailpipe and muffler assembly to the rear pipe.
(3) Remove the mounting bolts and slide the tailpipe and muffler assembly from the rear pipe.

NOTE; Should difficulty be experienced when separating the exhaust pipes, they may be cut with a hacksaw or pipe cutter if a replacement system is to be installed.
If heat is used to loosen frozen joints take extreme care near floor panels, fuel and brake lines or electrical wiring.

(4) Remove the bolts from the intermediate pipe and rear pipe mountings and lower the exhaust system. Use care not to drop the catalytic converter.
(5) If necessary the catalytic converter can be removed from the intermediate pipe and the rear pipe assembly by removing the retaining bolts.



Underbody view of the tailpipe and muffler.

(6) Carefully inspect the exhaust system and discard any components which are cracked, worn or corroded. Inspect the catalytic converter as described in the Emission Control Section.

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

(1) Install all components and check the system for correct positioning before tightening the retaining bolts and nuts.

(2) Ensure that the catalytic converter is installed in the correct direction as indicated on the housing.

COOLING AND HEATING SYSTEMS

SPECIFICATIONS

Coolant capacity	6.0 liters
Thermostat:	
Opening temperature	91 deg C
Fully open temperature	103 deg C
Cooling fan:	
Fan cut in temperature	100 deg C
Fan cut out temperature	95 deg C
Radiator cap opening pressure	78 -98 kPa

TORQUE WRENCH SETTINGS

Water pump retaining bolts	25 Nm
Thermostat housing bolts	15 Nm
Sender unit	10 Nm

1. COOLING SYSTEM TROUBLE SHOOTING

COOLANT LEAKAGE - EXTERNAL

(1) Loose hose clips or faulty hoses: Tighten the hose clips or renew the faulty water hoses.

(2) Leaking radiator core or tanks: Repair or renew the radiator.

(3) Leaking heater core or hoses: Repair or renew the heater core. Check the hose clips and hoses and renew if necessary.

(4) Leaks at the thermostat cover and/or water pump O rings. Renew the O rings.

(5) Worn or damaged water pump seal assembly: Renew the water pump.

(6) Worn or damaged water pump bearing assembly: Renew the water pump.

(7) Loose or rusted welch plugs; Renew the welch plugs.

(8) Faulty cylinder head gasket or loose cylinder head bolts: Renew the cylinder head gasket and correctly tighten the cylinder head bolts.

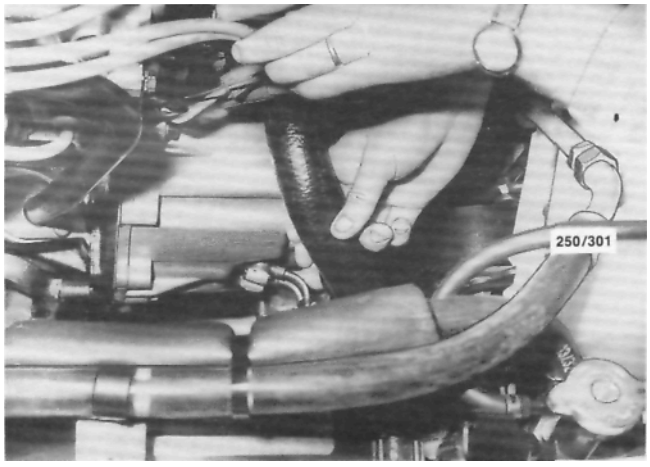
(9) External crack in the cylinder head or cylinder block: Repair or renew the faulty components.

NOTE: Check the system for external leakage by running the engine to operating temperature over a dry floor and checking for the leak source.

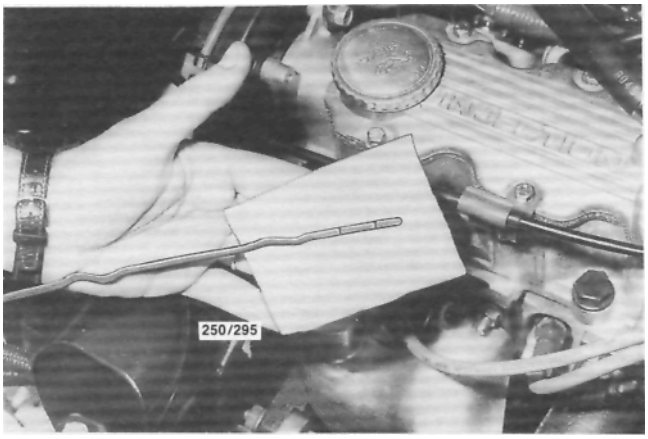
Check the vehicle interior below the heater core for moisture. If a rusted welch plug is found, it is a good practice to renew all the welch plugs.

COOLANT LEAKAGE - INTERNAL

(1) Cylinder head gasket leak due to warped cylinder head or cylinder block gasket faces: Reface



Checking the radiator hose for deterioration.



Check the engine oil for level and dilution on the dipstick.

the cylinder head or cylinder block and renew the cylinder head gasket.

(2) Crack in the cylinder head or cylinder block: Repair or renew as necessary.

NOTE; Check the engine for internal leakage by withdrawing the dipstick and inspecting for emulsified oil. Run the engine and check for excessive steam at the exhaust pipe which would indicate coolant leakage into the combustion chamber.

COOLANT LOSS BY OVERFLOW

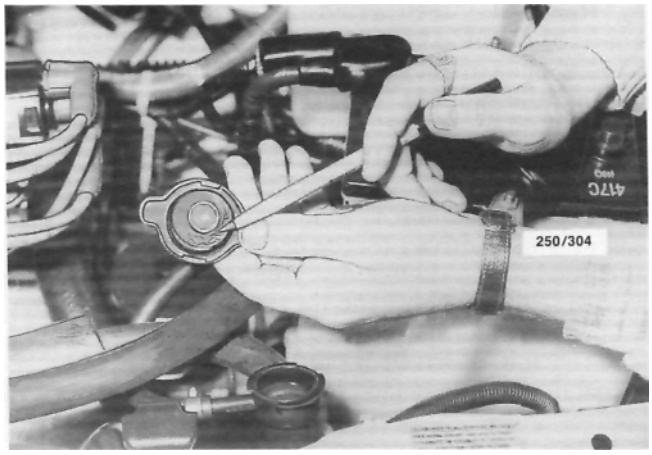
(1) Overfull system: Drain the excess coolant from the system.

(2) Faulty radiator cap: Renew the faulty cap.

(3) Blocked radiator core tubes: Clean or renew the radiator core.

(4) Faulty thermostat: Renew the thermostat.

(5) Coolant foaming due to poor quality anti-freeze or corrosion inhibitor: Drain the system and renew the coolant and additive.



Renew the radiator cap if the sealing rubber has deteriorated.

ENGINE OVERHEATING

(1) Radiator cap defective: Renew the radiator cap.

(2) Incorrect fuel mixture: Check the fuel system as described in the Fuel and Engine Management section.

(3) Obstructed air passage through the radiator core from the front to the rear: Blow the obstruction from the rear to the front of the radiator core using compressed air or water pressure.

(4) Faulty thermostat: Renew the thermostat.

(5) Incorrect ignition timing: Check and adjust the ignition timing as described in the Engine Tune-up section.

(6) Incorrect valve timing: Set the valve timing as described in the Engine section.

(7) Loss of coolant from the overflow: Check and rectify as described under the heading Coolant Loss By Overflow.

(8) Poor circulation: Check and rectify as described under the heading Coolant Circulation Faulty.

(9) Low engine oil level: Stop the engine immediately and replenish the oil in the sump.

(10) Restricted muffler, catalytic converter or damaged tailpipe, accompanied by loss of power: Remove the restrictions or renew the faulty components as necessary.

(11) Incorrectly adjusted or dragging brakes: Check and rectify by adjustment or renewal of components.

(12) Faulty temperature gauge and/or sender unit: Check and rectify as necessary.

NOTE: Engine overheating is indicated by an excessive rise in engine temperature shown by the temperature gauge.

Overheating is usually accompanied by steam emitting from the coolant overflow pipe and loss of engine power. A blown cylinder head gasket may be indicated by bubbles in the coolant.

COOLANT CIRCULATION FAULTY

(1) Partial blockage of the radiator core tubes: reverse flush or renew the radiator core.

(2) Sludge deposits in the engine water jacket: Clean and flush the engine water jacket and add inhibitor to the coolant.

(3) Faulty water pump: Renew the water pump.

(4) Faulty thermostat: Renew the thermostat.

(5) Collapsing lower radiator hose: Renew the lower radiator hose and check the radiator core tubes.

(6) Insufficient coolant in the system: Replenish the coolant and check for leaks.

NOTE: If rust or sludge deposits are suspected, check the color of the coolant in the radiator. Rusty or muddy coolant indicates rust or sludge in the system.

2. HEATER AND AIR CONDITIONER TROUBLE SHOOTING

NO HOT AIR INSIDE VEHICLE

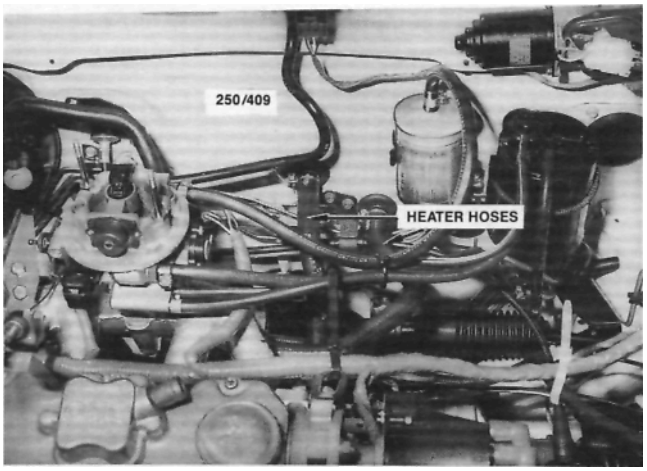
(1) Faulty thermostat: Renew the thermostat.

(2) Faulty heater valve: Check and renew the valve.

(3) Blocked heater hoses: Remove the blockage.

(4) Blocked heater core: Clean or renew the core.

NOTE: Ensure that the engine is reaching normal operating temperature. If in doubt check the operation of the thermostat as described under the Thermostat heading in this section.



Installed view of the heater hoses. 1.6 liter models with the air cleaner removed for clarity.

When the engine is at normal operating temperature and the heater valve is open, both of the heater hoses should feel warm/hot. If the valve is not allowing the coolant to flow, one hose will be hot while the other will be cold.

NO COOLED AIR INSIDE VEHICLE

(1) Compressor drive belt slipping or broken: Renew and/or adjust the drive belt as described in the Engine Tune-up section.

(2) Insufficient refrigerant: Check the system for leaks and charge as necessary. Refer to the Air Conditioning heading in this section for information on checking the refrigerant level.

(3) Compressor inoperative: Check for power to the compressor clutch before removing the compressor for repair by a specialist.

(4) Heater system allowing warm air to mix with cooled air: Check the operation of the heater system.

NOTE: The above trouble shooting procedures are basic checks only. If the air conditioning system is suspect, it is recommended that the vehicle be taken to an authorized dealer for testing and repair. It is normal for water to be seen draining under the vehicle from the evaporator after the vehicle has been operated with the air conditioning on.

3. DESCRIPTION

The cooling system is of the sealed, pressurized type with fan and water pump assistance. The system is pressurized in order to raise the boiling point of the coolant and so increase the efficiency of the engine. Provision for pressure and vacuum relief of the system is incorporated in the radiator cap.

The radiator overflow hose is connected to a reserve tank mounted adjacent to the battery. As the coolant volume expands due to an increase in temperature, the pressure valve in the radiator cap opens and allows the excess coolant to flow into the reserve tank. When the engine is stopped and the temperature of the coolant falls, the vacuum valve in the radiator cap opens and allows the excess coolant in the reserve tank to siphon back into the radiator. Thus the necessity for frequent topping up of the coolant is eliminated.

The temperature of the cooling system is controlled by a thermostat located in the thermostat housing attached to the cylinder head.

The thermostat prevents circulation of coolant through the radiator by directing coolant through the by-pass circuit, until the engine has reached operating temperature. This restricted circulation allows the engine to reach operating temperature quickly, improving drivability and fuel economy.

Removal of the thermostat to cure overheating is not recommended because the by-pass circuit will remain open reducing the amount of water flowing through the radiator.

An anti-corrosion inhibitor should always be added to the coolant to protect the cooling and heating systems from corrosion.

The water pump is mounted to the front of the engine and is driven by the camshaft drive belt. It is equipped with a double row ball bearing and a spring loaded seal assembly. The water pump is a disposable unit and cannot be repaired.

The fan is driven by an electric motor which is actuated by the coolant temperature sensor and the control unit.

On vehicles equipped with air conditioning, an additional electric fan is mounted to the radiator. This fan is controlled by a switch connected to the air conditioning compressor.

The radiator consists of an aluminum core with plastic side tanks. Minor damage to the core can be repaired using Nissan repair agent.

The left hand tank of the radiator houses the transaxle oil cooler on automatic transaxle models.

To drain the cooling system a drain plug is provided on the lower radiator pipe outlet.

4. RADIATOR

NOTE: To avoid scalding, use caution when releasing the radiator cap on an engine which is at the normal operating temperature. Turn the cap anti-clockwise to the first stop and allow any pressure in the system to release. When the pressure is released turn the cap past the stop and remove it from the radiator.

TO DRAIN AND REFILL

(1) Place a drain tin under the radiator drain plug.

(2) Switch the heater controls to the maximum heat position.

(3) Remove the radiator cap and open the radiator drain plug.

(4) Disconnect the reserve tank hose from the radiator filler neck.

(5) Lower the end of the hose and drain the coolant from the reserve tank.

(6) After all the coolant has drained from the cooling system, install the radiator drain plug ensuring
that the plug seal is in good condition.

(7) Disconnect the wire from the temperature sender switch and remove the switch using a suitable spanner.

(8) Using a clean container, mix Nissan long life coolant with clean soft water to the proportions stipulated on the coolant container.

(9) Slowly pour the premixed coolant into the radiator until the radiator is full and all air has escaped through the temperature sender switch hole. Install the radiator cap.

(10) Fill the coolant reserve tank to the Maximum mark.

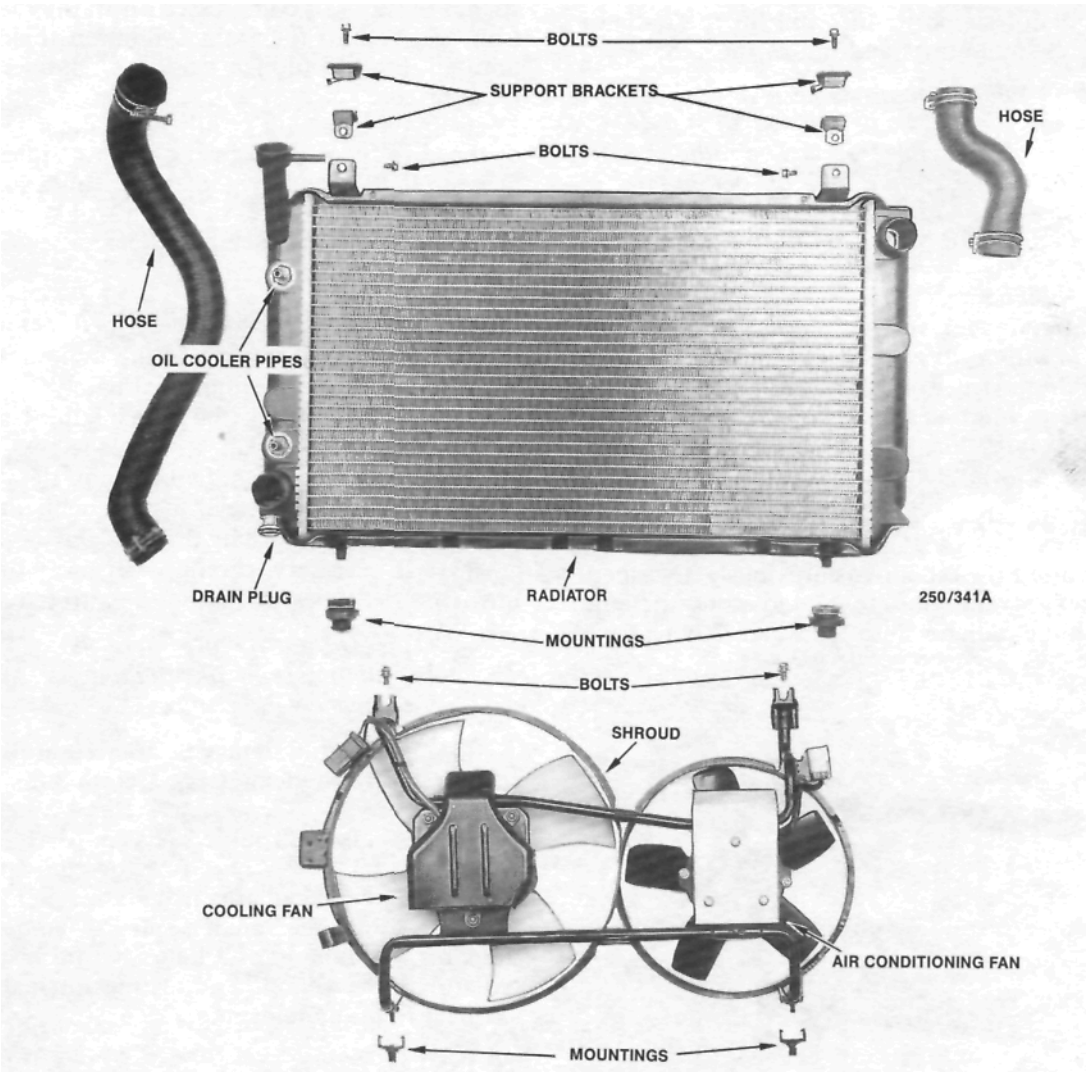
(11) Start the engine and allow it to idle.

(12) When coolant starts to flow through the temperature sender switch hole, install the temperature sender switch and tighten securely.

(13) Continue idling the engine until the cooling fan is activated.

(14) Switch the engine off and allow it to cool.

(15) Refill the radiator using coolant and install the radiator cap.



Dismantled view of the radiator and associated components. Automatic transaxle model with air conditioning.

(16) After the vehicle has been driven several kilometers check the coolant level in the reserve tank and top up if necessary.

TO REMOVE

(1) Drain the cooling system as previously described.

(2) Loosen the hose clamps and disconnect the hoses from the radiator.

(3) If applicable disconnect the automatic transaxle oil cooler hoses from the left hand side radiator tank. Plug the hoses and fittings to prevent the entry of dirt and the loss of fluid.

(4) Disconnect the hose from the reserve tank at the top of the radiator.

(5) On models with air conditioning, remove the hoses and support bracket bolts and move the bracket and hoses away from the top of the radiator.

(6) Remove the radiator support bracket bolts from the radiator support panel and lift the radiator from the lower mountings and out of the vehicle.

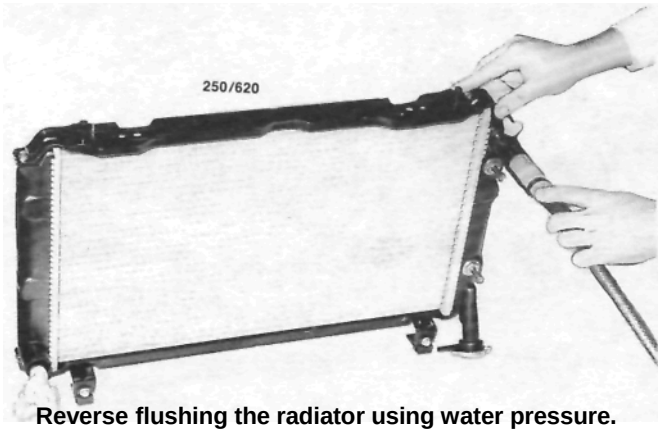
NOTE: A radiator that has been in use for some time should not be allowed to stand empty for any length of time. The radiator should be immersed in a tank of coolant or otherwise kept full. If applicable, ensure that no coolant is allowed to enter the automatic transaxle oil cooler in the left hand side tank of the radiator.

Failure to observe this precaution may result in overheating when the engine is put back into service. This is caused by internal deposits in the radiator drying and flaking and so obstructing the circulation of the coolant in the system.

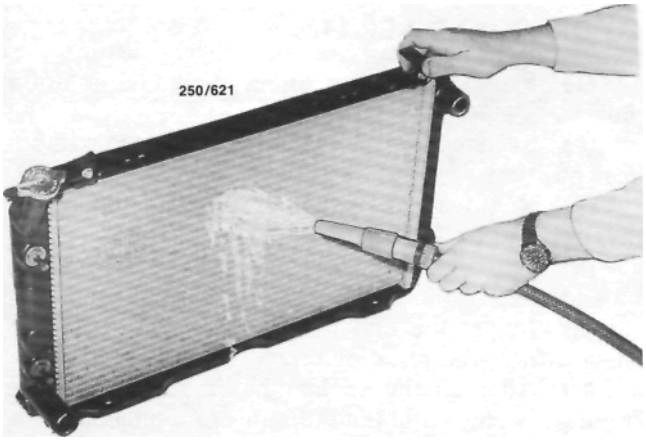
TO FLUSH AND CLEAN

(1) Remove the radiator as previously described.

(2) Apply a water hose to the radiator outlet and reverse flush the radiator until the water flowing from it is clean.



Reverse flushing the radiator using water pressure.



Cleaning the radiator core from the rear to the front using a garden hose.

(3) Stand the radiator upright and apply a stream of water or compressed air to the radiator core from the rear to [he front. Maintain this procedure until all dirt and foreign matter is removed from the radiator core.

(4) With the aid of a light, make a visual check of the core tubes through the radiator inlet or outlet fittings. If it is apparent that the tubes are severely impregnated with flakes of rust it will be necessary to renew the radiator assembly.

TO REPAIR

The repair procedure described below is only suitable for holes occurring in the radiator core tubes that are not bigger than approximately 1 mm.

(1) Suitably mark the area of the leak using a piece of chalk or similar.

(2) Remove the radiator from the vehicle as previously described, clean it thoroughly and dry the damaged area with a hair dryer.

(3) If necessary, carefully cut away or bend the fins from the tubes to expose the affected area.

NOTE: Do not remove more than 25 mm total finning from the radiator or cooling performance will be affected.

(4) Clean the damaged area carefully using a scraper and wipe clean using a cloth moistened with petrol.

(5) Apply well mixed Nissan or Holden adhesive part number 21411-J7025, or equivalent, sparingly to the damaged area using a wooden spatula.

(6) Allow the repair to dry in ambient conditions for a minimum of 3 hours before installing the radiator to the vehicle and testing for leaks. Do not use heat to promote drying.

TO INSTAL

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

(1) Renew all hoses that show signs of cracking or perishing.
(2) Before finally tightening the hose clips, ensure that the hoses are pushed fully onto the radiator and are not kinked.
(3) On automatic transaxle models, ensure that the oil cooler hoses are correctly installed to the radiator and show no signs of leakage. Check and top up the automatic transaxle fluid as necessary.

5. COOLING FAN

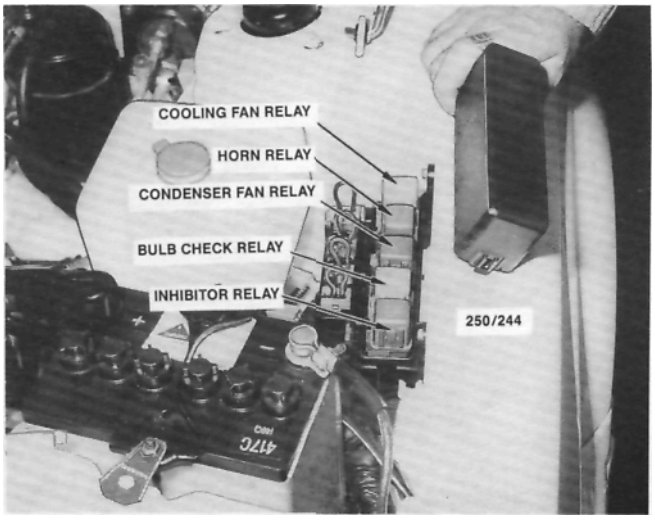
The radiator cooling fan is controlled by the electronic control unit, and on vehicles with air conditioning, the condenser fan relay. On vehicles with air conditioning there are two cooling fans, one is larger than the other. The large fan is for the radiator and the smaller fan provides extra cooling when the air conditioning is activated. Each fan is controlled by a separate system.

TO TEST COOLING FAN AND SYSTEM

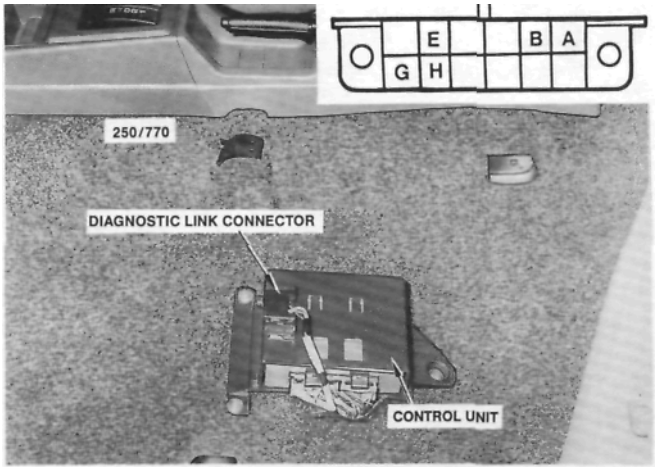
(1) With the cooling system cold and the air conditioning, if applicable, switched off, switch the ignition On and confirm that the cooling fan is stationary.

NOTE: Leave the ignition On for all tests unless otherwise stated.

(2) In the above test, if the cooling fan rotates, proceed as follows:
(a) Disconnect the cooling fan relay from the rear of the engine compartment relay box.
(b) If the fan stops, backprobe terminal C1 at the electronic control unit using an LED test lamp connected to the positive battery terminal. If no circuit exists, renew the cooling fan relay.

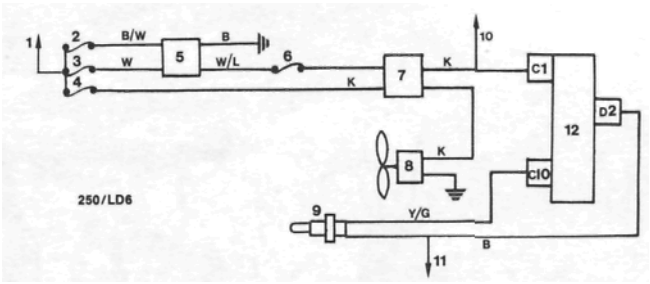


Installed view of the engine compartment relays.



View showing the location of the diagnostic link connector. Passengers seat removed for clarity.

If a circuit exists, check the wiring harness between the electronic control unit and the relay for short circuits to earth and repair if necessary. If no short circuit is present renew the electronic control unit.



Schematic layout of the cooling fan, coolant temperature sensor and related electrical components.

KEY

1. To Battery
2. Fusible link
3. Fusible link
4. Fusible link
5. Ignition relay
6. Fuse 20 amp
7. Cooling fan relay
8. Cooling fan
9. Coolant temperature sensor
10. To air conditioning fan relay
11. To throttle position sensor
12. Control unit

COLOUR CODE
B - Black
L - Blue
Y - Yellow
W - White
O - Orange

NOTE: Refer to the Fuel and Engine Management section for the correct procedure for backprobing the control unit.

(3) In operation (1) if the cooling fan is stationary proceed as follows:

(a) Connect a jumper lead between the terminals A and B of the diagnostic link connector.

(b) if the fan runs, the fan circuit is satisfactory. If the engine is overheating check the coolant temperature sensor as described in the Fuel and Engine Management section under the appropriate codes.

(c) If the fan does not run, check the fuse (6) and the fusible link (4) shown on the illustration.

(d) Backprobe terminal C1 at the electronic control unit using an LED test lamp connected to the positive battery terminal. If no circuit exists, renew the electronic control unit.

(e) If the fuse and fusible links are serviceable, ensure that power is available at the white and pink wires from the fuse and fusible link of the cooling fan relay. Repair any faults in the wiring to that point if necessary.

(f) Switch the ignition Off. disconnect the cooling fan wiring connector at the radiator and connect power to the fan. Renew the fan if it does not run.

(4) On air conditioned models, remove the jumper lead from the ALDL connector if still installed, start the engine and allow it to idle. Switch the air conditioning on and ensure that the cooling fan runs.

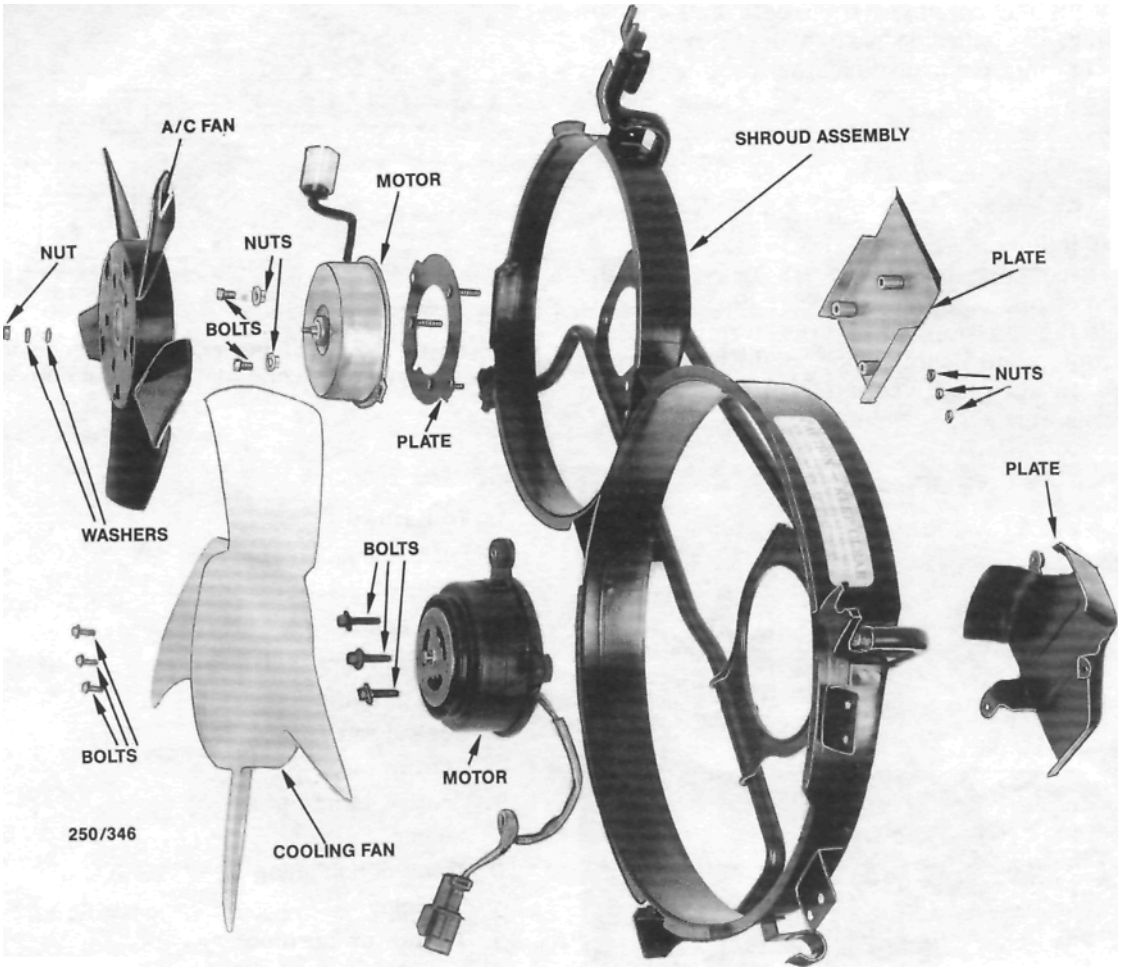
If the cooling fan is operating as described above but cooling system problems still exist, refer to the Trouble Shooting heading at the start of this section.

TO REMOVE AND INSTAL COOLING FAN

(1) Disconnect the negative battery terminal.

(2) Disconnect the cooling fan and, if applicable, the air conditioning fan wiring connectors at the upper edge of the radiator.

(3) On models with air conditioning, remove the compressor hose bracket bolt from the centre of the radiator support panel.



Dismantled view of the fans and the shroud assembly. Air conditioned model.

(4) Remove the bolts retaining the fan shroud assembly to the radiator and carefully move the shroud assembly upwards and towards the engine to release it from the lower mountings.

NOTE: On models with air conditioning, it will be necessary to hold the air conditioning compressor hoses towards the engine to allow clearance for removal of the shroud assembly.

(5) If necessary, remove the fan from the fan motor by removing the retaining bolts or on some models the nut and washers.

(6) If necessary, remove the fan motor from the shroud assembly by removing the retaining bolts or nuts.

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

(1) Ensure all the fan motor and fan retaining nuts and bolts are tightened securely.

(2) Ensure that all the rubber mountings are in good condition.

6. THERMOSTAT

Special Equipment Required:
To Check — Thermometer

TO REMOVE AND INSTAL

(1) Drain the cooling system as previously described under the Radiator heading.

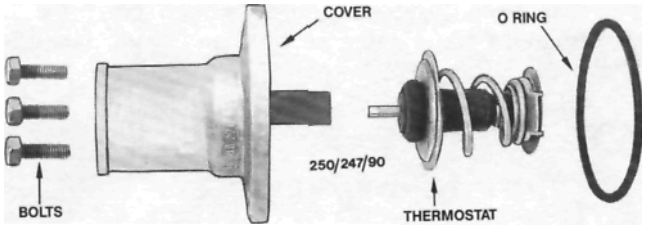
(2) On 1.6 liter models, remove the air cleaner assembly. Refer to the Fuel and Engine Management section if necessary.

(3) Disconnect the top radiator hose from the thermostat cover.

(4) Remove the bolts retaining the thermostat cover to the thermostat housing.

(5) Remove the thermostat cover, thermostat and O ring from the thermostat housing.

NOTE: The thermostat and cover are serviced as a unit and cannot be renewed separately.



View of the thermostat removed from the vehicle and dismantled for testing.

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

(1) Ensure that all sealing surfaces are clean.

(2) Renew the O ring on installation.

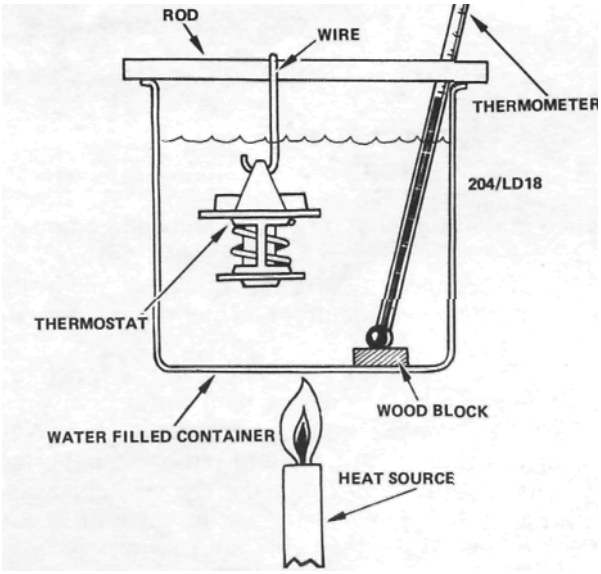
(3) Tighten the thermostat cover retaining bolts securely.

(4) Fill the cooling system as previously described ensuring that the heater control lever is in the maximum heat position. Check for coolant leaks.

TO CHECK

NOTE: A visual examination of the thermostat will often determine its serviceability and make further testing unnecessary. For instance, a thermostat with its valve fully-open when removed from a cold engine is obviously faulty and should be renewed.

Remove the thermostat from the thermostat



Line drawing showing the correct method to test the thermostat.

(4) Progressively heat the mixture noting the temperature reading on the thermometer as the thermostat valve commences to open and when it is fully open.

See the Specifications for opening and fully open temperatures.

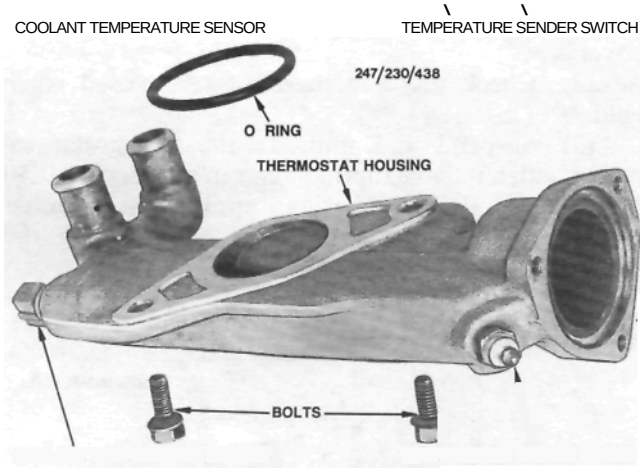
A thermostat which is not opening or is not open at the specified temperatures should be renewed.

7. THERMOSTAT HOUSING

Special Equipment Required:
To Adjust Camshaft Drive Belt — Adjusting tool

TO REMOVE AND INSTAL

(1) Disconnect the negative battery terminal.
(2) On 1.6 liter models, remove the air cleaner assembly from the engine. Refer to the Fuel and Engine Management section if necessary.
(3) Drain the cooling system as previously described.
(4) Remove the camshaft drive belt as described in the Engine section under the heading Camshaft Drive Belt.
(5) Remove the bolts retaining the camshaft drive belt rear cover to the cylinder block and remove the rear cover.



View of the thermostat housing and components.

(6) Disconnect the top radiator hose, the heater hose and the inlet manifold heater hose from the thermostat housing.
(7) Disconnect the wire from the temperature sender switch and the coolant temperature sensor.
(8) Remove the bolts retaining the thermostat housing to the cylinder head and remove the thermostat housing and the O ring from the cylinder head.

Installation is a reversal of the removal procedure with attention to the following points:
(1) Ensure that all mounting faces are clean.
(2) Renew the O ring on installation.

NOTE; Ensure that the O ring is not twisted. Do not use sealant.

(3) Tighten the thermostat housing retaining bolts to the specified torque.
(4) Adjust the camshaft drive belt tension as described in the Engine section under the heading Camshaft Drive Belt.
(5) Fill the cooling system as previously described and check for coolant leaks.

8. WATER PUMP

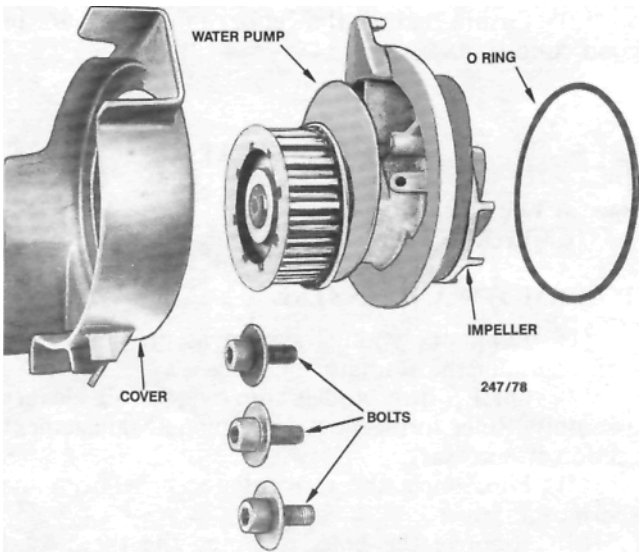
Special Equipment Required:
To Adjust Camshaft Drive Belt — Adjusting tool

TO REMOVE AND INSTAL

NOTE: The water pump is non-repairable and if faulty must be renewed as a complete assembly.

(1) Drain the cooling system as previously described.
(2) Remove the camshaft drive belt as described in the Engine section under the heading Camshaft Drive Belt.
(3) Remove the water pump retaining bolts and remove the water pump and the O ring from the engine.

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



View of the water pump and components removed from the vehicle.

(1) Ensure that all mounting faces are clean.
(2) Use a new O ring and smear it with a liberal amount of silicone grease.
(3) Install the water pump to the engine but do
not tighten the retaining bolts until the camshaft drive belt has been installed and tensioned correctly as described in the Engine section under the heading Camshaft Drive Belt.
(4) Fill the cooling system as previously described in this section and check for coolant leaks.

9. WELCH PLUGS

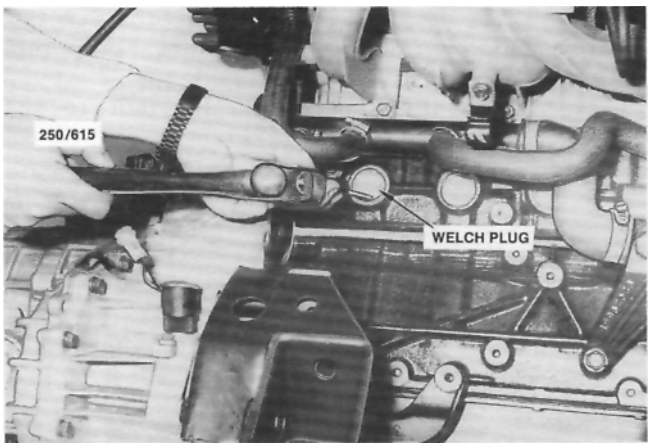
To facilitate the casting of the cylinder block and cylinder head passages and water jackets, a number of openings had to be made at manufacture.

These openings are plugged with welch plugs. The plugs may have to be renewed when cleaning the engine water jackets or when defective due to corrosion.

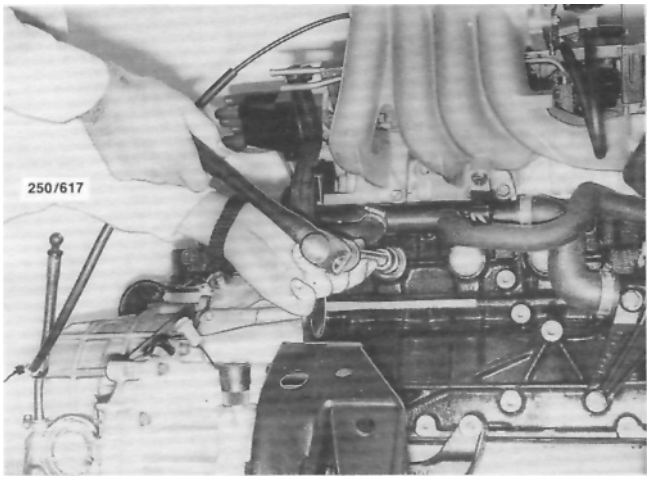
TO RENEW

NOTE: If a welch plug is found to be corroded it is good policy to renew all the welch plugs.

(1) Drain the radiator and cylinder block.
(2) Remove the necessary engine components or accessories to gain ample working space around the welch plug.
(3) Using a punch and hammer, tap the welch plug on its outer circumference into its opening.
(4) Grasp the edge of the welch plug with a pair of multi-grip pliers and using the shoulder of the pliers as a fulcrum, lever the plug out of its opening.
(5) Thoroughly clean and dry the welch plug opening.



Tap the welch plug on its outer circumference into the cylinder block.



Using a correct fitting tube or socket, drive the welch plug into its opening.

(6) Lightly smear the edge of a new welch plug and the opening with Loctite 675.
(7) Place the welch plug onto the opening and using a tube or socket fitting the rim of the plug, drive the plug squarely into its opening.

NOTE; The welch plug must be driven into the opening straight and squarely or leaks may occur.

(8) Install the components which were removed to gain access to the plug.
(9) Fill the cooling system as previously described. With the reserve tank pressure cap installed, run the engine until it reaches normal operating temperature and check for coolant leaks.

10. HEATER UNIT, WATER VALVE AND CONTROLS

DESCRIPTION

The heater controls use four adjustments to direct air through the vehicle.

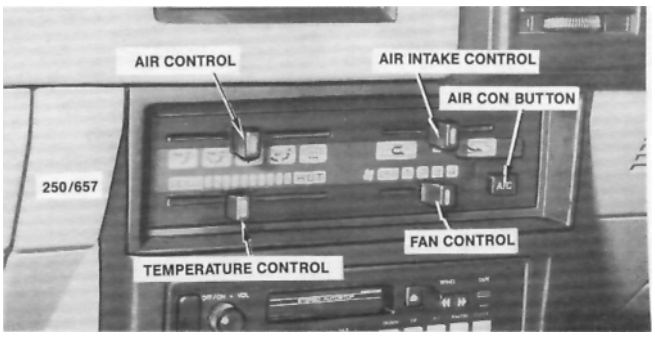
The air intake control selects fresh air from outside the vehicle or recirculates air from inside the vehicle. The recirculate position is used in dusty conditions or to rapidly heat or cool the vehicle interior. The fresh air position is the best to deodorize the vehicle interior or demist the windscreen.

The air control lever is used to direct air to the face outlets, the floor outlets and the windscreen outlets. This control also has two bi-level positions where air may be directed to the face and floor outlets or the windscreen and floor outlets.

The temperature control opens or shuts the heater water valve to control the flow of engine coolant through the heater core, which raises or lowers the temperature of the air passing through the core. Maximum heating is only available when the engine is at the normal operating temperature.

The fan speed control switches the fan on and off and is used to select the desired fan speed.

Air conditioned models use identical controls with the addition of an air conditioner on/off button. The centre of the button is illuminated when the air conditioner is switched on.



View of the heater controls.

The air conditioner operates only when the engine is running as the compressor is belt driven from the engine.

Operating the air conditioner with the temperature control raised to a hot setting will produce dehumidified hot air which is particularly useful for demisting the vehicle glass.

Maximum cooling is achieved by operating the air conditioner with the temperature control lowered fully to the coldest setting. Operate the fan at high speed when using the coldest temperature setting to avoid forming ice on the evaporator.

TO REMOVE AND INSTAL HEATER UNIT

(1) Remove the dashboard as described in the Body section.

(2) Drain the cooling system as previously described in this section.

(3) Loosen the hose clamps and disconnect the heater hoses from the heater pipes.

NOTE: If the heater hoses will not come off the heater pipes, do not use excess force or the heater core retaining strap will be damaged. Cut the hoses from the heater pipes.

(4) Remove the steering column upper mounting bolts.

(5) Remove the steering column cross support bolts and move the support towards the right hand side of the vehicle.

(6) Remove the centre support retaining bolts and remove the centre support from the vehicle.

(7) Remove the demister duct and the right hand side ventilator duct from the vehicle.

(8) Disconnect the blower fan wiring connector from the rear of the heater controls.

(9) Remove the heater retaining bolts.

(10) On models with air conditioning, it will be necessary to loosen the evaporator mounting bolts.

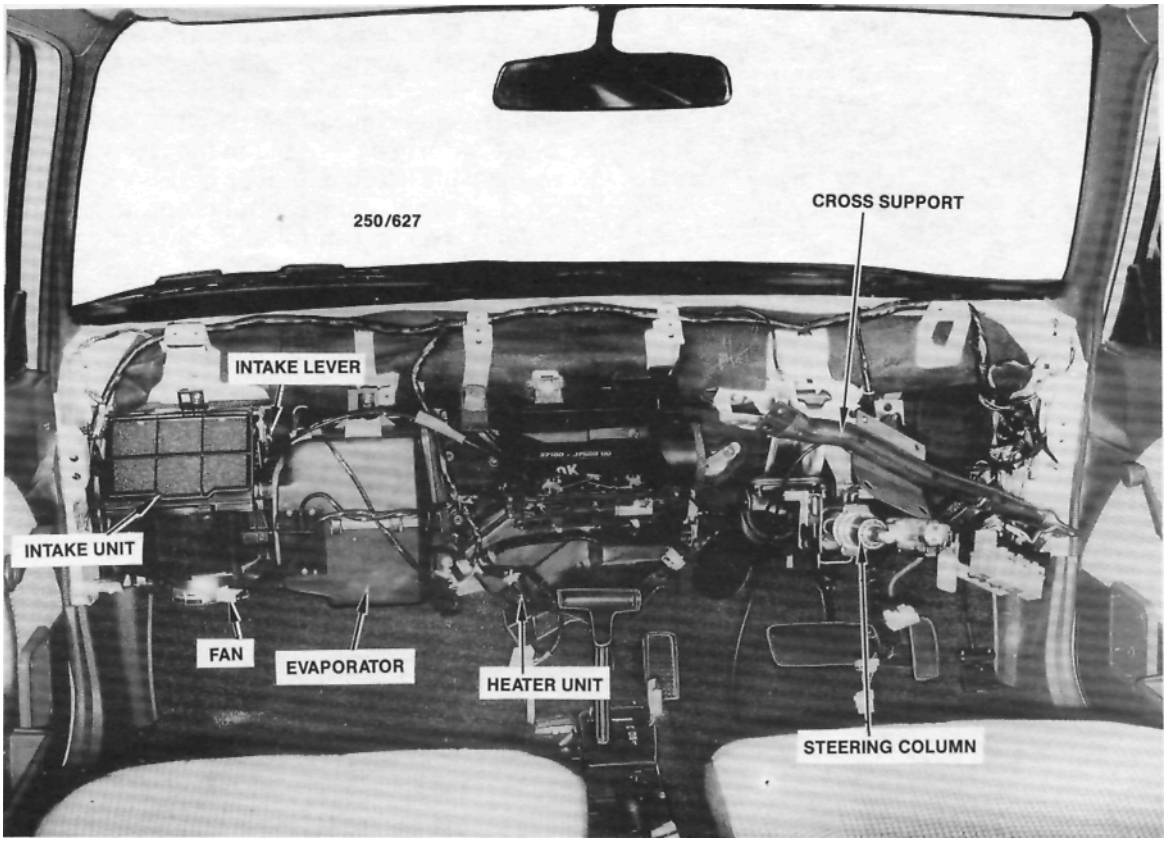
(11) Working in the engine compartment, push the heater pipe grommet through the bulkhead.

(12) Maneuver the heater unit upwards slightly and out from the bulkhead using care not to damage the heater pipes.

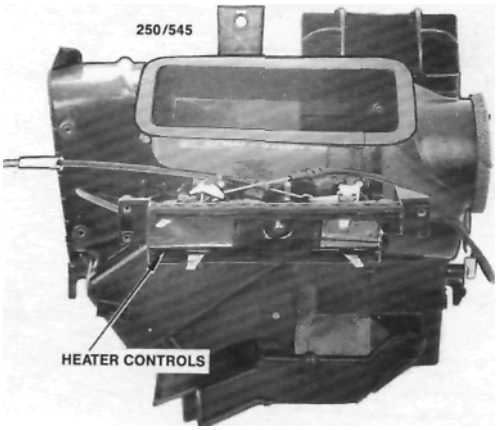
(13) To remove the heater core and tap assembly, remove the screws from the retaining strap and slide the heater core from the heater unit.

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

(1) Before installing the heater unit to the



View of the heater unit with the dashboard, centre support, demister duct and right hand ventilator duct removed.



Front view of the heater unit showing the heater controls.

vehicle adjust the heater water tap control rod as follows:

(a) Disconnect the control rod from the air mix door lever.

(b) Pull the control rod until there is a clearance of approximately 2 mm between the end of the control rod, which is inside the spring and the top lever. Hold the rod in this position.

(c) Turn the air mix door lever fully anti-clockwise and while holding the lever install the control rod to the air mix door lever.

(d) Ensure that the heater water tap is operating correctly and shutting off correctly by blowing through the heater pipes.

NOTE: No access to the heater water tap control rod is possible once the heater unit is installed in the vehicle.

(2) When maneuvering the heater unit into position use care not to damage the heater pipes.

(3) Wet the heater pipe grommets with soapy water and install onto the heater pipes.

(4) Check the heater controls for correct operation before installing the dashboard and adjust the controls if necessary using the procedure that follows.

(5) Operate the heater unit with the engine running and ensure that the operation is satisfactory and no leaks are present.

TO ADJUST HEATER CONTROLS

To Adjust Air Control Door Rods and Cable

(1) Disconnect the air control cable from the side link.

(2) Working on the right hand side of the heater unit disconnect the upper and lower door lever and demist door lever rods from the retaining clips.

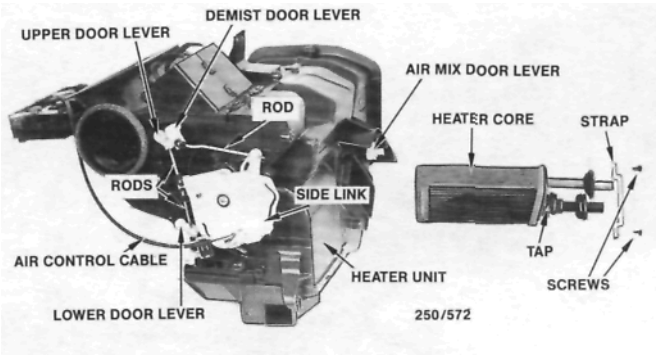
(3) Hold the side link fully anti-clockwise.

(4) Hold the upper and lower door levers fully clockwise and install the lower rod then the upper rod
in that order.

(5) Hold the side link fully clockwise and the demist door lever fully anti-clockwise and install the demist door rod.

(6) Holding the side link fully clockwise, set the air control lever on the dashboard to the face vent position and install the air control cable to the side link.

(7) With the fan running on the high speed setting, operate the air control lever through all ranges and ensure that the operation is correct.



Right hand side view of the heater unit.

To Adjust Temperature Control Rod and Cable

If the temperature control rod requires adjustment it will be necessary to remove the heater unit from the vehicle. Follow the procedure described under the heading To Remove and Install Heater Unit.

(1) Working in the passenger footwell disconnect the temperature control cable from the clip on the side of the heater unit.

(2) Set the heater controls to the maximum heat position.

(3) Hold the air mix door lever clockwise while lightly pulling on the outer control cable to remove slack, then install the control cable into the retaining clip.

(4) With the engine at operating temperature check the operation of the temperature control lever.

To Adjust Air Control Cable

(1) Working in the passenger footwell, disconnect the intake air control cable from the clip on the intake unit.

(2) Set the air intake lever to the recirculate position.

(3) Hold the intake lever towards the front of the vehicle and install the control cable into the retaining
clip.

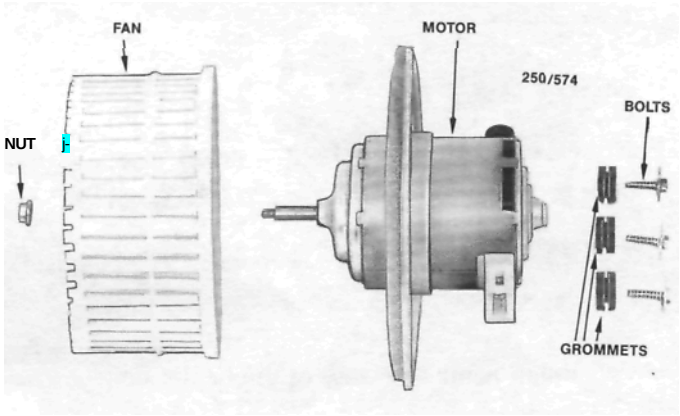
(4) Check the operation of the air intake control.

11. BLOWER FAN

TO REMOVE AND INSTAL

(1) Disconnect the negative battery terminal.
(2) Working below the glove compartment, disconnect the wiring connector to the blower fan motor.
(3) Remove the bolts retaining the blower fan motor and carefully lower the motor while disconnecting the drain hose.

Installation is a reversal of the removal procedure with attention to the following points:
(t) Tighten all bolts securely.
(2) Check that the blower fan operates correctly.



Dismantled view of the blower fan and associated components.

12. AIR CONDITIONING

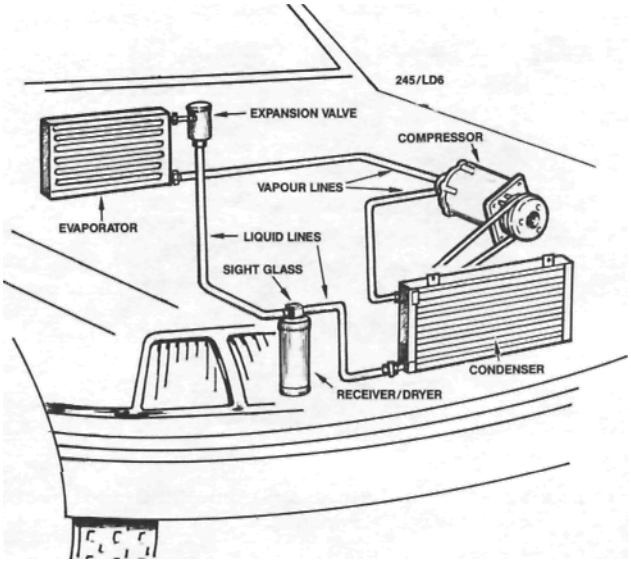
DESCRIPTION

The air conditioning system, when used in conjunction with the heater, enables any reasonable temperature to be achieved inside the vehicle. It can also reduce the humidity of the incoming air, aiding demisting even when cooling is not required.

The basic components of the air conditioning system are an evaporator, condenser, compressor, receiver/dryer, expansion valve and pipes and hoses carrying the refrigerant through the system. Various subsidiary controls and sensors are also utilized to protect the system against low or high pressure and excessive temperature.

The refrigerant will boil at a very low temperature (-33 deg C) and therefore must be contained under pressure. Escaping refrigerant can cause frostbite and eye damage and will produce a poisonous gas when burnt. Also, if the system suffers a rapid loss of refrigerant, oil from the compressor may be carried out with the refrigerant. It is recommended that any work requiring disconnection of the components be referred to an authorized dealer.

In the event of major repairs to the vehicle such as engine removal, the compressor hoses are of sufficient



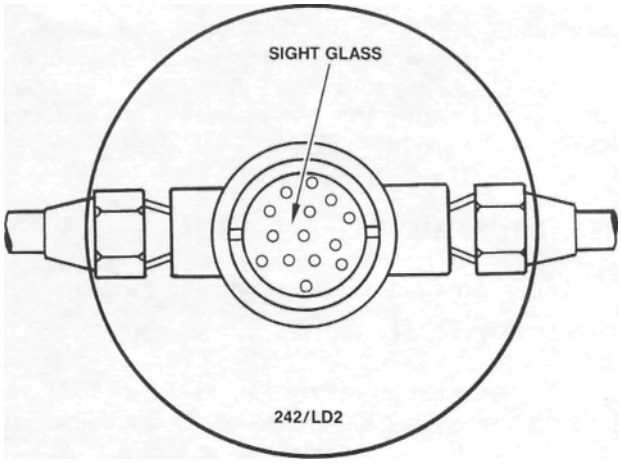
Schematic diagram of a typical air conditioning system.

length to allow the compressor to be removed as the engine is lowered from the engine compartment without disturbing any refrigerant line connections.

If the operation of the air conditioning system is in doubt, it is recommended that the vehicle be taken to an authorized dealer for testing and repair.

TO CHECK REFRIGERANT CHARGE

(1) Start the engine and operate the air conditioner on maximum cooling for a few minutes.
(2) Observe the flow of refrigerant through the sight glass located at the top of the receiver/dryer. On some models it may be necessary to use a mirror to see the sight glass.
(3) If the system is operating correctly, the sight glass will be clear during the operation of the compressor. Occasional bubbles may be seen when the compressor cycles on and off during operation, but a



Bubbles in the sight glass when the air conditioner is operating indicates a low refrigerant charge.

continuous stream of bubbles indicates that the refrigerant charge is low.

A large number of bubbles or foam indicates that the refrigerant charge is very low.

No bubbles or the presence of oil streaks in the sight glass indicate that the system is completely empty.

NOTE: If the outside air temperature is high, a certain number of bubbles may be observed in the sight glass, even though the system is fully charged.

If the system requires recharging, the vehicle should be taken to an authorized dealer for evacuation, leak testing and recharging.

Do not operate the system if it is known that the refrigerant charge is low as damage may result.

MAINTENANCE

The air conditioning system requires little maintenance other than the following. Where applicable, refer to the Lubrication and Maintenance section for the recommended service intervals.

(1) Check the refrigerant charge level in the receiver/dryer sight glass. Recharge the system as necessary. It is considered normal for the system to require periodic recharging.

(2) Inspect the air conditioner pipes and hoses for leaks, deterioration and alignment. Evidence of oil leakage is an indication of refrigerant leakage. Repair or renew as necessary.

(3) Inspect the evaporator drain tube and the condenser cooling fins for blockage. Clean as necessary.

(4) Check the drive belt for deterioration and for correct tension. Refer to the Engine Tune-up section for the correct procedure.

(5) Operate the system at least once a week for approximately 15 minutes to keep the compressor seals lubricated.

FUEL AND ENGINE MANAGEMENT

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. See the text for precautionary notes.

SPECIFICATIONS

FUEL INJECTION

Type:
- 1.6 liter engine ..... Single point
- 1.8 liter engine ..... Multi point

FUEL PUMP

Type ..... Electric
Pressure at idle:
- 1.6 liter engine ..... 62-90 kPa
- 1.8 liter engine ..... 190-230 kPa

FUEL FILTER

Type ..... Inline, disposable

AIR FILTER

Type ..... Disposable paper element

DISTRIBUTOR

Make ..... Delco Remy
Advance control ..... Electronic
Rotation of rotor ..... Anti-clockwise
Firing order ..... 1 -3-4-2

ADJUSTMENTS

Base idle speed ..... 550-650 rpm
Ignition timing ..... 10° BTDC

TORQUE WRENCH SETTINGS

Throttle body nuts ..... 10 Nm
*Throttle body bolts ..... 12 Nm
*Fuel hose fittings ..... 35 Nm
Fuel rail bolts ..... 8 Nm
Fuel tank drain plug ..... 24 Nm
Coolant temperature sensor ..... 12 Nm
Oxygen sensor ..... 40 Nm
MAT sensor ..... 14 Nm
*1.6 liter engine
l.8 liter engine

1. FUEL AND ENGINE MANAGEMENT TROUBLE SHOOTING

NOTE: The following Trouble Shooting procedures are basic checks only. If these procedures fail to locate the fault, refer to the System Diagnosis and Adjustments heading for more thorough testing.

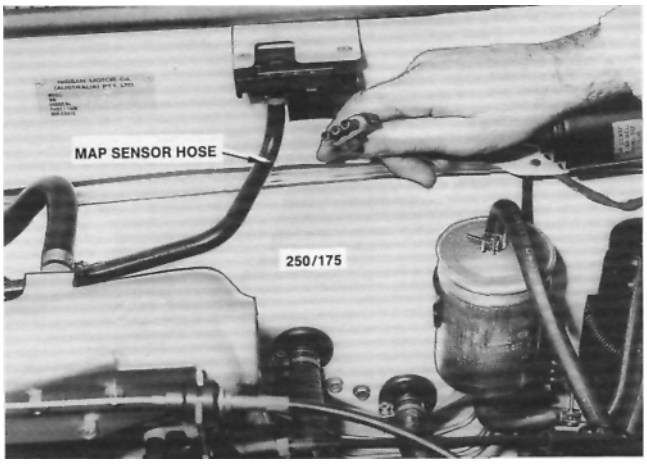
Prior to performing any of the following operations, refer to the Service Precautions and Procedures heading.

ENGINE WILL NOT START OR HARD TO START

(1) Water in the fuel: Drain the fuel from the system and renew the fuel filter.

(2) Fault in the power supply: Check the battery, fusible links and fuses. Check for clean, secure connections, particularly the earth connections. Check the EG1 and fuel pump relays.

NOTE: If the fuel pump relay fails, power will be supplied to the fuel pump via the oil pressure switch. When starting the engine,



Check that the MAP sensor hose is not blocked or split and ensure that all electrical connections are clean and secure.

the fuel pump will not operate until the oil pressure is sufficient to extinguish the oil pressure warning lamp. Therefore it will be necessary to operate the starter motor for a longer period than usual to start the engine.

(3) Faulty EFI component wiring connections: Check that all component wiring connections are clean and secure.

(4) Manifold absolute pressure (MAP) sensor vacuum hose blocked or disconnected: Clear or reconnect the vacuum hose.

(5) Fault in the ignition system: Check the primary and secondary ignition circuits.

(6) Engine flooded: Fully depress the throttle pedal until the engine starts. Check the coolant temperature sensor. Check the injector(s) for leakage.

ENGINE STARTS THEN STALLS

(1) Water in the fuel: Drain the fuel from the system and renew the fuel filter.

(2) Air leakage at the inlet manifold: Check all joints and hoses for air leaks.

(3) Faulty EFI wiring connections: Check that all component wiring connections are clean and secure.

(4) Ignition timing incorrectly set: Check and adjust the timing.

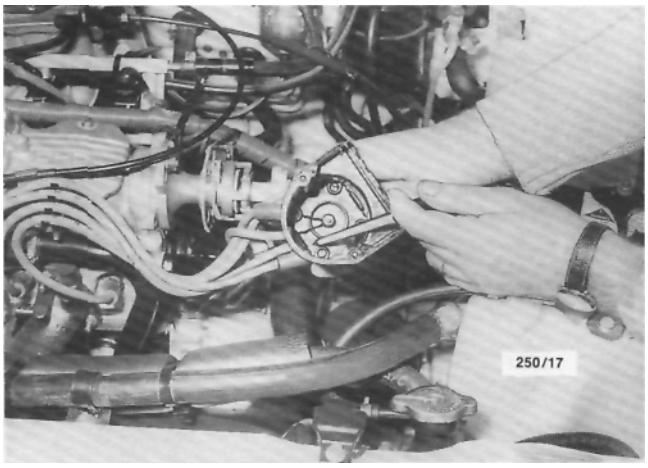
(5) MAP sensor faulty or supply hose disconnected or blocked: Check the vacuum supply hose. Check the operation of the MAP sensor.

ENGINE MISFIRES

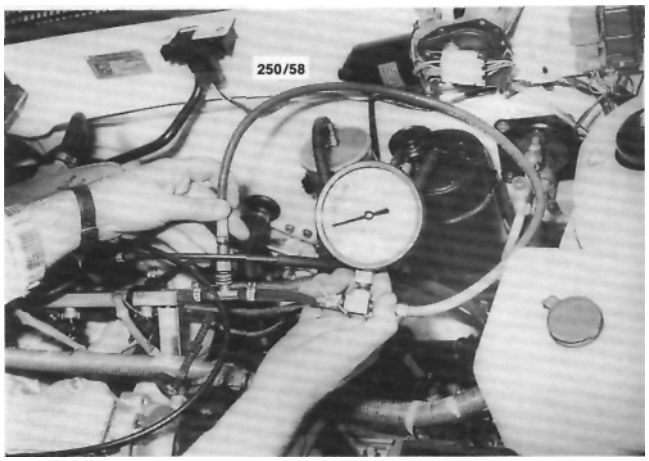
(1) Faulty, dirty or incorrectly adjusted spark plugs: Renew or clean and adjust the spark plugs.

(2) Condensation in the distributor cap: Dry and examine the cap for cracks.

(3) Faulty high tension leads: Check and renew the high tension leads.



Check the distributor cap for cracks or tracking between the terminals.



Testing the fuel system pressure using a pressure gauge.

(4) Faulty ignition coil: Check and renew the ignition coil.

(5) Fuel blockage: Check for blockage in the fuel filter, lines and injector(s).

(6) Low fuel pressure: Check the fuel pump and fuel pressure regulator.

(7) Water in the fuel: Drain the fuel from the system and renew the fuel filter.

(8) Loose fuel supply wiring connectors: Check all connectors for tightness.

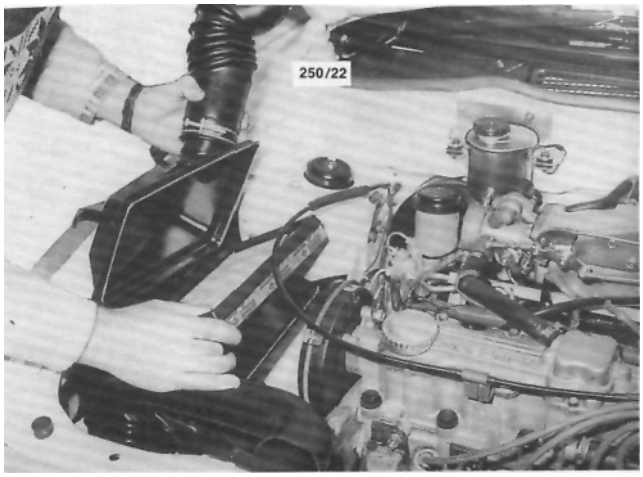
(9) Faulty fuel injector: Check the connections and test the condition of the fuel injectors.

ENGINE LACKS POWER

(1) Ignition timing incorrectly set: Check and adjust the timing.

(2) Water in the fuel: Drain the fuel from the system and renew the fuel filter.

(3) Incorrectly adjusted throttle cable: Adjust the throttle cable.

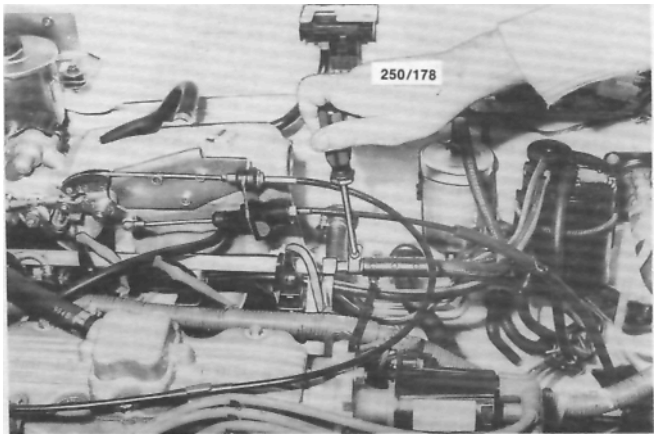


The air filter element should be renewed at 40 000 km intervals. 1.8 liter engine.

(4) MAP sensor faulty or supply hose disconnected or blocked: Check the vacuum supply hose. Check the operation of the MAP sensor.

EXCESSIVE FUEL CONSUMPTION

(1) Blocked air cleaner element: Check the element and clean or renew as necessary.
(2) Incorrect fuel pressure: Check the fuel pump and fuel pressure regulator.
(3) Faulty coolant temperature sensor: Check the connections and operation.



Ensure that all fuel connections are securely tightened.

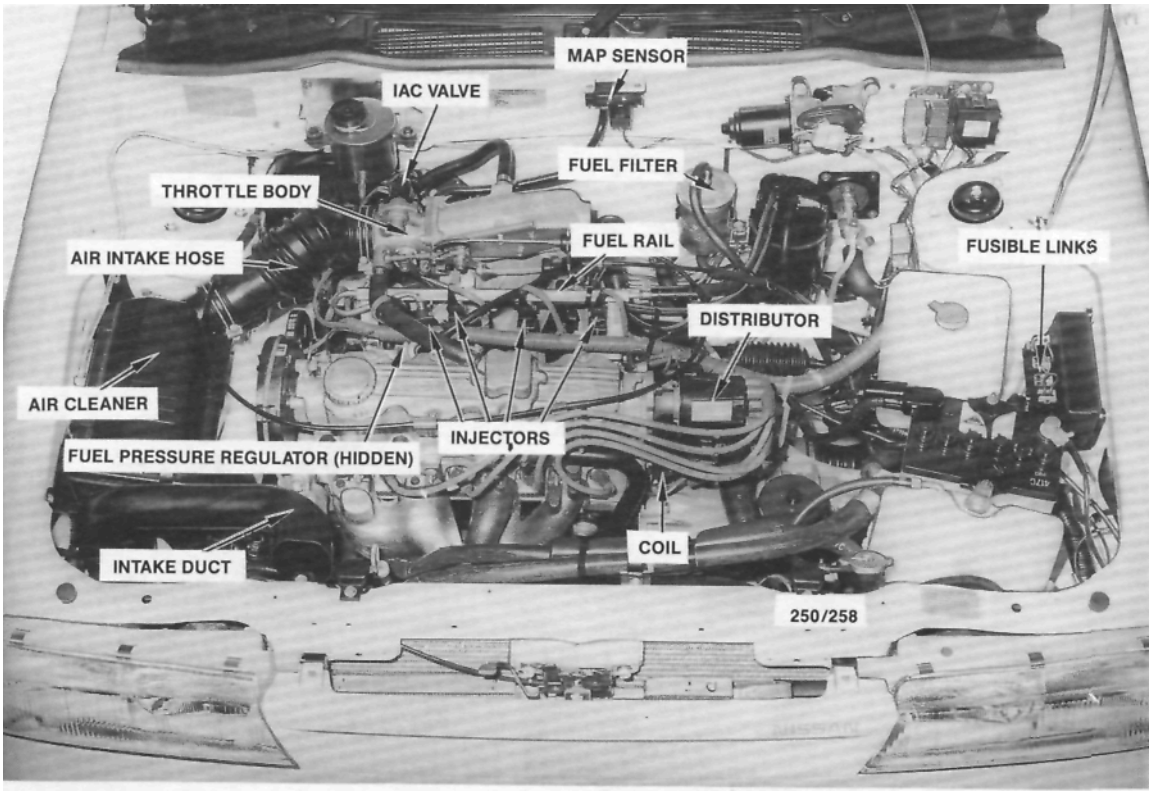
(4) Leaks in the fuel supply system: Check the connections and components for leakage.
(5) Leaking fuel injector(s): Clean or renew the faulty injector(s).
(6) Engine operating temperature too low: Check the thermostat and electric cooling fan as described in the Cooling and Heating Systems section.

2. DESCRIPTION

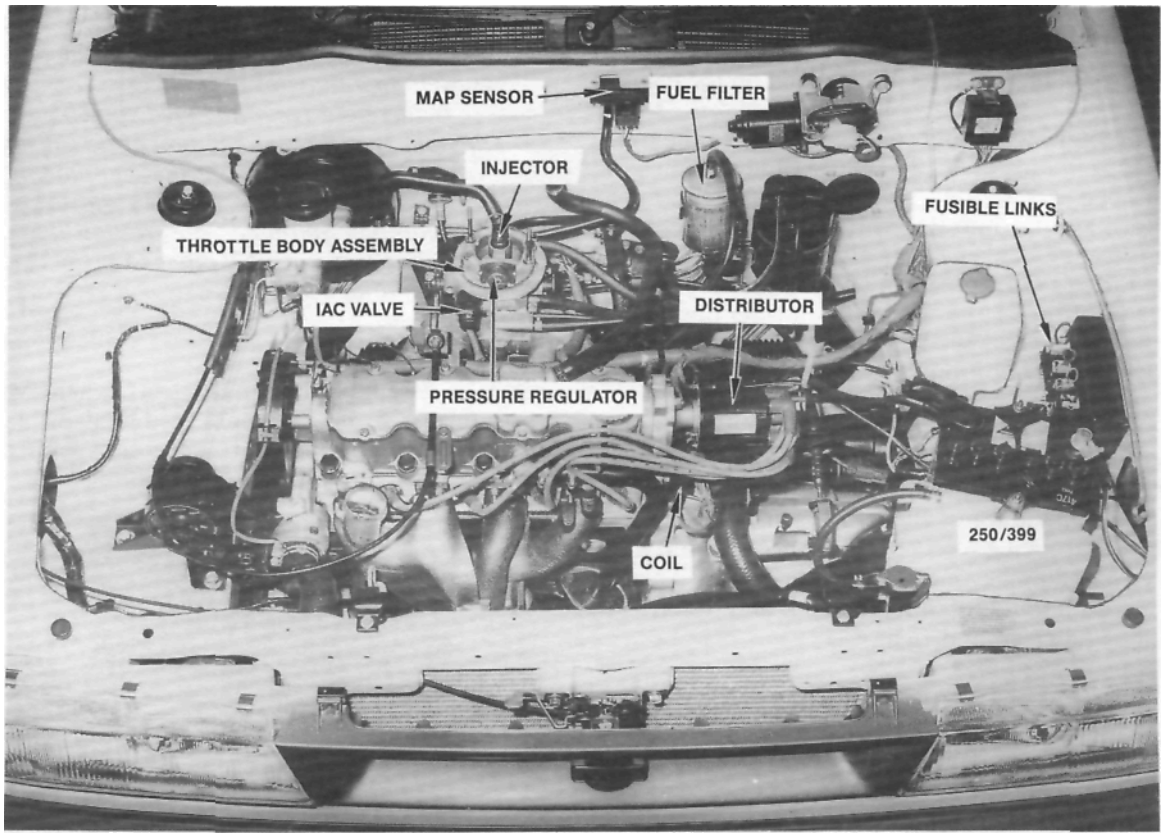
The engine management system on the range of vehicles covered by this manual controls the operation of the ignition system and the fuel system.

The central component of the engine management system is the electronic control unit (ECU). The control unit is a micro-computer which controls the ignition timing and the amount of fuel injected according to signals received from various sensors. As changes are detected in engine load and speed, coolant temperature, barometric pressure, air temperature (1.8 liter engine), throttle position and vehicle speed, the control unit alters the ignition timing and the fuel injection amount to achieve optimum engine efficiency.

The control unit incorporates a self diagnosis mode which stores and displays codes relating to certain system malfunctions. Whenever power is supplied to the control unit, the control unit performs a



View of the 1.8 liter engine showing the engine management components.



View of the 1.6 liter engine showing the engine management components. Air cleaner removed for clarity.

series of tests on various components in the system and records the results, If a fault is discovered, the ECM warning lamp on the instrument cluster will illuminate while the engine is running. When the self diagnosis mode is activated, the ECM warning lamp will flash codes indicating the area in which the fault has occurred.

This function is very useful in locating system faults, particularly intermittent problems. However, the self diagnosis mode does not provide comprehensive testing of the EFI system, and therefore should always be used in conjunction with the other test procedures described later in this section in order to accurately locate system faults.

The high energy electronic ignition system consists of a distributor and an ignition coil.

The distributor has two functions. The first is to produce and distribute secondary high tension voltage to the spark plugs.

The second function is to provide the control unit with information on engine speed and crankshaft position.

The ignition timing is constantly adjusted by the control unit to suit varying engine and vehicle operating conditions.

In the fuel injection system, a metered amount of fuel is sprayed into the air stream. The air/fuel mixture then enters the combustion chamber via the inlet valves.

On 1.6 liter engines, the fuel is injected by a single injector, located above the throttle valve within the throttle body assembly. The injector fires twice per engine revolution under most operating conditions.

On 1.8 liter engines, four injectors are used. The fuel is distributed to the injectors via the fuel rail. All injectors fire simultaneously once per engine revolution under most operating conditions.

Under conditions of high load the control unit may signal the injector(s) to fire more often. However, if the engine speed exceeds 6 700 rpm the control unit will cease firing the injectors until the engine speed is below 6 200 rpm.

Fuel is supplied under pressure by an electric fuel pump mounted in the fuel tank and the pressure is regulated by a pressure regulator.

On 1.6 liter engines, the regulator consists of a spring tensioned diaphragm which is mounted to the side of the throttle body assembly. The fuel pressure is regulated by the tension of the spring against the diaphragm, opening and closing the fuel return port.

On 1.8 liter engines, the pressure regulator is mounted adjacent to the fuel rail and consists of a diaphragm with fuel pressure acting on one side and spring tension and manifold vacuum acting on the

other. The fuel pressure is maintained at a constant pressure relevant to the manifold vacuum. A disposable paper element fuel filter is mounted on the engine bulkhead.

The amount of fuel injected is relevant to the time the injector remains open. The basic time the injector remains open is governed by the control unit which uses information from the various sensors to give optimum engine efficiency for given conditions.

The idle air control (IAC) valve controls the fast idle speed during engine warm up and maintains the basic idle speed at a set value by compensating for loads such as air conditioning or the selection of Drive on automatic transaxle models.

The throttle body assembly is mounted to the inlet manifold and controls the amount of air entering the engine by the action of the throttle valve.

Efficient operation of the EFI system depends on accurate signals being received by the control unit and controlled air flow beyond the throttle valve. Therefore it is essential that all air, fuel and electrical connections be clean and tight.

3. SERVICE PRECAUTIONS AND PROCEDURES

Electronic ignition systems can produce dangerously high voltages in both the primary and secondary circuits. For this reason, extreme care must be taken when working on or near the ignition system.

Do not start the engine if the battery terminals are not clean and tight.

Do not use the fast charge or boost settings on a battery charger to start the engine.

Do not disconnect the battery terminals while the engine is running.

Disconnect the battery terminals before charging the battery.

Disconnect the negative battery terminal before working on the engine management system.

Do not subject the control unit to temperatures above 80 deg C.

Ensure that all wiring connectors are clean and tight.

Disconnect the battery terminals and the control unit wiring connectors before attempting any welding operations.

Do not direct a steam cleaning or pressure washing nozzle at engine management components when cleaning the engine.

Ensure that the ignition is Off prior to disconnecting the battery terminals, fusible links or the control unit wiring connectors.

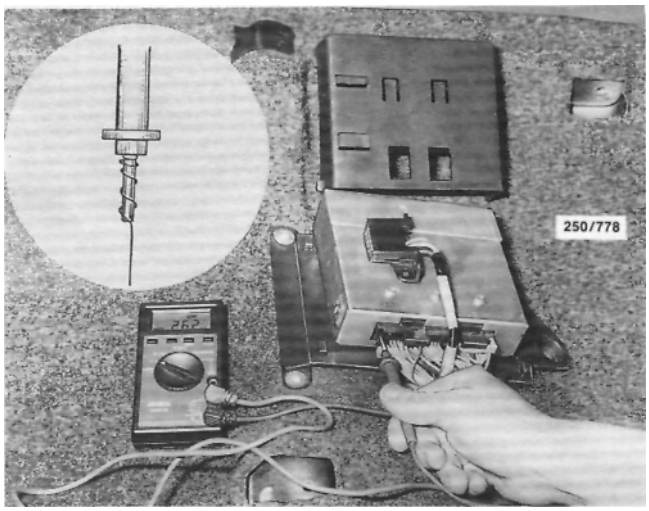
TO CONNECT ELECTRICAL TEST EQUIPMENT

NOTE: Some types of tachometers, timing lights and ignition system analysers are not compatible with this engine management system and may result in incorrect readings. It is therefore recommended that the manufacturer of the lest equipment be consulted before proceeding to use the equipment.

If a test procedure requires the use of a test lamp or voltmeter, ensure that only the specified instrument is used to prevent misleading diagnosis.

MULTIMETER

It is essential that in all tests where voltage or resistance is to be measured, a digital display multimeter with a minimum 10 megohms impedance be used.



The correct method of backprobing the wiring connectors. The meter test probe should be modified with a piece of thin wire as shown.

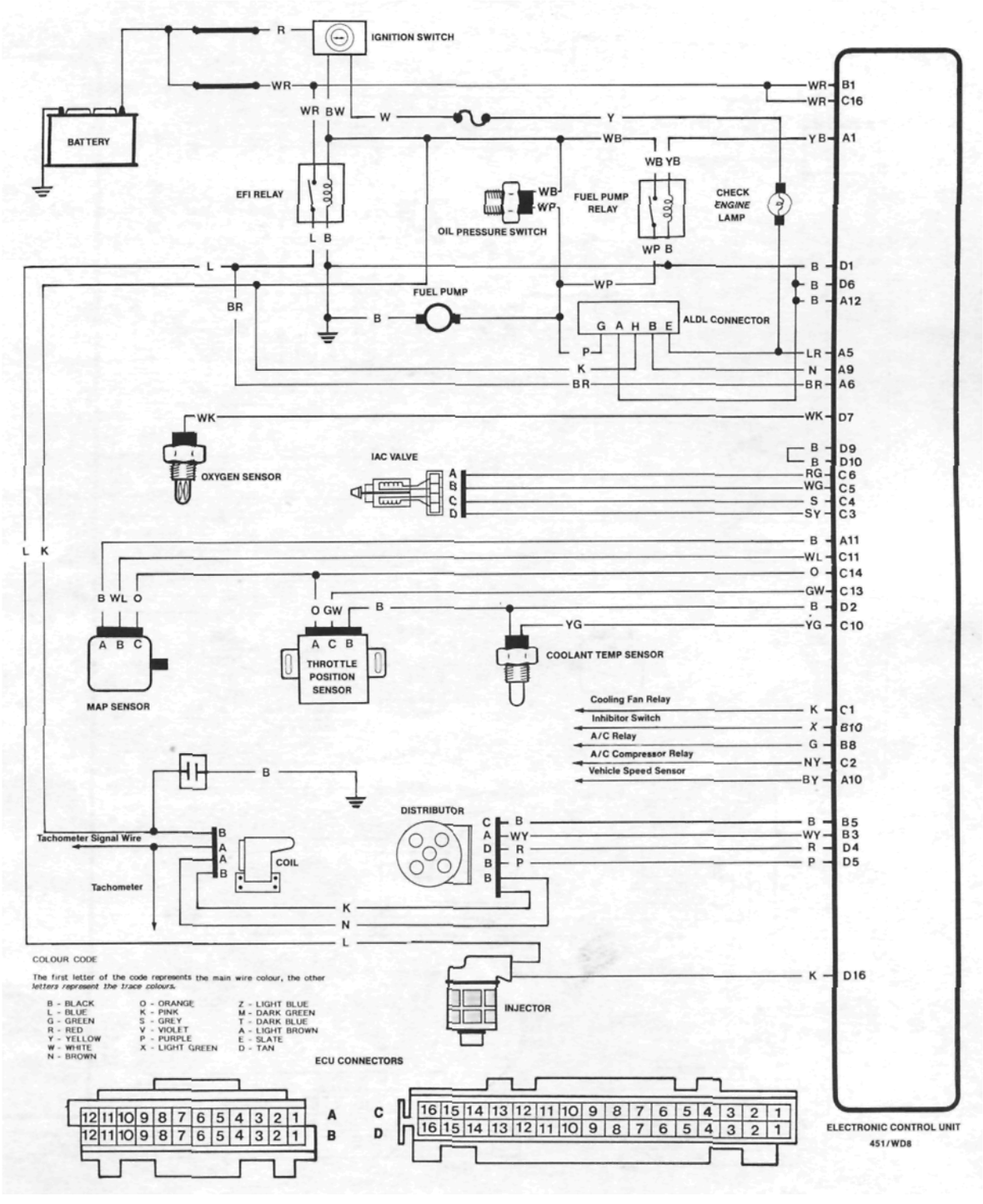
All meter readings are to be performed with the component wiring connectors installed unless otherwise instructed. This can be done by inserting the meter test probes from the wiring harness side of the connector or backprobing. If the test probes are not thin, they should be modified by attaching a thin piece of wire to the end, giving a fine point that will not damage the connector. Ensure that the wire is making good contact with the probe.

If sealing plugs or boots are removed from wiring connectors to facilitate backprobing, ensure that they are correctly installed at the conclusion of the test procedure.

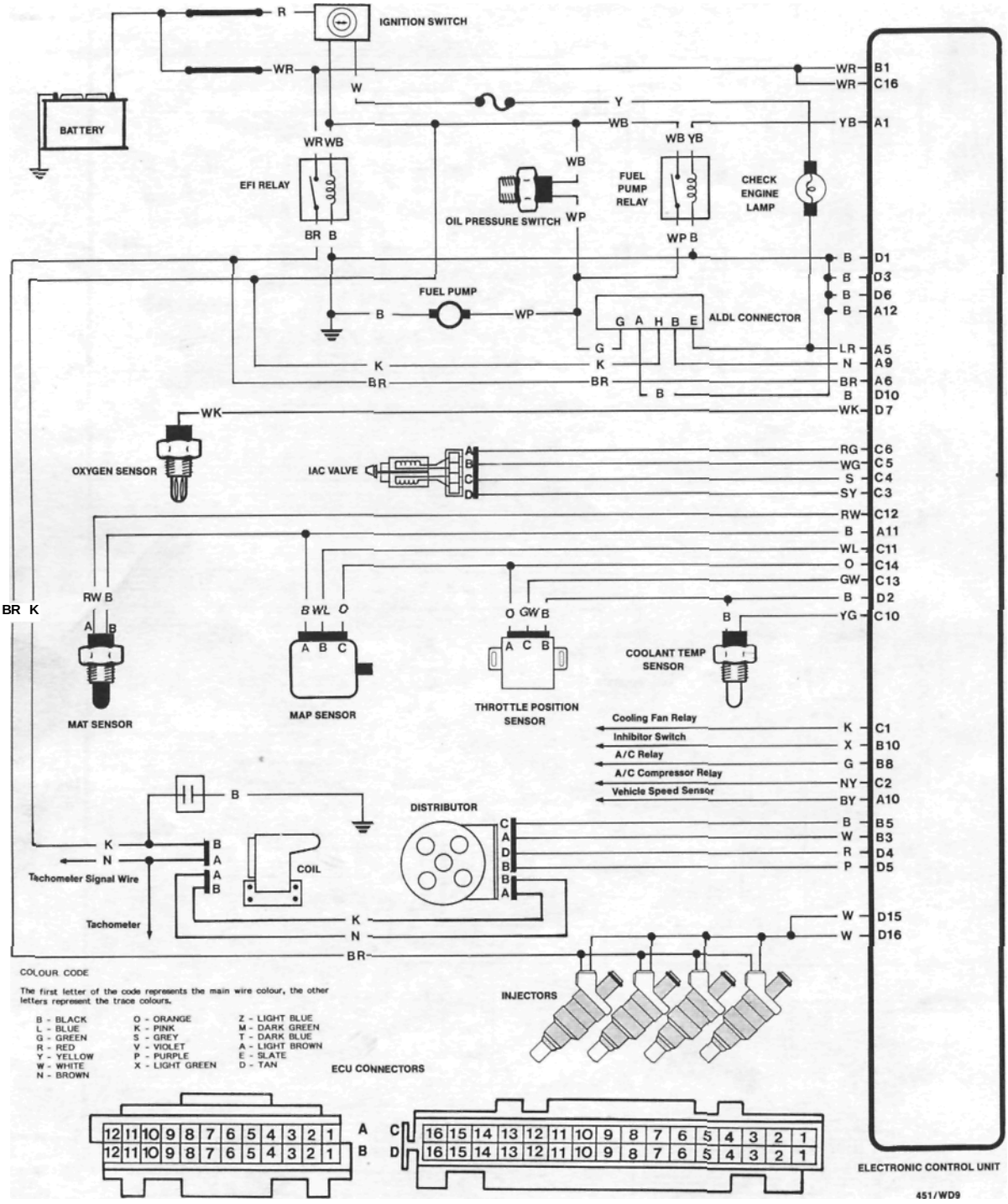
To identify wiring connector terminals refer to the wiring circuit diagrams.

Test Lamp

To avoid damage to the electronic components when testing, the use of an LED (light emitting diode) test lamp is recommended.



Fuel system wiring diagram for the 1.6 liter engine.



Fuel system wiring diagram for the 1.8 liter engine.

The procedure for fabricating an LED test lamp is fully described in the Electrical System section.

If a conventional test lamp with a filament type bulb is to be used, ensure that the current draw of the test lamp does not exceed 0.3 amp to avoid damage to the electronic components.

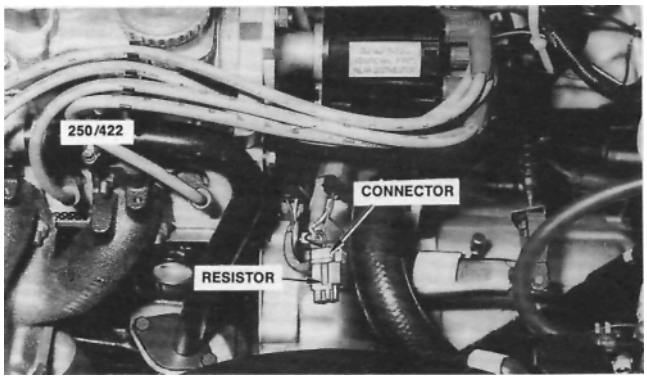
To check the current draw connect an accurate ammeter, such as the multimeter described previously, in series with the test lamp and a battery.

If the ammeter reads less than 0.3 amp the test lamp is suitable.

Tachometer

(1) Disconnect the resistor from the tachometer pick-up wiring connector which is located on the ignition coil wiring harness, and connect the positive lead of an accurate tachometer to the brown wire terminal in the wiring connector.

(2) Connect the negative lead to a good earthing point.



View showing the location of the tachometer pickup wiring connector with the resistor installed.

Timing Light

(1) Connect the timing light to the engine following the instrument manufacturers instructions.

NOTE: Do not connect or disconnect the timing light with the engine running as voltage surges could damage the alternator or control unit. Do not allow the high tension leads to open circuit with the engine running as damage to the engine management system could result.

(2) Do not connect the timing light positive lead to the alternator output terminal. Where possible, connect the power leads of the timing light to an external power source to prevent possible transient voltages damaging the alternator or control unit.

4. SYSTEM DIAGNOSIS AND ADJUSTMENTS

NOTE: Due to the use of complex electronic components in the engine management system, the diagnosis and testing procedures described in this section should not be carried out by persons lacking an understanding of electronics and the precautions associated with the servicing of electronic components. It is recommended that should a fault arise in the system, the vehicle be referred to an authorized workshop.

The control unit can be damaged by component faults not indicated by the self diagnosis codes and the renewal of the control unit without locating the cause of the failure will result in the failure of the replacement unit. It is for this reason that the practice of substituting components to isolate faults is not recommended.

Prior to performing any of the following operations, refer to the Service Precautions and Procedures heading.

PRELIMINARY CHECKS

Prior to performing the Self Diagnosis Test Procedures, perform the following preliminary checks and rectify any problems as necessary.

(1) Check for an adequate supply of fuel in the fuel tank.

(2) Check the wiring connectors and earth points of all engine management components for clean, secure connections. To prevent damage to the control unit, disconnect the negative battery terminal before disconnecting any engine management wiring connectors.

(3) Check the condition of the battery. Refer to the Electrical System section for checking procedures. Rectify any faults as necessary.

(4) Check the air cleaner element for restriction.

(5) Check for air leaks at the throttle body, inlet manifold and all related hoses.

(6) Check the fuel pump pressure as described later in this section.

(7) Ensure that the engine is in a satisfactory mechanical condition and is in tune. Refer to the Engine and Engine Tune-up sections as necessary.

SELF DIAGNOSIS

This function is very useful in locating system faults particularly intermittent problems. However, the self diagnosis mode does not provide comprehensive testing of the engine management system, and therefore should always be used in conjunction with the other test procedures described later, in order to accurately locate system faults.

To Interpret Self Diagnosis Codes

Once the self diagnosis mode is activated, various fault codes will be displayed as a series of flashes by the ECM warning lamp on the instrument cluster.

To identify the code number, count the number of times the ECM warning lamp flashes. Each fault code comprises two groups of flashes separated by a 1.2 second pause. The first group represents tens and the second group represents single units. For example 1 flash followed by a 1.2 second pause followed by 4 flashes would be code number 14. Similarly 4 flashes followed by a 1.2 second pause followed by 2 flashes would be code number 42.

The code will be displayed three times. If more than one fault code is present, the self diagnosis system will indicate each one in numerical order, with a 3.2 second pause between each code, and then repeat the sequence.

The fault codes can be identified as follows:

CODE NUMBER	FAULT AREA
12	Satisfactory operation
13	Oxygen sensor open circuit
14	Coolant temperature sensor circuit (voltage low)
15	Coolant temperature sensor circuit (voltage high)
21	Throttle position sensor circuit (voltage high)
22	Throttle position sensor circuit (voltage low)
23	MAT sensor circuit (voltage' high) 1.8 liter engine only
24	Vehicle speed sensor circuit
25	MAT sensor circuit (voltage low) 1.8 liter engine only
33	MAP sensor circuit (voltage high)
34	MAP sensor circuit (voltage low)
42	Electronic spark timing circuit
44	Oxygen sensor circuit (lean exhaust)
45	Oxygen sensor circuit (rich exhaust)
51	Mem-Cal
55	Control unit input circuits

Test Procedure

(1) Perform the following checks:

(a) Ensure that the battery voltage is above 11 volts.

(b) Ensure that the throttle valve is fully closed.

(c) Place the transaxle in neutral.

(d) Ensure that the air conditioner, fan, tights and all other accessories are switched off.

(2) Turn the ignition On and confirm that the ECM warning lamp on the instrument cluster is illuminated but not flashing.

If code 55 is displayed, refer to the Control Unit heading, perform the circuit test procedure and rectify the cause of the code before proceeding.

If the ECM warning lamp flashes codes other than code 55, check the wiring harness between the diagnostic link connector terminal B and the control unit wiring connector terminal A9 for shorts. Repair or renew the wiring harness as necessary.

If no fault can be found, renew the control unit.

If the ECM warning lamp does not illuminate, proceed as follows:

(a) Check the METER fuse located in the fuse panel adjacent to the steering column and the fusible links located in the fusible link connecting block at the rear of the battery. Renew the fuse or fusible links as necessary.

(b) Check the wiring harness to the instrument cluster. Repair or renew the harness.

(c) Check the Check Engine lamp bulb. Renew if necessary.

(d) Check the EGI relay. Renew as necessary.

(3) Connect a jumper lead across terminals A and B on the diagnostic link connector located under the front passengers seat above the control unit.

(4) Note the codes indicated by the flashing ECM warning lamp.

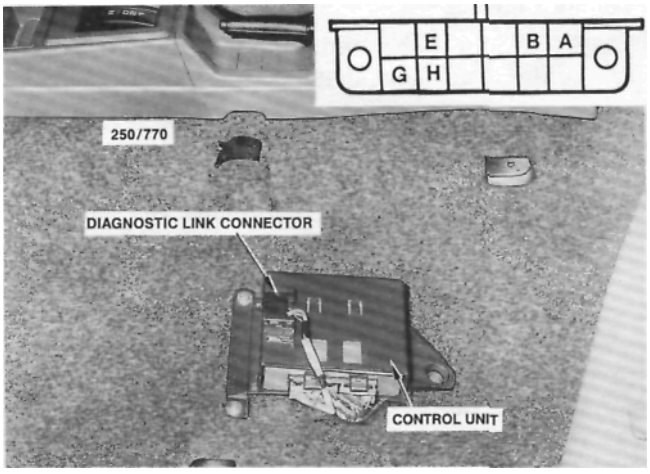
If code 12 is displayed, the system is operating correctly.

If codes other than code 12 are displayed, refer to the component or circuit test procedure under the appropriate heading as indicated by the code number.

If more than one code is being displayed, test each indicated fault working in the order of display of the code numbers.

(5) After completing the self diagnosis test procedure, remove the jumper lead from the diagnostic link connector.

(6) After repairing or renewing the necessary



View showing the location of the diagnostic link connector. Passengers seat removed for clarity. Inset shows the diagnostic link connector terminal identification.

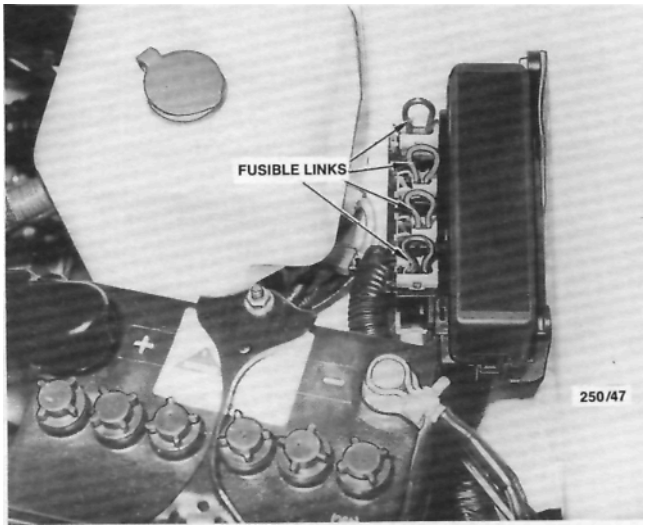
components, erase the self diagnosis memory as described under the following heading.

(7) Repeat the self diagnosis test procedure and ensure that code 12 is displayed.

To Erase Memory

(1) With the ignition Off, remove the fusible link that is positioned third from the front of the fusible link connecting block located at the rear of the battery.

(2) Install the fusible link after 10 seconds.



View showing the location of the fusible links.

TO CHECK AND ADJUST IGNITION TIMING

(1) Connect a timing light to the engine as previously described under the Service Precautions and Procedures heading.

(2) Start the engine and allow it to reach normal operating temperature.

(3) Connect a jumper lead between terminals A and B on the diagnostic link connector.

(4) With the engine idling at the specified speed, check the ignition timing with the timing light.

The timing mark on the crankshaft pulley should be aligned with the pointer on the inner liming belt cover.

(5) If necessary, loosen the distributor body retaining nuts and turn the distributor until the timing marks are aligned.

(6) Tighten the distributor body retaining nuts and check that the timing is correct.

(7) Remove the jumper lead from the diagnostic link connector and disconnect the timing light from the engine.

TO ADJUST BASE IDLE SPEED

NOTE: The idle speed is controlled by the idle air control (IAC) valve and is not adjustable. The throttle stop screw controls the base idle speed and is factory set. The following base idle speed adjustment should only be performed if the throttle body has been renewed, or if comprehensive testing of related components indicates that adjustment is required.

(1) Before adjusting the base idle speed perform the following tests;

(a) Check the spark plug gaps, the high tension leads and the ignition timing as described previously in the Engine Tune-up section.

(b) Check the air inlet system for leaks between the throttle body and inlet manifold and the inlet manifold and cylinder head.

NOTE; Any vacuum leaks will make the engine idle faster than it should.

(c) Check that all wiring connectors and vacuum hoses are securely connected.

(d) Ensure that the transaxle is in Park or Neutral.

(e) Ensure that the air cleaner element is serviceable.

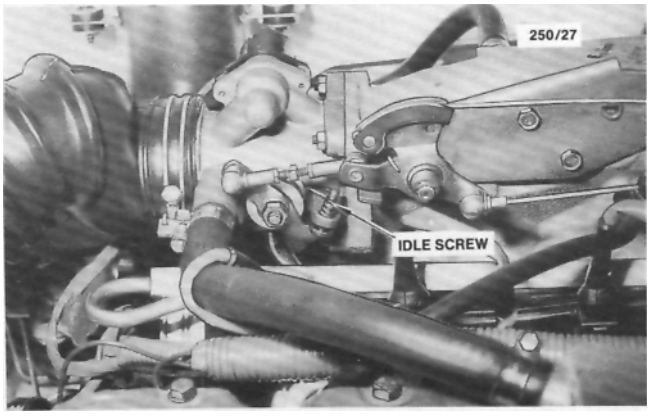
(2) On 1.6 liter engines, remove the air cleaner assembly, disconnect the vacuum hose from the throttle body and seal the vacuum hose fitting.

(3) Ensure that the throttle valve moves freely and returns to the fully closed position when slowly released.

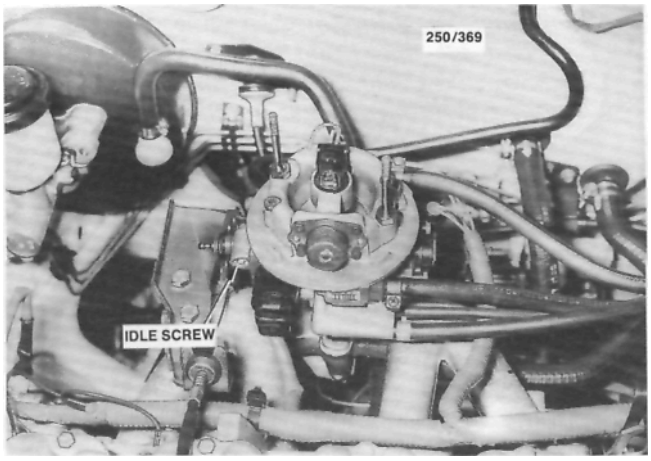
(4) Connect an accurate tachometer to the engine as previously described under the Service Precautions and Procedures heading.

(5) Start the engine and allow the engine to warm up and the idle rpm to stabilize. Check that all electrical accessories and the air conditioning, if equipped, are turned off.

(6) With the engine idling in Park or Neutral, slowly disconnect the brake servo unit vacuum supply hose from the inlet manifold. Allow the engine to run for one minute.



Location of the base idle adjusting screw. 1.8 liter engine.



Installed view of the throttle body assembly showing the location of the base idle adjusting screw. 1.6 liter engine.

(7) Disconnect the IAC valve wiring connector and slowly connect the vacuum supply hose to the inlet manifold. Allow five seconds to elapse and note the engine speed.

(8) If the engine speed is not to Specifications, remove the plug from the throttle body housing on 1.6 liter engines, or the cap from the base idle adjusting screw on 1.8 liter engines, and adjust the idle screw until the engine speed is 625 rpm.

(9) Stop the engine and connect the IAC valve wiring connector.

(10) On 1.8 liter engines, install a new cap to the
base idle adjusting screw.

On 1.6 liter engines, seal the throttle stop screw with silicone sealant and install the air cleaner assembly.

(11) Erase the memory codes as previously described.

(12) Start the engine and increase the speed to 3 000 rpm for 10 seconds to allow the idle air control valve to reset.

5. FUEL SUPPLY COMPONENTS

Special Equipment Required:

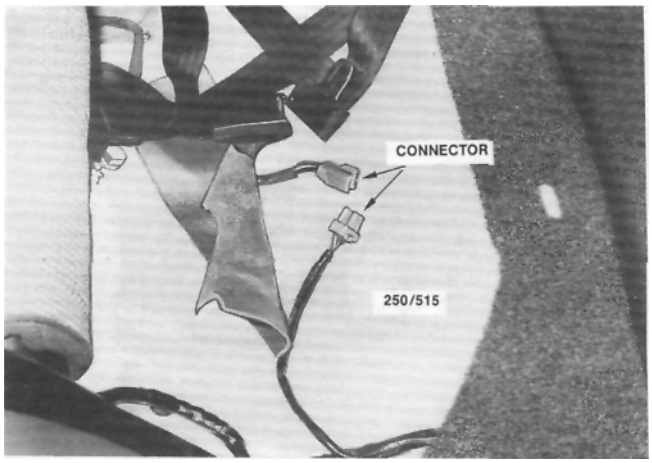
To Check Fuel Pressure — 0-500 kPa pressure gauge

NOTE: Before proceeding with any of the operations in this section, refer to the Service Precautions and Procedures heading.

TO DEPRESSURISE FUEL SYSTEM

(1) Lift the front edge of the rear seat cushion on each side, slide the cushion forward and remove it from the vehicle.

(2) Disconnect the fuel pump wiring harness connector.



When depressurizing the fuel system, remove the rear seat cushion and disconnect the fuel pump wiring connector.

(3) Start and run the engine until it stalls. Operate the starter motor for 10 seconds to ensure that the pressure has dissipated.

(4) Connect the fuel pump wiring connector and install the rear seat cushion.

NOTE: Failure to depressurize the fuel system when instructed may result in a fuel spray and possible fire.

TO TEST FOR EXTERNAL LEAKS

(1) Connect a jumper lead between terminals G and H on the diagnostic link connector.

(2) Switch the ignition On.

(3) Check for leaks at all hose connections and joints between the fuel pump and the engine.

(4) Switch the ignition Off and remove the jumper lead from the diagnostic link connector.

(5) If renewal of a component is necessary, depressurize the fuel system as previously described.

(6) Use only hoses and clamps as specified by the manufacturer.

TO CHECK FUEL PRESSURE

(1) Depressurize the fuel system as previously described.

(2) On 1.6 liter engines, remove the air cleaner as described in this section under the Air Cleaner Assembly heading.

(3) On 1.8 liter engines, release the hose clamp securing the fuel supply hose to the fuel rail and disconnect the hose.

On 1.6 liter engines, release the hose clamp securing the fuel supply hose to the rear throttle body hose fitting and disconnect the hose.

(4) Using a suitable gauge, tee piece, short piece of fuel hose and clamps, install the pressure
gauge
between the fuel supply hose and the fuel rail on 1.8

liter engines, or the throttle body hose fitting on 1.6 liter engines.

(5) Tighten all connectors securely. Check for external leaks as previously described.

(6) Start the engine and note the pressure while the engine is idling.

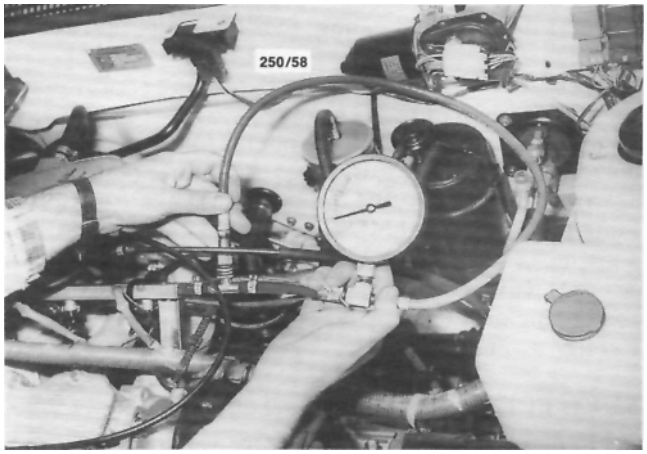
(7) Switch the engine Off and check that the residual pressure does not decrease.

If the fuel pressure is within Specifications and does not decrease, the fuel system is in a serviceable condition. Depressurize the fuel system and disconnect the pressure gauge.

If the fuel pressure is above Specifications proceed to operation (9).

If the fuel pressure is below Specifications proceed to the following operation.

If the fuel pressure decreases, an internal leak is indicated. Proceed to the following heading and carry out the test procedure.



Testing the fuel system pressure using a pressure gauge. 1.8 liter engine.

NOTE: There may be a small initial decrease in pressure when the engine is switched Off This is acceptable and does not indicate a fault in the system.

(8) If the fuel pressure is below Specifications proceed as follows:

(a) Check the fuel lines for blockages and kinks or a blocked fuel filter or fuel pump pickup strainer.

(b) If no fault can be found in the previous checks, on 1.8 liter engines clamp the fuel return hose at the fuel rail.

On 1.6 liter engines, clamp the hose that is connected to the front throttle body hose fitting.

(c) Connect a jumper lead between terminals G and H on the diagnostic link connector and switch the ignition On.

NOTE: Do not operate the fuel pump for longer than is necessary to obtain a pressure reading.

If the fuel pressure is less than 270 kPa on 1.8 liter engines or 90 kPa on 1.6 liter engines, renew the fuel pump.

If the fuel pressure is more than previously specified, renew the pressure regulator assembly on 1.8 liter engines or the pressure regulator diaphragm on 1.6 liter engines.

(9) If the fuel pressure in operation (6) is above Specifications, proceed as follows:

(a) On 1.8 liter engines, disconnect the fuel return hose from the pressure regulator outlet.

On 1.6 liter engines, disconnect the fuel return hose from the front throttle body hose fitting.

(b) Connect a suitable length of fuel hose to the pressure regulator or the front throttle body hose filling and place the opposite end of the hose into a petroleum resistant container.

(c) Connect a jumper lead between terminals G and H on the diagnostic link connector and switch the ignition On.

If the fuel pressure is 230-270 kPa on 1.8 liter engines or 62-90 kPa on 1.6 liter engines, locate and remove the restriction in the fuel return hose or pipe.

If the fuel pressure is more than previously specified, renew the pressure regulator assembly on 1.8 liter engines or the pressure regulator diaphragm on 1.6 liter engines.

TO TEST FOR INTERNAL FUEL LEAKAGE

Check the residual fuel pressure as previously described.

If the pressure has decreased it is an indication of an internal leak. With the pressure gauge still attached, proceed as follows:

(1) Switch the ignition On to pressurize the fuel system.

(2) As the pressure begins to decrease clamp the fuel supply hose shut. If the pressure remains steady the fuel pump may be considered faulty and should be renewed as described later in this section.

(3) If the pressure continues to decrease switch the ignition On after it has been Off at least 10 seconds. As the pressure begins to decrease clamp the fuel return hose shut.

If the pressure remain steady on 1.8 liter engines, renew **the** pressure regulator. If the pressure continues to decrease, leaking injectors are indicated. Remove the injectors as described later in this section to locate the leaking injectors.

If the pressure remains steady on 1.6 liter engines, renew the pressure regulator diaphragm as described later in this section. If the pressure continues to decrease remove the injector and renew the O ring seals as described later in this section. If this fails to rectify the fault remove the injector and clean or renew the injector as necessary.

FUEL FILTER

To Remove and Install

Refer to the Engine Tune-up section for the procedure to remove and install the fuel filter.

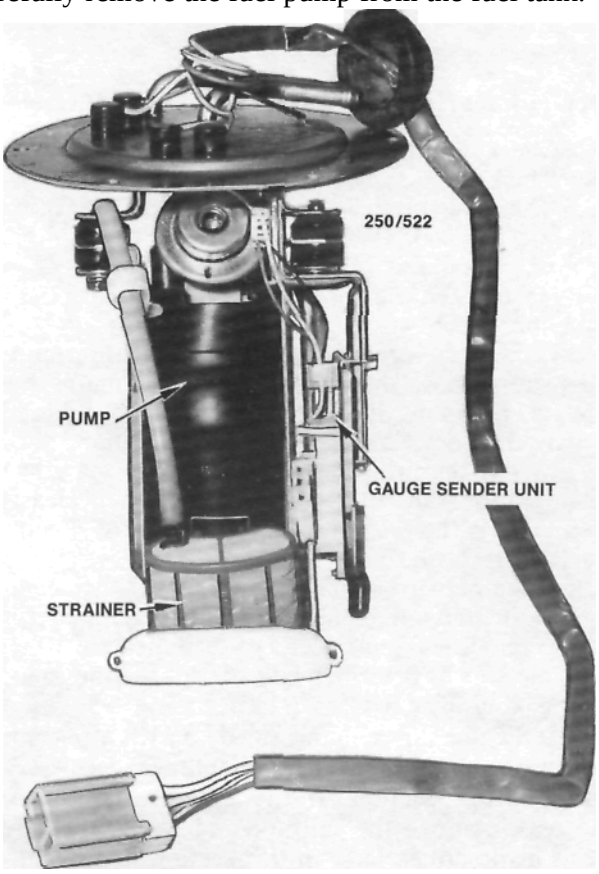
FUEL PUMP

To Test Electrical Circuit

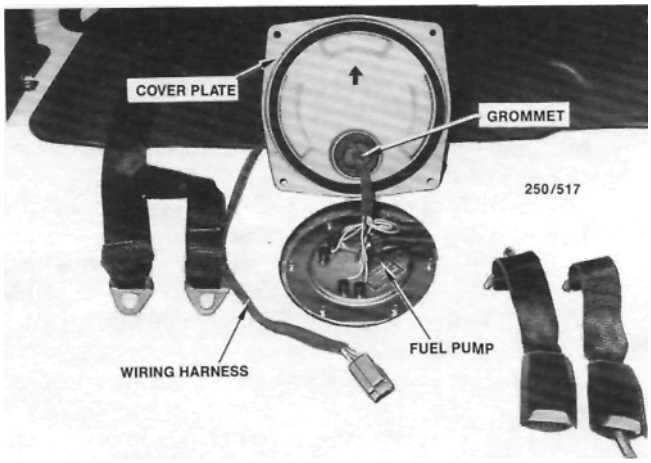
Refer to the EGI and Fuel Pump Relays heading later in this section for the test procedures.

To Remove and Install

(1) Depressurize the fuel system as previously described.
(2) Disconnect the negative battery terminal.
(3) Remove the rear seat backrest as described under the Seats heading in the Body section.
(4) Remove the bolts securing the fuel pump cover plate to the floor panel, remove the rubber grommet and slide the cover plate from the wiring harness.
(5) Mark the fuel hoses to ensure correct installation and disconnect the hoses from the fuel pump.
(6) Remove the fuel pump retaining screws and carefully remove the fuel pump from the fuel tank.



View of the fuel pump assembly removed from the fuel tank.



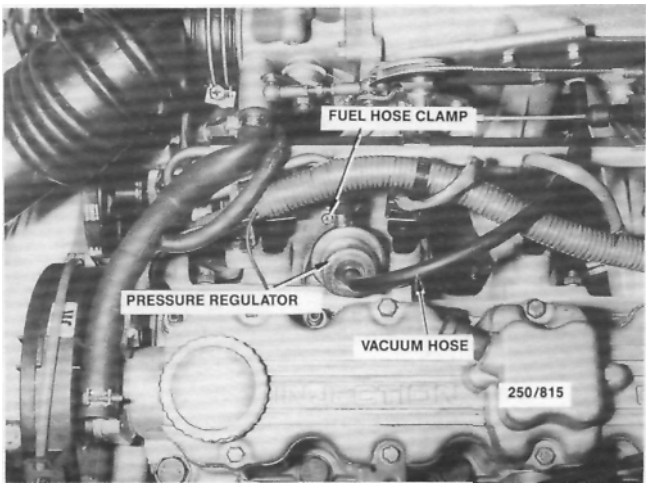
View of the fuel pump cover plate removed, showing the fuel pump installed.

Installation is a reversal of the removal procedure with attention to the following points:
(1) Ensure that a new fuel pump O ring seal is installed.
(2) Tighten the fuel pump retaining screws and the fuel hose clamps securely.
(3) Ensure that the rubber grommet is seated correctly in the fuel pump cover plate.
(4) Install the fuel pump cover plate ensuring that the arrow on the plate is facing the front of the vehicle.
(5) Connect the negative battery terminal, start the engine and test for leaks as previously described. Rectify as necessary.

FUEL PRESSURE REGULATOR

To Remove and Install — 1.8 Liter Engine

(1) Depressurize the fuel system as previously described.
(2) Disconnect the negative battery terminal.



Installed view of the fuel pressure regulator. 1.8 liter engine.

(3) Disconnect the vacuum hose from the pressure regulator.

(4) Release the fuel hose clamps, disconnect the hoses from the pressure regulator and remove the pressure regulator.

Installation is a reversal of the removal procedure ensuring that the fuel hose clamps are tightened securely.

To **Remove and Install — 1.6 Liter Engine**

(1) Depressurize the fuel system as previously described.

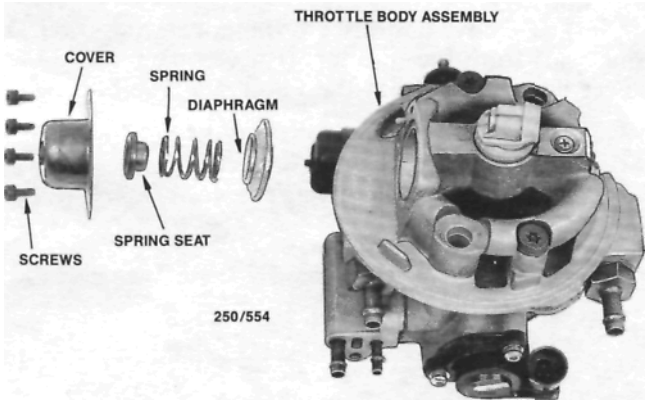
(2) Disconnect the negative battery terminal.

(3) Remove the air cleaner assembly. If necessary, refer to the Air Cleaner Assembly heading in this section.

(4) Remove the screws securing the pressure regulator cover to the throttle body assembly.

When removing the final screw hold the cover firmly as it is under spring tension.

(5) Remove the cover, spring seat, spring and diaphragm from the throttle body assembly. Discard the diaphragm.



View of the pressure regulator components removed from the throttle body assembly. 1.6 liter engine.

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

(1) Install **a** new diaphragm ensuring that the diaphragm is correctly seated in the groove in the throttle body assembly.

(2) Apply Loctite 262 to the threads of the retaining screws.

(3) Place the spring seat and the spring in the cover and install the cover to the throttle body assembly, ensuring that the cover is positioned on the locating dowels.

(4) While holding the cover in position install the retaining screws and tighten securely.

NOTE: When installing the pressure regulator cover ensure that the diaphragm is not disturbed, to prevent the possibility of a fuel leak.

INJECTORS

To Test Injector Circuit and Injectors

(1) Disconnect the injector wiring connectors.

(2) Connect a test lamp between the injector wiring connector terminals, ensuring that the test lamp probes do not contact each other.

(3) With the ignition switched On the test lamp should not light. On 1.8 liter engines, check each of the other connectors.

If the test lamp lights check the wiring harness for a short to earth between the injector wiring connector(s) and the control unit wiring connector terminal - D15 and D16 on 1.8 liter engines, or D16 on 1.6 liter engines.

(4) With the aid of an assistant, operate the starter motor. The test lamp should flash. On 1.8 liter engines, check each of the other connectors.

If the test lamp does not flash when connected to the injector wiring connector(s), proceed to operation (6).

If the test lamp lights as described, proceed as follows.

If the test lamp lights but fails to flash, a faulty control unit is indicated. Prior to renewing the control unit, check the condition of the injectors as follows.

(5) Connect an ohmmeter between the terminals of the injectors).

The resistance should be more than 1.2 ohms on 1.6 liter engines or more than 12 ohms on 1.8 liter engines.

If the injector resistance is as specified, the injector circuit can be considered serviceable.

If the injector resistance is not as specified, renew the faulty injector(s).

(6) With the ignition switched On, probe the injector wiring connector terminals with a test lamp to earth.

If the test lamp lights when the probe contacts the pink wire terminal on 1.6 liter engines, or the white wire terminal on 1.8 liter engines, check the wiring harness for a short to voltage between the injector wiring connector(s) and the control unit wiring connector terminal(s) D16 on 1.6 liter engines, or D15 and D16 on 1.8 liter engines.

If the test lamp does not light when the probe contacts the blue wire terminal on 1.6 liter engines, or the black and red wire terminal on 1.8 liter engines, check the EGI relay and circuit as described under the EG! and Fuel Pump Relays heading in this section.

If the test lamp lights when the probe contacts the blue wire terminal on 1.6 liter engines, or the blue and red wire terminal on 1.8 liter engines, proceed as follows.

(7) Switch the ignition Off and connect the injector wiring connectors).

(8) Switch the ignition On and, using a test lamp to earth, backprobe the control unit wiring connector

terminal D16 on 1.6 liter engines, or D15 and D16 on
1.8 liter engines.

The test lamp should light.

If the test lamp does not light check the wiring harness for continuity between the injector wiring connector(s) and the control unit wiring connector terminals.

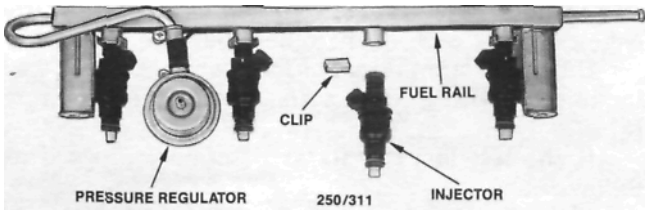
Repair or renew the wiring harness as necessary.

To Remove and Install Injectors and Fuel Rail — 1.8 Liter Engine.

(1) Depressurize the fuel system as previously described.

(2) Disconnect the negative battery terminal.

(3) Thoroughly clean around the injectors and



View of the fuel rail, injectors and pressure regulator removed from the engine.

the fuel rail to prevent foreign material entering the engine.

(4) Suitably mark the fuel hoses, loosen the hose clamps and disconnect the fuel hoses from the fuel rail.

(5) Disconnect the vacuum hose from the fuel pressure regulator.

(6) Loosen the hose clamp and disconnect the engine ventilation hose from the throttle body.

(7) Remove the bolts securing the fuel rail and injectors to the inlet manifold.

(8) Carefully raise the fuel rail and injectors from the inlet manifold until the injector nozzles are clear of the manifold.

(9) Disconnect each injector wiring connector by pushing in the wire retaining clip.

(10) Using a small screwdriver, remove the injector retaining clip and withdraw the injectors from the fuel rail.

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

(1) Check the condition of the injector O ring seals and renew if necessary.

(2) Install the injectors to the fuel rail and secure with the retaining clips.

(3) Connect the wiring connectors to each injector ensuring that the wire clip is locked in position.

(4) Install the injectors to the inlet manifold, carefully guiding the injectors into place ensuring that the O ring seals are not damaged.

(5) Install the fuel rail retaining bolts and tighten to the specified torque.

(6) Install the fuel hoses to the fuel rail and
tighten the hose clamps securely.

(7) Check for fuel leaks as previously described.

To Remove and Install Injector — 1.6 Liter Engine

(1) Depressurize the fuel system as previously described.

(2) Disconnect the negative battery terminal.

(3) Remove the air cleaner assembly. If necessary refer to the heading Air Cleaner Assembly in this section.

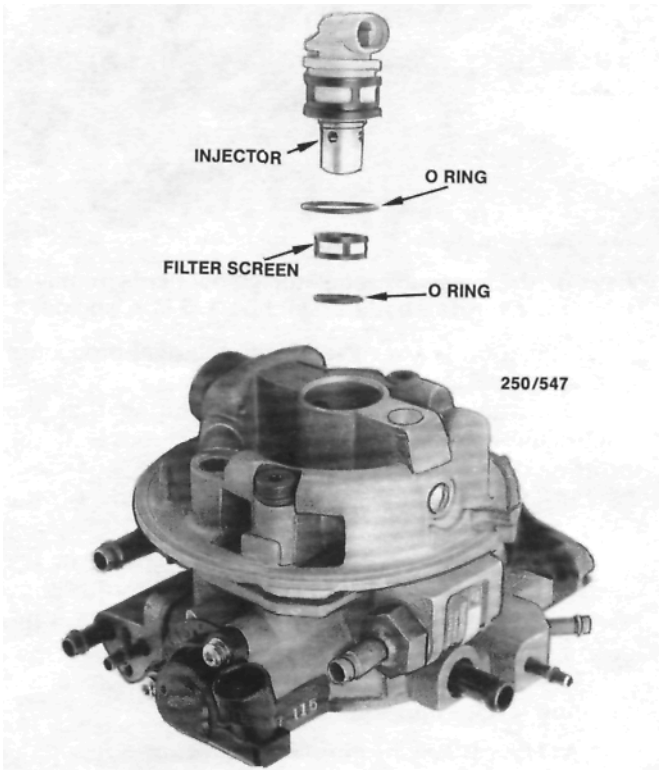
(4) Remove the injector retaining plate screw and remove the injector retaining plate from the throttle body assembly.

(5) Insert the blade of a screwdriver from the front of the throttle body assembly under the rim of the injector in which the retaining plate locates. Support the screwdriver on a suitable object to act as a fulcrum.

(6) Carefully lever the screwdriver until the injector can be withdrawn from the throttle body assembly.

(7) Remove and discard the upper and lower O ring seals from the injector. If necessary remove the lower filter screen from the injector.

NOTE: As the injector contains electrical



View of the fuel injector removed from the throttle body assembly. 1.6 liter engine.

circuitry do not immerse it in cleaning solvent as this may result in irreparable damage.

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

(1) Lubricate the new O ring seals with automatic transmission fluid prior to installing them to the injector. If removed, ensure that the lower filter screen is installed.

(2) Firmly push the injector into the throttle body assembly until it is fully seated, ensuring that the injector connection terminals face towards the rear of the vehicle.

(3) Apply Loctite 262 to the injector retaining plate screw and tighten securely.

(4) Start the engine and check for fuel leaks as previously described.

(5) Install the air cleaner and tighten the retaining nuts securely.

FUEL METER ASSEMBLY - 1.6 LITRE ENGINE

To Remove and Install

(1) Remove the injector as previously described.

(2) Mark the fuel supply and return hoses, release the clamps and disconnect the hoses from the fuel meter assembly.

(3) Remove the air cleaner assembly base gasket from the fuel meter assembly.

(4) Remove the bolts and screws securing the fuel meter assembly to the throttle body and remove the fuel meter assembly. Remove and discard the gasket.

(5) If necessary, remove the fuel pressure regulator as previously described.

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

(1) If removed, install the fuel pressure regulator as previously described.

(2) Place a new gasket on the throttle body, aligning the holes in the gasket with those in the throttle body, ensuring that the idle air passage is not blocked.

(3) Coat the fuel meter assembly retaining screws with Loctite 262 and tighten securely.

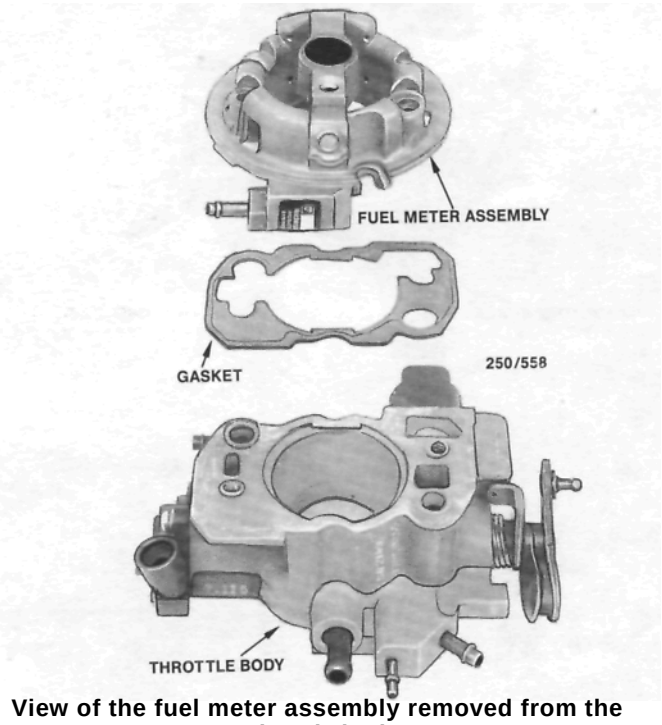
(4) Install the fuel meter assembly retaining bolts and tighten to the specified torque.

(5) Connect the fuel supply and return hoses and tighten the clamps securely.

(6) Install the injector as previously described.

(7) Start the engine and check for fuel leaks. Rectify as necessary.

(8) Install the air cleaner assembly.



View of the fuel meter assembly removed from the throttle body.

FUEL TANK

To Remove and Install

(1) Depressurize the fuel system as previously described.

(2) Disconnect the negative battery terminal.

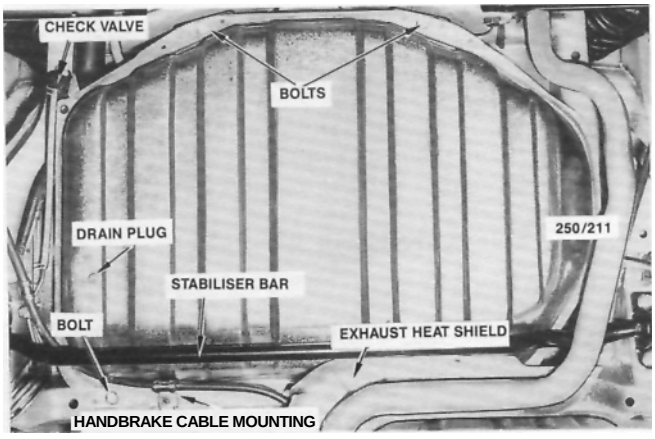
(3) Remove the fuel pump cover plate retaining screws, disconnect the wiring harness rubber grommet from the cover plate and remove the cover plate from the wiring harness.

(4) Raise the rear of the vehicle and support it on chassis stands. Refer to the Wheels and Tires section if necessary.

(5) Remove the fuel tank drain plug and drain the fuel into a petroleum resistant container.

(6) Mark the fuel hoses and disconnect the hoses from the fuel pump.

(7) Disconnect the hoses from the fuel filler neck pipe, the fuel check valve and the fuel tank breather pipe.



Installed view of the fuel tank.

(8) Remove the bolts retaining the intermediate exhaust pipe to the rear of the catalytic converter, remove the bolt securing the exhaust mounting to the underbody and slightly lower the intermediate exhaust pipe. Support the intermediate pipe to prevent the tailpipe fouling the lower bumper panel.

(9) Remove the bolts retaining the stabilizer bar mounting brackets to the underbody and allow the stabilizer bar to drop.

(10) Remove the bolts retaining the exhaust heat shield to the underbody, located at the front of the fuel tank.

(11) Remove the handbrake cable mounting bracket retaining nuts and remove the mounting brackets from the mounting studs.

(12) Remove the fuel tank retaining bolts and maneuver the fuel tank from the vehicle.

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

(1) When installing the fuel tank, ensure that the fuel pump wiring harness is directed through the aperture in the floor.

(2) Install the stabilizer bar mounting bracket
bolts and tighten to the specified torque. Refer to the Rear Suspension section.

(3) Using a new gasket, install the intermediate exhaust pipe to the catalytic converter ensuring that the earth wire terminal is installed and tighten the bolts securely.

(4) Connect the fuel filler neck hose, the fuel check valve hose and the breather hose ensuring that they are secured firmly.

(5) Tighten the fuel tank drain plug to the specified torque.

(6) Connect the fuel hoses to the fuel pump, using the marks made during removal to ensure correct installation.

(7) Install the fuel pump wiring harness and the rubber grommet to the fuel pump cover plate. Install the cover plate and tighten the retaining bolts securely.

(8) Connect the fuel pump wiring connector securely.

(9) Check for fuel leaks as previously described.

6. AIR FLOW COMPONENTS

NOTE: Before proceeding with any of the operations in this section, refer to the Service Precautions and Procedures heading.

AIR CLEANER ASSEMBLY

To Renew Element

The procedure for renewing the air cleaner element is covered in the Engine Tune-up section.

To Remove and Install — 1.8 Liter Engine

(1) Disconnect the negative battery terminal.

(2) Release the air intake hose retaining clamps, disconnect the hose from the air cleaner upper housing and the throttle body and remove the hose.

(3) Remove the screw securing the air cleaner intake duct to the front panel mounting bracket.

(4) Remove the hexagon head screws retaining the air cleaner mounting bracket to the right hand inner mudguard and remove the air cleaner from the engine compartment.

(5) Release the upper housing retaining clips, separate the upper housing from the lower housing and remove the element.

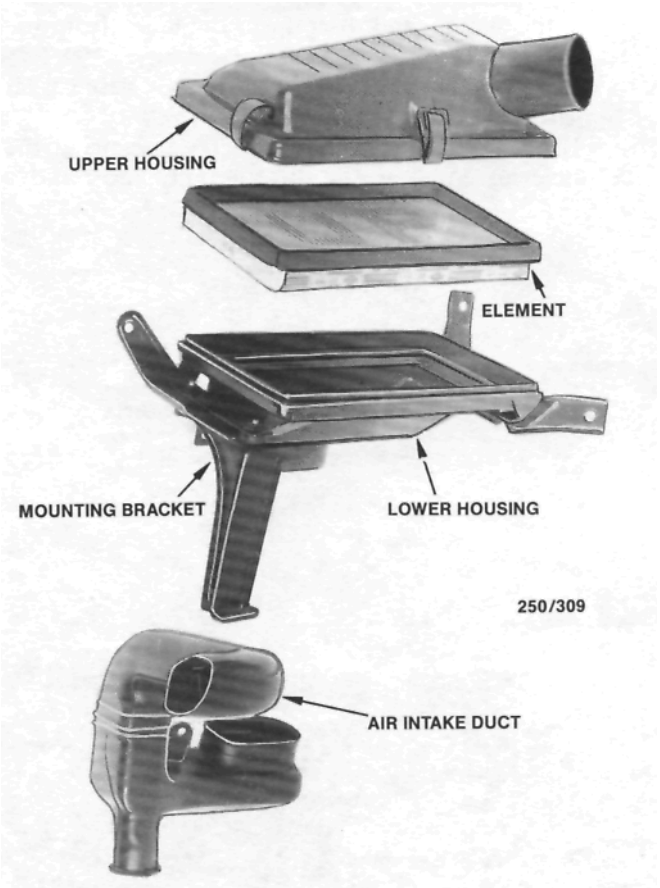
(6) Remove the air cleaner intake duct retaining screw and disconnect the duct from the lower air cleaner housing.

(7) If necessary, remove the bolts securing the mounting bracket to the air cleaner lower housing and separate the mounting bracket from the housing.

(8) Thoroughly clean the upper and lower housings in cleaning solvent and check for cracks, splits or damage that would allow unfiltered air to enter the engine. Renew any components as necessary.

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

(1) Ensure that the rubber insulators are in-



Dismantled view of the air cleaner assembly. 1.8 liter engine.

stalled on each side of the air cleaner mounting bracket when installing the mounting bolts.

(2) If renewing the element, ensure that the specified element is installed and is correctly seated in the air cleaner housing.

(3) Ensure that the air intake hose clamps are tightened securely.

To Remove and Install — 1.6 Liter Engine

(1) Disconnect the negative battery terminal.

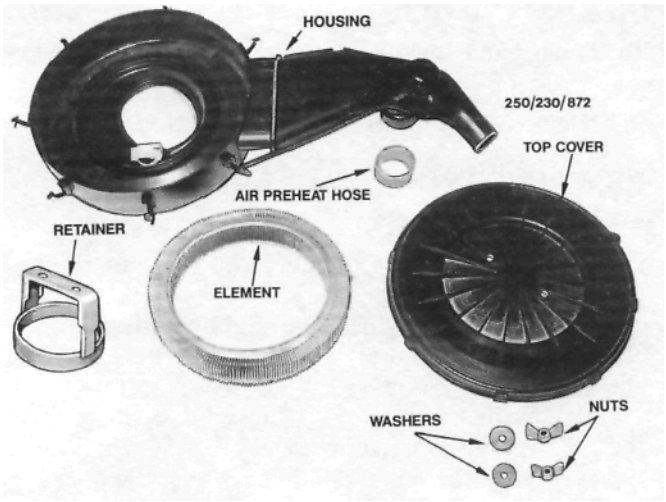
(2) Remove the nuts and washers retaining the air cleaner to the throttle body assembly.

(3) Release the top cover retaining clips and remove the top cover and the air cleaner element. Remove the air cleaner retainer from the throttle body bolts.

(4) Disconnect the engine vent hose from the air cleaner support clamp.

(5) Slightly raise the air cleaner and **tilt** it towards the windscreen. Disconnect the engine vent hose and the temperature sensor vacuum hose from the underside of the air cleaner.

(6) Remove the air cleaner housing from the engine.



Dismantled view of the air cleaner.

(7) Thoroughly clean the air cleaner housing and top cover and check for cracks or damage that would allow unfiltered air to enter the engine. Renew any components as necessary.

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

(1) Inspect the air cleaner base gasket. Renew if necessary.

(2) Connect the engine vent hose and the temperature sensor vacuum hose.

(3) Install the air cleaner ensuring that the hot air inlet tube is located correctly between the exhaust heat shield and the air cleaner housing.

(4) When installing the top cover retaining nuts, hand tighten only.

THROTTLE BODY ASSEMBLY

To Remove and Install — 1.8 Liter Engine

(1) Disconnect the negative battery terminal.

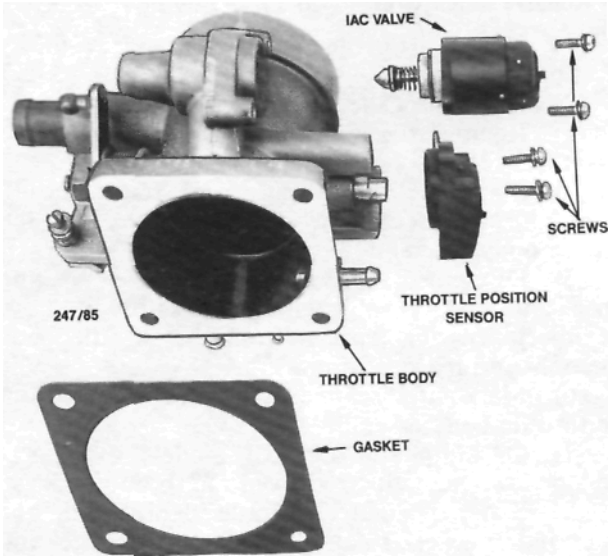
(2) Release the air intake hose clamp and disconnect the air intake hose from the throttle body.

(3) Unclip the actuating rod from the throttle lever using a small screwdriver under the ball socket if necessary.

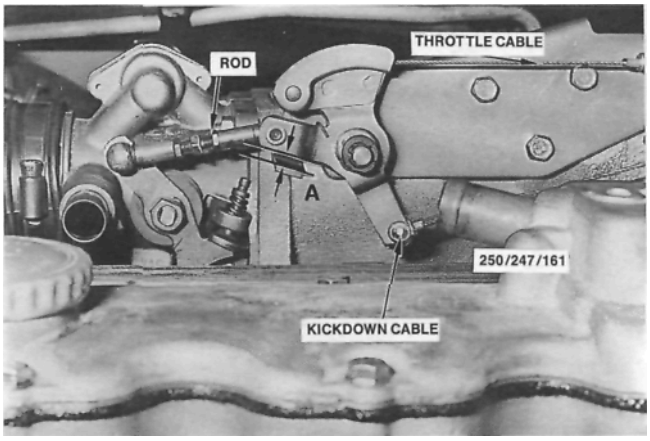
(4) Mark the throttle body vacuum hoses with quick drying paint or similar and disconnect the hoses from the throttle body. Disconnect the engine vent hose from the throttle body.

(5) Disconnect the wiring connectors from the throttle position sensor and the IAC valve.

(6) Remove the retaining nuts and withdraw the throttle body and gasket.



View of the throttle body and associated components.



View of the throttle body and actuating rod. The rod length must be set so that dimension A - 8—9 mm for automatic transaxle models and 3—4 mm for manual transaxle models.

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

(1) Ensure that all throttle body passages are clean. Blow out with compressed air if necessary.

(2) Install the throttle body to the inlet manifold using a new gasket and tighten the retaining nuts to the specified torque.

(3) Connect the vacuum hoses to the throttle body in the positions previously marked.

(4) Clip the actuating rod to the throttle body lever. Check the dimensions shown in the illustration and adjust the rod length if necessary.

(5) Check the adjustment of the throttle cable as described later in this section.

(6) Connect the air intake hose and tighten the hose clamps securely.

To Remove and Install — 1.6 Liter Engine

(1) Depressurize the fuel system as previously described.

(2) Disconnect the negative battery terminal.

(3) Remove the air cleaner assembly and base gasket as previously described.

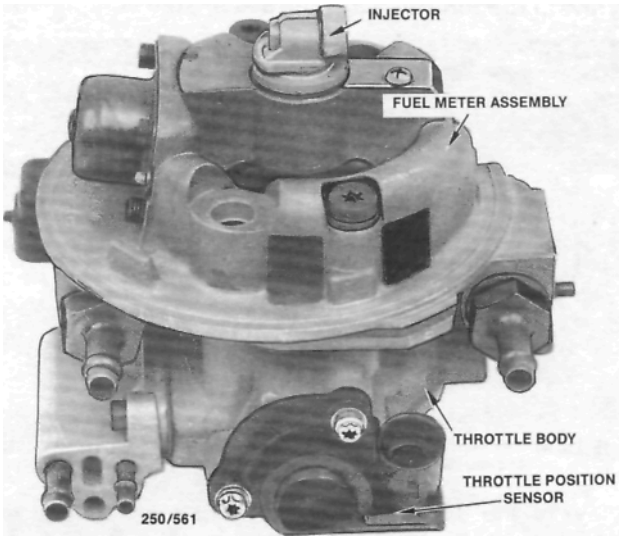
(4) Mark the fuel supply and return hoses, release the clamps and disconnect the hoses from the throttle body assembly.

(5) Disconnect the injector, throttle position sensor and the IAC valve wiring connectors. Remove the injector wiring harness from the throttle body assembly and place it to one side.

(6) Mark and disconnect the vacuum hoses from the throttle body assembly.

(7) On automatic transaxle models, disconnect the kickdown actuating rod from the throttle linkage.

(8) Slide the outer throttle cable from the mounting bracket, rotate the throttle linkage and disconnect the inner throttle cable from the throttle linkage.



View of the throttle body assembly showing the location of the base idle adjusting screw. 1.8 liter engine.

(9) Remove the bolts retaining the throttle body assembly to the inlet manifold and remove the assembly and the gasket from the engine.

(10) If necessary remove the retaining screws and remove the fuel meter assembly, the IAC valve and the throttle position sensor from the throttle body assembly.

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

(1) If removed, install the fuel meter assembly, the throttle position sensor and the IAC valve as described under the relevant headings.

(2) Install the throttle body assembly to the inlet manifold using a new gasket and tighten the retaining bolts to the specified torque.

(3) Connect the vacuum hoses to the throttle body using the marks made on removal to ensure correct installation.

(4) On automatic transaxle models, connect the kickdown actuating rod to the throttle linkage.

(5) Install the throttle cable and check the adjustment as described later in this section.

INLET MANIFOLD

To Remove and Install

To remove and install the inlet manifold, refer to the relevant heading in the Engine section.

IDLE AIR CONTROL (IAC) VALVE

To Test

(1) Connect an accurate tachometer to the engine.

(2) With the engine at normal operating temperature and all accessories switched Off, note the idle speed.

(3) With the ignition switched Off, disconnect the IAC valve wiring connector.

(4) Start the engine and check the idle speed.

If the idle speed is the same as that noted in operation (2) proceed to operation (7).

If the idle speed is higher than noted in operation (2) proceed as follows.

(5) With the ignition switched Off, connect the IAC valve wiring connector.

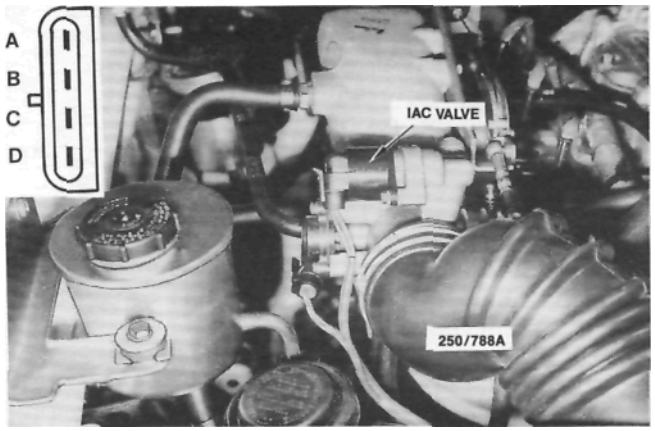
(6) Start the engine and check the idle speed.

If the idle speed is not the same as that noted in operation (2) proceed to operation (7).

If the idle speed is the same as noted in operation (2) the IAC valve is operating correctly. However, if the engine is not idling correctly carry out the following checks.

(a) Check the air inlet system for vacuum leaks.

NOTE: Any vacuum leak will cause a fast idle.



Location of the idle air control (IAC) valve. Inset shows the terminal identification.

(b) Check for a binding throttle cable, throttle shaft or throttle position sensor.

(c) Check the coolant temperature sensor resistance as described later in this section.

(d) Ensure that the battery terminals and the engine earth terminals are clean and secure.

(e) Check the operation of the Park/Neutral switch and the transaxle as described in the Automatic Transaxle section under the Neutral Safety Switch heading.

(f) Check the spark plug gaps as described in the Engine Tune-up section.

(g) Check the base idle speed adjustment.

(h) Check the fuel pressure and check the system for leaks as described previously.

(I) Check the alternator voltage output as described in the Electrical System section to ensure that it is between 9-17 volts.

(j) Remove the IAC valve and check the bore in the throttle body for dirt or damage.

(7) Stop the engine, switch the ignition On and connect a jumper lead between terminals A and B on the diagnostic link connector.

(8) Disconnect the wiring connector from the IAC valve.

(9) Check for voltage at each of the terminals on the IAC valve wiring connector using a test lamp.

If the test lamp flashes at each terminal, correct operation of the wiring and control unit is indicated. check for faulty IAC valve terminals. If no fault is found renew the IAC valve.

If the test lamp is a steady light at one or more terminals, proceed to operation (10).

If the test lamp does not flash at one or more of the terminals proceed as follows:

(a) Check the circuit with no voltage for shorts and for continuity between the IAC valve and the control unit. Repair or renew the wiring harness as necessary.

(b) Measure the resistance across the IAC valve terminals A and B, and across terminals C and D.

The resistance should be more than 30 ohms.

If the resistance is not as specified, renew the IAC valve.

If the resistance is as specified, check for faulty wiring connector terminals on the IAC valve and the control unit. If no fault is found, renew the control unit

(10) Switch the ignition Oft' and disconnect the control unit wiring connectors.

(11) Switch the ignition On and check the IAC connector with the test lamp again. If the light is stilt steady on one or more terminals there is a short circuit to voltage in the wiring harness. Repair or renew as necessary.

(12) If the light is not on, check for faulty IAC valve terminals. If no fault is found renew the IAC valve.

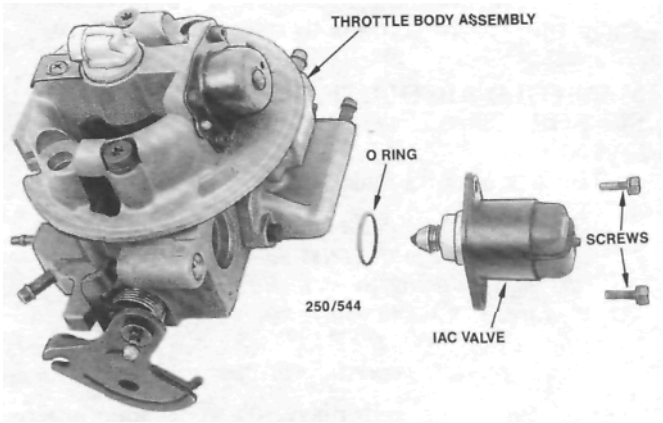
To Remove and Install

(1) Disconnect the negative battery terminal.

(2) On 1.6 liter engines, remove the air cleaner assembly as previously described.

(3) Disconnect the wiring connector from the IAC valve.

(4) Remove the IAC valve retaining screws and withdraw the IAC valve and O ring.



View of the IAC valve removed from the throttle body assembly. 1.6 liter engine.

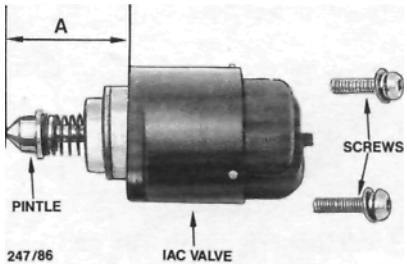
(5) Clean the IAC sealing surfaces to ensure proper operation.

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

(1) When installing a new IAC valve ensure that the part number is correct as the valve is not interchangeable between the 1.8 and 1.6 liter engines.

(2) Measure the length of the pintle extension as shown in the illustration. If necessary push the pintle in by exerting firm thumb pressure with a slight rocking motion.

NOTE: Installing (he IAC valve with the pintle protruding too far can damage the valve.



View of the IAC valve removed from the engine. Dimension A must not exceed 28 mm.

(3) Lubricate the IAC valve O ring with engine oil and install the IAC valve. Tighten the retaining screws securely.

(4). Install the IAC valve wiring connector and the negative battery terminal.

(5) On 1.6 liter engines, install the air cleaner assembly as previously described.

(6) Run the engine until normal operating temperature and idle speed are attained.

NOTE: Several minutes may elapse before the normal idle speed is attained.

(7) Hold the throttle open at approximately 3 000 rpm for 10 seconds to reset the IAC valve.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR

To Test - Codes 33 and 34

NOTE: The following test procedure assumes that fault codes 33 or 34 have been displayed during the self diagnosis test procedure. If no codes have been displayed but the operation of the MAP sensor is suspect, begin the test procedure at operation (15).

(1) Erase the self diagnosis code memory **as** previously described.

(2) Start and run the engine at idle speed for 60 seconds or until the ECM warning lamp lights.

(3) Stop the engine, switch the ignition On and connect a jumper lead between terminals A and B on the diagnostic link connector. Note any fault codes displayed.

If code 34 is displayed, remove the jumper lead from the diagnostic link connector, erase the self diagnosis codes and proceed to operation (7).

If code 33 is displayed, remove the jumper lead from the diagnostic link connector, erase the self diagnosis code memory and proceed to operation (4).

If no codes are displayed, but codes 33 or 34 were displayed when the self diagnosis test procedure was originally performed, an intermittent fault is indicated. Proceed as follows:

(a) Check for faulty wiring connections. Check that all wiring connectors are clean and secure.

(b) Check that all earth wires are secure.

(c) Check the vacuum hose to the MAP sensor for deterioration or restriction.

(4) Disconnect the wiring connector from the MAP sensor.

(5) Start and run the engine at idle speed for 60 seconds or until the ECM warning lamp lights.

(6) Stop the engine, switch the ignition On and connect a jumper lead between terminals A and B on the diagnostic link connector. Note any fault codes displayed.

If code 33 is displayed, measure the voltage at the MAP sensor wiring connector terminal B with a voltmeter to earth. Renew the control unit if the voltage is less than 1 volt.

If the voltage is more than 1 volt, check the wiring harness for a short to voltage between terminal B and the control unit wiring connector terminal Cll. Repair or renew the wiring harness as necessary.

If code 34 is displayed, proceed as follows:

(a) Check for a restricted or leaking MAP sensor vacuum hose.

(b) Check the wiring harness for continuity and shorts between terminals A on the MAP sensor connector and terminal A11 on the control unit wiring connector. Repair or renew the wiring harness as necessary.

If no faults are indicated in the above two checks, proceed to operation (15).

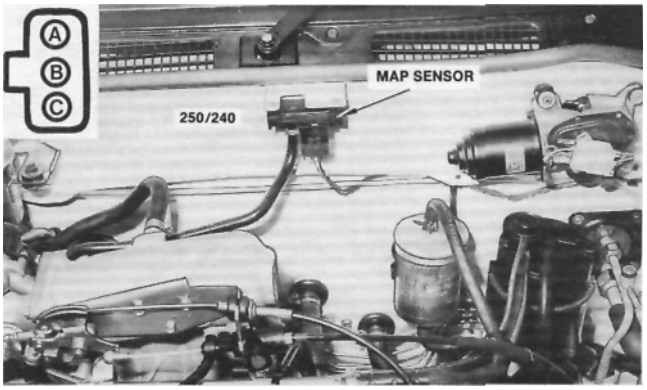
(7) Disconnect the wiring connector from the MAP sensor and connect a jumper lead between terminals B and C on the wiring connector.

(8) Start and run the engine at idle speed for 60 seconds or until the ECM warning lamp lights.

(9) Stop the engine, switch the ignition On and connect a jumper lead between terminals A and B on the diagnostic link connector. Note any fault codes displayed.

If code 33 is displayed, proceed to operation (15).

If code 34 is displayed, proceed as follows.



Location of the MAP sensor. Inset shows the terminal identification.

(10) Remove the jumper lead from the MAP sensor wiring connector and measure the voltage across terminals A and C on the MAP sensor wiring connector.

If the voltage is below 4 volts, proceed to operation (12).

If the voltage is 4-6 volts, proceed as follows.

(11) With the ignition switched Off, disconnect the wiring connectors from the control unit and check the wiring harness for continuity and shorts between MAP sensor wiring connector terminal B and control unit wiring connector terminal C11. Check the wiring connectors for faults. Repair or renew the wiring harness as necessary.

If no fault is found, renew the control unit and retest for fault codes.

(12) Disconnect the wiring connector from the throttle position sensor.

(13) Measure the voltage across terminals A and C on the MAP sensor wiring connector.

If the voltage is 4-6 volts, renew the throttle position sensor as described later in this section.

If the voltage is below 4 volts, proceed as follows.

(14) With the ignition switched Off, disconnect the wiring connectors from the control unit and check the wiring harness for continuity and shorts between the MAP sensor wiring connector terminal C and control unit wiring connector terminal C14. Check the wiring connectors. Repair or renew the wiring harness as necessary.

If no fault is found, renew the control unit and retest for fault codes.

(15) Test the MAP sensor as follows:

(a) With the ignition switched On and the MAP sensor wiring connector connected, measure the voltage across terminals A and B by backprobing the MAP sensor wiring connector. The voltage should be as follows:

ALTITUDE	VOLTAGE
Below 305 m	3.8-5.5 volts
305-610 m	3.6-5.3 volts
610-914 m	3.5-5.1 volts
914-1 219 m	3.3-5.0 volts
1 219-1 524 m	3.2-4.8 volts
1 524-1 829 m	3.0-4.6 volts
1 829-2 133 m	2.9-4.5 volts
2 133-2 438 m	2.8-4.3 volts
2 438-2 743 m	2.6-4.2 volts
2 743-3 048 m	2.5-4.0 volts

If the voltage is not as specified, renew the MAP sensor.

(b) If the voltage is as specified, apply a 34 kPa vacuum to the MAP sensor using a vacuum pump. The voltage should be 1.2-2.3 volts lower than that measured in operation (a).

If the voltage is not as specified, renew the MAP sensor.

If no fault is found, check the vacuum supply hose for restriction, leakage or correct installation.

To Remove and Install

(1) Disconnect the negative battery terminal.

(2) Disconnect the MAP sensor wiring connector and the vacuum hose.

(3) Remove the retaining screws and remove the MAP sensor from the vehicle.

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

(1) If a new MAP sensor is to be installed ensure that the colored insert inside the connector cavity matches the color of the wiring connector.

(2) Ensure that the wiring connector and the vacuum hose are connected securely.

THROTTLE CABLE

To Remove and Install

(1) On 1.6 liter engines, remove the air cleaner assembly as previously described.

(2) Slide the outer throttle cable from the mounting bracket, rotate the throttle linkage and disconnect the inner throttle cable from the throttle linkage.

(3) Disconnect the throttle cable from the retaining clamps in the engine compartment.

(4) Disconnect the plastic retainer from the top of the throttle pedal and disengage the inner throttle cable from the pedal.

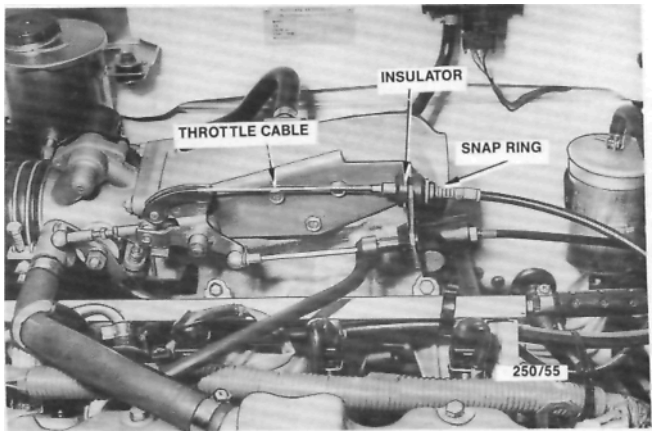
(5) Remove the bolts securing the throttle cable to the bulkhead and withdraw the throttle cable.

Installation is a reversal of the removal procedure.

To Adjust

(1) On 1.6 liter engines, remove the air cleaner assembly as previously described.

(2) Remove the snap ring securing the outer throttle cable to the insulator in the mounting bracket.



View showing the throttle cable adjustment point. 1.8 liter engine.

(3) Gently pull the outer throttle cable until the inner cable remains taut without moving the throttle linkage.

(4) Install the snap ring into the groove positioned second from the insulator.

(5) Depress the throttle pedal and check that the throttle valve opens fully and returns to the idle position when the pedal is released.

(6) On 1.6 liter engines, install the air cleaner assembly.

7. ELECTRONIC COMPONENTS

NOTE: Before proceeding with any of the operations in this section, refer to the Service Precautions and Procedures heading.

TO CHECK IGNITION SYSTEM

(1) Perform the test procedure described in the Roadside Trouble Shooting section. Repair or renew components as necessary.

(2) Perform the self diagnosis test procedure as previously described and rectify any faults. If there is no spark, proceed as follows.

(3) Disconnect the 4 pin wiring connector from the distributor and check for spark at a spark plug high tension lead using the test spark plug.

If there is a spark, renew the pickup coil in the distributor.

If there is no spark, proceed as follows.

(4) Connect the coil high tension lead to the test spark plug and check for spark.

If there is a spark, check the distributor cap and rotor for cracks and moisture. Repair or renew as necessary.

If there is no spark, proceed as follows.

(5) Disconnect the 2 pin wiring connector from the distributor.

(6) With the ignition switched On. measure the voltage at terminals A and B on the distributor 2 pin wiring connector.

If the voltage at terminal B only is under 10 volts, check the wiring harness for continuity between terminal B on the distributor 2 pin wiring connector and terminal 2 on the black ignition coil wiring connector. Repair or renew the wiring harness as necessary. If no fault is found, renew the ignition coll.

If the voltages at both terminals is under 10 volts, check the wiring harness between terminal A on the distributor 2 pin wiring connector and terminal 1 on the black ignition coil wiring connector for continuity. Also check the fuel pump fuse and the wiring harness between the ignition switch and the ignition coil. Repair or renew the wiring harness as necessary.

If the voltage at both terminals is 10 volts or more, proceed as follows.

(7) Connect the 2 pin wiring connector to the distributor.

(8) With the ignition switched On, measure the voltage at the tachometer signal wire.

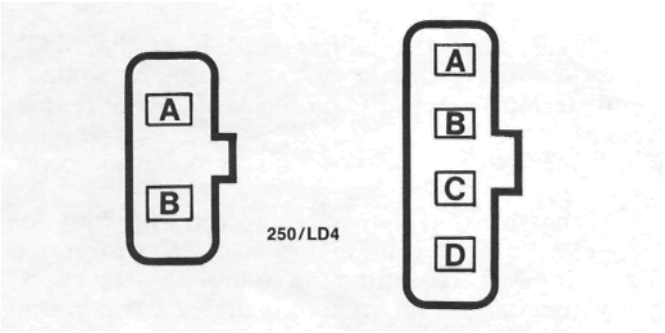


Illustration identifying the 2 and 4 pin distributor wiring connector terminals.

If the voltage is under 1 volt, check the tachometer signal wire for continuity from the ignition coil. Repair or renew the wiring harness as necessary.

If the voltage is 1-10 volts, renew the distributor control module. If there is still no spark, renew the ignition coil also.

If the voltage is over 10 volts, proceed as follows.

(9) With the ignition switch in the Start position, check for voltage at the tachometer signal wire using a test lamp.

If the test lamp flashes, replace the ignition coil with a known serviceable unit. If there is still no spark, install the original coil and renew the control module.

If the test lamp remains illuminated, proceed as follows.

(10) Remove the distributor cap and disconnect the pickup coil wiring connector from the control module.

(11) Connect a voltmeter between the tachometer signal wire and earth.

(12) Connect the lead of a test lamp to a power supply of 1.5-8 volts.

(13) With the ignition switched On, momentarily connect the probe of the test lamp to terminal P on the control module and note the voltage. The voltage should decrease to 7-9 volts.

If there is no voltage decrease, check the control module earth. If the earth is satisfactory, renew the control module.

If the voltage decreases, proceed as follows.

(14) Check for spark at the coil high tension lead as the test lamp is disconnected from terminal P on the control module.

If there is no spark, proceed to operation (15).

If there is a spark, check that the steel rotor on the distributor shaft is magnetized. If it is not renew the distributor shaft assembly.

If the steel rotor is magnetized, check that the resistance between the pickup coil leads is 500-1 500 ohms and not earthed. Renew the pickup coil as necessary.

(15) Renew the ignition coil and check for spark.

If there is no spark check the coil high tension lead. If no fault can be found, renew the control module.

DISTRIBUTOR

To Remove and Install

(1) Disconnect the negative battery terminal.
(2) Disconnect the distributor wiring connectors.
(3) Disconnect the high tension leads from the spark plugs.
(4) Remove the distributor cap retaining screws and remove the cap and high tension leads from the vehicle.
(5) Turn the engine in the normal direction of rotation until the mark on the crankshaft pulley aligns with the timing pointer and the rotor is pointing towards the No. 1 spark plug lead terminal on the distributor cap.
(6) Mark the distributor body to camshaft housing relationship to aid in setting the ignition timing on installation.
(7) Remove the distributor retaining nuts and withdraw the distributor from the camshaft housing.

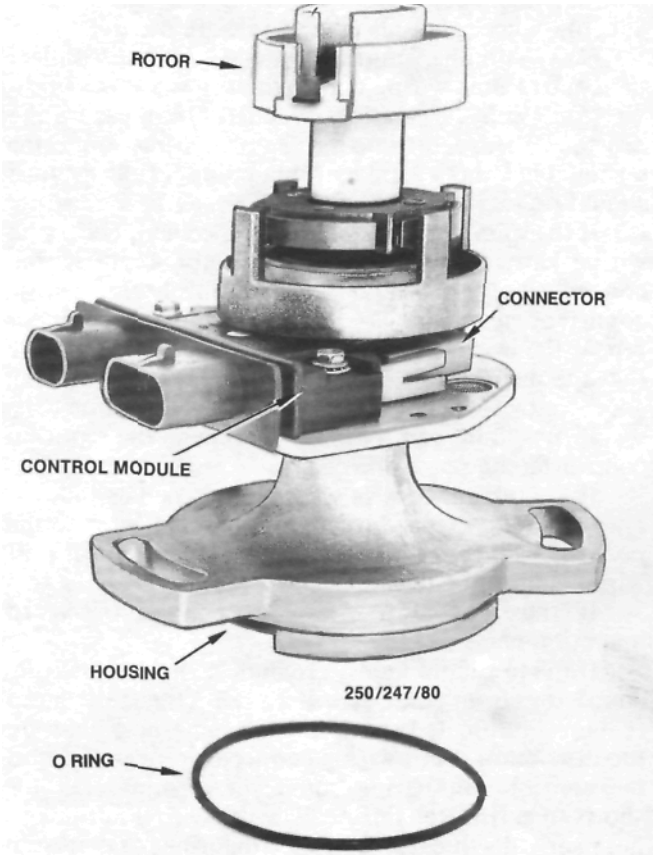
Installation is a reversal of the removal procedure with attention to the following points:

(1) Ensure that the engine has not been rotated while the distributor has been removed. If the engine has been rotated, align the timing marks and ensure that No. 1 piston is on the compression stroke.
(2) Check and renew the distributor base O ring if the sealing quality is suspect.
(3) Install the distributor to the camshaft housing, aligning the coupling with the slot in the camshaft and ensuring that the rotor does not move in relation to the distributor body. Align the marks made on removal.
(4) Install and securely tighten the distributor retaining nuts.
(5) Install the distributor cap and tighten the retaining screws.
(6) Connect the distributor wiring connector.
(7) Connect the negative battery terminal and check the ignition timing as previously described in this section.

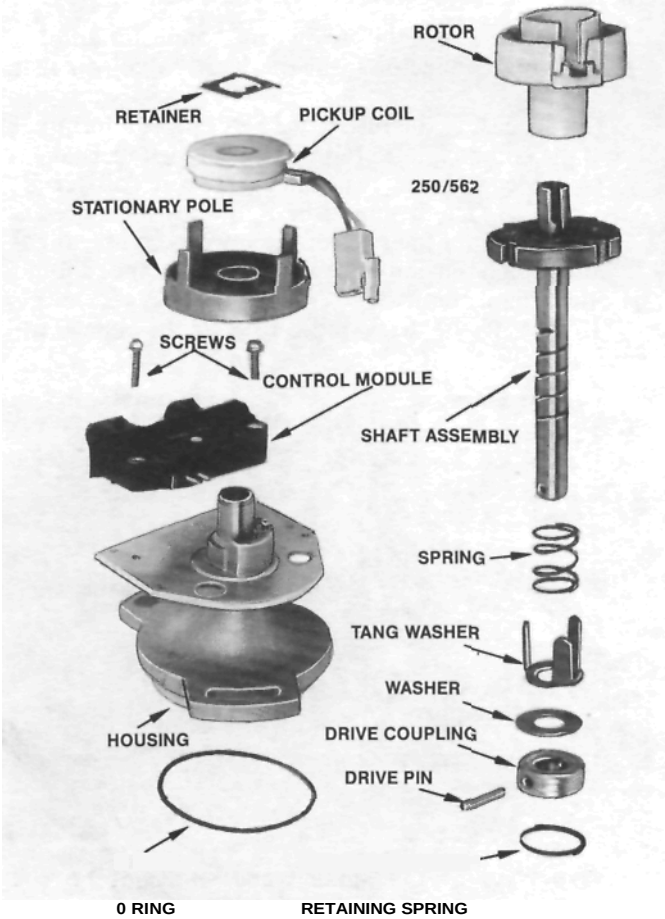
To Dismantle and Assemble

With the distributor removed from the engine and the distributor cap removed, dismantle the distributor as follows:

(1) Disconnect the pickup coil wiring connector from the control module.
(2) Measure the resistance between the terminals on the pickup coil wiring connector and the distributor body. The resistance should be infinity.
(3) Measure the resistance between the terminals



View of the distributor removed from the engine showing the pickup coil connector.



Dismantled view of the distributor.

on the pickup coil wiring connector. The resistance should be 500-1 500 ohms.

If the resistance is not as specified in either of the above tests, renew the pickup coil.

(4) Remove the retaining spring from the distributor drive coupling.

(5) Using a pin punch, remove the drive pin from the shaft.

(6) Remove the drive coupling, washer, tang washer and thrust spring from the shaft.

(7) Remove the rotor and shaft from the distributor housing.

(8) Remove the retainer from the distributor housing and withdraw the pickup coil.

(9) Remove the retaining screws and remove the control module from the distributor body.

(10) Carefully lever the stationary pole from the housing using a suitable screwdriver.

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

(1) Ensure that the mating surfaces of the distributor housing and the control module are clean.

(2) Apply a silicone heat sink compound to the surfaces between the control module and the distributor housing.

IGNITION COIL

To Test

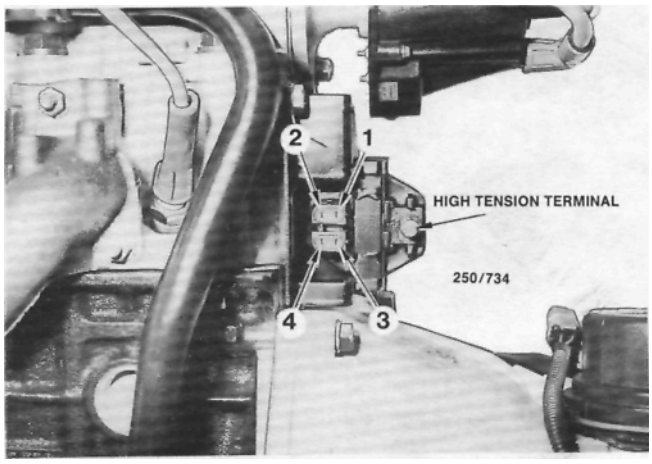
(1) Disconnect the grey wiring connector and the black wiring connector from the ignition coil in that order.

(2) Measure the resistance between coil terminal I and the coil body. There should be a high resistance.

(3) Measure the resistance between coil terminals 2 and 4. There should be a low resistance.

(4) Measure the resistance between coil terminal 3 and the high tension terminal. The resistance should be other than infinity.

If any of the tests indicate a fault, renew the ignition coil.



Installed view of the ignition coil showing the coil terminal identification.

To Remove and Install

(1) Disconnect the negative battery terminal.

(2) Disconnect the grey wiring connector and the black wiring connector from the ignition coil in that order. Disconnect the high tension lead.

(3) Remove the coil mounting bracket retaining bolts and remove the coil and bracket from the engine.

Installation is a reversal of the removal procedure.

ELECTRONIC SPARK TIMING

To Test - Code 42

(1) Erase the self diagnosis code memory as previously described.

(2) Start and run the engine at idle speed for 60 seconds or until the ECM warning lamp lights.

(3) Stop the engine, switch the ignition On and connect a jumper lead between terminals A and B on the diagnostic link connector. Note any fault codes displayed.

If code 42 is displayed, proceed to operation (4).

If code 42 is not displayed, but was displayed when the self diagnosis test procedure was originally performed, an intermittent fault is indicated. Proceed as follows:

(a) Check for faulty wiring connections. Check that all wiring connectors are clean and secure.

(b) Check that all earth wires are secure.

(4) With the ignition switched Off, disconnect the control unit wiring connectors.

(5) With the ignition switched On, measure the resistance between the control unit wiring connector terminal D4 and a good earthing point. The resistance should be less than 500 ohms.

If the ohmmeter reading is as specified, check the wiring harness between the distributor 4 pin wiring connector terminal D and the control unit wiring connector terminal D4 for continuity. Repair or renew the wiring harness as necessary. Also ensure that the distributor 4 pin wiring connector is making good contact when connected to the distributor.

If no fault can be found, renew the ignition control module.

If the resistance is as specified proceed as follows.

(6) With the lead of a test lamp connected to the positive battery terminal, backprobe the control unit wiring connector terminal D5.

If the test lamp does not light, proceed to operation (7).

If the test lamp lights, disconnect the 4 pin wiring connector from the distributor. If the test lamp remains illuminated check the wiring harness between the distributor 4 pin wiring connector terminal B and the control unit wiring connector terminal D5 for shorts to earth. Repair or renew the wiring harness as necessary. If the test lamp extinguishes, renew the ignition system control module.

(7) Connect an ohmmeter between the control

unit wiring connector terminal D4 and a good earthing point.

(8) With the lead of a test lamp connected to the positive battery terminal, backprobe the control unit wiring connector terminal D5. As the test lamp probe touches the terminal, the ohmmeter reading should change from less than 500 ohms to over 5 000 ohms.

If the ohmmeter reading is not as specified, proceed to operation (9).

If the ohmmeter reading is as specified, switch the ignition Off and install the control unit wiring connectors. Run the engine for 60 seconds or until the ECM warning lamp lights and check for fault codes.

If code 42 is displayed renew the control unit.

If code 42 is not displayed, check the wiring harness for continuity or shorts between the control unit wiring connector terminals D4 and D5 and the distributor 4 pin wiring connector terminals D and B.

(9) Disconnect the 4 pin wiring connector from the distributor.

(10) Check for continuity between the control unit wiring connector terminal D4 and a good earthing point. There should be no continuity.

If the continuity is not as specified, check the wiring harness between the distributor 4 pin wiring connector terminal D and the control unit wiring connector terminal D4 for shorts to earth. Repair or renew the wiring harness as necessary.

If the continuity is as specified, check the wiring harness between the distributor 4 pin wiring connector terminal B and the control unit wiring connector terminal D5 for continuity. Repair or renew the wiring harness as necessary. If no fault is found, renew the ignition system control module.

CONTROL UNIT

To Test Input Circuits — Code 55

(1) Switch the ignition On with the engine stopped and note the ECM warning lamp.

(2) If a steady light is showing, proceed to operation (3).

If code 55 is displayed, proceed as follows:

(a) Switch the ignition Off and disconnect the wiring connector from the control unit.

(b) Switch the ignition On and measure the voltage at the wiring connector on terminals C10, CI1, C12, C13 and A9. Disregard terminal C12 on 1.6 liter engines.

(c) If there is voltage at any of the terminals tested above, a faulty wiring harness is indicated. Repair the short circuit to voltage and return to operation (1).

(d) If there is no voltage at any of the terminals tested, a faulty control unit is indicated. Renew the control unit and return to operation (1).

(3) Connect a jumper lead between terminals A and B on the diagnostic link connector and note if code 55 is displayed.

If code 55 is displayed, an intermittent fault is indicated. Switch Off the engine, erase the self diagnosis codes and run the engine for 2 minutes. Return to operation (1) and repeat the test procedures.

If code 55 continues to return, renew the control unit.

To Remove and Install

(1) Disconnect the negative battery terminal.

(2) Slide the passengers front seat to the rearmost position and working under the seat, disconnect the control unit wiring connectors.

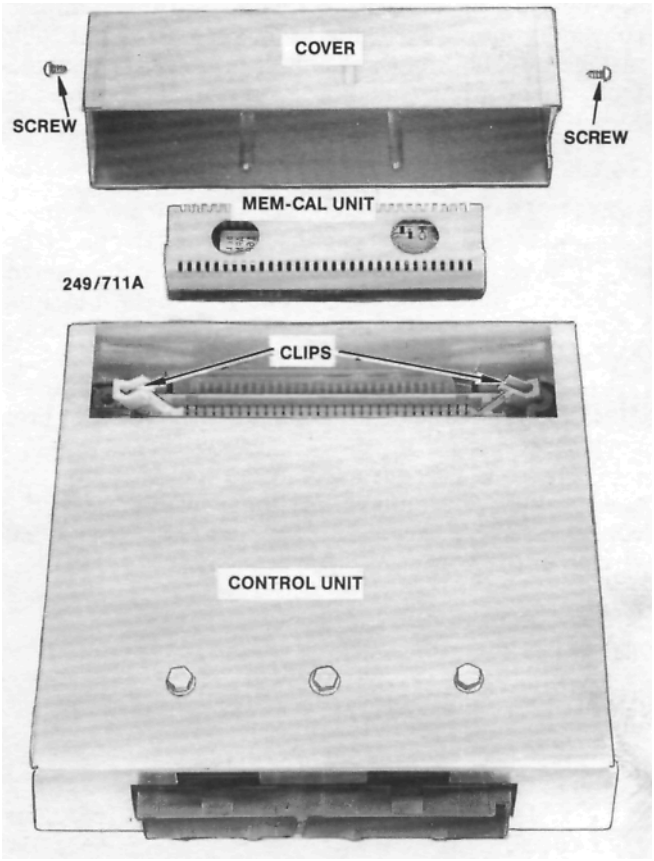
(3) Disengage the plastic control unit cover from the mounting plate and remove the control unit from the vehicle.

(4) If necessary, remove the screws retaining the Mem-Cal cover to the control unit.

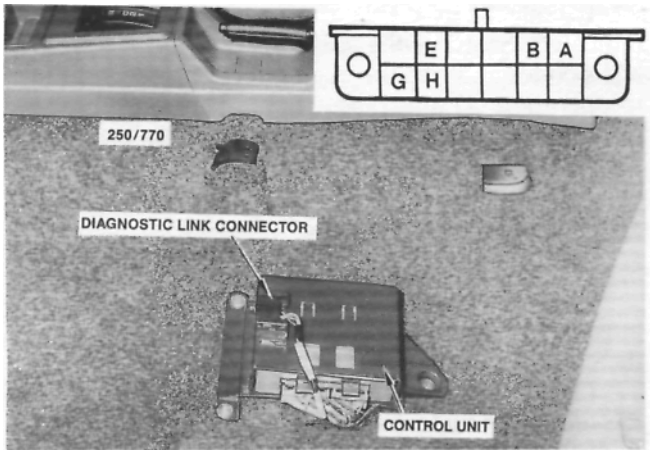
(5) Release the Mem-Cal unit retaining clips, grasp the Mem-Cal unit at each end and remove it from the control unit.

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

(1) When installing the Mem-Cal unit, align the notches in the Mem-Cal with those in the control unit and push on each end of the Mem-Cal unit. Do not push on the middle section of the Mem-Cal unit.



View of the control unit with the Mem-Cal unit removed.



Installed view of the control unit with the passengers seat removed.

(2) Secure the Mem-Cal unit retaining clips. Ensure that the clips locate into the Mem-Cal unit.

(3) When installing a new control unit, transfer the identification and bar code label to the new control unit.

(4) Ensure that the control unit wiring connectors are securely installed to the control unit.

(5) Activate the self diagnosis codes. If code 51 is displayed or the Check Engine warning lamp is constantly illuminated, the Mem-Cal unit is not fully installed. If the Mem-Cal unit is installed correctly, a fault in the Mem-Cal unit is indicated. Renew the Mem-Cal unit as previously described.

To Check Power Supply and Earth Circuit

(1) Disconnect the control unit wiring connectors and check for voltage at terminals B1 and C16.

If there is no voltage check the fusible link which is located third from the front in the fusible link connecting block. If the fusible link is serviceable, repair the open circuit in the wiring harness.

(2) Check for continuity to earth on terminals A12, D1, D6 and also D3 and D10 on 1.8 liter engines.

If there is no continuity check the earth connections at the right hand rear cylinder head bolts. If the connections are clean and secure, repair the open circuit in the wiring harness.

MEM-CAL UNIT

To Test - Code 51

If code 51 is displayed during the self diagnosis test procedure, proceed as follows:

(1) Check that the Mem-Cal unit is fully inserted in the control unit.

(2) Erase the fault code memory and retest for fault codes.

(3) If code 51 is still displayed, renew the Mem-Cal unit.

(4) Erase the fault code memory and retest for fault codes.

(5) If code 51 is still displayed, renew the control unit.

To Remove and Install

The Mem-Cal unit is incorporated within the control unit. Refer to the previous heading for the removal and installation procedure.

FUEL PUMP AND EGI RELAYS

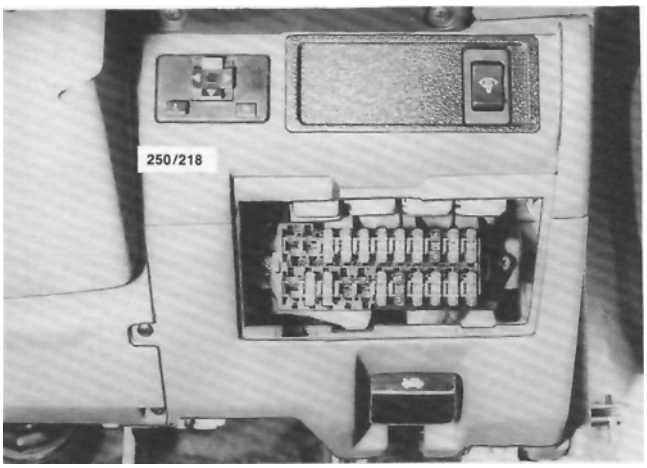
To Remove and Install

(1) Disconnect the negative battery terminals.

(2) Remove the fuse panel cover which is located adjacent to the steering column under the instrument cluster.

(3) Remove the spare fuse holder from the fuse panel and remove the relevant relay from the connector.

Installation is a reversal of the removal procedure.



View showing the location of the EGI and fuel pump relays.

To Test Relays

NOTE: When testing the fuel pump relay circuit ensure that the EGI relay is serviceable and installed to the relay connector

(1) Remove the relevant relay as previously described.

(2) Using an ohmmeter, check for continuity between terminals 1 and 2, and 3 and 5.

Continuity should exist between terminals 1 and 2 but should not exist between terminals 3 and 5.

(3) Using suitable jumper leads, apply 12 volts to terminal 1 and connect terminal 2 to a good earth point.

(4) Connect the ohmmeter between terminals 3 and 5. Continuity should exist. If continuity does not exist, renew the relay.

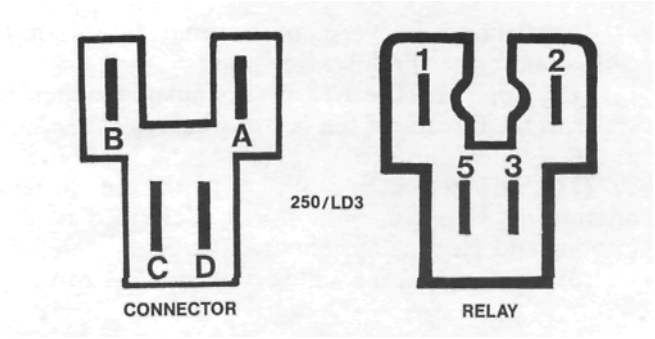


Diagram showing the identification of the relay and the relay connector terminals.

To Test Relay Circuits

(1) Remove the relevant relay as previously described and connect the negative battery terminal.

(2) Connect a test lamp to earth and probe the fuel pump relay connector terminal C or the EGI relay connector terminal A. With the ignition switched On the test lamp should light.

If the test lamp does not light check the fuel pump fuse and the wiring harness for continuity between the ignition switch and the fuel pump relay connector terminal C or EGI relay connector terminal A.

(3) With the ignition remaining switched On, connect the test lamp between the fuel pump relay connector terminals C and B or the EGI relay connector terminals A and B.

If the test lamp does not light, repair the open circuit between terminal B and earth.

(4) When checking the EGI relay circuit, proceed to operation (9).

When checking the fuel pump relay circuit proceed as follows.

(5) Probe the relay connector terminal A with a test lamp to earth. Switch the ignition On and note the test lamp.

If the test lamp lights for 2 seconds, proceed to step (7).

If the test lamp does not light as specified, proceed as follows.

(6) Switch the ignition Off and backprobe the control unit wiring connector terminal A1 with a test lamp to earth. With the ignition switched On the test lamp should light as previously described.

If the test lamp does not light as described, renew the control unit.

If the test lamp does light as described, locate the open circuit or short in the wiring harness between the control unit wiring connector terminal Al and the relay connector terminal A. Repair or renew the wiring harness as necessary.

(7) With the ignition switched Off connect a jumper lead between the relay connector terminals C and D.

(8) Switch the ignition On and listen for the operation of the fuel pump. It should be possible to feel vibrations in the fuel return hose.

If the fuel pump is operating, the fuel pump relay circuit can be considered serviceable.

If the fuel pump is not operating, check the wiring harness for continuity between the fuel pump wiring harness connector, the fuel pump relay connector terminal D and earth. If no fault can be found, renew the fuel pump.

(9) Probe the relay connector terminal C with a test lamp to earth. The test lamp should light.

If the test lamp does not light, locate the open circuit between the battery and terminal C. Check the fusible link which is located third from the front in the fusible link connecting block.

(10) Connect a jumper lead between the relay connector terminals C and D and backprobe the control unit wiring connector terminal A6 with a test lamp to earth.

If the test lamp lights, the EGI relay circuit can be considered serviceable.

If the test lamp does not light locate the open circuit between the control unit wiring connector terminal A6 and the relay connector terminal D. Repair or renew the wiring harness as necessary.

COOLANT TEMPERATURE SENSOR

To Test — Codes 14 and 15

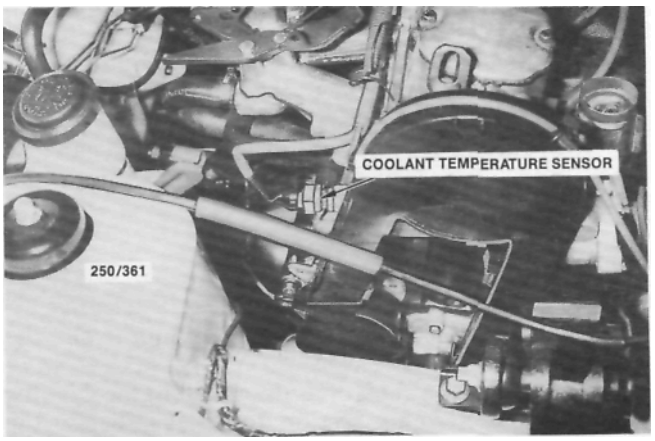
(1) Erase the self diagnosis code memory as previously described.

(2) Start and run the engine at idle speed for 60 seconds or until the ECM warning lamp lights.

(3) Stop the engine, switch the ignition On and connect a jumper lead between terminals A and B on the diagnostic link connector. Note any fault codes displayed.

If codes 14 or 15 are displayed, proceed to operation (4).

If codes 14 or 15 are not displayed, but were displayed when the self diagnosis test procedure was



View showing the location of the coolant temperature sensor. 1.6 liter engine.

originally performed, an intermittent fault is indicated. Proceed as follows:

(a) Check for faulty wiring connections. Check that all wiring connectors are clean and secure.

(b) Check that all earth wires are secure.

(4) Disconnect the wiring connector from the coolant temperature sensor.

(5) With the ignition switched On, measure the voltage across the terminals on the coolant temperature sensor wiring connector. The voltage should be 4-6 volts.

If the voltage is below 4 volts, proceed to operation (9).

If the voltage is as specified, proceed as follows.

(6) Remove the coolant temperature sensor from the vehicle.

(7) Connect an ohmmeter to the coolant temperature sensor terminals.

(8) Immerse the meta1 end of the coolant temperature sensor in a 50/50 mixture of glycol and iced water at a temperature of 0 deg C. The resistance should be 6 000 ohms.

Slowly heat the mixture and measure the resistance of the coolant temperature sensor at the following temperatures. Compare the results with the specified values:

0 deg C	6 000 ohms
20 deg C	2 500 ohms
30 deg C	1 800 ohms
40 deg C	1 200 ohms
70 deg C	450 ohms
90 deg C	250 ohms
100 deg C	190 ohms
110 deg C	110 ohms

If the resistances obtained are not as specified at any of the given temperatures, renew the coolant temperature sensor and retest for fault codes.

(9) Disconnect the control unit wiring connectors.

(10) Check the wiring harness for shorts and continuity between the coolant temperature sensor wiring connector terminals and the control unit wiring connector terminals C10 and D2. Repair or renew the wiring harness as necessary.

Also check the control unit terminals for damage.

If no fault is found, renew the control unit and retest for fault codes.

To Remove and Install

(1) Disconnect the negative battery terminal.

(2) Disconnect the wiring connector from the coolant temperature sensor.

(3) Drain the coolant as described in the Cooling and Heating Systems section to a level below the sensor.

(4) Unscrew the sensor from the thermostat housing.

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

(1) Apply Loctite 675 or a similar conductive sealer to the threads of the sensor. Tighten the sensor to the specified torque.

(2) Fill the cooling system with the correct mixture of water and inhibitor as described in the Cooling and Heating Systems section.

(3) Ensure that the wiring connector is clean and secure.

THROTTLE POSITION SENSOR

To Test - Codes 21 and 22

NOTE: The following test procedure assumes that fault codes 21 or 22 have been displayed during the self diagnosis test procedure. If no codes have been displayed but the operation of the throttle position sensor is suspect, begin the test procedure at operation (24).

(1) Erase the self diagnosis code memory as previously described.

(2) Start and run the engine at idle speed for 60 seconds or until the ECM warning lamp lights.

If the engine will not start, disconnect the throttle position sensor wiring connector and proceed to operation (8). .

(3) With the engine idling, quickly increase the engine speed to 3 000 rpm and return to idle.

If the ECM warning lamp remains illuminated, proceed to operation (4).

If the ECM warning lamp extinguishes, an intermittent fault is indicated. Proceed as follows:

(a) Check for faulty wiring connections. Check that all wiring connectors are clean and secure.

(b) Check that all earth wires are secure.

(4) Stop the engine, switch the ignition On and connect a jumper lead between terminals A and B on the diagnostic link connector. Note any fault codes displayed.

If codes 21 or 22 are displayed, proceed as follows.

(5) Remove the jumper lead from the diagnostic link connector.

(6) Erase the self diagnosis codes as previously described.

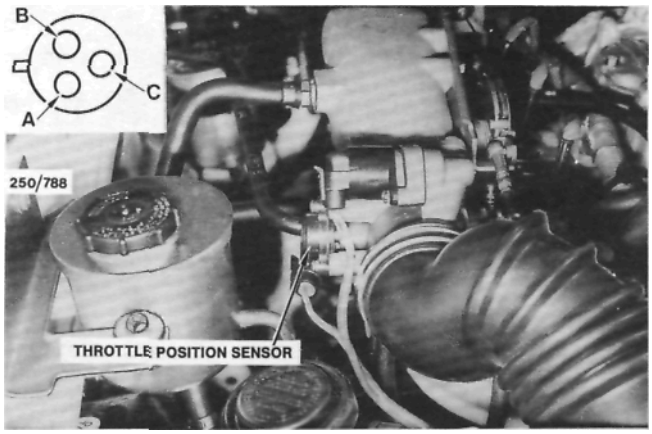
(7) Disconnect the wiring connector from the throttle position sensor.

If code 22 was displayed in operation (4), proceed to operation (13).

If code 21 was displayed in operation (4), proceed as follows.

(8) Start and run the engine at idle speed for 2 minutes or until the ECM warning lamp lights. If the engine will not start, proceed to operation (11).

(9) Stop the engine, switch the ignition On and connect a jumper lead between terminals A and B on



Location of the throttle position sensor. Inset shows the terminal identification.

the diagnostic link connector. Note any fault codes displayed.

If code 21 is displayed, proceed to operation (11).

If code 22 is displayed, proceed as follows.

(10) Connect the lead of a test lamp to the positive battery terminal and insert the probe into terminal B on the throttle position sensor wiring connector.

If the test lamp lights, proceed to operation (24).

If the test lamp does not light, check the wiring harness between the throttle position sensor wiring connector terminal B and the control unit wiring connector terminal D2 for continuity. Repair or renew the wiring harness as necessary and retest for fault codes.

(11) With the ignition switched Off, disconnect the control unit wiring connectors.

(12) With the ignition switched On, measure the voltage at terminal C13 on the control unit wiring connector.

If the voltage is less than 1 volt, check the wiring harness for shorts between the throttle position sensor wiring connector terminals C and A and the control unit wiring connector terminals C13 and C14. Repair or renew the wiring harness as necessary. If no fault can be found, renew the control unit.

(13) Start and run the engine at idle speed.

(14) Connect a jumper lead across terminals A and C on the throttle position sensor wiring connector.

(15) Stop the engine, switch the ignition On and connect a jumper lead between terminals A and B on the diagnostic link connector. Note any fault codes displayed.

If codes 21 and 22 are displayed, proceed to operation (24).

If code 22 only is displayed, proceed as follows.

(16) Remove the jumper lead from the throttle position sensor wiring connector.

(17) Measure the voltage across the throttle position sensor wiring connector terminals A and B.

If the voltage is below 4 volts, proceed to operation (20).

If the voltage is 4-6 volts, proceed as follows:

(18) With the ignition switched Off, disconnect the control unit wiring connectors.

(19) Check the wiring harness between the control unit wiring connector terminal C13 and the throttle position sensor wiring connector terminal C for continuity and shorts. Repair or renew the wiring harness as necessary and retest for fault codes.

If no fault is found, renew the control unit and retest for fault codes.

(20) Disconnect the wiring connector from the MAP sensor.

(21) Measure the voltage across the throttle position sensor wiring connector terminals A and B.

If the voltage is 4 - 6 volts, renew the MAP sensor.

If the voltage is below 4 volts, proceed as follows.

(22) With the ignition switched Off, disconnect the control unit wiring connectors.

(23) Check the wiring harness between the control unit wiring connector terminal C14 and the throttle position sensor wiring connector terminal A for continuity and shorts. Repair or renew the wiring harness as necessary and retest for fault codes.

If no fault is found, renew the control unit and retest for fault codes.

(24) With the ignition switched On, measure the voltage at the control unit wiring connector terminal C13.

If the voltage is 0.2-1.2 volts, proceed to operation (27).

If the voltage is 1.2-2.5 volts, proceed to operation (25).

If the voltage is over 2.5 volts, proceed as follows:

(a) Disconnect the wiring connector from the throttle position sensor.

(b) Measure the voltage at the control unit wiring connector terminal C13.

If the voltage is less than 1 volt, check the wiring harness for continuity between the throttle position sensor terminal B and the control unit wiring connector terminal D2. If the wiring harness is satisfactory, renew the throttle position sensor.

(25) Check the base idle speed and adjust if necessary as previously described.

(26) With the ignition switched On, measure the voltage at the control unit wiring connector terminal C13. The voltage should be 0.2-1.2 volts.

If the voltage is not as specified, renew the throttle position sensor.

If the voltage is as specified, proceed as follows.

(27) With the ignition switched On, measure the voltage at the control unit wiring connector terminal C13 as the throttle is steadily opened to the wide open throttle position. The voltage should increase steadily with no sudden variations.

If the voltage does not increase as specified, renew the throttle position sensor.

If the voltage is as specified, proceed as follows.

(28) With the ignition switched On and the throttle valve held fully open, measure the voltage at control unit wiring connector terminal C13. The voltage should be above 4 volts.

If the voltage is below 4 volts, renew the throttle position sensor.

To Remove and Install

(1) Disconnect the negative battery terminal.

(2) On 1.6 liter engines, remove the air cleaner assembly as previously described.

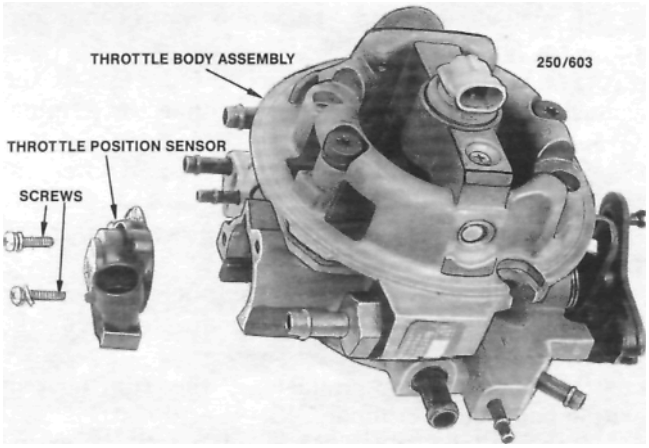
(3) Disconnect the throttle position sensor wiring connector.

(4) Remove the throttle position sensor retaining screws and remove the throttle position sensor from the throttle body.

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

(1) Ensure that the throttle valve is in the fully closed position.

(2) Tighten the retaining screws securely and install the wiring connector.



View of the throttle position sensor removed from the throttle body assembly.

MANIFOLD AIR TEMPERATURE (MAT) SENSOR - 1.8 LITRE ENGINE

To Test - Codes 23 and 25

(1) Erase the self diagnosis code memory as previously described.

(2) Start and run the engine for 2 minutes or until the ECM warning lamp lights.

(3) Stop the engine, switch the ignition On and connect a jumper lead between terminals A and B on the diagnostic link connector. Note any fault codes displayed.

If codes 23 or 25 are displayed, proceed to operation (4).

If codes 23 or 25 are not displayed but were displayed when the self diagnosis test procedure was originally performed, an intermittent fault is indicated. Proceed as follows:

(a) Check for faulty wiring connections. Check that all wiring connectors are clean and secure.

(b) Check that all earth wires are secure.

(4) Disconnect the wiring connector from the MAT sensor.

(5) With the ignition switched On, measure the voltage across the terminals on the MAT sensor wiring connector. The voltage should be 4-6 volts.

If the voltage is below 4 volts, proceed to operation (9).

If the voltage is as specified, proceed as follows.

(6) Remove the MAT sensor from the engine.

(7) Connect an ohmmeter to the MAT sensor terminals.

(8) Immerse the metal end of the MAT sensor in a container of iced water at a temperature of 4 deg C. The resistance should be 7 500 ohms.

Slowly heat the water and measure the resistance of the MAT sensor at the following temperatures. Compare the results with the specified values:

20 deg C	3 400 ohms
38 deg C	1 800 ohms
70 degC	450 ohms
100 deg C	185 ohms

If the resistances obtained are not close to the specified figures at any of the given temperatures, renew the MAT sensor and retest for fault codes.

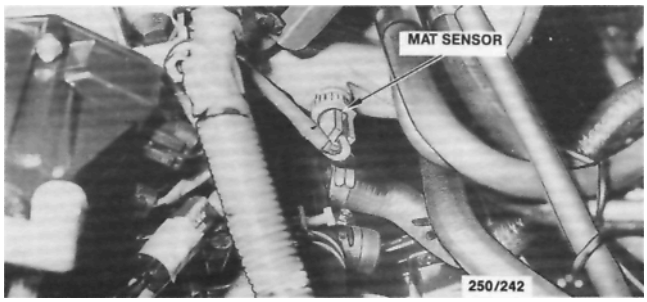
(9) Disconnect the control unit wiring connectors.

(10) Check the wiring harness between the MAT sensor wiring connector and the control unit wiring connector terminals C12 and A11 for shorts and continuity. Also check the control unit terminals for damage.

Repair or renew the wiring harness as necessary. If no fault is found, renew the control unit and retest for fault codes.

To Remove and Install

(1) Disconnect the negative battery terminal.



Installed view of the MAT sensor. 1.8 liter engine.

(2) Disconnect the wiring connector from the MAT sensor.

(3) Unscrew the sensor from the inlet manifold.

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

(1) Apply Loctite 567 or a similar conductive sealer to the threads of the sensor. Tighten the sensor to the specified torque.

(2) Ensure that the wiring connector is clean and tight.

OXYGEN SENSOR

To Test - Code 13

(1) Run the engine until the normal operating temperature is obtained.

(2) With the ignition switched Off, connect a jumper lead between terminals A and B on the diagnostic link connector.

(3) Start and run the engine at approximately 1 600-1 800 rpm for 2 minutes and note the ECM warning lamp.

If the ECM warning lamp flashes at the rate of twice per second, proceed to operation (5).

If the ECM warning lamp flashes at the rate of once per second or slower, proceed as follows.

(4) Remove the jumper lead from the diagnostic link connector and run the engine above 2 000 rpm for 2 minutes, noting the ECM warning lamp.

If the ECM warning lamp lights, stop the engine, switch the ignition On and connect a jumper lead between terminals A and B on the diagnostic link connector. If code 13 is displayed proceed to operation (5).

If the ECM warning lamp does not light, an intermittent fault is indicated. Proceed as follows:

(a) Check for faulty wiring connections. Check that all wiring connectors are clean and secure.

(b) Check that all earth wires are secure.

(5) Switch the ignition Off and disconnect the oxygen sensor wiring connector. Using a jumper lead connect the oxygen sensor wiring connector to a suitable engine earth.

(6) Start and run the engine at approximately 1 600-1 800 rpm and note the ECM warning lamp. The lamp may flash for a few seconds but should then extinguish for at least 30 seconds.

If the ECM warning lamp functions as described, proceed to operation (7).

If the ECM warning lamp does not function as described proceed as follows:

(a) Check the wiring harness between the oxygen sensor wiring connector and the control unit wiring connector D7 for open circuits. Repair or renew the wiring harness as necessary.

{b) Check the earth circuit between the control unit wiring connect D6 and the right rear cylinder head bolts. Repair or renew the wiring harness as necessary.

(c) If no fault is found in (a) and (b) renew the control unit and retest for fault codes.

(7) Check the wiring harness earth circuit between the control unit wiring connector D6 and the right rear cylinder head bolts. Repair or renew the wiring harness as necessary.

If no fault is found, thoroughly check the oxygen sensor connector. If the connector is not faulty, renew the oxygen sensor.

To **Test** - Code 44

(1) Run the engine until normal operating temperature is attained.

(2) With the ignition switched Off, connect a jumper lead between terminals A and B on the diagnostic link connector.

(3) Start and run the engine at approximately 1 600-1 800 rpm for 2 minutes and note the ECM warning lamp.

If the ECM warning lamp is off more than on or flashes at the rate of twice per second, proceed to operation (4).

If the ECM warning lamp flashes evenly at the rate of once per second an intermittent fault is indicated. Proceed as follows:

(a) Check for faulty wiring connections. Check that all wiring connectors are clean and secure.

(b) Check that all earth wires are secure.

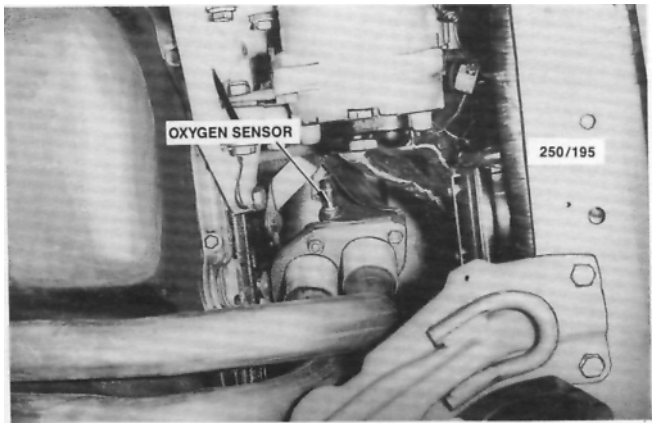
(4) Switch the engine Off and disconnect the oxygen sensor wiring connector.

(5) Start and run the engine at 1 600-1 800 rpm for at least 30 seconds and note the ECM warning lamp.

If the ECM warning lamp flashes at the rate of twice per second proceed to operation (6).

If the ECM warning lamp extinguishes for at least 30 seconds, check the wiring harness between the oxygen sensor wiring connector and the control unit wiring connector terminal D7 for shorts to earth.

Repair or renew the wiring harness as necessary. If no fault can be found in the wiring harness, renew the control unit.



Installed view of the oxygen sensor.

(6) Check the vehicle for the following:
(a) Low fuel pressure.
(b) Contaminated fuel.
(c) Vacuum leaks at the inlet manifold, engine vacuum hoses and engine ventilation hoses.
(d) Exhaust manifold leaks before the oxygen sensor.
(e) Correct MAP sensor operation.
(f) Blocked oxygen sensor metal vent cover eg. plugged with mud etc.
(g) Fuel injectors) partially blocked. Refer to a fuel injection specialist or a Nissan dealer.

If the above items have been checked and no faults have been found, a faulty oxygen sensor is indicated. Renew the oxygen sensor, run the engine and ensure that no fault codes are set.

To Test — Code 45

(1) Run the engine until normal operating temperature is attained.
(2) With the ignition switched Off, connect a jumper lead between terminals B and A on the diagnostic link connector.
(3) Start and run the engine at approximately 1 600-1 800 rpm for 2 minutes and note the ECM warning lamp.

If the ECM warning lamp is on more than off or flashes at the rate of twice per second, proceed to the following operation.

If the ECM warning lamp flashes evenly at the rate of once per second an intermittent fault is indicated. Proceed as follows:
(a) Check for faulty wiring connections. Check that all wiring connectors are clean and secure.
(b) Check that all earth wires are secure.
(4) Switch the engine Off and disconnect the oxygen sensor wiring connector.
(5) Using a jumper lead, connect the oxygen sensor wiring connector to a suitable engine earth.
(6) Start and run the engine at 1 600-1 800 rpm and note the ECM warning lamp.

If the ECM warning lamp extinguishes for at least 30 seconds, proceed to operation (7).

If the ECM warning lamp flashes on more than off or flashes at the rate of twice per second, switch the engine Off and disconnect the control unit wiring connectors. Using an ohmmeter, check that there is no resistance between the control unit wiring connector terminal D6 and earth. Repair or renew the wiring as necessary.

If no fault can be found in the wiring harness, renew the control unit.

NOTE: The wiring harness for terminal D6 earths through the right hand rear cylinder head bolt.

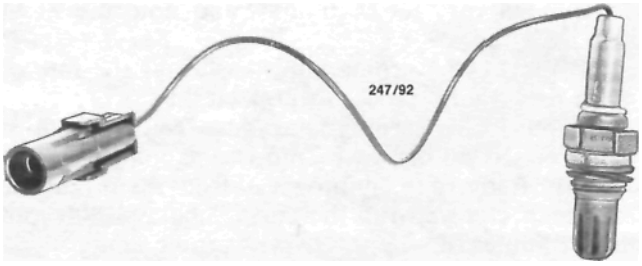
(7) Check the vehicle for the following:
(a) High fuel pressure.
(b) Leaking injector(s).
(c) Faulty ignition wiring.
(d) Charcoal canister purge system blocked or restricted.
(e) Faulty coolant temperature sensor circuit.
(f) Faulty MAT sensor circuit (1.8 liter engine).
(g) MAP sensor operation.
(h) Throttle position sensor operation.

If the above items have been checked and no faults have been found, a faulty oxygen sensor is indicated.

Renew the oxygen sensor, run the engine and ensure that no fault codes are set.

To Remove and Install

(1) If the engine is cold, run the engine for approximately two minutes to allow easy oxygen sensor removal.
(2) Disconnect the negative battery terminal and the oxygen sensor connector.



View of the oxygen sensor removed from the exhaust manifold.

(3) Remove the exhaust manifold heat shield retaining bolts and remove the heat shield from the engine.
(4) Remove the oxygen sensor with a short ring spanner using care not to damage the sensor wire.

Installation is a reversal of the removal procedure with attention to the following points:
(1) When installing a sensor that has previously been removed, coat the sensor threads with anti-seize compound. Nissan recommend a mixture of liquid graphite and glass beads.
(2) Install the sensor and tighten to the specified torque.
(3) Connect the electrical connector ensuring that the wiring is secured away from the exhaust.
(4) Install the heat shield and tighten the retaining bolts securely.

On 1.6 liter engines, ensure that the hot air inlet tube is located correctly between the heat shield and the air cleaner housing.
(5) Start the engine and check for leaks.

VEHICLE SPEED SENSOR

To Test - Code 24

(1) Check the fuel pump and meter fuses. If the fuses are serviceable, proceed to operation (5). If a fuse is blown, rectify the cause and renew the fuse.

Erase the fault codes and retest for fault codes as follows:

(2) Start and run the engine until normal operating temperature is attained.

(3) Drive the vehicle at a speed of at least 80 km/h and, with the throttle closed, allow the vehicle to decelerate until the engine speed is below 1 500 rpm.

NOTE: After rectifying any fault it will be necessary to retest for fault codes. To test for Code 24 the vehicle must be driven as previously described.

(4) Switch the engine Off and connect a jumper lead between terminals A and B on the diagnostic link connector. Switch the ignition On and note the fault codes. If code 24 is displayed proceed as follows.

(5) Check the operation of the speedometer and the instrument cluster warning lamps. If the speedometer only is not functioning, proceed to operation (13).

If the speedometer and the instrument cluster warning lamps are not functioning, a fault in the instrument cluster wiring harness is indicated. Refer the fault to an auto electrical workshop or a Nissan dealer.

If the speedometer is functioning, proceed as follows:

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

(7) Place the transaxle in Neutral and switch the ignition On.

(8) With the aid of assistants, slowly spin the front wheels by hand while backprobing the control unit wiring connector terminal A10 with a digital voltmeter to earth.

The voltage should alternate from under 1 volt to over 10 volts.

If the voltmeter reading is not as specified, proceed to operation (9).

If the voltmeter reading is as specified, the vehicle speed sensor is operating satisfactorily, indicating an intermittent fault was the cause of the fault code. Proceed as follows:

(a) Check for faulty wiring connections. Check that all wiring connectors are clean and secure.

(b) Check that all earth connections are secure.

(9) Remove the instrument cluster as described in the Electrical System section.

(10) With the ignition switched On, backprobe the control unit wiring connector terminal A10 with a voltmeter to earth. The voltage should be over 10 volts.

If the voltage is less than specified, check the wiring harness for shorts to earth between the black and yellow wire terminal on the instrument cluster wiring connector and the control unit connector terminal A10. Repair or renew the wiring harness as necessary. If no fault can be found, renew the control unit.

(11) With the ignition switched On, backprobe the black and yellow wire terminal on the instrument cluster wiring connector with a voltmeter to earth. The voltage should be over 10 volts.

If the voltage is less than specified, locate the open circuit between the instrument cluster black and yellow wire terminal and the control unit wiring connector terminal A10. Repair or renew the wiring harness as necessary.

(12) With a test lamp connected to 12 volts, backprobe the black wire terminals on the instrument cluster wiring connectors. The test lamp should light.

If the test lamp does not light locate the open circuit between the black wire terminals and earth. Repair or renew the wiring harness as necessary.

If the test lamp does light, renew the signal divider circuit board which is located in the instrument cluster.

(13) With the ignition switched On and the engine not running, disconnect the vehicle speed sensor wiring connector from the harness connector.

(14) With a test lamp connected to earth, probe the yellow wire terminal on the harness wiring connector. The test lamp should light.

If the test lamp does not light, locate the open circuit between the yellow wire terminal and the Fuel Pump fuse. Repair or renew the wiring harness as necessary.

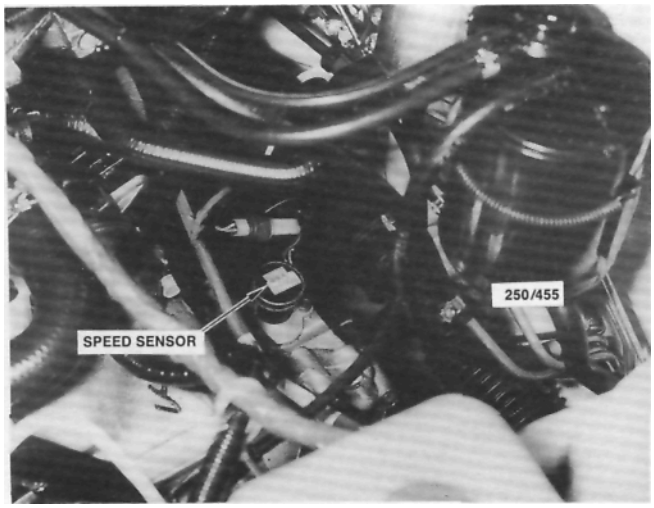
(15) With a test lamp connected to 12 volts, probe the black wire terminal on the harness wiring connector. The test lamp should light.

If the test lamp does not light, locate the open circuit between the black wire terminal and earth. Repair or renew the wiring harness as necessary.

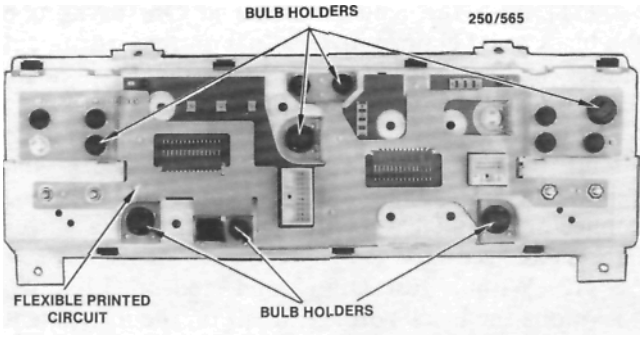
(16) Using a voltmeter measure the voltage at the red wire terminal on the harness wiring connector.

If the voltage is 5-9 volts proceed to operation (19).

If the voltage is over 9 volts proceed to operation (18).



Installed view of the vehicle speed sensor.



Rear view of the instrument cluster showing the flexible printed circuit.

If the voltage is under 5 volts proceed as follows.

(17) Check the wiring harness for continuity or shorts to earth between the red wire terminal on the speed sensor harness connector and the green and black wire terminal on the instrument cluster wiring connector.

If no fault can be found check the instrument cluster printed circuit for continuity or shorts. If no fault can be found, renew the speedometer and the signal divider circuit board.

(18) Remove the instrument cluster as described in the Electrical System section and repeat operation (16).

If the voltage is under 1 volt, check the flexible printed circuit on the rear of the instrument cluster for continuity or shorts and renew as necessary. If no fault can be found, renew the speedometer and the signal divider circuit board.

(19) Connect the harness connector to the vehicle speed sensor wiring connector.

(20) Raise the front of the vehicle and support it on chassis stands. Place the transaxle in Neutral.

(21) With the aid of assistants, slowly spin the front wheels by hand while backprobing the brown wire terminal on the vehicle speed sensor wiring connector with a voltmeter to earth.

The voltage should alternate between approximately 1 and 7 volts.

If the voltage is as specified, check the flexible printed circuit on the rear of the instrument cluster for continuity or shorts. If no fault can be found, renew the speedometer and the signal divider circuit board.

If the voltage is not as specified, proceed as follows.

(22) Disconnect the vehicle speed sensor wiring connector and unscrew the sensor from the speedometer drive housing.

(23) Rotate both front wheels in the same direction and check that the speedometer drive shaft is turning and does not slip.

If the drive shaft does not operate as described, renew the drive assembly as described in the Manual or Automatic Transaxle section.

If the drive shaft operates satisfactorily, renew the vehicle speed sensor.

To Remove and Install

(1) Disconnect the negative battery terminal.

(2) Disconnect the vehicle speed sensor wiring connector.

(3) Unscrew the vehicle speed sensor from the speedometer drive housing.

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

(1) Align the cut-out in the speedometer drive shaft with the notch in the vehicle speed sensor shaft.

(2) Tighten the vehicle speed sensor securely.

EMISSION CONTROL

INTRODUCTION

To reduce the output level of the three primary automotive emissions, carbon monoxide (CO), hydrocarbons (HC) and oxides of nitrogen (NOx), and thus comply with legislation on the maintenance of clean air, several different emission control systems are used in the Pulsar range of vehicles covered by this manual.

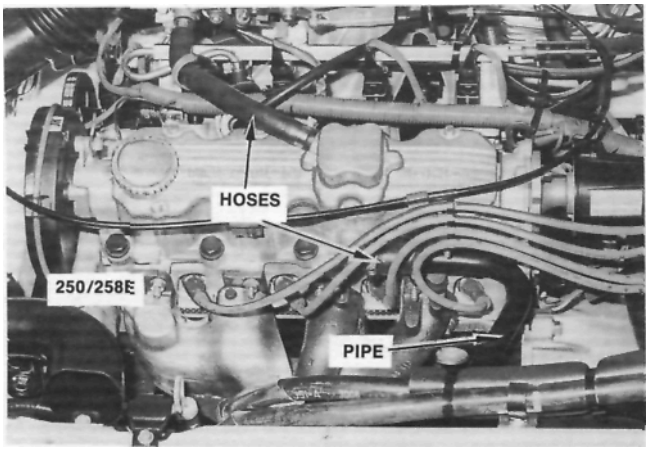
The systems will be discussed under the headings (1) Crankcase Ventilation System, (2) Evaporative Control System, (3) Air Preheat System — 1.6 Liter Engine and (4) Exhaust Control System.

1. CRANKCASE VENTILATION SYSTEM

DESCRIPTION

The crankcase ventilation system is of the closed type and is designed to prevent crankcase vapors being emitted into the atmosphere. Crankcase vapors are caused by gases escaping past the piston rings into the crankcase during the combustion process.

The crankcase vapors are collected in the camshaft housing from the crankcase via the various oil drain passages and the pipe from the side of the crankcase.



View of the engine ventilation hoses and pipe. 1.8 liter engine.

The crankcase vapors are then drawn into the engine via a branched hose connected to the camshaft housing oil baffle and the throttle body (1.8 liter engines) or inlet manifold (1.6 liter engines).

At idle speed, vapors are drawn through the small branch of the hose and into the engine.

As the engine speed increases, vapors are also drawn into the engine via the main hose.

TO SERVICE THE SYSTEM

(1) At intervals of 40 000 km, disconnect the small engine ventilation hose from the throttle body or inlet manifold and check that the metering orifice is not blocked.

If necessary, clean the orifice using compressed air and solvent.

(2) Disconnect all the engine ventilation hoses and check for blocking, collapsing and deterioration. Renew the hoses as necessary.

2. EVAPORATIVE CONTROL SYSTEM

Special Equipment Required:

To Test Purge Valve — Hand vacuum pump

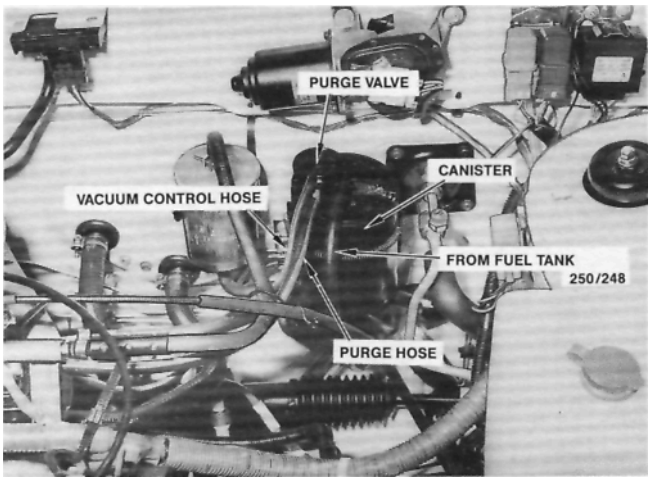
DESCRIPTION

The evaporative control system reduces the amount of hydrocarbons emitted to the atmosphere through fuel evaporation.

The vehicles covered by this manual use an absorption regeneration system to reduce vapor loss. The system utilizes a canister of activated charcoal to trap and hold the fuel vapors until they can be fed into the induction system for burning in the combustion chambers.

The basic components of the evaporative control system are a fuel tank with a sealed filler cap, a charcoal canister with a purge control valve, a fuel check valve and pipes and hoses to connect the various components.

NOTE: The fuel tank filler cap is not vented to the atmosphere but is equipped with a one way relief valve to prevent a vacuum forming in the fuel tank.



Installed view of the charcoal canister.

When the engine is at rest, fuel vapor through evaporation gradually fills the air space in the fuel tank. The sealed filler cap prevents the escape of this vapor and pressure builds up within the system, forcing the vapor to flow into the charcoal canister which is located in the engine compartment beneath the windscreen wiper motor.

The fuel check valve prevents liquid fuel entering the charcoal canister when the fuel tank is full or the vehicle is parked on a steep incline. When the engine is running, the vapor is drawn via a hose from the charcoal canister to the throttle body and burnt in the combustion chambers.

TO RENEW CHARCOAL CANISTER

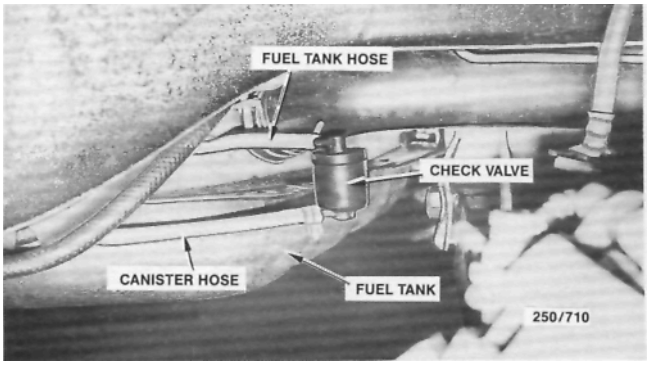
(1) Suitably mark and disconnect the hoses from the canister.

(2) Release the retaining spring and remove the canister from the engine compartment.

Installation is a reversal of the removal procedure.

TO RENEW FUEL CHECK VALVE

(1) Disconnect the negative battery terminal.



Installed view of the fuel check valve as seen with the left hand rear wheel removed.

(2) Raise the rear of the vehicle and support it on chassis stands. Remove the left hand rear wheel.

(3) Drain the fuel from the fuel tank using a hand pump or a suitable siphon. Do not siphon fuel using the mouth.

(4) Remove the hoses from the check valve.

(5) Squeeze the retaining clip and remove the check valve from the mounting bracket.

Installation is a reversal of the removal procedure.

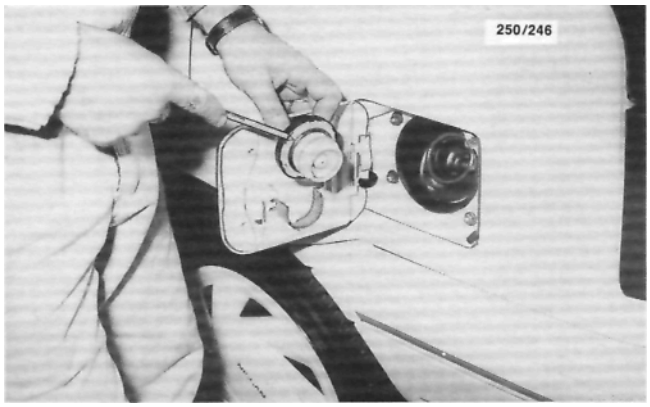
TO SERVICE THE SYSTEM

(1) Inspect the vacuum lines and connectors for signs of leakage, cracks and deterioration and renew as necessary.

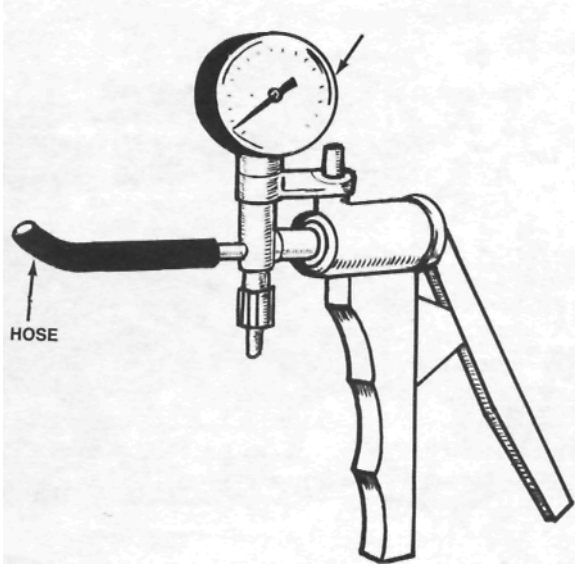
(2) Remove the fuel tank cap and check that a slight resistance is felt, when vacuum is applied to the one-way relief valve in the centre of the cap.

Renew the fuel tank cap if no resistance is felt or if the valve is blocked.

(3) Inspect the fuel tank cap seal for deterioration. Renew as necessary.



Check the fuel filler cap seal for damage.



Line drawing showing a hand vacuum pump.

(4) Remove the charcoal canister as previously described under the heading To Renew Charcoal Canister.

(5) Shake the canister, there should no audible carbon movement. If there is, renew the canister.

(6) Check the purge valve by applying 20-35 kPa of vacuum with a hand pump to the control port.

Using a piece of hose, blow through the purge hose connection. If this is not possible, renew the canister.

Remove the vacuum source and blow air through the purge hose connection. If this is possible, renew the canister.

(7) Apply 20-35 kPa air pressure into the fuel tank connector. Air should flow freely from all the other connectors.

If poor air flow through the drain tube exists, block off the fuel tank tube and blow compressed air at approximately 300 kPa through the purge port. Check the air flow and if still poor, renew the canister.

(8) Apply 20-35 kPa air pressure to any one of the canister ports except the purge valve control port and with the other ports blocked, ensure that there are no leaks from the canister. If leaks exist, renew the canister.

(9) Remove the fuel check valve as previously described under the heading To Renew Fuel Check Valve.

(10) Blow through the check valve from the side that is connected to the fuel tank hose. Considerable resistance should be felt with only a small amount of air passing through the valve. If no resistance is felt or if the valve is blocked renew the fuel check valve.

(11) Blow air through the fuel check valve from the opposite end. There should be a smooth flow of air through the valve. If the valve is blocked, renew the fuel check valve.

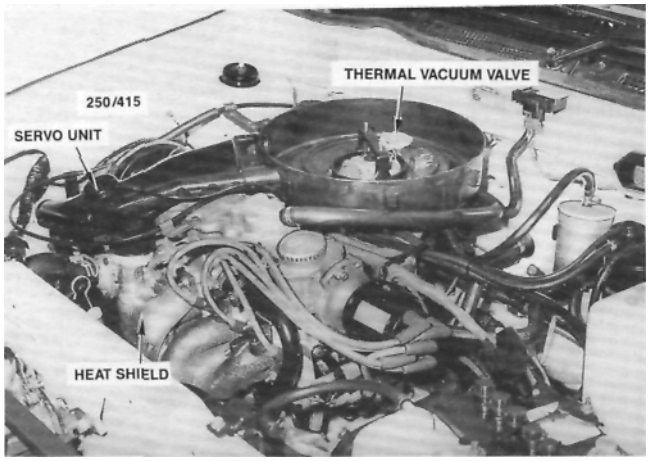
3. AIR PREHEAT SYSTEM — 1.6 LITRE ENGINE

DESCRIPTION

To reduce emissions and improve drivability when the engine is cold, hot air is drawn into the air cleaner from a heat shield which partially surrounds the exhaust manifold.

When the ambient temperature is below 30°C, the thermal vacuum valve, which is located inside the air cleaner housing, allows vacuum to operate a servo actuated flap in the air cleaner intake duct. When the flap closes, hot air is drawn from the exhaust heat shield, through the hot air inlet tube into the air cleaner intake duct.

When the ambient temperature is above 30°C, the flap in the air cleaner intake duct opens allowing cool air to enter the air cleaner.



View of the air preheat system components. 1.6 liter engine.

TO CHECK OPERATION

(1) When the engine is cold, use a mirror to check that the passage from the hot air inlet tube is closed by the flap.

(2) Start and run the engine at approximately 1 200 rpm. The hot air inlet passage should now be open, allowing hot air from the exhaust heat shield to be drawn into the air cleaner.

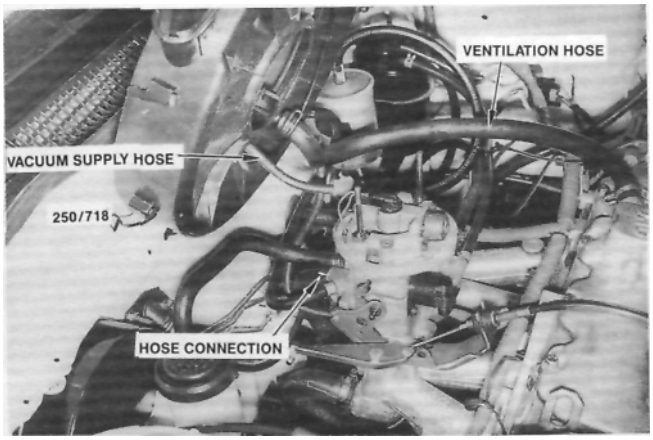
(3) Allow the engine to idle for fifteen minutes and inspect the position of the air cleaner intake flap. The flap should now be in the open position allowing cool air to be drawn into the air cleaner and shutting oft' air from the exhaust manifold heat shield.

TO CHECK COMPONENTS

(1) Disconnect the vacuum hose from the servo unit and connect a vacuum pump to the unit.

When the vacuum is applied to the servo unit, the flap in the air cleaner intake duct should close.

When the vacuum is removed, the flap should open.



View of the air cleaner raised showing the engine ventilation hose and the thermal vacuum valve supply hose connection. 1.6 liter engine.

If the flap does not operate as described, renew the air cleaner housing.

(2) Disconnect the vacuum hose from the servo unit and connect it to **a** vacuum gauge.

(3) Start and run the engine at approximately 1 200 rpm. If the engine is cold there should be vacuum.

(4) As the engine temperature increases the vacuum should decrease to zero.

If the vacuum gauge does not read as described, check that the vacuum supply hose is connected to the thermal vacuum valve and the throttle body.

If no fault is found, renew the thermal vacuum valve.

4. EXHAUST CONTROL SYSTEM

DESCRIPTION

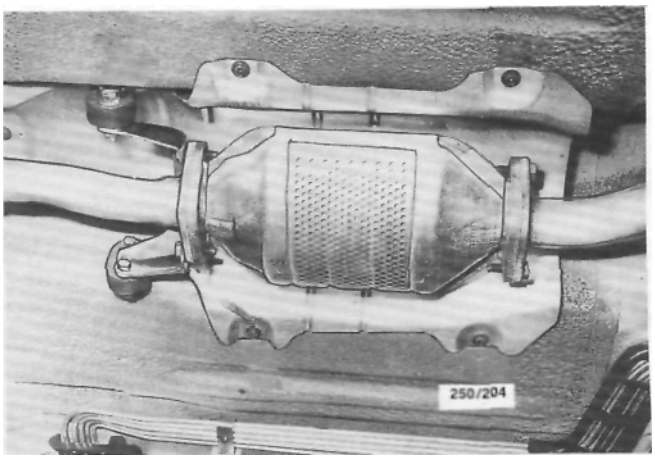
The exhaust system is the greatest source of pollutant emission from the internal combustion engine.

On the Pulsar range of vehicles covered by this manual, the exhaust control system consists of **a** catalytic converter and the engine management system. The engine management system constantly monitors the exhaust gases via an oxygen sensor located in the exhaust system. Fuel injection is then adjusted accordingly to give the minimum amount of exhaust emissions. Refer to the Fuel and Engine Management section for further information.

CATALYTIC CONVERTER

The catalytic converter, which is located in the exhaust system, converts hydrocarbons, oxides of nitrogen and carbon monoxide present in the exhaust gases into carbon dioxide, nitrogen, water and heat.

The catalytic converter does not require periodic maintenance or replacement under normal circumstances. However, it can be damaged or poisoned by excessively high exhaust gas temperatures, raw fuel and the use of leaded fuel.



Installed view of the catalytic converter.

To prevent the use of leaded fuel, a small diameter fuel filler neck with a spring loaded trap door is used.

To prevent damage to the catalytic converter, the following precautions should be observed.

(1) Do not operate the vehicle on leaded fuel.

(2) Do not push or tow start the vehicle.

(3) Do not allow the engine to idle for prolonged periods.

(4) Do not operate the vehicle if the engine is misfiring.

(5) Avoid running the vehicle out of fuel.

(6) Ensure that the engine oil is formulated to contain low phosphorous levels.

To Inspect Catalytic Converter

(1) Inspect the converter for dents and damage. If the converter is damaged, it should be renewed.

(2) Inspect the converter heat shield for damage and ensure that it is positioned correctly. Renew the converter heat shield if necessary.

To Remove and Install

To remove and install the catalytic converter, refer
to the Exhaust System heading in the Engine section.

CLUTCH

SPECIFICATIONS

Type	Single dry plate
Operation	Mechanical
Pressure plate type	Diaphragm
Release bearing type	Prelubricated ball
Driven plate:	
Outside diameter	215 mm
Rivet depth limit	0.3 mm
Runout limit	0.5 mm
Maximum spline backlash	0.7 mm
Pressure plate:	
Diaphragm spring height (installed)	30.5-32.5 mm
Spring finger variation limit	0.5 mm
Clutch pedal:	
Height	175-185 mm
Free play	12.5-17.5 mm
Release lever free play	2.5-3.5 mm
Flywheel machining limit	0.3 mm

TORQUE WRENCH SETTINGS

Pressure plate bolts	29 Nm
Pedal pivot pin nut	22 Nm
Cable locknut	4 Nm
Lower clutch housing to engine bolts	21 Nm
Centre and upper clutch housing to engine bolts	49 Nm

1. CLUTCH TROUBLE SHOOTING

CLUTCH SLIPPING

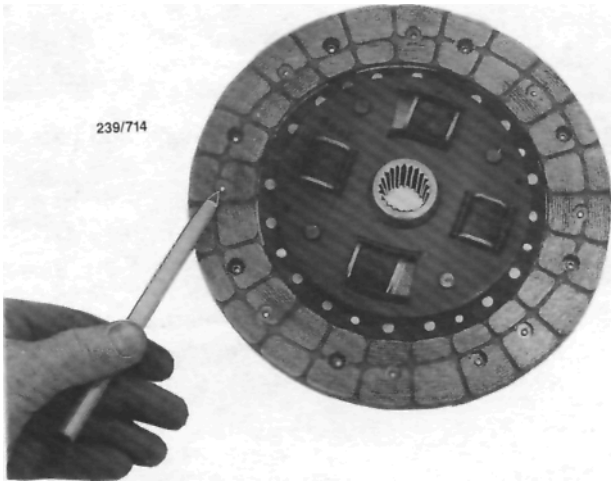
(!) Worn driven plate facing: Check and renew the clutch driven plate.

(2) Insufficient clutch pedal free play: Check and adjust the clutch pedal free play. Ensure that the release lever free play is correct.

(3) Weak or broken pressure plate diaphragm spring: Check and renew the pressure plate assembly.

(4) Worn or scored flywheel: Machine or renew the flywheel.

Worn or scored pressure plate face: Renew the pressure plate assembly.



Renew the clutch driven plate if the friction material is worn down to, or is within 0.3 mm of the rivets.

NOTE: In most cases clutch slippage is first evident by a marked increase in engine revs, for no apparent reason, when pulling up a steep hill. The clutch condition can be positively diagnosed as follows: With the handbrake firmly applied, and the rear wheels chocked, select top gear and release the clutch with the engine running at approximately 2 000 rpm. Clutch slippage is evident if the engine does not stall. Make the test as quickly as possible to prevent any further clutch damage.

CLUTCH SHUDDER

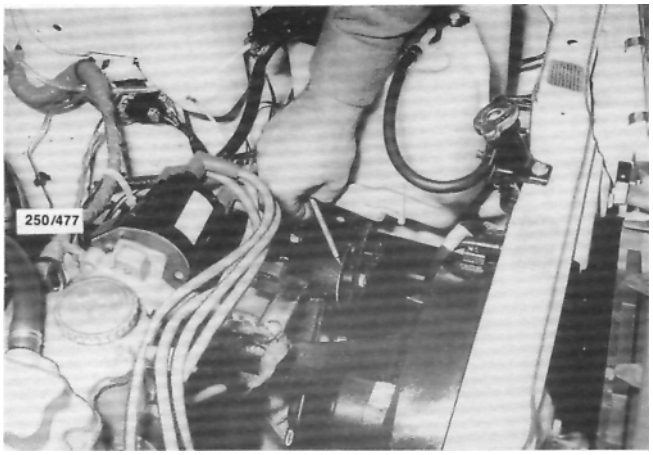
(1) Oil on the driven plate facings: Renew the clutch driven plate. Investigate and rectify the source of the oil leak.

(2) Scored pressure plate or flywheel face: Renew the pressure plate assembly or machine the flywheel.

(3) Loose or damaged driven plate hub: Check and renew the clutch driven plate.

(4) Loose driven plate facings: Renew the clutch driven plate.

(5) Cracked pressure plate face: Renew the pressure plate assembly.



Check the engine mountings for damage and deterioration.

NOTE: Clutch shudder is usually most evident when reversing up an incline. As loose or damaged engine mountings are a cause for clutch shudder, thoroughly check the engine mounting rubbers and mounting hardware for damage or looseness before removing the clutch for inspection.

CLUTCH GRAB

(1) Oil soaked driven plate facings: Renew the clutch driven plate. Investigate and rectify the source of the oil leak.

(2) Cracked pressure plate face: Renew the pressure plate assembly.

(3) Loose or broken engine mountings: Check and renew the engine mountings as necessary.

(4) Binding release mechanism: Check the operation of the release mechanism.

NOTE: Visually check the operation of the cable actuated release mechanism. Check the inner cable for fraying and jamming in the outer cable.

INSUFFICIENT CLUTCH RELEASE

(1) Stretched, frayed or broken clutch cable: Check and renew the clutch cable.

(2) Worn or damaged release mechanism: Check and renew components as necessary.

(3) Insufficient pedal height: Check and adjust the pedal height.

(4) Warped clutch driven plate: Renew the clutch driven plate.

(5) Excessive clutch release lever free play: Check and adjust the release lever free play to Specifications.

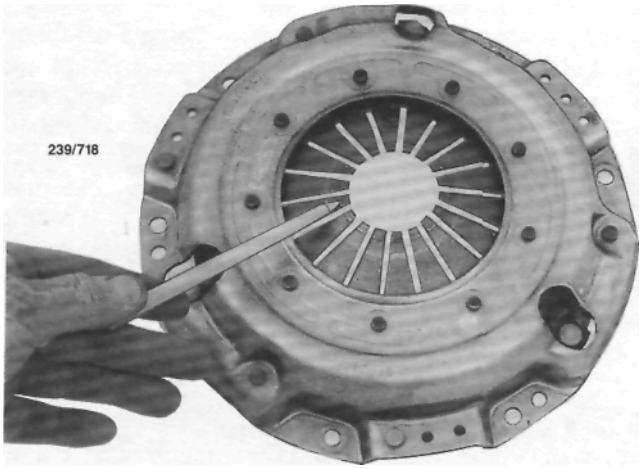
NOTE: Visually check that the clutch cable operates the release lever before removing the clutch for inspection.

RELEASE BEARING NOISE

(1) Dry or worn release bearing: Check and renew the release bearing.

(2) Damaged pressure plate diaphragm spring; Check and renew the pressure plate assembly.

NOTE: Lightly depress the clutch pedal with the engine running to check for release bearing noise. If the release bearing is faulty and has to be renewed, always check the other clutch components.



Check the diaphragm spring fingers for scoring and damage.

2. DESCRIPTION

The clutch consists of a single, dry, driven plate assembly, splined to slide on the transaxle input shaft. A diaphragm spring type pressure plate assembly is bolted to the engine flywheel.

The driven plate is sandwiched between the pressure plate and the flywheel and transmits the drive from the engine to the transaxle.

Cushion rubbers are interposed between the hub of the driven plate assembly and the plate friction surfaces in order to cushion the drive.

The release mechanism is actuated by the clutch pedal through a cable to the release lever and bearing.

Operation of the clutch pedal moves the release lever which pushes the release bearing into contact with the diaphragm spring fingers, forcing the diaphragm centre towards the flywheel. When the outer edge of the diaphragm deflects, the clutch is caused to disengage.

Clutch pedal free play is adjusted at the release lever end of the clutch cable.

Clutch pedal height is adjusted at the pedal stop on the pedal mounting bracket located under the dashboard.

3. CLUTCH UNIT AND RELEASE MECHANISM

Special Equipment Required:

To Install — Clutch aligning tool

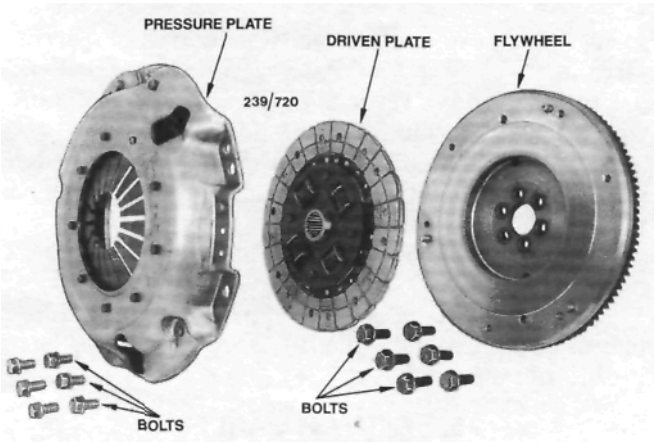
TO REMOVE

(1) Remove the transaxle from the vehicle as described in the Manual Transaxle section.

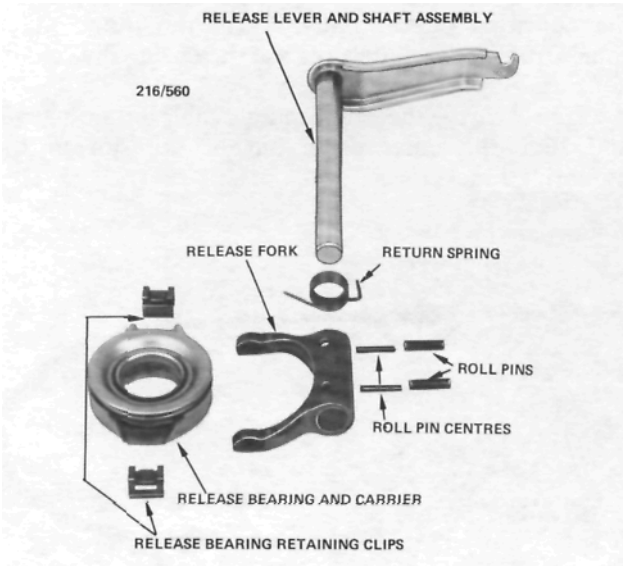
(2) Mark the pressure plate cover in relation to the flywheel to ensure installation to the original location.

(3) Progressively loosen and remove the pressure plate assembly retaining bolts working in a diagonal sequence across the assembly.

(4) Remove the pressure plate and driven plate assemblies from the flywheel. Note the installed direction of the driven plate to aid assembly.



Dismantled view of the flywheel, driven plate and clutch pressure plate.



Dismantled view of the clutch release components.

(5) Disengage the clips retaining the release bearing carrier to the release fork and slide the release bearing assembly out of the clutch housing. Note the installed position of the retaining clips to aid assembly.

(6) Align the release fork retaining pins with the slots in the clutch housing and remove the pins using a pin punch.

(7) Remove the release lever and shaft and withdraw the release fork and return spring from the clutch housing.

TO CHECK AND INSPECT

(1) Check the driven plate facings. Renew the driven plate if the facings are worn down to within 0.3 mm of the rivet heads or are gummy and oil soaked.

(2) Check the driven plate hub cushion rubbers for deterioration and damage. Renew the driven plate if the hub is damaged.

(3) Mount the driven plate on the transaxle input shaft and measure the spline backlash at the outer edge of the driven plate. Renew the driven plate if the spline backlash is beyond Specifications.

(4) Check the pressure plate assembly for wear on the diaphragm spring fingers, cracked diaphragm spring and a cracked or distorted cover. Check that the pressure plate face is not badly scored.

(5) Check the flywheel face for heat cracks, burn marks and scoring. Renew the flywheel if it is badly scored.

NOTE: Slight glazing or burn marks on the pressure plate or flywheel faces can be corrected using emery paper. Minor scoring on the flywheel face may be corrected by machining the flywheel.

(6) Rotate the release bearing by hand and check for noise or roughness. Renew the bearing and carrier as an assembly if faults are found.

(7) Check the release lever and shaft for wear and damage. Renew as necessary.

(8) Check the release shaft bushes and seal for wear or damage. Renew as necessary.

(9) Check the release fork for wear and the return spring for fatigue. Renew as necessary.

TO INSTAL

(1) Sparingly apply lithium base molybdenum disulphide grease to the transaxle input shaft splines, release bearing carrier bore and rear contact surfaces, release shaft bushes and release fork contact surfaces. Slide the driven plate onto the transaxle input shaft and remove the excess grease from the splines.

(2) Install the release shaft to the clutch housing, return spring and release fork. Install the retaining pins

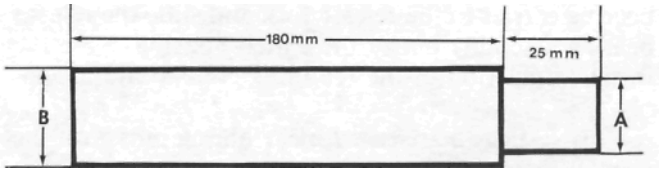


Illustration showing the clutch aligning tool. The tool can be readily fabricated from a length of round section wood or metal. Dimension A = diameter of the machined section of the crankshaft. Dimension B - inside diameter of the driven plate hub.

to the release fork ensuring that the return spring is correctly anchored.

(3) Install the release bearing to the clutch housing and install the clips retaining the release bearing carrier to the release fork.

(4) Install the driven plate to the flywheel in the direction noted on removal. Install the aligning tool to hold the driven plate in position.

NOTE: Some driven plates are marked Flywheel side to indicate the correct installed direction.

(5) Install the pressure plate to the flywheel in the position marked on removal.

(6) Ensure that the driven plate is correctly centered and install the pressure plate retaining bolts.

Tighten the bolts progressively in a diagonal sequence to the specified torque.

(7) Install the transaxle to the vehicle as described in the Manual Transaxle section.

(8) Adjust the clutch pedal height and free play as described under the Adjustments heading later in this section.

4. CLUTCH PEDAL

TO REMOVE AND INSTAL

(1) Working in the engine compartment, loosen the adjusting nut and disconnect the inner clutch cable from the clutch release lever at the clutch housing.

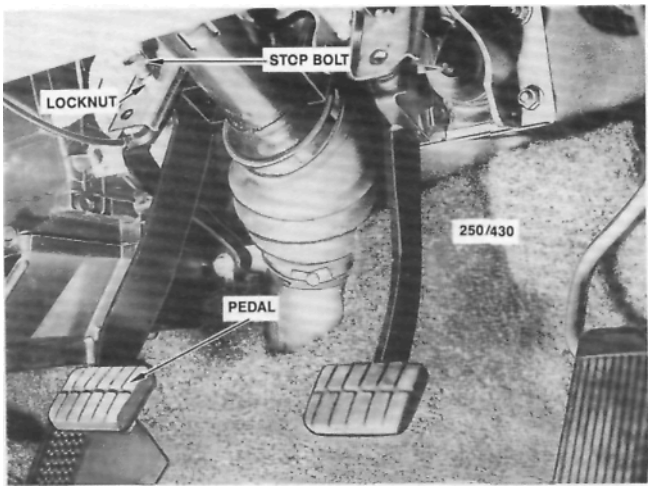
(2) Working inside the vehicle, release the inner clutch cable from the top of the clutch pedal.

(3) Remove the nut from the end of the clutch pedal pivot pin.

(4) Note the installed position of the clutch pedal return spring and remove the pivot pin from the clutch pedal.

(5) Remove the clutch pedal from the vehicle and remove the bush from the clutch pedal.

(6) Examine the clutch pedal and the bush for bend, cracks, wear and damage. Examine the return



Installed view of the clutch pedal.

spring for cracks and fatigue. Renew parts as necessary.

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

(1) Lubricate the hook on the top of the clutch pedal and the pivot pin and bush with lithium base molybdenum disulphide grease.

(2) Install the return spring to the position noted on removal.

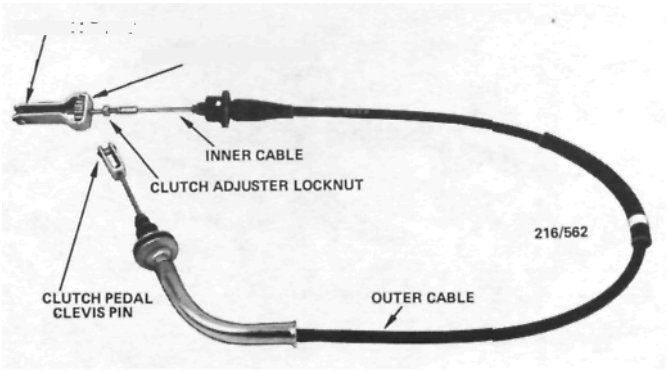
(3) If necessary, adjust the pedal height and free play as described under the Adjustments heading later in this section.

5. CLUTCH CABLE

TO REMOVE AND INSTAL

(1) Working in the engine compartment, loosen the adjusting nut and disconnect the inner clutch cable from the clutch release lever at the clutch housing.

(2) Release the outer clutch cable retaining nut and slide the outer cable out of the slot in the mounting bracket.



View of the clutch cable assembly.

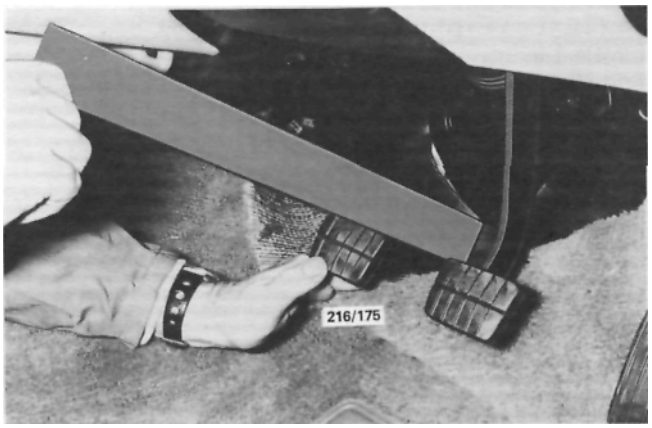
(3) Remove the nuts retaining the outer cable flange to the vehicle bulkhead.
(4) Working inside the vehicle, disconnect the inner cable from the top of the clutch pedal.
(5) Pull the clutch cable through the bulkhead into the engine compartment.
(6) Release the clip retaining the centre of the clutch cable and remove the cable from the vehicle.
(7) Check the inner cable for fraying, wear and damage. Check the outer cable for kinks, wear and damage. If necessary, renew the cable assembly.

Installation is a reversal of the removal procedure with attention to the following points:
(1) Lubricate the inner cable ends with lithium base molybdenum disulphide grease prior to installation.
(2) Tighten the nuts retaining the outer cable flange to a torque of 11 Nm.
(3) Check and if necessary, adjust the clutch pedal height and free play as described under the heading Clutch Adjustments.

6. CLUTCH ADJUSTMENTS

TO ADJUST PEDAL HEIGHT

(1) Fold back the floor carpet and the sound insulation from the drivers side floor panel.
(2) Measure the distance at right angles from the floor panel to the centre of the pedal pad.

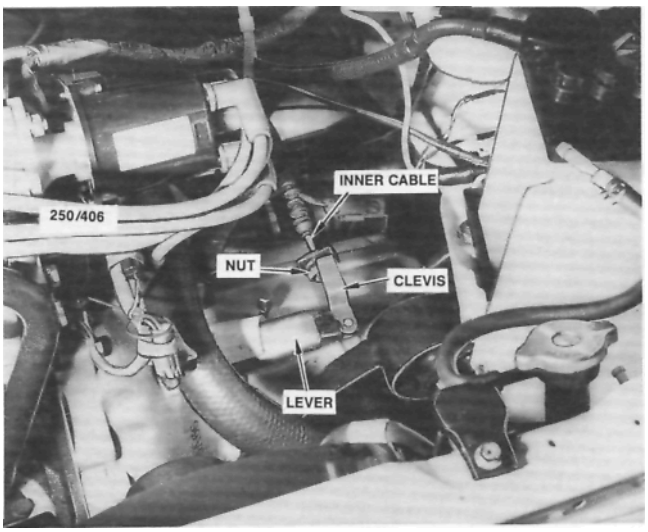


Measuring the clutch pedal height with the carpet removed.

(3) If the pedal height is not as specified, adjust the pedal stop bolt until the correct pedal height is obtained.

TO ADJUST PEDAL AND RELEASE LEVER FREE PLAY

(1) Loosen the inner cable locknut at the release lever clevis.
(2) Push the release lever until resistance is felt when the release bearing contacts the pressure plate fingers and hold the release lever in this position.
(3) Tighten the inner cable adjusting nut until the inner cable is taut.
(4) Loosen the adjusting nut 2.5-3.5 turns and tighten the inner cable locknut.
(5) Measure the release lever free play. If the free play is not as specified, loosen the locknut and turn the adjusting nut until the correct free play is obtained.



View of the clutch release lever free play adjusting nut.

(6) Lightly depress the clutch pedal until resistance is felt when the release bearing contacts the pressure plate fingers. Measure the distance from the centre of the pedal pad in this position to the centre of the pedal pad when the pedal is contacting the stop bolt. If necessary, check and adjust the release lever free play which should bring the pedal free play within Specifications.

MANUAL TRANSAXLE AND DRIVE SHAFTS

SPECIFICATIONS

TRANSAXLE

Type .....Five speed, synchromesh on all forward gears
Model RS5F31A
Gear ratios:
1.6 liter -
First 3.333:1
Second..... 1.955:1
Third..... 1.286:1
Fourth..... 0.975:1
Fifth..... 0.810:1
Reverse 3.417:1
1.8 liter -
First 3.063:1
Second..... 1.826:1
Third..... 1.286:1
Fourth..... 0.975:1
Fifth..... 0.810:1
Reverse 3.417:1
Gear end float:
Fifth.....0.18-0.41 mm
Second, third and fourth.....0.20-0.40 mm
First .....0.18-0.31 mm
Synchro ring to gear clearance:
Standard .....1.0-1.3 mm
Minimum ..... 0.7 mm
Turning torque (new bearings):
Differential assembly .....3.9-7.8 Nm
Total differential and mainshaft __ 5.9-13.7 Nm
Differential and final drive:
Type .....Helical ring gear and pinion
Ratio..... 4.167:1
Lubricant:
Grade..... 80W-90 GL-4
Capacity .....2.7 liters

DRIVE SHAFTS

C.V. joint lubrication:
Lubricant..... Valvoline Special Moly EP grease
Amount ..... 40 grams

TORQUE WRENCH SETTINGS

Transaxle case retaining bolts ..... .21 Nm
Cover plate to transaxle case .....8.3 Nm
Input shaft bearing retainer bolts..... 21 Nm
Control bracket bolts .....8.3 Nm
Reverse check plug..... 25 Nm
Ring gear to differential case..... 88 Nm
Filler and drain plugs..... 34 Nm
Reverse lamps switch ..... 29 Nm
Upper and centre clutch housing to engine…..49 Nm
Lower clutch housing to engine ..... 21 Nm

1. MANUAL TRANSAXLE AND DRIVE SHAFT TROUBLE SHOOTING

DIFFICULT GEAR CHANGE

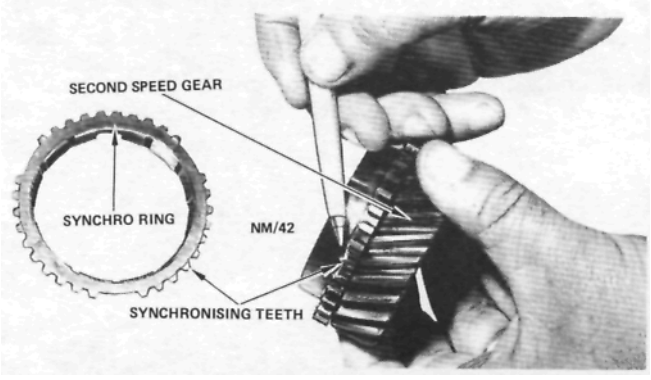
(1) Faulty clutch or clutch release mechanism: Check and adjust or overhaul the clutch or the clutch release mechanism.

(2) Loose control bracket retaining bolts: Dismantle the transaxle and tighten the control bracket retaining bolts. Apply Loctite or an equivalent to the bolt threads to prevent a repeat of the problem.

(3) Faulty gear lever assembly: Check and renew
or repair the gear lever assembly.

(4) Bent or worn gear lever control rod: Repair or renew the faulty components.

(5) Worn transaxle selector mechanism: Overhaul the transaxle assembly. Renew components as necessary.



Check the synchronizing teeth on the gears and synchro rings for chipping or wear.

(6) Lubricating oil too thick: Drain the transaxle and refill with the correct amount and grade of lubricating oil.

(7) Excessive end float in the mainshaft or input shaft gears: Overhaul the transaxle.

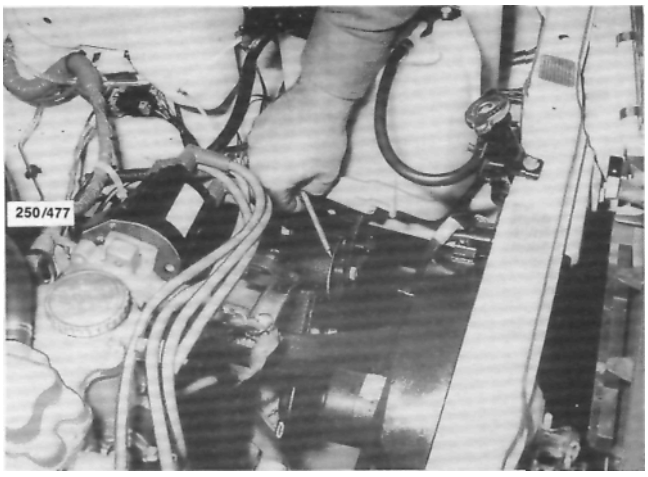
NOTE: Check the clutch for correct operation. If reverse gear can be selected without any gear clash this is a good indication that the clutch is operating normally. Also check that the correct type and grade of lubricating oil is being used.

SLIPPING OUT OF GEAR

(1) Worn gear control rod assembly bushes: Check and renew the worn components as necessary.

(2) Faulty gear lever assembly: Check and renew the faulty components.

(3) Faulty synchroniser mechanism: Overhaul the transaxle.



Check the engine mountings for damage and deterioration.

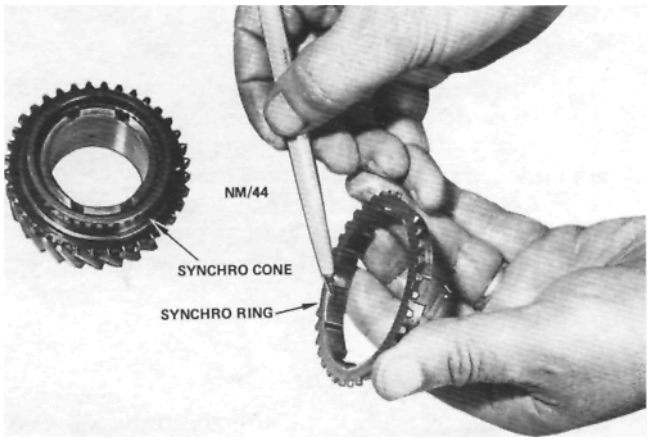
(4) Worn or fatigued detent components: Renew the faulty components as necessary.

(5) Excessive end float in the mainshaft or input shaft: Overhaul the transaxle. Check and renew the faulty components.

NOTE: In most cases, slipping out of gear is caused by wear or damage to internal components of (he transaxle. However, prior to removing and dismantling the ***transaxle*** *assembly, check the engine mounting rubbers and mounting hardware as vibrations caused by loose or deteriorated engine mountings can cause the transaxle to slip out of gear.*

GEARS CLASH ON CHANGING DOWN

(1) Faulty clutch or clutch release mechanism: Check, adjust or overhaul the clutch or the clutch release mechanism.



Check the friction surface of the synchro rings and cones for wear or damage.

(2) Faulty synchro rings or cones: Overhaul the transaxle assembly.

(3) Lubricating oil too thick: Drain the transaxle and refill with the correct grade and quantity of lubricating oil.

(4) Broken, weak or incorrect positioning of the springs in the synchro assemblies: Overhaul the transaxle assembly.

(5) Excessive end float in the mainshaft or input shaft gears: Overhaul the transaxle assembly.

NOTE: Check the clutch as previously described prior to removing and dismantling the transaxle. Also check that the correct grade of transaxle oil is being used.

TRANSAXLE NOISE (IN NEUTRAL)

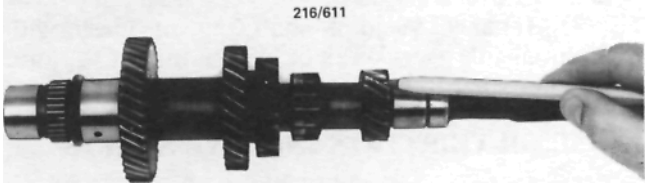
(1) Insufficient lubricant: Fill the transaxle with the correct quantity and grade of lubricant.

(2) Worn input shaft bearings: Overhaul the transaxle and renew the bearings.

(3) Chipped or pitted constant mesh gears: Overhaul the transaxle and renew the damaged components as necessary.

(4) Worn mainshaft bearings: Overhaul the transaxle as necessary.

NOTE: First check the oil level in the transaxle. To isolate the noise in neutral, run the engine, depress the clutch and engage any gear. If the noise ceases with the clutch depressed it indicates that the noise is in the transaxle.



Check the input shaft for damaged gears.

TRANSAXLE NOISE (FORWARD GEARS ENGAGED, VEHICLE MOVING)

(1) Insufficient lubricant: Fill the transaxle with the correct grade and quantity of oil.
(2) Worn input shaft or mainshaft bearings: Overhaul the transaxle and renew the faulty bearings.
(3) Chipped or pitted gears: Check and overhaul the transaxle and renew the faulty gears.
(4) Damaged or worn synchroniser assemblies: Overhaul the transaxle and renew the synchroniser assemblies.

FINAL DRIVE GEAR NOISE

(1) Insufficient lubricant: Fill the transaxle case with the correct grade and quantity of oil.
(2) Chipped or pitted final drive gear and/or ring gear: Overhaul the transaxle and renew components as necessary.
(3) Worn differential carrier bearings: Overhaul the differential assembly.
(4) Worn mainshaft or input shaft bearings: Overhaul the transaxle.

NOTE: Check the oil level in the transaxle case and the condition of the front hub bearings and drive shaft joints prior to overhauling the transaxle.

EXCESSIVE BACKLASH IN FINAL DRIVE

(1) Excessive end float in the differential carrier bearings due to worn or incorrect bearing preload adjustment: Check and adjust the bearing preload or renew the bearings.
(2) Ring gear to differential case bolts loose: Overhaul the transaxle and tighten the bolts to the specified torque.
(3) Excessive wear in the final drive gear: Check and overhaul the transaxle.
(4) Excessive wear in the differential pinions, side gears or pinion shaft: Overhaul the differential assembly.

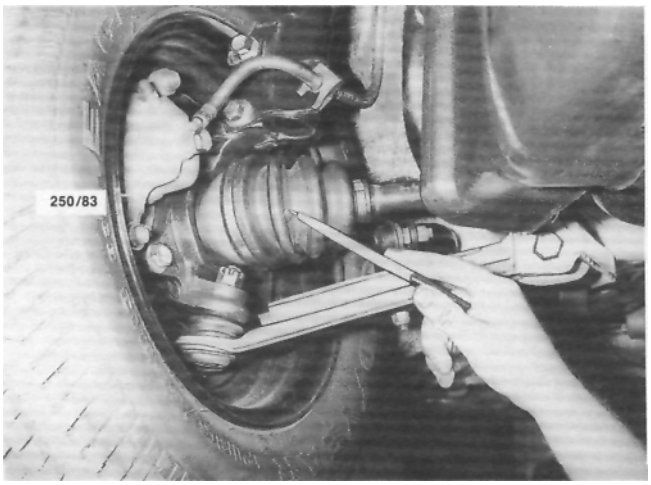
NOTE: Prior to overhauling the differential, check the serviceability of the C.V joints on the drive shafts.

NO DRIVE IN ANY GEAR

(1) Sheared ring gear to differential case bolts: Overhaul the differential assembly.
(2) Broken drive shaft: Check and renew components as necessary.
(3) Inner C.V. joint shaft out of mesh with differential side gear: Weak or broken inner C.V. joint shaft snap ring. Renew as necessary.

NOISE OR VIBRATION IN DRIVE SHAFTS

(1) Bent or twisted drive shafts: Check and renew the drive shafts as necessary.



Check the drive shaft rubber boots for deterioration.

(2) Worn or damaged inner or outer C.V. joint: Check and renew components as necessary.
(3) Lack of lubricant due to damaged C.V. joint boots: Check the C.V. joints for wear, repack the C. V. joints and renew the C.V. joint boot.
(4) Loose drive shaft hub nut: Tighten the hub nut to Specifications.
(5) Worn splines on the drive shaft or C.V. joint inner race. Check and renew the faulty components or drive shaft as an assembly.

NOTE: Noise or vibration in the front end can also be caused by excessive tire or wheel unbalance.

2. DESCRIPTION

The five speed transaxle installed in the Pulsar range of vehicles covered by this manual has synchromesh on all the forward gears.

The reverse gear is a spur idler gear which is selected by sliding the idler gear into mesh with the input shaft and the mainshaft.

The transaxle and differential assemblies are accommodated in the same housing and the one oil level check covers both assemblies.

Gear selection is by means of selector forks and a striking rod which is operated by a floor mounted gear lever assembly. A mechanism inside the transaxle prevents the selection of reverse gear from fifth gear until the gear lever is moved sideways in neutral. The differential and final drive assembly runs on two tapered roller bearings. Preload on these bearings is adjusted by shims installed behind the bearing cups. The assembly is driven by the mainshaft pinion engaging the ring gear on the differential case.

The drive shafts are engaged with the differential side gears at the inner end and the front wheel hubs at the outer end.

The drive shafts and each C.V. joint can be

renewed as individual units. The C.V. joints are lubricated in manufacture and need no attention in service unless one of the rubber boots is damaged. In this case the joint can be cleaned and repacked with the recommended grease and a new boot installed.

From July 1989, Pulsar Q and Vector SSS manual transaxle models are equipped with a limited slip differential incorporating a viscous coupling. The coupling is not repairable and must be renewed as an assembly if unserviceable. A test procedure for the viscous coupling is included in the text in this section.

3. TRANSAXLE ASSEMBLY

Special Equipment Required:

To Dismantle and Assemble — Puller set, press and press plates, dial gauge
To Measure Mainshaft Turning Torque — Suitable slotted adaptor and torque gauge

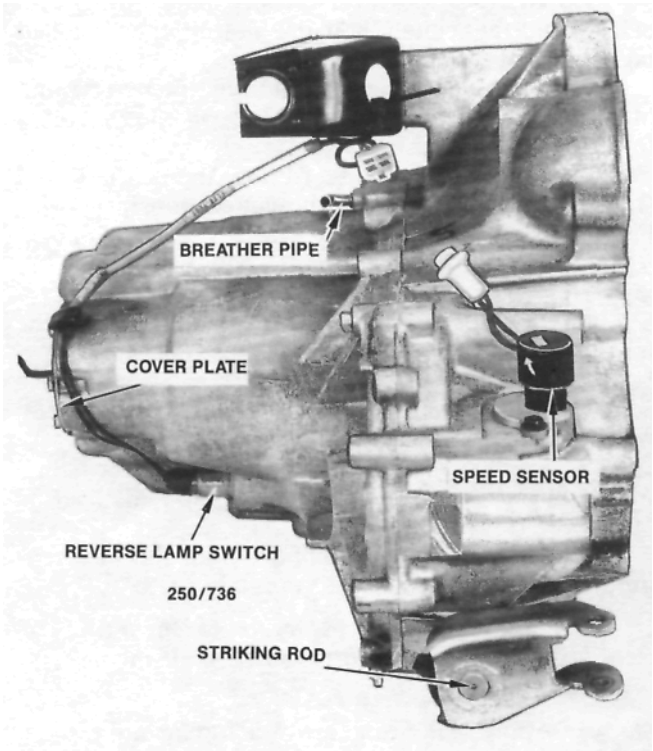
TO REMOVE AND INSTAL

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

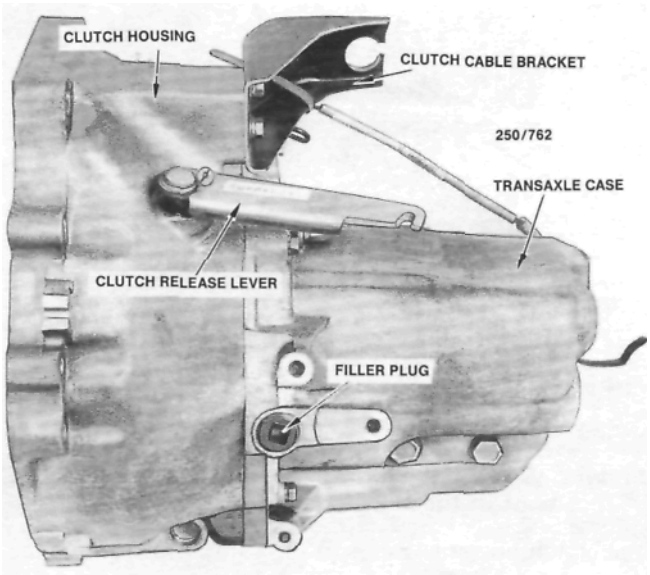
(2) Remove the battery as described in the Electrical System section.

(3) Remove the drive shafts as described later in this section.

(4) Disconnect and remove the starter motor as described in the Electrical System section.



Rear view of the transaxle removed from the vehicle.



Front view of the transaxle removed from the vehicle.

(5) Support the rear of the engine using a jack with a piece of timber between the jack head and the engine sump.

(6) Remove the bolts retaining the clutch housing to the engine.

(7) Disconnect the vehicle speed sensor wiring, the reverse lamp wiring, the gear lever control rod and the gear lever support rod from the transaxle.

(8) Remove the transaxle mounting through bolt and remove the bolts retaining the mounting bracket to the transaxle.

(9) With the left hand front wheel removed, remove the left hand inner mudguard panel.

(10) Maneuver the transaxle away from the engine. Lower and withdraw the transaxle from under the vehicle.

NOTE: Do not allow the transaxle to hang on the clutch driven plate during removal. Support the transaxle on a trolley jack if necessary.

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

(1) Lubricate the input shaft splines sparingly with lithium base molybdenum disulphide grease.

(2) Support the transaxle during installation. Do not allow the transaxle to hang on the clutch driven plate.

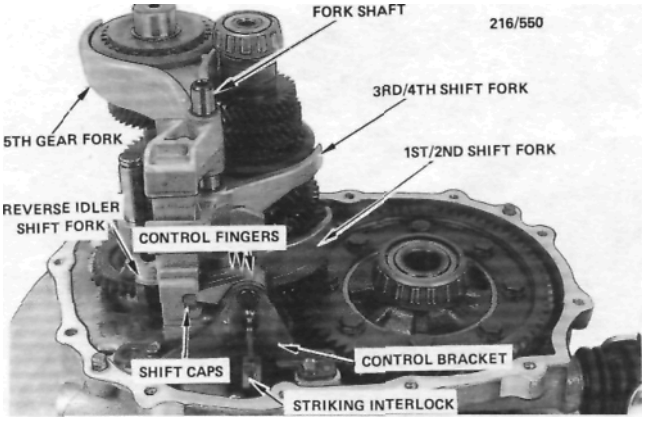
(3) Tighten all bolts to the specified torque.

(4) Fill the transaxle with the specified quantity and grade of oil.

(5) Road test the vehicle and check for correct transaxle operation. Also check for transaxle oil leaks and rectify as necessary.

TO DISMANTLE

(1) Remove the clutch release components from



Internal view of the transaxle showing the installed positions of the shift forks and control bracket.

the clutch housing. Refer to the Clutch section for the correct procedure.

(2) Thoroughly clean the outside of the transaxle assembly using solvent and compressed air.

(3) Remove the bolts retaining the transaxle case to the clutch housing and using a soft faced hammer, tap the transaxle case to separate the mating surfaces.

(4) Carefully lift the transaxle case from the clutch housing. Tilt the case to provide clearance for the fifth gear shift fork.

(5) Withdraw the spacer from the reverse idler shaft and withdraw the fork shaft and spring from the transaxle.

(6) Remove the fifth and third/fourth shift forks taking care not to lose the shift cap.

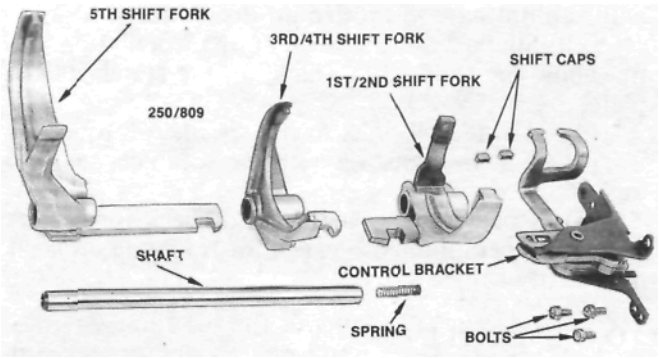
(7) Remove the retaining bolts and remove the control bracket and the first/second shift fork taking care not to lose the shift cap.

(8) Lift the mainshaft out of the clutch housing.

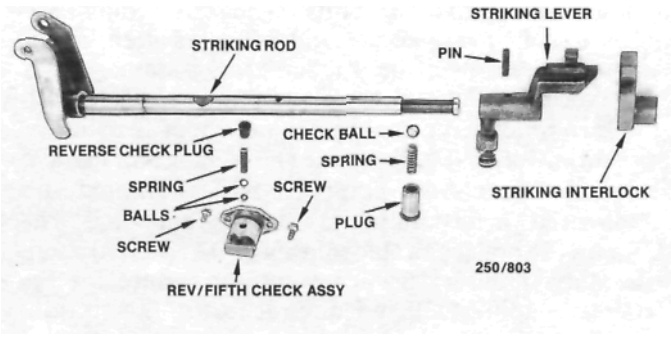
NOTE: When lifting, do not tilt the mainshaft as the resin oil channel behind the front mainshaft bearing could be damaged.

(9) Lift the differential assembly out of the clutch housing.

NOTE: For information on the overhaul of the differential assembly refer to the Differential and Final Drive Assembly heading.



Dismantled view of the shift fork components.



Dismantled view of the striking rod components.

(10) Remove the retaining bolts from the input shaft front bearing retainer.

(11) Position the transaxle assembly on its side and tap the input shaft out of the clutch housing using a soft faced hammer. Remove the input shaft, bearing retainer and reverse idler gear from the clutch housing.

(12) Remove the shift check ball, plug and spring from the passage adjacent to the upper control bracket retaining bolt on the clutch housing.

(13) Position the striking lever so that the retaining pin will not contact the clutch housing and remove the pin using a suitable punch.

(14) Remove the striking rod, striking lever and striking interlock from the clutch housing.

(15) Remove the reverse check plug, spring and balls from the clutch housing noting the installed position of the small check ball.

(16) Remove the screws retaining the reverse and fifth gear check assembly and remove the assembly from the clutch housing.

(17) Remove and discard the input shaft and striking rod oil seals from the clutch housing noting the installed direction of the seals.

(18) Renew the rear input shaft bearing as follows:

(a) Remove the plastic oil channel from the transaxle case.

(b) Using a suitable punch through the hole adjacent to the rear input shaft bearing, tap the small welch plug out of the transaxle case.

(c) Using a suitable punch through the small welch plug opening, tap the rear input shaft bearing out of the transaxle case.

(d) Using a suitable mandrel, tap the new rear input shaft bearing into the transaxle case.

NOTE: It may be necessary to use a hydraulic press if the bearing is a tight fit in the housing.

(e) Apply sealer to a new welch plug and tap the plug squarely into the transaxle case until the edge of the plug is level with the case.

(19) Renew the rear mainshaft bearing outer race as follows:

(a) Remove the bolts retaining the rear cover to the transaxle case.

(b) Remove the rear cover. O ring, spacer and adjusting shim from the transaxle case. Discard the O ring.

(c) Using a suitable punch, tap the bearing outer race out of the transaxle case.

(e) Install the adjusting shim, spacer and a new O ring to the transaxle case. Install the rear cover and tighten the retaining bolts securely.

(20) Renew the front mainshaft bearing outer race as follows:

(a) Using a suitable puller, pull the outer race out of the clutch housing.

(b) Ensure that the oil groove in the resin oil channel is facing the oil pocket in the clutch housing.

(c) Install the new outer race to the clutch housing.

(21) Measure the end float of the input shaft fifth gear using feeler gauges between the fifth gear and the adjacent gear shoulder. Note the measurement for later reference.

(22) Dismantle the input shaft as follows:

(a) Remove the snap ring and spacer from the front of the input shaft.

(b) Using a suitable puller, remove the bearing from the front of the input shaft. Remove the bearing retainer noting the installed direction.

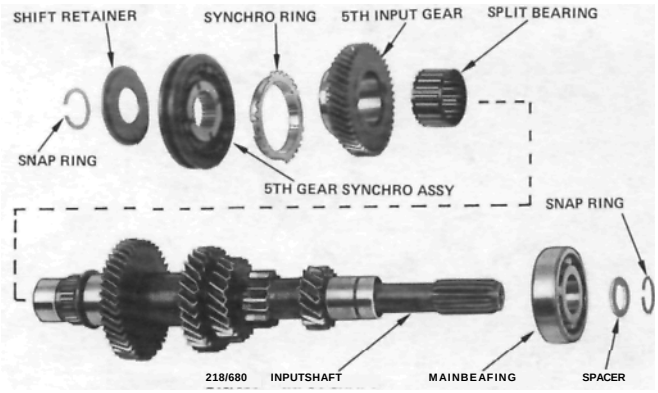
(c) Remove the snap ring from the rear of the input shaft.

(d) Remove the shift retainer, fifth gear synchro assembly, fifth gear and the split bearing from the rear of the input shaft.

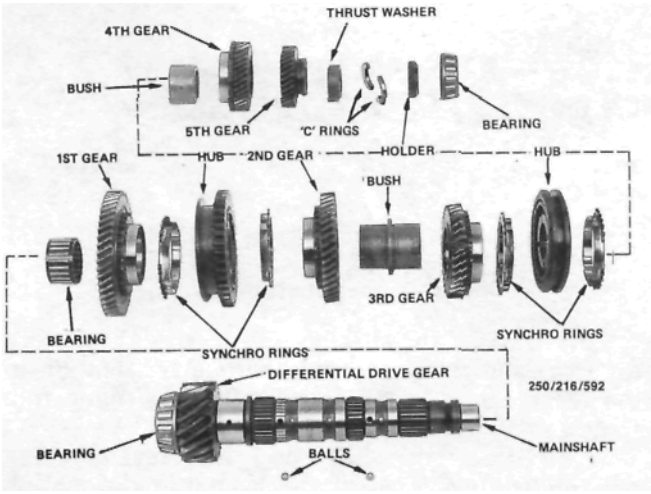
(23) Measure the end float of the mainshaft first, second, third and fourth gears using feeler gauges between the gear and the adjacent shaft shoulder. Note the measurements for later reference.

(24) Dismantle the mainshaft as follows:

(a) Remove the front and rear bearing cones using a suitable puller.



Dismantled view of the input shaft.



Dismantled view of the mainshaft.

(b) Remove the C ring holder, the C rings and the thrust washer from the rear of the mainshaft.

(c) Using a puller positioned on the fifth gear rear flange, remove the fifth gear from the mainshaft.

(d) Remove the fourth gear, bush and steel ball from the mainshaft.

(e) Remove the third/fourth synchro assembly, using a suitable puller if necessary.

(f) Remove the third gear, bush, steel ball and second gear from the mainshaft.

(g) Remove the first/second synchro assembly, using a suitable puller if necessary.

(h) Remove first gear and the needle roller bearing from the mainshaft.

(25) Suitably mark the assembled positions of the synchro assemblies components and remove the springs from the assemblies.

(26) Slide the sleeves off the hubs and remove the shift plates.

(27) Arrange the various synchro components separately to avoid mixing the components on assembly.

TO CLEAN AND INSPECT

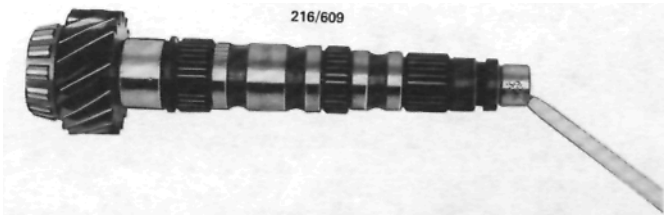
(1) Clean all the components in cleaning solvent and allow to dry.

(2) Inspect the teeth on all the gears for wear, pitting and damage.

(3) Push each synchro ring onto its respective gear cone and measure the distance between the synchro ring and the synchro teeth on the gear. Renew the synchro ring and/or the gear if the distance is less than 0.7 mm.

(4) Inspect the shift forks for excessive clearance in the synchro sleeves and the control fingers. Renew the forks as necessary if the clearance is excessive.

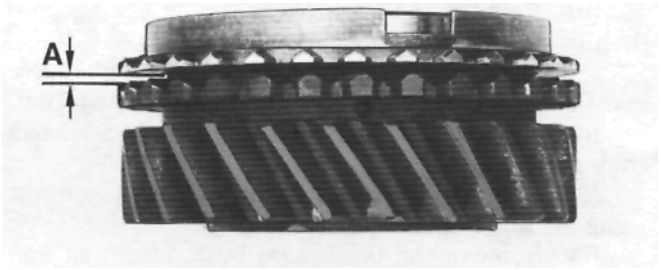
(5) Inspect the components of the control bracket for wear and damage. Inspect the shift caps for wear. Renew the control bracket and/or the shift caps as necessary.



Check the mainshaft for pitting.

(6) Inspect the striking rod, lever and interlock for wear and damage paying particular attention to the detent grooves in the end of the striking rod. Renew parts as necessary.

(7) Inspect the shift check and reverse check balls and springs for wear, cracks and loss of tension in the springs. Renew parts as necessary.



Check clearance A between the synchro ring and the gear synchro teeth and compare with Specifications.

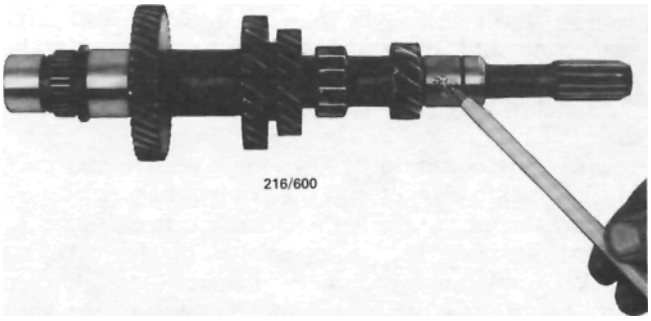
(8) Inspect the reverse and fifth gear check assembly for wear, damage and loss of spring tension. Renew the assembly as necessary.

(9) Inspect all the bearings for pitting, wear and damage. Renew the bearings as necessary.

NOTE: If the transaxle has seen considerable service, it is advisable to renew all the bearings, oil seals, O rings and snap rings during the overhaul.

(10) Inspect the various synchro components for wear and damage paying particular attention to the shift plates and springs and the internal teeth of the synchro sleeves. Renew parts as necessary.

(11) Compare the various gear end floats measured during dismantling with the Specifications and if the end floats are excessive, check the contact surfaces of the gears, shaft and synchro hubs. Renew worn parts as necessary.



Check the friction surfaces of the input shaft for pitting.

TO ASSEMBLE

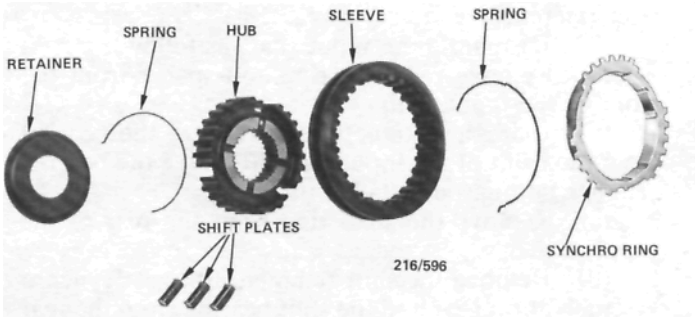
(1) Lubricate all the components with the specified gear oil prior to assembly.

(2) Install new input shaft and striking rod oil seals to the clutch housing in the direction noted on removal. Lubricate the oil seal lips with multipurpose grease prior to installation.

(3) Assemble the components of the fifth gear synchro assembly aligning the marks made on dismantling. Ensure that the ends of the shift plate springs are not aligned.

(4) Install the split bearing to the rear of the input shaft and install the fifth gear.

(5) Install the fifth gear synchro assembly and the shift retainer to the rear of the input shaft. Ensure that the slots in the synchro ring are aligned with the shift plates.



Dismantled view of the fifth gear synchro assembly.

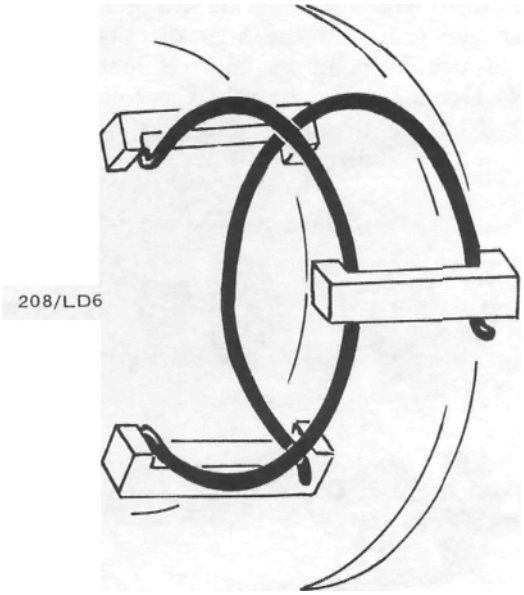
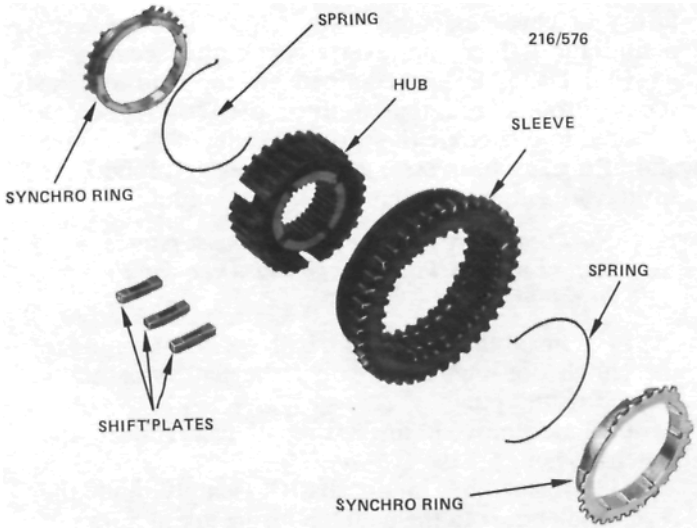


Illustration showing the correct positioning of the shift plates and springs.



Dismantled view of the 1st/2nd gear synchro assembly.

(6) Select a snap ring to obtain the minimum clearance in the input shaft groove and install the snap ring to the rear of the input shaft.

NOTE: The maximum allowable clearance is O.I mm. Snap rings are available from 2.00 mm to 2.30 mm in increments of .05 mm.

(7) Ensure that the fifth gear end float is within the specifications.

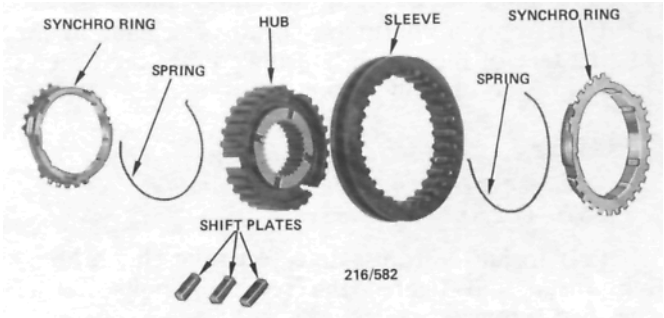
(8) Install the bearing retainer to the front of the input shaft in the direction noted on removal.

(9) Install the front bearing and spacer to the input shaft.

(10) Select a snap ring to obtain the minimum clearance in the input shaft groove and install the snap ring to the front of the input shaft.

NOTE: The maximum allowable clearance is 0.1 mm. Snap rings are available from 1.27 mm to 1.45 mm in increments of .06 mm.

(11) Assemble the components of the first/second and third/fourth synchro assemblies aligning



Dismantled view of the 3rd/4th gear synchro assembly.

the marks made on dismantling. Ensure that the ends of the shift plate springs are not aligned.

(12) Install the needle roller bearing and first gear to the mainshaft.

(13) Install the first/second synchro assembly to the mainshaft. Ensure that the slots in the synchro ring are aligned with the shift plates.

(14) Install the steel ball to the mainshaft using grease to retain the ball.

(15) Install second gear to the mainshaft and install the bush aligning the groove in the bush with the steel ball.

(16) Install third gear to the mainshaft.

(17) Install the third/fourth synchro assembly to the mainshaft ensuring that the slots in the synchro ring are aligned with the shift plates.

(18) Install the other steel ball to the mainshaft using grease to retain the ball.

(19) Install the fourth gear bush to the mainshaft aligning the groove in the bush with the ball.

(20) Install the fourth gear to the mainshaft.

(21) Install the fifth gear to the mainshaft.

(22) Install the thrust washer to the mainshaft.

(23) Select C rings to obtain the minimum clearance in the mainshaft grooves and install the C rings to the mainshaft groove. Install the C ring holder to the mainshaft.

NOTE: The maximum allowable clearance is 0.1 mm. C rings are available in thicknesses of 3.63 mm to 4.54 mm in increments of 0.07 mm.

(24) Install the rear and front bearing cones to the mainshaft using a press and press plates.

(25) Ensure that the mainshaft first, second, third and fourth gear end floats are within the Specifications.

(26) Temporarily install the differential assembly to the clutch housing.

(27) Install the transaxle case to the clutch housing.

(28) Tighten the transaxle case retaining bolts to the specified torque.

(29) Install a suitable slotted adaptor into the differential pinion shaft and, using a torque gauge, measure the differential turning torque. The turning torque should be in a range from slightly below 3.9 Nm to 7.9 Nm.

If the turning torque is not as specified, proceed to the Differential and Final Drive heading and perform operations (22) to (29).

If the turning torque is as specified, proceed as follows:

(30) Remove the transaxle case and install the mainshaft to the clutch housing ensuring that the resin oil channel is located centrally in the end of the mainshaft.

(31) Install the transaxle case to the clutch housing.

(32) Install and tighten the retaining bolts to the specified torque.

(33) Repeat operation (29). The total turning torque should be 5.9-13.7 Nm if new bearings have been installed or slightly less if the original bearings have been installed.

If the turning torque is not as specified, adjust the mainshaft turning torque as follows:

(a) Remove the transaxle case rear cover, O ring, spacer and adjusting shim from the transaxle case.

(b) Ensure that the mainshaft rear bearing outer race is fully seated on the bearing cone.

(c) Using micrometer depth gauge, measure the distance from the transaxle case to the bearing outer race and note the reading.

(d) Referring to the following table, select the appropriate shim, according to the reading noted in operation (c), required to correct the mainshaft turning torque.

READING	SHIM
2.35-2.40 mm	0.10 mm
2.40-2.45 mm	0.15 mm
2.45-2.50 mm	0.20 mm
2.50-2.55 mm	0.25 mm
2.55-2.60 mm	0.30 mm
2.60-2.65 mm	0.35 mm
2.65-2.70 mm	0.40 mm
2.70-2.75 mm	0.45 mm
2.75-2.80 mm	0.50 mm
2.80-2.85 mm	0.55 mm
2.85-2.90 mm	0.60 mm
2.90-2.95 mm	0.65 mm
2.95-3.00 mm	0.70 mm
3.00-3.05 mm	0.75 mm
3.05-3.10 mm	0.80 mm
3.10-3.15 mm	0.85 mm
3.15-3.20 mm	0.90 mm
3.20-3.25 mm	0.95 mm
3.25-3.30 mm	1.00 mm.

(e) Install the spacer, shim, O ring and rear cover to the transaxle case. Tighten the retaining bolts securely.

(34) Measure the total turning torque as previously described.

(35) Install the striking interlock and striking lever to the clutch housing.

(36) Install the striking rod to the clutch housing sliding the rod through the lever and interlock. Take care that the end of the rod does not damage the seal.

(37) Install a new retaining pin to the striking rod using a pin punch.

(38) Install the reverse and fifth gear check assembly to the clutch housing. Tighten the retaining screws securely.

(39) Install the balls, spring and reverse check plug to the clutch housing ensuring that the smaller diameter ball enters the hole in the body of the reverse and fifth gear check assembly body. Apply locking compound and tighten the reverse check plug securely.

(40) Using a bar clamped to the end of the striking rod, check that a force of 4.9-7.4 Nm is required to overcome the spring loading of the reverse and fifth gear check assembly. If necessary, renew the springs to achieve this correct spring loading.

NOTE: Ensure that the reverse check plug is coated with locking compound when finally installed.

(41) Install the shift check ball, spring and plug to the clutch housing. Ensure that the ball is centrally located in the plug.

(42) If removed, install the oil reservoir to the clutch housing.

(43) Install the input shaft assembly and the reverse idler gear to the clutch housing taking care not to damage the seal.

(44) Apply locking compound to the bearing retainer bolts and tighten the bolts to the specified torque.

(45) Install the spacer to the reverse idler shaft.

(46) Install the differential assembly to the clutch housing.

(47) Install the mainshaft to the clutch housing ensuring that the resin oil channel is located centrally in the end of the mainshaft.

(48) Install the shift cap to the slot in the first/second shift fork and install the shift fork and control bracket to the clutch housing. Use grease to hold the shift cap in the shift fork slot. Ensure that the reverse idler shift fork is correctly located over the gear.

(49) Apply locking compound to the threads of the control bracket retaining bolts and tighten the bolts to the specified torque.

(50) Install the shift cap in the slot in the third/fourth shift fork and install the fork to the transaxle assembly. Use grease to hold the shift cap in the shift fork slot.

(51) Install the fifth gear shift fork to the transaxle ensuring that the shift fork slot engages the control finger.

(52) Install the fork shaft and spring to the clutch housing sliding the shaft through the shift forks. Use grease to hold the spring in the end of the shaft.

(53) Apply a continuous bead of sealant to the mating face of the clutch housing so that the bead is located inside the row of bolt holes.

NOTE: Sealant is available from Nissan spare parts using the part number KP 610-00250.

(54) Install the transaxle case to the clutch housing. Install and tighten the retaining bolts to the specified torque.

(55) Select each gear in turn and check that the transaxle turns freely in each gear. Ensure that it is not

possible to move the striking rod from fifth gear to reverse without first moving sideways in the neutral gate.

4. DIFFERENTIAL AND FINAL DRIVE ASSEMBLY

Special Equipment Required:
To Measure Differential Turning Torque — Suitable slotted adaptor and torque gauge

TO CHECK VISCOUS COUPLING

From July 1989, Manual transaxle Pulsar Q and Vector SSS models are equipped with a limited slip differential incorporating a viscous coupling.

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

(2) Rotate one front wheel and check the rotational direction of the opposite wheel.

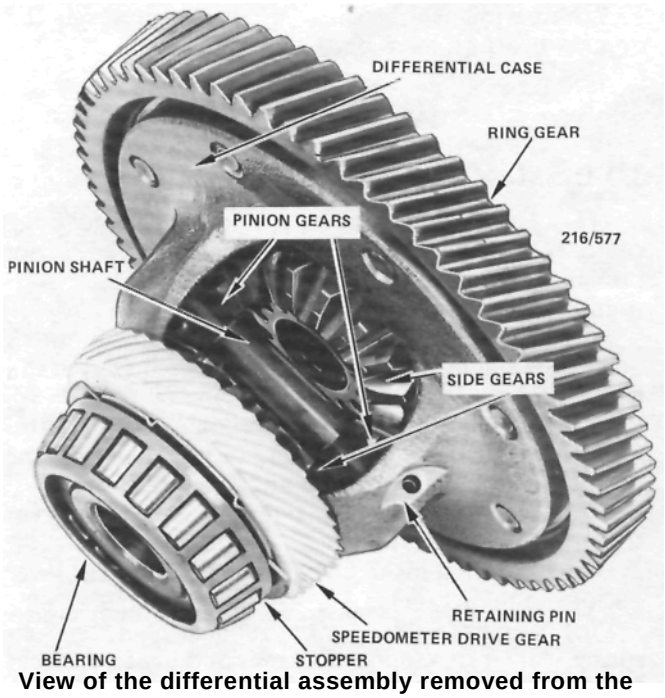
(3) If both front wheels rotate in the same direction, the viscous coupling is functioning normally.

(4) If the front wheels rotate in opposite directions, the viscous coupling is unserviceable and must be renewed as an assembly.

TO DISMANTLE AND ASSEMBLE

It is necessary to remove and dismantle the transaxle assembly to gain access to the differential and final drive assembly.

Refer to the Transaxle Assembly heading for the removal of the transaxle from the vehicle. Operations 1-9 of the dismantling procedure under the same heading describe the removal of the differential and final drive assembly from the transaxle.



View of the differential assembly removed from the transaxle.

(1) If necessary, cut and remove the speedometer drive gear from the differential case.

(2) Using a suitable puller, remove the differential carrier bearing cone and roller assemblies from the differential case and remove the speedometer drive gear stopper.

(3) Remove the ring gear retaining bolts and separate the ring gear from the differential case using a soft faced hammer.

(4) Using a pin punch, remove the retaining pin from the differential pinion shaft.

(5) Remove the pinion shaft from the differential case.

(6) Remove the pinion gears and thrust washers from the differential case.

(7) Remove the side gears and spacers from the differential case.

NOTE: If applicable, the viscous coupling is integral with the left hand side gear.

(8) Wash all the differential components with cleaning solvent.

(9) Check the gears, spacers, thrust washers, pinion shaft and differential case for wear, pitting and damage. Renew parts as necessary.

(10) Install the side gears and spacers to the differential case.

(11) Install the pinion gears and thrust washers to the differential case.

(12) Install the pinion shaft to the differential case aligning the retaining pin hole.

(13) Install the retaining pin to the pinion shaft until the end of the pin is level with the differential case.

(14) With a dial gauge contacting the end of the side gear, lift the side gear evenly and measure the clearance between the side gear and the differential case. The clearance should be 0.1-0.2 mm.

NOTE: Do not tilt the side gear or the dial gauge reading will be incorrect.

(15) If necessary, adjust the side gear clearance using selective fit spacers.

NOTE: Spacers are available from 0.15 mm to 1.00 mm in increments of 0.05 mm.

(16) Measure and if necessary, adjust the other side gear clearance.

(17) On models equipped with a viscous coupling, adjust the side gear clearance as follows:

(a) Temporarily secure the differential case with two bolts.

(b) Position the differential case so that the right hand side gear is uppermost.

(c) Insert a 0.03 mm feeler gauge between the

right hand side gear and the adjacent spacer in an area where there is no oil groove in the differential case.
(d) Insert another 0.03 mm feeler gauge diagonally opposite the first feeler gauge to avoid tilting the side gear.

(e) Insert a splined adaptor into the right hand side gear and attempt to rotate the gear by hand.

(f) If the gear cannot be rotated, change the thickness of the left hand side gear spacer, repeating the test until the gear can be rotated.

NOTE: Spacers are available in thicknesses from 0.8 mm to 1.5 mm in increments of 0.1 mm.

(g) Remove the 0.03 mm feeler gauges and insert 0.09 mm feeler gauges to the same position. The gear should lock.

(h) The spacer selection is correct when the right hand side gear can be rotated with 0.03 mm feeler gauges inserted but locks when 0.09 mm feeler gauges are inserted.

(18) Install the ring gear to the differential case with the chamfered edge of the ring gear inwards.

(19) Install and tighten the retaining bolts in a diagonal sequence to the specified torque.

(20) Install a new speedometer drive gear to the differential case. Install the stopper adjacent to the drive gear.

(21) Install the differentia] carrier bearing cones and roller assemblies to the differential case.

(22) Remove the adjusting shim from behind the carrier bearing outer race in the transaxle case and replace the outer race in the transaxle case.

(23) Install the differential assembly to the clutch housing.

(24) Install the transaxle case to the clutch housing and tighten the retaining bolts to the specified torque.

(25) Mount a dial gauge to the clutch housing so that the contact point is resting on the differential case.

(26) Insert a bar through the opposite side gear and, contacting the pinion shaft, raise and lower the differential case and measure the end float in the carrier bearings.

(27) Using the following table, select a shim to correspond to the relevant end float.

END FLOAT	SHIM THICKNESS
0.30-0.34 mm	0.64 mm
0.34-0.38 mm	0.68 mm
0.38-0.42 mm	0.72 mm
0.42-0.46 mm	0.76 mm
0.46-0.50 mm	0.80 mm
0.50-0.54 mm	0.84 mm
0.54-0.58 mm	0.88 mm
0.58-0.62 mm	0.92 mm
0.62-0.66 mm	0.96 mm
0.66-0.70 mm	1.00 mm
0.70-0.74 mm	1.04 mm
0.74-0.78 mm	1.08 mm
0.78-0.82 mm	1.12 mm
0.82-0.86 mm	1.16 mm
0.86-0.90 mm	1.20 mm
0.90-0.94 mm	1.24 mm
0.94-0.98 mm	1.28 mm
0.98-1.02 mm	1.32 mm
1.02-1.06 mm	1.36 mm
1.06-1.10 mm	1.40 mm
1.10-1.14 mm	1.44 mm
1.14-1.18 mm	1.48 mm
1.18-1.22 mm	1.52 mm
1.22-1.26 mm	1.56 mm
1.26-1.30 mm	1.60 mm
1.30-1.34 mm	1.64 mm
1.34-1.38 mm	1.68 mm
1.38-1.42 mm	1.72 mm
1.42-1.46 mm	1.76 mm

The thickest shim available is 0.88 mm. Multiple shims are required above this thickness.

(28) Install the shim behind the carrier bearing outer race in the transaxle case and assemble the unit once more.

(29) Using a suitable slotted adaptor engage the pinion shaft and using a torque gauge, measure the differential turning torque.

The turning torque when new carrier bearings have been installed should be 3.9-7.8 Nm or slightly lower if the original carrier bearings have been replaced.

(30) Assemble the transaxle and measure the total turning torque of the differential assembly and the mainshaft. The total turning torque should be 5.9 to 13.7 Nm with new bearings or slightly lower if the original bearings have been replaced.

5. GEAR LEVER ASSEMBLY

TO DISMANTLE AND ASSEMBLE

(1) Remove the gear lever knob and remove the centre console as described in the Body section. If not previously removed, remove the rubber boot surrounding the gear lever.

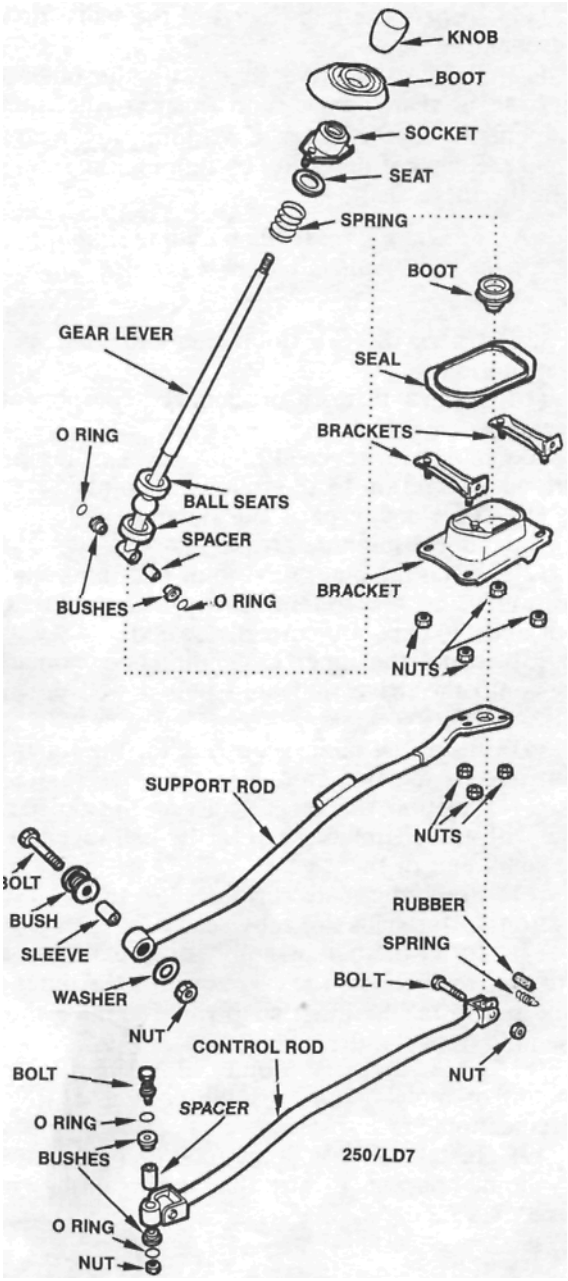
(2) Raise the front of the vehicle and support it on chassis stands. Remove the catalytic converter and heat shield as described in the Engine section.

(3) Remove the bolt and disconnect the control rod from the bottom of the gear lever, noting the position of the return spring and bracket.

(4) Remove the nuts retaining the gear lever socket to the support rod.

(5) Working inside the vehicle, lift the gear lever out of the floor bracket.

(6) Separate the lower rubber boot, socket, spring seat, spring, upper ball seat and lower ball seat from the gear lever, noting the location of each component to aid assembly.



Dismantled view of the gear lever assembly.

(7) Remove the bushes, spacer and O rings from the bottom of the gear lever.

(8) Remove the nuts retaining the floor bracket to the vehicle floor panel and remove the bracket from the vehicle.

(9) If necessary, disconnect the control rod and the support rod from the transaxle and remove the rods from the vehicle.

(10) Check all the components for deterioration, wear and damage. Renew the unserviceable components as necessary.

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

(1) Install all the components to the locations noted during dismantling.

(2) Lubricate all the pivot points with multipurpose grease prior to assembly.

(3) Tighten all the nuts securely.

(4) Road test the vehicle and check for correct gear selection.

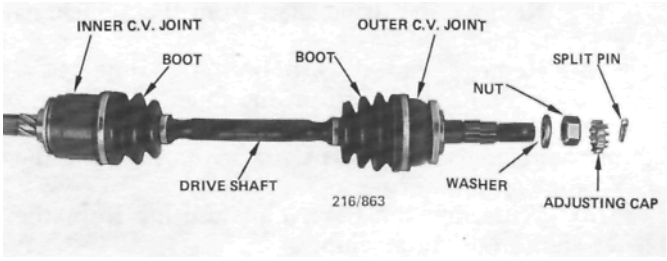
6. DRIVE SHAFTS

TO REMOVE AND INSTAL

(1) Remove the dust cap from the centre of the front hub. Remove the split pin and nut retainer from the outer end of the drive shaft.

(2) With an assistant applying the brakes, loosen the nut on the outer end of the drive shaft.

(3) Raise the front of the vehicle and support it on chassis stands. If necessary, refer to the Wheels and Tires section for the correct jacking points.



Assembled view of the left hand side drive shaft assembly.

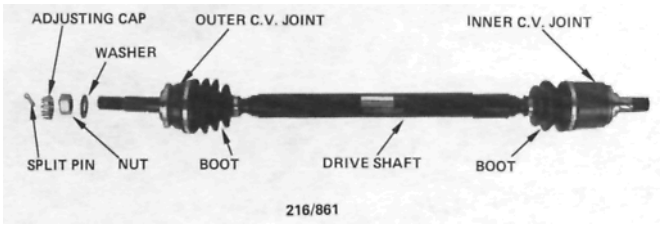
(4) Remove the split pin and castellated nut retaining the tie rod to the steering knuckle.

(5) Disconnect the tie rod end from the steering knuckle using a suitable puller or alternatively place a hammer or dolly on one side of the steering knuckle and strike the opposite side with a hammer.

(6) Remove the split pin and castellated nut retaining the suspension ball joint to the bottom of the steering knuckle.

(7) Disconnect the suspension ball joint from the steering knuckle using a suitable puller or alternatively place a hammer or dolly on one side of the steering knuckle and strike the opposite side with a hammer.

(8) Remove the retaining bolts and remove the brake caliper from the steering knuckle. Refer to the



Assembled view of the right hand side drive shaft assembly.

Brakes section if necessary. Suspend the caliper with wire or cord attached to the coil spring.

(9) Hold the steering knuckle and hub assembly and tap the drive shaft out of the hub using a soft faced hammer.

(10) Drain the oil from the transaxle into a container.

(11) Prise the drive shaft out of the transaxle and remove the drive shaft from the vehicle.

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

(1) Ensure that the drive shaft is firmly attached to the differential side gear by attempting to pull the shaft out of the gear.

(2) Tighten all nuts securely and install new split pins.

(3) Fill the transaxle with the specified grade and quantity of oil.

TO DISMANTLE AND ASSEMBLE

(1) Remove the drive shaft from the vehicle as previously described.

(2) Remove and discard both the inner C.V. joint boot retaining clips from the inner C.V. joint.

(3) Roll back the large end of the inner C.V.-joint boot using a thin blade screwdriver, prise out the C.V. joint retaining ring.

(4) Withdraw the C.V. joint housing from the drive shaft and ball assembly.

(5) Remove the inner snap ring retaining the ball assembly to the drive shaft and withdraw the ball assembly.

(6) Remove the remaining inner C.V. joint retaining snap ring and the C.V. joint boot from the drive shaft.

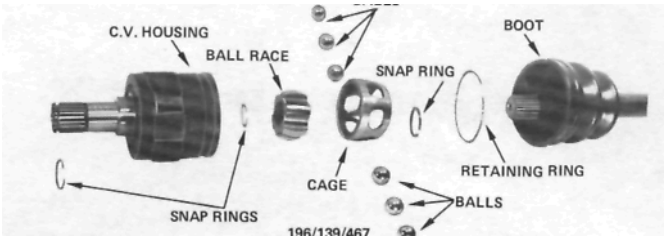
(7) Noting their installed positions remove the cage and ball assembly off the inner race and press the balls out of the cage.

(8) Remove and discard the clips retaining the outer C.V. joint boot to the drive shaft and remove the C.V. joint boot.

NOTE: The outer C.V. joint cannot be dismantled.

(9) Wash all parts in a suitable solvent and blow dry with compressed air.

(10) Inspect the ball contact faces of the inner ball race and C.V. joint housing for pitting and wear.



Dismantled view of the inner C.V. joint.

(11) Inspect the ball cage and the balls for wear and damage.

(12) Rotate the drive shaft with the outer C.V. joint at a sharp angle and inspect the internal components of the outer C.V. joint for wear and damage. Renew if necessary by tapping the C.V. joint from the drive shaft.

NOTE: Do not reuse the retaining snap ring if the C. V. joint is removed from the drive shaft.

(13) Check the C.V. joint boots for damage and deterioration.

(14) Renew all worn or damaged components as necessary.

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

(1) Thoroughly pack the outer C.V. joint with molybdenum disulphide grease.

(2) Install the outer C.V. joint boot and retain in position using new retaining clips. Ensure that the boot and the clips are correctly seated.

(3) Install the inner C.V. joint boot, small end
first, onto the drive shaft and pull it well down the shaft.

(4) Install the outer snap ring for the inner C.V. joint into its locating groove in the drive shaft.

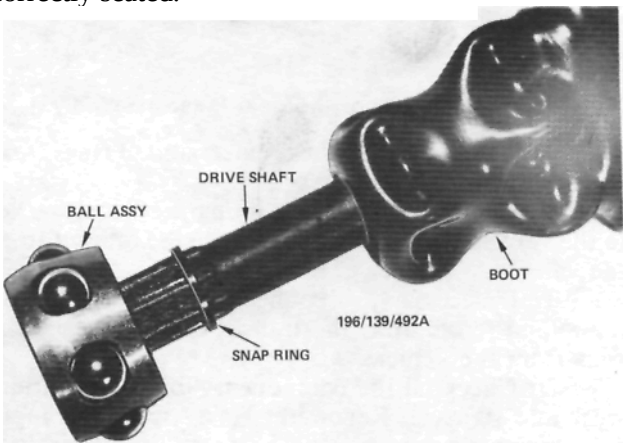
(5) Position the inner ball race inside the ball cage with the chamfered end of the ball race towards the small end of the cage.

(6) Press the balls firmly into the ball cage, ensure that the balls are fully seated.

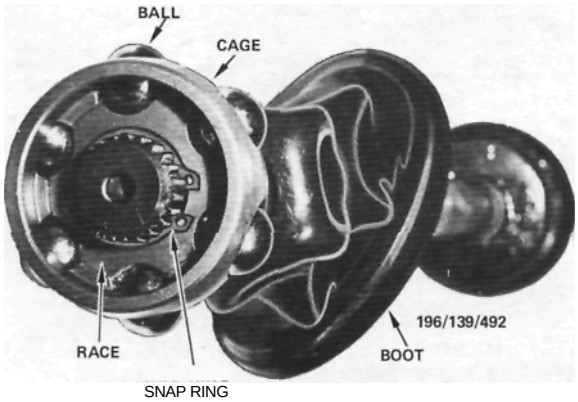
(7) Install the ball assembly onto the drive shaft
with the small end of the cage towards the outer C.V. joint and install the inner snap ring retaining the ball
assembly onto the drive shaft.

(8) Pack the C.V. joint with the prescribed amount of molybdenum disulphide grease. Refer to Specifications.

(9) Install the C.V. joint retaining ring into the C.V. joint housing. Ensure that the retaining ring is correctly seated.



Install the ball assembly onto the drive shaft, with the small end of the cage towards the outer C.V. joint.

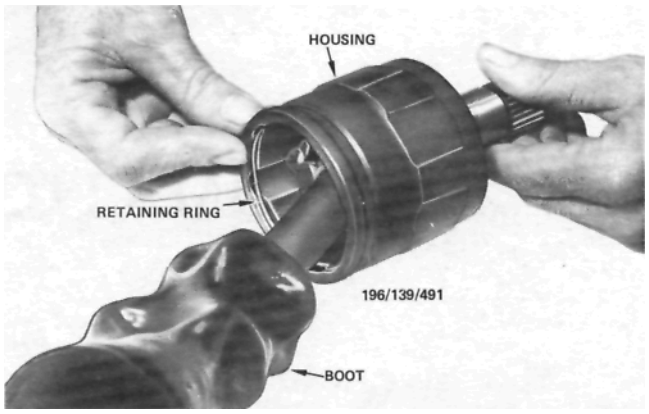


Assembled view of the inner C.V. joint.

(10) Slide the large end of the inner C.V. joint boot over the inner C.V. joint housing and locate the boot in the groove in the housing.

(11) Pull the C.V. joint until the boot is the normal length. Deformation of the boot could occur if this operation is neglected.

(12) With no vacuum or pressure present in the C.V. joint boot, install the two C.V. joint boot retaining clips.



Install the C.V. joint retaining ring into the C.V. joint housing. Ensure that the retaining ring is correctly seated.

NOTE: Ensure that the retaining dips are securely installed preventing the entry of damaging dust or water and that the lock tabs on the retaining clips are correctly bent over.

(13) Install the remaining snap ring onto the inner C.V. joint housing shaft and install the drive shaft to the vehicle as previously described.

AUTOMATIC TRANSAXLE

SPECIFICATIONS

Make	JATCO RL3F01A
Type	3 speed and reverse epicyclic gear train with lock up torque converter
Operation	Automatic hydraulic
Lubricant:	
Type	Dexron IT
Capacity	6.3 liters

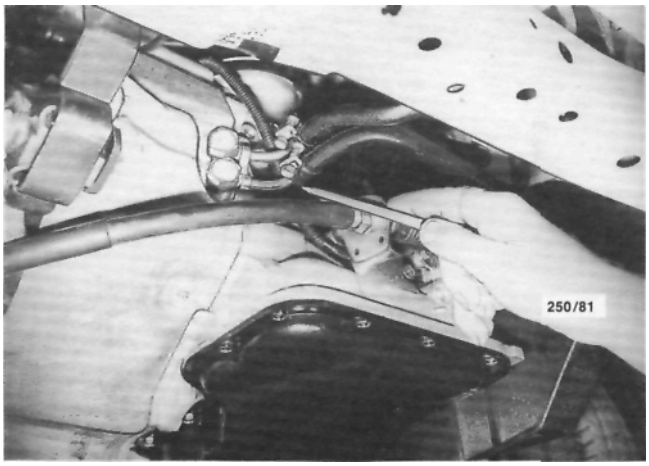
TORQUE WRENCH SETTINGS

Drive plate to crankshaft bolls	60 Nm
Drive plate to torque converter bolts	49 Nm
Convener housing to engine	22 Nm
Converter housing to transaxle	23 Nm
Transaxle sump to transaxle	7 Nm
Oil cooler pipe to transaxle	49 Nm
Selector shaft locknut	42 Nm
Transaxle filter bolts	12 Nm

1. AUTOMATIC TRANSAXLE TROUBLE SHOOTING

NO DRIVE IN D RANGE

{1) Low fluid level in transaxle: Check the fluid level in the transaxle and top up if required.



Check the oil cooler hose connections for leaks if the fluid level is low.

(2) Incorrectly adjusted selector cable: Check and adjust the selector cable as detailed.

(3) Incorrect or contaminated transaxle fluid: Drain and refill with the recommend type and quantity of transaxle fluid.

NOTE: Check the possible causes in the order given.

NO REVERSE IN R RANGE

(1) Low fluid level in transaxle: Check the fluid level and top up if required.

(2) Incorrectly adjusted selector linkage: Check the condition of the selector cable, selector quadrant and selector arm for wear and damage. Adjust as required.

Check the drive shaft oil seals as a likely leak source.

SLIPPING OR ROUGH UPSHIFT

(1) Incorrectly adjusted selector linkage: Check and adjust the selector linkage.

(2) Low fluid level in transaxle: Check the fluid level and top up if required.

NO TRANSAXLE KICKDOWN

(1) Incorrectly adjusted throttle cable: Check and adjust the cable as detailed in the Fuel and Engine Management section.

(2) Incorrectly adjusted kickdown cable: Check and adjust or renew the kickdown cable as required.

NOTE: Check and adjust the throttle cable before adjusting the kickdown cable.

ENGINE WILL NOT START IN P OR N RANGE OR WILL START IN ANY RANGE

(1) Neutral safety switch faulty: Adjust or renew the neutral safety switch.
(2) Incorrectly adjusted selector cable: Check and adjust the selector cable as detailed.

2. DESCRIPTION

The automatic transaxle combines a fluid coupling or torque converter with a fully automatic three speed epicyclic gear system.

The transaxle provides three forward ratios and one reverse. The hydraulic system consists of a single pump and valve arrangement.

The final drive or differential and the transaxle use a common lubricant. The transaxle oil pan and final drive drain plug will have to be removed to drain the transaxle completely. Topping up or refilling is done through the dipstick tube.

The gear selector lever is floor mounted and connected to the transaxle by an adjustable cable. The selector quadrant adjacent to the base of the lever is marked P, R, N, D, 2, 1.

It is necessary for the selector lever to be in P or N before the engine can be started. When testing or tuning the engine, the handbrake must be firmly applied and the selector lever placed in the P position, otherwise the vehicle could move forward or backwards as the engine speed is increased.

For long distance towing the vehicle should be towed with the front end raised.

It is not possible to start the engine by either towing or pushing the vehicle.

The transaxle can be removed from the vehicle without engine removal.

NOTE: As extensive knowledge and equipment is required to overhaul the automatic transaxle assembly, it is therefore not a worthwhile repair proposition for the average person. However if the transaxle must be overhauled by a specialist or be replaced with a reconditioned unit, the removal and installation procedure is fully described at the end of this section.

3. TRANSAXLE FLUID

Only use the recommended transaxle fluid specified by the manufacturer when topping up or changing the fluid in the system.

TO CHECK AND TOP UP

NOTE: The fluid level should be checked after approximately 5 minutes driving on the road when the engine has achieved its normal operating temperature of approximately 65 deg C.

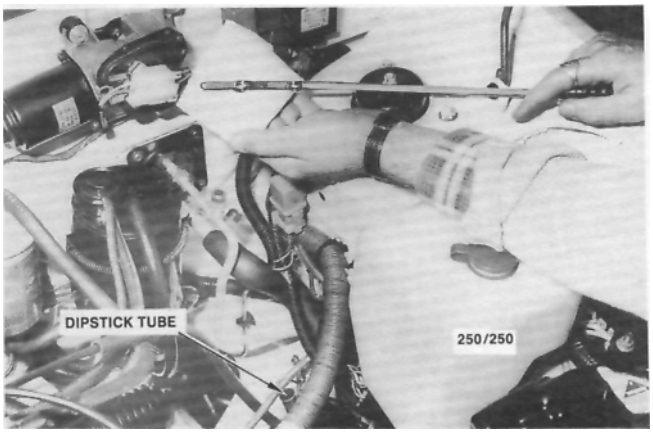
(1) Place the vehicle on a level floor and open the engine bonnet.

NOTE: When working on the automatic transaxle cleanliness is very important. Do not reuse transaxle fluid and do not allow foreign matter to enter the filler opening.

(2) Clean around the top of the dipstick to ensure that no dirt or foreign matter can enter the dipstick tube.
(3) Place the selector in the P position and firmly apply the handbrake.
(4) Move the selector through each gear returning it to the P position.
(5) Check the fluid level with the engine running at idle. Install the dipstick fully into the dipstick tube.

NOTE: If the vehicle has been driven at high speed, or has been towing a load, or driven through heavy city traffic in hot weather, a period of about 30 minutes should be allowed to permit the transaxle to cool before checking the fluid level.

(6) Withdraw the dipstick and check the fluid level reading. The fluid should be at the H mark on the dipstick. If the fluid is low, stop the engine and remove the dipstick from the vehicle. Using a funnel, top up the transaxle with the recommended type of transaxle fluid through the dipstick tube.
(7) If the level is reading too high allow the engine to cool down for about 30 minutes and recheck the level as described. If the level is still too high, a small amount of transaxle fluid may be drained from the transaxle.



Checking the fluid level on the automatic transaxle dipstick.

(8) Install the dipstick and start the engine and recheck the fluid level.

NOTE; Do not overfill the transaxle or foaming and unsatisfactory operation of the transaxle will result.

TO DRAIN AND REFILL

This is not a normal maintenance and lubrication procedure. It is only necessary to drain the complete system, including the torque converter and the oil cooler, when the transaxle assembly is removed for overhaul or the renewal of transaxle components such as bearings, clutches or assemblies. When this condition arises, the torque converter and the cooler should be cleaned and flushed to remove any dirt or sludge.

After transaxle overhaul, install approximately 6 liters of new transaxle fluid, and top up as previously described.

4. BRAKE BAND

Band adjustment is not a normal maintenance procedure.

The adjustment entails removal of the valve body and for this reason the vehicle should be taken to an authorized dealer.

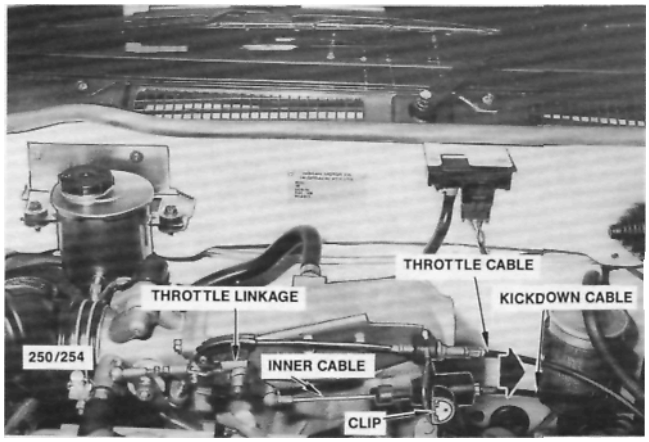
5. KICKDOWN CABLE

TO ADJUST

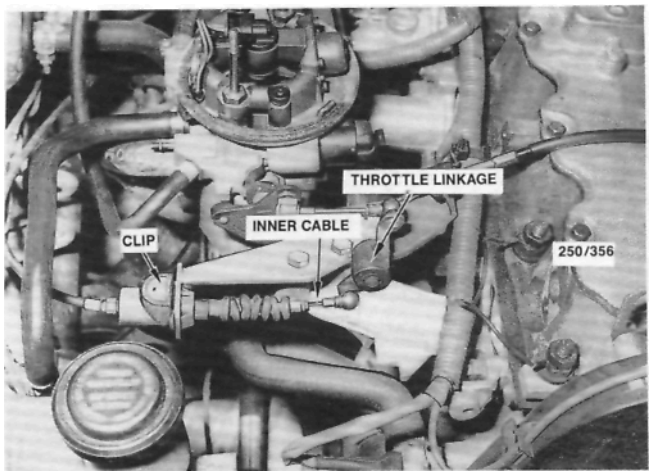
(1) On models with a 1.6 liter engine, remove the air cleaner assembly.

(2) With the aid of an assistant, ensure that the throttle valve is fully open when the throttle pedal is fully depressed.

(3) Push the clip on the outer kickdown cable and pull the cable away from the throttle linkage.



View of the kickdown cable adjustment point. The arrow indicates the direction in which the outer kickdown cable must be pulled to initiate the automatic adjustment. 1.8 liter engine.



View of the kickdown cable adjustment point. 1.6 liter engine.

(4) Slowly depress the throttle pedal to the full throttle position.

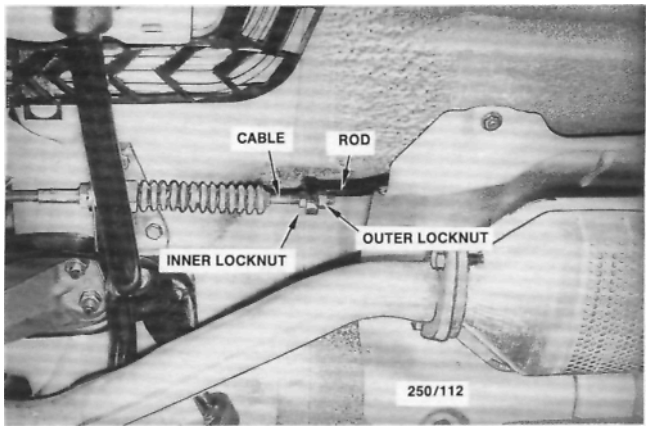
The outer kickdown cable will automatically adjust and emit a clicking noise.

6. TRANSAXLE SELECTOR LINKAGE

TO ADJUST CONTROL CABLE

(1) Place the selector lever in the Park position.

(2) Loosen the control cable locknuts and ensure that the transaxle selector lever is in the Park position.



View of the transaxle selector linkage control cable adjustment.

(3) Hold the selector rod horizontal and adjust the outer locknut until it touches the selector rod.

(4) Tighten the inner locknut securely.

7. NEUTRAL SAFETY SWITCH

The neutral safety switch, incorporating the reverse lamp switch is located on the transaxle case

facing towards the radiator support panel at the front of the vehicle.

The neutral safety switch allows electrical current to pass to the starter circuit only when the selector lever is in the Park or Neutral position. The switch is adjustable but non-repairable.

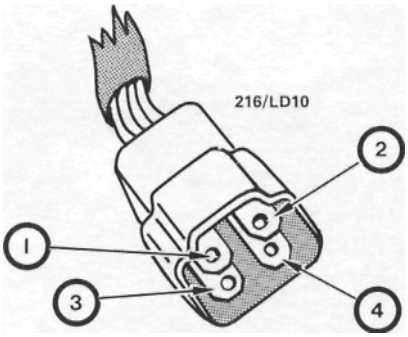
TO TEST

(1) Disconnect the neutral safety switch wiring connector.

(2) Connect an ohmmeter between terminals 1 and 2 at the neutral safety switch wiring connector. Continuity should exist when the selector lever is in the P or N positions.

(3) Perform the same check with terminals 3 and 4 with the selector lever in the R position. Continuity should exist.

NOTE: If the readings are other than that specified, the neutral safety switch will have to be adjusted or renewed.

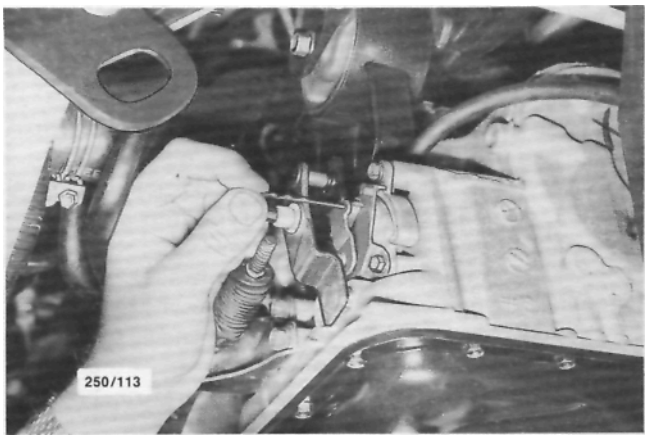


Neutral safety switch connector terminal identification.

TO ADJUST

(1) Select Neutral and firmly apply the handbrake.

(2) Loosen the neutral safety switch retaining bolts.



Using a 2.5 mm drill bit to adjust the neutral safety switch.

(3) Align the holes in the neutral safety switch body and the neutral safety switch arm.

(4) Install a 2.5 mm diameter split pin or drill bit into the holes to align the arm with the neutral safety switch body.

(5) Secure the retaining bolts and test the switch as previously described.

If the test indicates a fault, renew the neutral safety switch.

TO REMOVE AND INSTAL

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

(2) Remove the selector cable split pin and wave washer from the transaxle selector lever.

(3) Disconnect the electrical connector and remove the neutral safety switch retaining bolts.

(4) Maneuver the neutral safety switch clear of the transaxle selector lever and withdraw the switch from the vehicle.

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

(1) Clean the area around the neutral safety switch mounting.

(2) Apply a small amount of chassis grease to the jaws of the neutral safety switch arm.

(3) Check the adjustment of the selector cable as previously described.

(4) Adjust the neutral safety switch as previously described.

(5) Check the operation of the neutral safety switch and ensure that the engine will not start in any position other than P and N. Check that the reversing lamps operate only when R is selected.

8. TRANSAXLE ASSEMBLY

Special Equipment Required:

To Remove and Install — Suitable trolley jack to which the transaxle can be secured

TO REMOVE AND INSTAL

(1) Raise the front of the vehicle and support it on chassis stands. Remove the left hand front wheel.

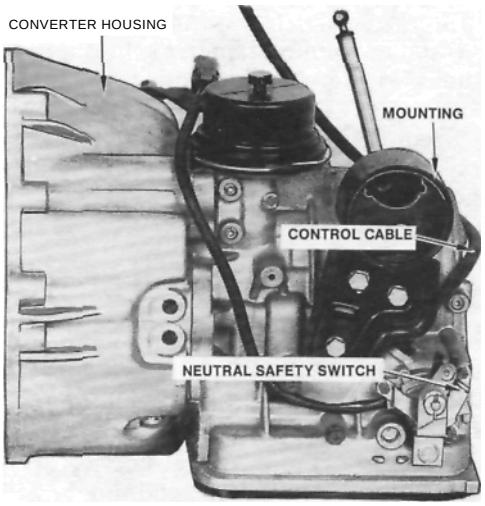
(2) Disconnect the negative battery terminal.

(3) Remove the left hand side inner mudguard panel.

(4) Remove the left hand drive shaft as described in the Manual Transaxle and Drive Shafts section.

(5) Disconnect the vehicle speed sensor wiring, selector control cable and the neutral safety switch wiring from the transaxle. Disconnect the kickdown cable from the throttle linkage and the support bracket.

(6) Disconnect the oil cooler hoses from the



Front view of the automatic transaxle.

transaxle. Plug the hoses and connections to prevent the ingress of dirt and the loss of fluid.

(7) Remove the starter motor as described in the Electrical System section.

(8) Mark the torque converter and the drive plate to aid assembly.

(9) Remove the bolts retaining the torque converter to the drive plate. Rotate the engine to access the bolts through the starter motor opening.

(10) Remove the bolts retaining the converter housing to the rear of the engine.

(11) Secure the transaxle to a trolley jack and raise the transaxle slightly.

(12) Remove the through bolt from the transaxle mounting.

(13) Support the engine on a jack with timber between the engine sump and the jack.

(14) Maneuver the transaxle away from the engine. Lower the trolley jack and withdraw the transaxle from beneath the vehicle.

NOTE: To prevent accidental separation of the torque converter from the transaxle assembly, attach a metal strap across the converter housing.

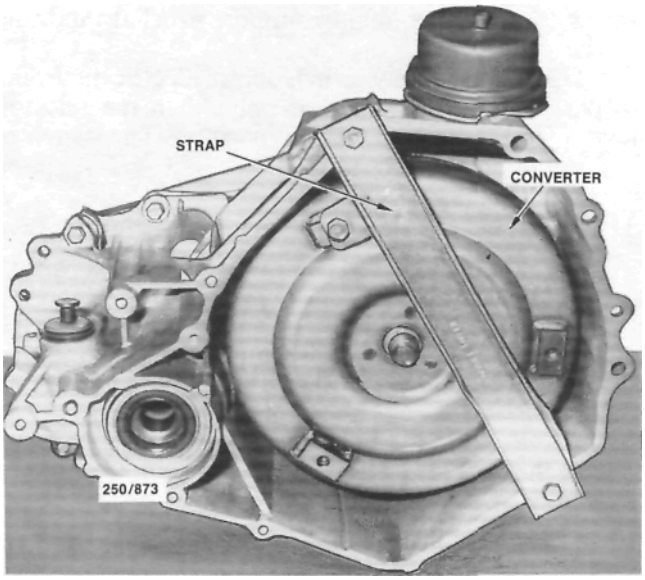
Installation is a reversal of the removal procedure with attention to the following points:

(1) Check the torque converter drive plate for any damage, wear and runout. The maximum runout permissible is 0.50 mm.

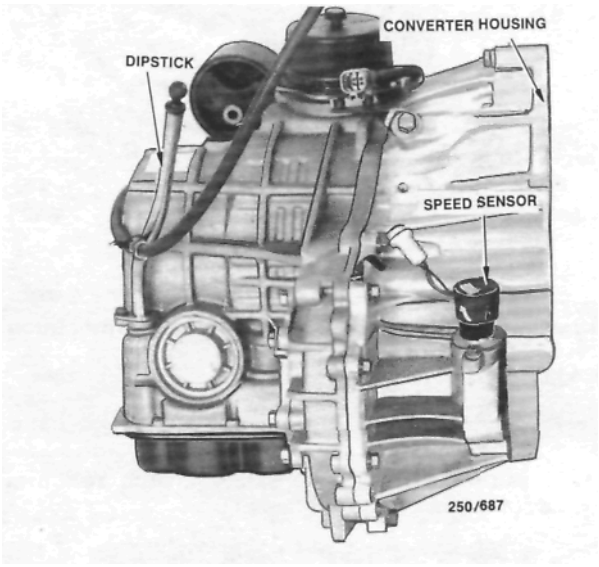
(2) Ensure that the torque converter is fully engaged in the transaxle before attempting to install the transaxle to the engine.

(3) Install the transaxle assembly to the vehicle and install the converter housing retaining bolts.

(4) Align the torque converter and drive plate



Install a strap to the converter housing to hold the torque converter in position.



Rear view of the automatic transaxle.

with the marks made on removal.

(5) Install the torque converter retaining bolts.

(6) Turn the engine over by hand several times to ensure that the torque converter is not binding.

(7) Use only the specified type and quantity of transaxle fluid.

(8) Connect and adjust the neutral safety switch and kickdown cable as previously described.

(9) Road test the vehicle and check the operation of the kickdown cable and selector cable.

(10) After road testing inspect the transaxle for any fluid leaks and rectify as required.

STEERING

PART 1. STEERING TROUBLE SHOOTING

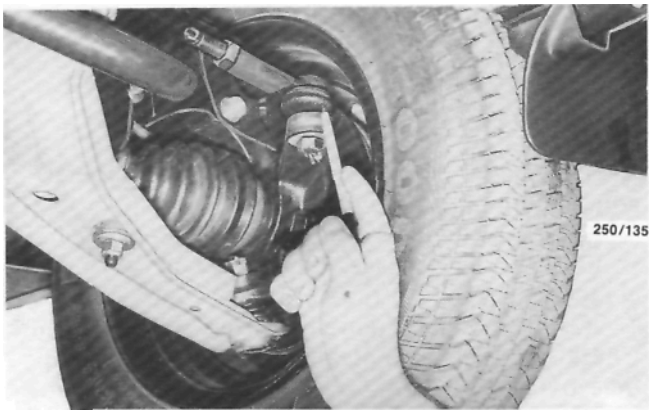
FAULTS, CAUSES AND REMEDIES

EXCESSIVE PLAY OR LOOSENESS IN STEERING GEAR

(1) Tie rod end ball joint loose or worn: Tighten or renew the worn tie rod end ball joint.

(2) Steering gear assembly loose on cross-member: Inspect for damage and tighten the steering gear mounting bolts.

(3) Steering gear worn: Overhaul the steering gear.



Check the tie rod ends for wear and the rubber boots for deterioration.

(4) Worn front hub bearings: Check the condition and renew the front hub bearings.

(5) Worn or damaged front suspension control arm bushes: Renew the control arm or bushes.

NOTE: Looseness in the steering linkage is best assessed with the weight of the vehicle on the front wheels. Have an assistant turn the steering wheel from left to right while the inspection for wear is being made. If looseness is found to be in the steering gear, it will be necessary to overhaul the steering gear assembly.

HEAVY STEERING

(1) Low or uneven tire pressures: Check the tires and inflate to the recommended pressures.

(2) Low fluid level in the power steering reservoir: Check for leakage, repair and/or renew the faulty components. Top up the fluid level.

(3) Suspension worn or out of alignment: Check the front suspension for wear, renew the worn components and realign.

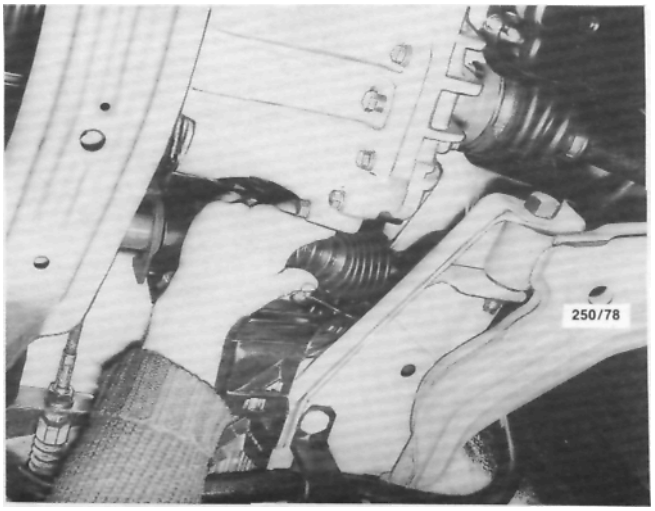
(4) Misalignment between the steering gear and column mountings: Check and align the steering gear and column mountings.

(5) Binding in the steering shaft universal coupling joints: Check the joints and renew if necessary.

(6) Ingress of dirt into the steering gear due to a defective boot: Clean, check and lubricate the internal components of the steering gear and renew the defective boot.

(7) Insufficient power steering pump pressure: Check the pump drive belt tension and reservoir fluid level. If necessary renew the pump assembly.

NOTE: Ensure that both front tires have ample depth of tread and are inflated to the correct pressure. Check the front suspension components for wear before having the steering geometry checked. See the Front Suspension section for the component checking procedures.



Checking the steering rack boots for splits and deterioration.

STEERING PULLS TO ONE SIDE

(1) Uneven tire wear or pressures: Check the condition of the tires and inflate to the recommended pressures.

(2) Incorrect front wheel alignment: Check and align the front end.

(3) Dragging brakes: Check each wheel for dragging brakes. Overhaul the brakes as necessary.

(4) Damaged suspension or crossmember: Inspect and renew the damaged components.

(5) Faulty power steering gear assembly: Remove the power steering gear for overhaul.

FRONT WHEEL WOBBLE OR SHIMMY

(1) Uneven tire wear or incorrect tire pressures; Check the condition of the tires and inflate to the recommended pressures.

(2) Tire or wheel imbalance: Check and balance as necessary

(3) Worn or badly adjusted hub bearings: Check the condition and adjust the front hub bearings.

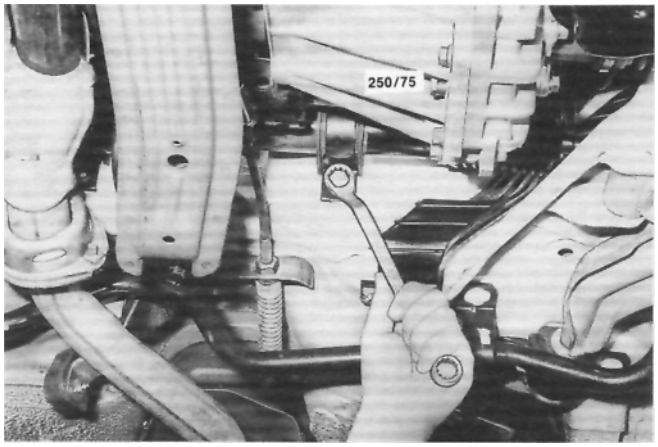
(4) Faulty or worn suspension, units: Check and overhaul or renew as a pair.

NOTE: Check the steering linkage as previously described. Raise the front of the vehicle and check the adjustment of the hub bearings by moving the road wheel in and out at the top and bottom. No movement in the bearings should be felt. Check the suspension units as outlined in the Front Suspension section.

STEERING ERRATIC OR WANDERING

(1) Incorrect or uneven wheel alignment setting: Check and adjust the steering geometry.

(2) Smooth front tires: Check and renew the tires as necessary.



Checking the steering gear mounting bolts for security.

(3) Steering gear assembly loose on the crossmember: Inspect for damage and tighten the steering gear mounting bolts.

(4) Wear in the tie rod ball housing: Renew the worn tie rod and ball housing.

(5) Wear in the rack and pinion: Remove the steering gear assembly for overhaul.

(6) Loose or incorrectly adjusted hub bearings: Check and adjust the front hub bearings.

FAILURE OF POWER ASSISTANCE

(1) Loose or broken pump drive belt: Renew or adjust the pump drive belt.

(2) Low fluid level in the power steering reservoir: Check for leakage, repair or renew the faulty components. Top up the fluid level.

(3) Insufficient power steering pump pressure: Check the delivery pressure, renew the pump if defective.

(4) Faulty power steering gear assembly: Remove the power steering gear assembly for overhaul.

PART 2. MANUAL STEERING

SPECIFICATIONS

Steering gear type	Rack and pinion
Steering column type	Energy absorbing collapsible and tilt adjustable
Steering wheel free play (maximum)	35 mm
Linkage	Direct from rack ends to tie rods and steering knuckles
Turns lock to lock	3.6
Steering column length	534.7-537.3 mm
Steering gear lubricant	Castrol EPL 1 grease

TORQUE WRENCH SETTINGS

Steering wheel retaining nut	39 **Nm**
Steering gear to bulkhead mounting bolts	108 Nm
Tie rod to steering knuckle nut	98 **Nm**
Tie rod to tie rod end locknut	98 **Nm**
Tie rod ball housing to rack	88 **Nm**
Steering column to mounting bracket bolt	14 Nm
Steering column universal coupling joint pinch bolts	29 **Nm**

1. DESCRIPTION

The steering gear is a rack and pinion type which is mounted on the lower section of the engine compartment bulkhead by rubber mountings and brackets.

The design of this assembly requires a range of special tools to dismantle and assemble the steering gear. If the steering gear is found to have a fault which requires overhaul of the rack and pinion, it is recommended that this be performed by an authorized workshop or steering specialist.

However, the procedures for the removal and installation of the steering gear and the renewal of the tie rods, the tie rod ends and the rubber boots are fully covered in this section.

The rack and pinion assembly requires no lubrication during service.

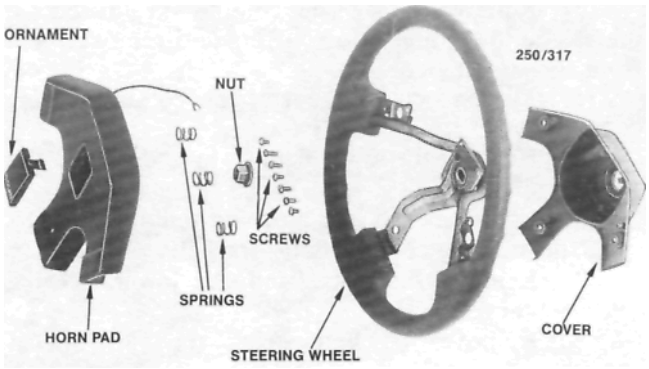
The steering column is of the energy absorbing type designed to compress in the event of a severe front end collision. The energy absorbing units are the outer steering column, the tilt bracket and the steering shaft. All these units should be handled with extreme care if service operations are performed on the steering column assembly.

2. STEERING WHEEL

Special Equipment Required:
To Remove Steering Wheel - Steering wheel puller

TO REMOVE AND INSTAL

(1) Disconnect the negative battery terminal.
(2) Using a small screwdriver, carefully prise the centre ornament from the steering wheel.



View of the steering wheel removed from the vehicle. Steering wheels may vary between models.

(3) Remove the steering wheel retaining nut and mark the steering shaft and steering wheel hub in relation to each other as an aid to assembly.
(4) Remove the steering wheel from the steering shaft.

NOTE: If the steering wheel will not separate from the steering shaft, loosen the horn pad retaining screws at the rear of the steering wheel and withdraw the horn pad after disconnecting the wire. A puller can now be used to pull the steering wheel from the steering shaft. Do not strike the end of the steering shaft as sharp blows can cause irreparable damage to the collapsible steering shaft.

(5) If necessary the steering wheel can be dismantled as shown in the illustration.

Installation is a reversal of the removal procedure with attention to the following points:
(1) Apply a light coat of multipurpose grease to the horn slip ring and the turn signal canceling pins.
(2) Ensure that the marks on the steering wheel and steering shaft are aligned.
(3) Tighten the steering wheel retaining nut to the specified torque.

3. STEERING COLUMN

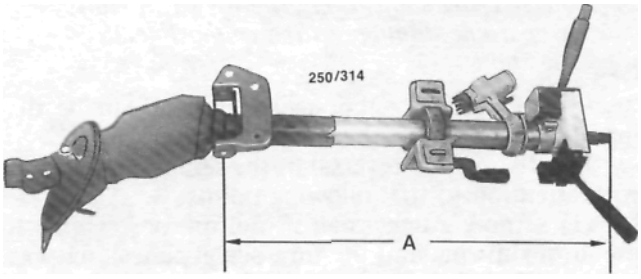
Special Equipment Required:
To Remove Steering Wheel — Steering wheel puller

TO REMOVE AND INSTAL

(1) Disconnect the negative battery terminal.
(2) Working in the engine compartment, mark the relationship between the steering shaft universal coupling joint and the steering gear pinion shaft.
(3) Remove the pinch bolts from the universal joint.
(4) Working inside the vehicle, remove the steering wheel as previously described.
(5) Remove the steering column shroud screws, unclip the lower and upper covers and remove them from the steering column.
(6) Disconnect all the steering column wiring connectors.
(7) Remove the lower trim from underneath the steering column.
(8) Fold back the insulator and remove the nuts from the steering column floor bracket.
(9) Remove the nuts from the lower steering column bracket.
(10) Remove the bolts from the tilt bracket assembly.
(11) Maneuver the steering column from the vehicle.

Installation is a reversal of the removal procedure with attention to the following points:
(1) Measure the dimension between the lower bracket pin and the upper edge of the steering shaft as shown in the illustration.

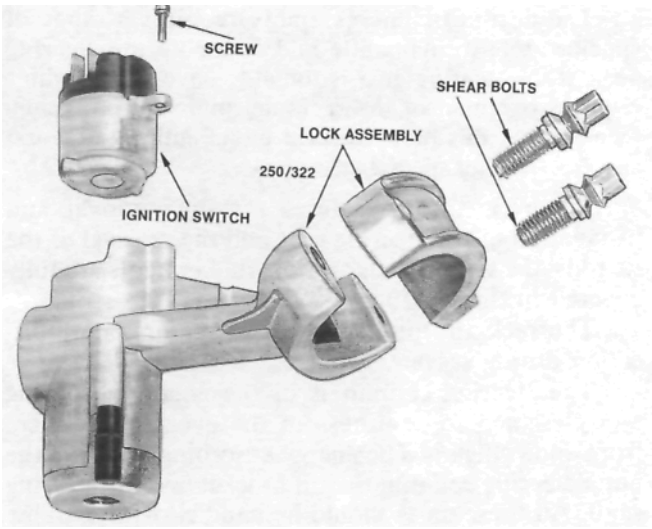
If **the** dimension is not as specified, the steering shaft has collapsed and the steering column should be renewed.
(2) Rotate the steering shaft in the column and check the shaft bearing for roughness and damage. Renew as necessary.
(3) Inspect the steering shaft universal coupling joints for wear and damage and renew as necessary.
(4) Position the steering column assembly under the dashboard ensuring that the floor bracket is located correctly and that the steering shaft universal joint is aligned with the steering gear pinion shaft marks.
(5) Install all the steering bracket nuts and bolts finger tight.
(6) Install the universal coupling joint pinch bolts and tighten securely.
(7) Tighten all the steering column nuts and bolts securely.
(8) Test the operation of all the steering column controls when installation is complete.



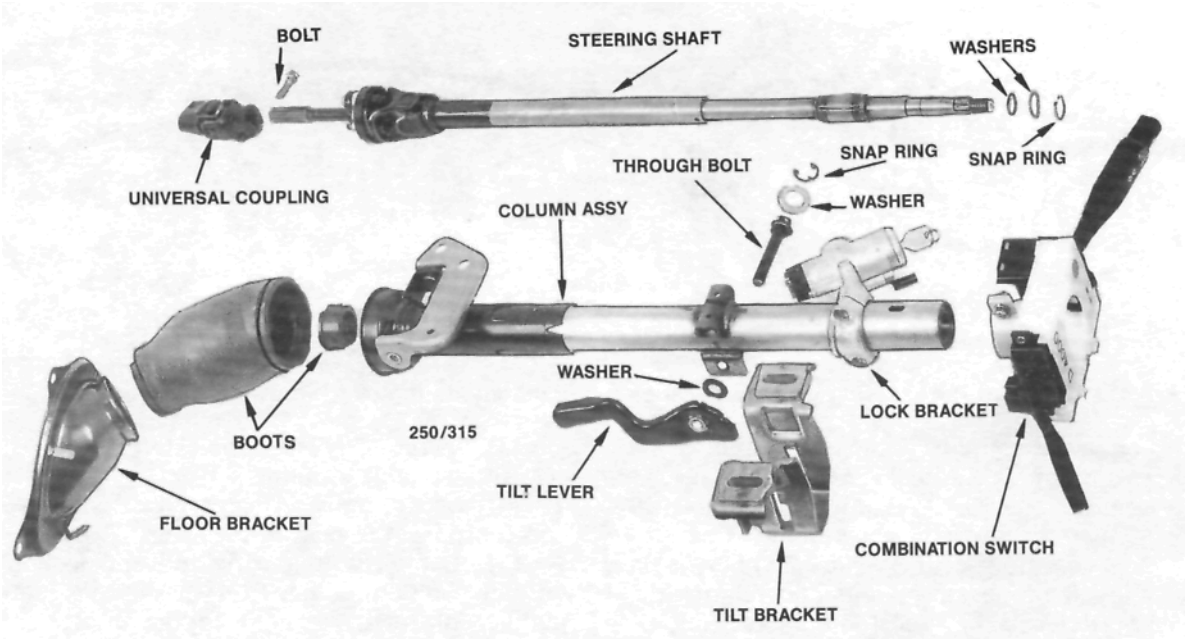
View of the steering column assembly removed from the vehicle. Steering column length is shown as dimension A. A - 534.7-537.3 mm.

TO DISMANTLE

(1) Remove the steering column assembly from the vehicle as previously described.
(2) Suitably mark the position of the universal coupling joint and remove it from the steering shaft.
(3) Mark the position of the rubber boot in relation to the floor bracket and steering column. Loosen the retaining bands and remove the boot and floor bracket from the steering column.
(4) Using snap ring pliers, remove the snap ring, plain washer and wave washer from the upper end of the steering shaft.
(5) Loosen the combination switch retaining screw, push the combination switch in, turn the switch and remove it from the steering column.
(6) Turn the ignition switch to the On position and slide the steering shaft from the column assembly.
(7) If necessary dismantle the tilt bracket components after removing the through bolts. Note the position of the components to aid assembly.
(8) To remove and install the steering lock proceed as follows:
(a) Remove the ignition switch retaining screw and carefully withdraw the switch from the steering lock bracket.



Dismantled view of the steering lock and ignition switch assembly.



Dismantled view of the steering column and tilt bracket assembly.

(b) Using a suitable drill, carefully remove the heads of the steering lock bracket shear type retaining bolt heads. Remove the steering lock bracket from the column.

(c) Install the steering lock to the column using new shear bolts. Ensure that the steering lock is operating correctly and tighten the shear bolts until the heads snap off.

(d) Install the ignition switch and tighten the retaining screw securely.

TO CHECK AND INSPECT

(1) Thoroughly clean and dry the components using a suitable solvent.

(2) Inspect the steering shaft for bends, damage and wear. Pay particular attention to the steering shaft universal coupling joint and the internal and external splines. Renew as necessary.

(3) Inspect the steering column upper bearing for ease of operation and if necessary, renew the column assembly.

TO ASSEMBLE

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

(1) Install the steering shaft to the column. Ensure that the steering shaft is correctly located in the upper bearing and install the wave washer and the plain washer. Install the snap ring using a ring spanner which has minimum clearance over the steering shaft.

(2) Install the rubber boot and floor bracket to the steering column aligning the marks made during removal. If no marks were made, align the cutouts of the rubber boots with the protrusions on the steering column and the floor bracket.

(3) Before installing the tilt bracket assembly to the column, measure the steering column length as shown on the illustration.

If the length is not as specified, the steering column and the steering shaft must be renewed as an assembly.

(4) Install the tilt bracket, lever, through bolt, washers and adjusting nut to the tilt bracket.

(5) Before installing the column assembly to the vehicle adjust the column tilt lever as follows:

(a) Position the tilt lever in its locked position, the end of the lever should contact the flanged portion of the tilt bracket.

(b) Tighten the adjusting bolt to 11 Nm.

(c) Unlock the tilt lever fully and ensure that the column moves smoothly up and down the tilt bracket.

(d) Return the tilt lever to the locked position and ensure that the column is locked securely. Adjust the tilt bracket through bolt if necessary.

(6) Install the universal coupling joint to the lower steering shaft and tighten the pinch bolt securely.

(7) Install the steering column assembly to the vehicle as previously described.

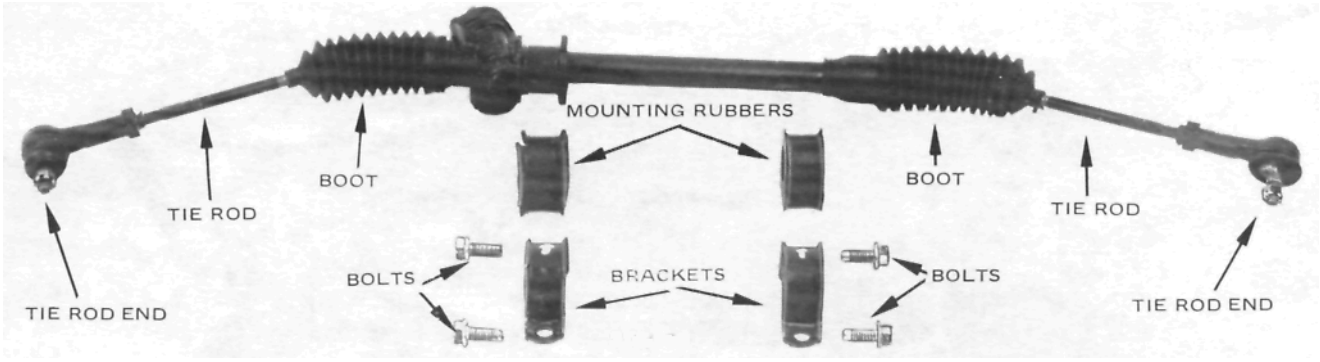
4. STEERING GEAR ASSEMBLY

Special Equipment Required:

To Renew Tie Rod Ball Housings — Large Stillsons.

TO REMOVE AND INSTAL

(1) Working in the engine compartment and with the wheels in the straight ahead position, suitably



View of the steering gear and associated components removed from the vehicle.

mark the universal coupling joint in relation to the steering gear pinion as an aid to installation.

(2) Remove the bolt retaining the universal coupling joint to the steering gear pinion.

(3) Raise the front of the vehicle, support it on chassis stands at the jacking points and remove the front wheels. Refer to the Wheel and Tires section.

(4) Remove the split pins and castellated nuts from the tie rod end studs and disconnect the tie rod ends from the steering arms.

NOTE: Disconnect each tie rod end by placing a suitable dolly or hammer against one side of the steering arm eye and striking the opposite side with a hammer.

(5) Remove the bolts from the steering gear mounting brackets.

(6) Separate the steering gear pinion from the universal coupling joint and maneuver the steering gear from the vehicle.

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

(1) Ensure that the steering gear mounting bracket rubbers are in good condition. Renew if necessary.

(2) Renew the split pins on the tie rod castellated nuts.

(3) Check and if necessary adjust the front wheel toe in. Refer to the Front Suspension section for the correct procedure.

TO OVERHAUL

To overhaul the steering gear a range of special tools is required. If the steering gear has a fault which requires the removal of the rack or pinion it is recommended that the necessary repairs be carried out by an authorized dealer.

TO RENEW TIE ROD BALL HOUSINGS

(1) Remove the steering gear from the vehicle as previously described.

(2) Note or mark the installed position of the mounting rubbers as an aid to assembly and remove the rubbers from the steering gear.

(3) Thoroughly clean the exterior of the steering gear in a suitable cleaning solvent.

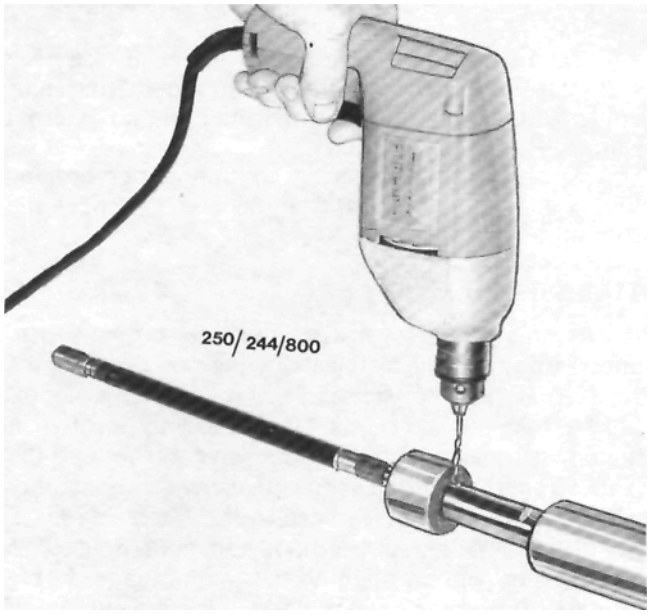
(4) Secure the steering gear in a soft jawed vice and centralize the rack in the steering gear.

(5) Loosen both the tie rod end locknuts and unscrew the tie rod ends from the tie rods, noting the number of turns required to do so. Remove the locknuts from the tie rods.

(6) Remove the tie rod rubber boot retaining clamps, detach the boots from the steering gear housing and slide them from the tie rods. Take care to position a container to catch the oil contained in the steering gear assembly.

(7) Where the tie rod ball housing is retained by staking, drill the staking away from the rack and tie rod using a 4.0 mm drill. Do not drill into the rack more than is necessary to drill out the staking.

Where the tie rod ball housing is retained by a lock pin, drill out the lock pin from the ball housing and tie rod using a 4.0 mm drill. Do not exceed a drilling depth of 10.0 mm.



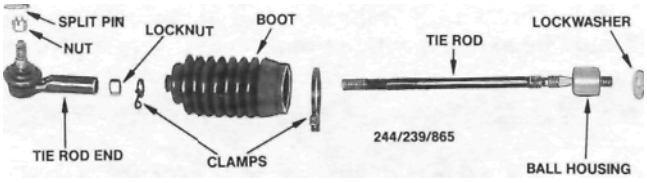
Using a 4.0 mm drill to remove the staking from the tie rod ball housing.

(8) Slide the rack out of the housing slightly so that an adjustable spanner can be used to hold the rack.

(9) Using a Stillsons wrench, unscrew the ball housings in turn using care not to allow the rack to rotate. Keep all the tie rod parts in order.

(10) Inspect the rack boots for cracks and deterioration and renew as necessary.

(11) Inspect the tie rod ends for wear and damage and renew as necessary.



Dismantled view of the tie rod ball housing and the tie rod end assemblies removed from the steering gear.

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

(1) Using large Stillsons and a large adjustable spanner, install the tie rod and ball housing assemblies to the rack. Tighten the ball housings to the specified torque.

NOTE: To avoid damage to the rack or pinion the adjustable spanner must be firmly tightened over the rack teeth and the rack must not be allowed to rotate when installing the ball housings.

(2) Measure a point 9 mm in from the rear face of the ball housing of the rack and at 90 deg to the rack teeth. Centre punch this point.

(3) At this point drill a 4 mm hole, 10 mm deep through the rack and into the ball housing thread.

(4) Place a locking pin above the hole and drive it into position.

(5) Lubricate the rack, rack teeth and tie rod boot groove with suitable EPL 1 grease.

(6) Install the rack boots and secure with the clamps. Renew the clamps if necessary.

(7) Install the tie rod end locknuts and then the tie rod ends, ensuring that they are screwed on the same number of turns as was necessary to remove them.

(8) Tighten the locknuts to the specified torque.

(9) Install the mounting rubbers and brackets to the steering gear as noted on removal.

(10) Install the steering gear assembly to the vehicle as previously described.

(11) Check and if necessary adjust the front wheel toe in as described in the Front Suspension section under the appropriate heading.

TO RENEW TIE ROD END

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

(2) Remove the relevant front wheel.

(3) Loosen the tie rod end locknut and remove the tie rod end castellated nut. Disconnect the tie rod from the steering arm by placing a suitable dolly or hammer against one side of the steering arm eye and striking the opposite side with a hammer.

(4) Unscrew the tie rod end from the tie rod, noting the number of turns necessary to remove it.

(5) Screw the new tie rod end onto the tie rod the same number of turns noted during removal.

(6) Connect the tie rod to the steering arm and install the castellated nut. Tighten the nut to the specified torque and secure it with a new split pin.

(7) Install the front wheel and lower the vehicle to the ground.

(8) Check and if necessary, adjust the front wheel toe in as described in the Front Suspension section. Ensure that the rubber boots are not distorted or twisted on the tie rod when the adjustment is completed.

TO RENEW RUBBER BOOT

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

(2) Remove the relevant tie rod end as previously described.

(3) Release the clamps securing the boot to the tie rod and steering gear housing.

(4) Unscrew and remove the locknut from the tie rod.

(5) Remove the rubber boot together with the outer retaining clamp from the tie rod.

(6) Sparingly lubricate the tie rod boot groove with EPL 1 grease, install the new boot to the tie rod and push it onto the steering gear rack housing. Install and secure the inner and outer retaining clamps.

(7) Install the tie rod end locknut and screw the tie rod end onto the tie rod the same number of turns noted during removal.

(8) Connect the tie rod to the steering arm and install the castellated nut. Tighten the nut to the specified torque and secure it with a new split pin.

(9) Install the wheel and lower the vehicle to the ground.

(10) Check and if necessary, adjust the front wheel toe in as described in the Front Suspension section. Ensure that the rubber boots are not distorted or twisted when the adjustment is completed.

PART 3. POWER STEERING

SPECIFICATIONS

Steering gear type	Rack and pinion with integral power cylinder
Steering column type	Energy absorbing collapsible and lilt adjustable
Steering wheel free play	35 mm
Number of turns lock to lock:	
TRW	2.82
PR24SA	2.7
Linkage	Direct from rack ends to tie rods and steering knuckles
Power steering pump maximum pressure	6 865 kPa
Lubricant	Dexron II

TORQUE WRENCH SETTINGS

Steering gear to bulkhead mounting bolts	108 Nm
Tie rod to steering knuckle nut	98 Nm
Tie rod to tie rod end locknut	98 Nm
Tie rod ball housing to rack	88 Nm
Power steering pump pulley nut	68 Nm

1. DESCRIPTION

The vehicles covered by this manual are equipped with either a TRW power steering system or a Japanese PR24SA power steering system.

Both types are similar in construction and appearance.

The power steering is a rack and pinion type which is mounted on the lower section of the engine compartment bulkhead by rubber mountings and brackets.

Hydraulic pressure is supplied to the power steering gear by a pump driven by a drive belt from the engine.

The power steering pump has a separate fluid reservoir located on the right side of the bulkhead.

No lubrication of the steering gear or steering pump is required in service and in the event of the loss of power assistance, the steering will continue to operate but will require a greatly increased effort. However, as the steering gear and pump are lubricated by the power steering fluid, the cause of the loss of power steering or fluid loss must be determined and repaired promptly to prevent damage to the steering pump and to a lesser extent, the steering gear.

The tie rod ends and rubber boots can be renewed without removing the steering gear from the vehicle. To renew the integral tie rod and tie rod ball housings, the steering gear must be removed.

As specialist knowledge and equipment are required to overhaul the power steering gear and the hydraulic pump, it is recommended that these operations be carried out by an authorized dealer. However, procedures for the removal and installation of the steering gear and pump are fully described in this section.

The steering column is of the energy absorbing type and is designed to collapse in the event of a severe front end collision. The energy absorbing components are the column tubes, steering shaft and tilt bracket breakaway capsules. All these components should be handled with extreme care if service operations are to be carried out on the steering column assembly.

2. IN CAR ADJUSTMENTS, CHECKS AND MINOR REPAIRS

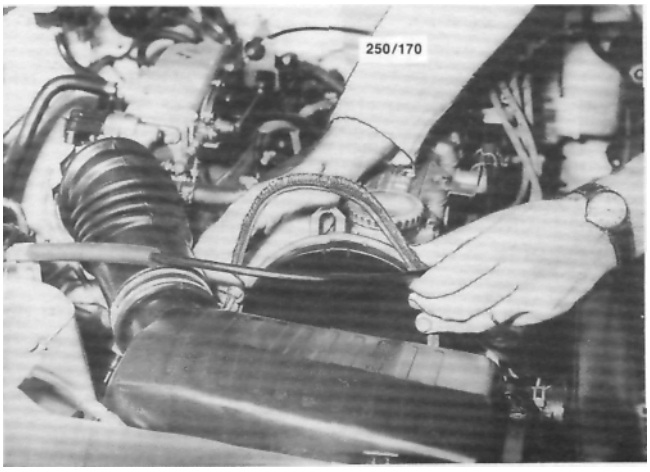
If the power steering system becomes partially or fully inoperative it is most important that the following preliminary inspection and testing procedure be performed prior to undertaking any trouble shooting or repair operations.

PUMP DRIVE BELT

Inspect the pump drive belt for breakage, glazing or wear. If any of these characteristics are evident, renew the belt using only a genuine replacement.

If the belt is loose but still serviceable, adjust it using the procedure outlined in the Engine Tune-up section.

NOTE: In most cases a loose drive belt can be heard squealing when a load is placed on the pump as the steering wheel is turned or as the engine speed is increased.



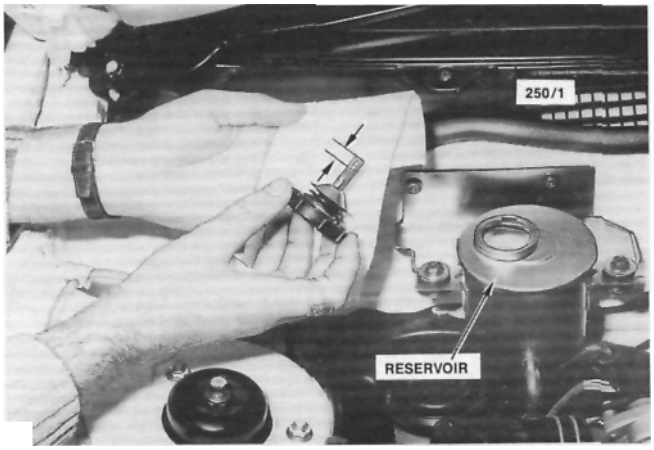
Checking the power steering pump drive belt for deterioration.

TO CHECK FLUID LEVEL

Check the fluid level in the power steering reservoir when the fluid is cold.

If it is necessary to top up the fluid, fill to between the arrow marks on the dipstick using the recommended fluid.

NOTE: Do not overfill the reservoir.



Checking the power steering fluid level using the dipstick incorporated in the cap.

TO CHECK FOR FLUID LEAKS

Using a suitable solvent, clean around all power steering assemblies and hose fittings where fluid leakage might occur and start the engine. Turn the steering wheel from one steering lock to the other several times and stop the engine. Check for leakage. Where leakage is found at hose fittings, tighten and recheck.

If the leak remains, renew the hoses or fittings as required.

Where leakage is found in the steering gear assembly or pump assembly, specialist attention is necessary.

TO CHECK STEERING WHEEL FREE PLAY

With the engine running and the steering wheel in the straight ahead position, measure the free movement of the steering wheel before the front wheels move. This is specified as steering wheel free play and if it exceeds Specifications, check for free play in the steering linkages and the universal coupling joints. If these components are satisfactory, it will be necessary to remove the steering gear from the vehicle for renewal or overhaul.

PUMP BELT TENSION

The procedure for adjusting the power steering pump bell tension is described in the Engine Tune-up section

TO PURGE THE POWER STEERING SYSTEM OF AIR

(1) Check that the pump reservoir is filled to the correct mark on the dipstick.

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

(3) Turn the steering wheel quickly from lock to lock several times, recheck the fluid level within the pump reservoir and top up if required.

(4) Start the engine, allow it to idle and slowly turn the steering wheel from lock to lock several times. Do not hold the steering at full lock for more than 15 seconds.

(5) Check the fluid level in the pump reservoir, top up if necessary.

(6) If the fluid is aerated within the pump reservoir or if pump noise persists, repeat operations (3) to (6).

3. STEERING WHEEL

The procedure for removing and installing the steering wheel is fully covered in the Manual Steering section under the above heading.

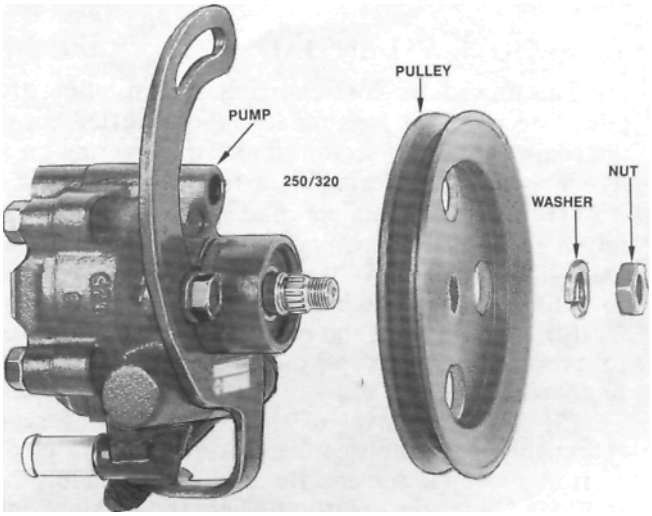
4. STEERING COLUMN

The procedure for removing, dismantling and assembling the steering column is fully covered in the Manual Steering section under the above heading.

5. POWER STEERING PUMP

TO REMOVE AND INSTAL

(1) Disconnect the negative battery terminal.



View of the power steering pump removed from the vehicle.

(2) Remove the air inlet duct from the air cleaner and throttle body.

(3) Position a container or a piece of cloth beneath the steering pump reservoir and disconnect the fluid return and power steering pump supply hose from the reservoir.

(4) Loosen the steering pump drive belt as described in the Engine Tune-up section.

(5) Loosen the return hose clamp and the supply union and disconnect the hoses from the power steering pump. Plug the hoses to prevent the loss of fluid.

(6) Loosen the retaining bolts and withdraw the pump.

(7) Thoroughly clean the exterior of the steering pump and inspect it for cracks, damage and signs of leakage.

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

(1) Install the pump and retaining bolts.

(2) Install the drive belt and adjust it as described in the Engine Tune-up section.

(3) Install the hoses to the power steering pump and tighten securely.

(4) Top up the pump reservoir and purge the power steering system of air as previously described.

TO OVERHAUL

As specialist knowledge and equipment arc required to overhaul the power steering pump, it is recommended that this operation be performed by an authorized dealer or steering specialist.

6. POWER STEERING GEAR ASSEMBLY

Special Equipment Required:

To Renew Tie Rod Ball Housings — Large Still-sons

TO REMOVE AND INSTAL

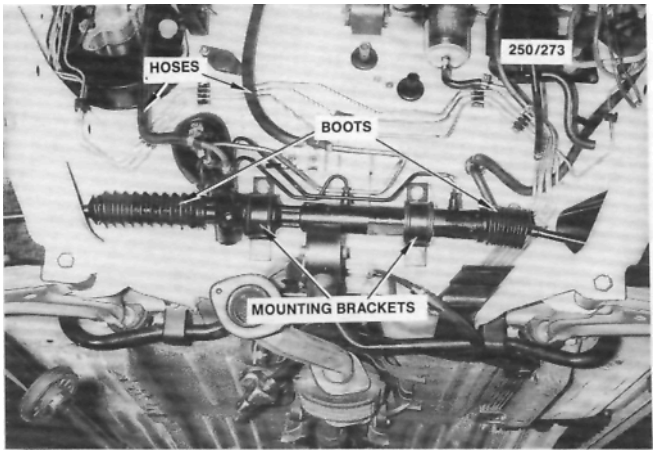
The procedures for removing and installing the power steering gear are similar to those carried out in the Manual Steering section under the Steering Gear Assembly heading except for the following differences.

(1) Place a container under the pressure and return pipes that are connected to the steering gear valve housing. Remove the pipes and allow the fluid to drain into the container.

(2) Suitably seal the pipes and the steering gear **to** prevent the entry of dirt whilst the pipes are removed.

(3) Upon removal of the power steering gear, thoroughly clean the steering gear except the tie rod ends in a suitable solvent. Be careful not to allow the solvent to enter the apertures where the pressure and return pipes were removed.

(4) Check the pipes and connections for cracks, damage or obstructions and renew as necessary.



Installed view of the power steering gear with the engine removed.

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

(1) Install the pressure and return pipes to the steering gear valve housing and tighten securely.

(2) Fill the power steering reservoir to the correct level and bleed the system as described previously under the heading In Car Adjustments. Checks and Minor Repairs.

(3) Check all power steering pipe connections for leaks and repair as necessary.

(4) Check, and if necessary, adjust the front wheel toe in as described in the Front Suspension section. After adjustment ensure that the rubber boots are not distorted or twisted and the rubber boot clamps and clips are facing downward.

TO OVERHAUL

As specialist knowledge and equipment are required to overhaul the power steering gear, it is recommended that this operation be performed by an authorized dealer or steering specialist.

TO RENEW TIE ROD BALL HOUSINGS

TRW Steering Gear

The renewal of the tie rod ball housings is the same as for the manual steering gear. Refer to Part 2. Manual Steering section.

PR24SA Steering Gear

(1) Remove the power steering gear assembly from the vehicle as previously described.

(2) Carefully mount the power steering gear in a vice equipped with soft jaws. Loosen the tie rod end locknuts without disturbing the location of the tie rod ends and unscrew the tie rod ends, taking note of the number of turns required to remove them. Unscrew and remove the locknuts from the tie rod.

(3) Remove the clamps from the rubber boots and remove the boots.

(4) Support the rack carefully and lever back the tabs of the ball housing lock washers. To prevent damage to the steering gear, avoid any impact to the steering rack.

(5) Holding the rack with an adjustable spanner, unscrew the ball housings from the rack using a Stillsons wrench. Remove and discard the lock washers.

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

(1) Install the new lock washer to the rack,
ensuring that the lockwasher tangs are located in the rack end.

(2) Install the ball housing assemblies to the rack. Tighten the ball housings to the specified torque and secure by bending the lock washer.

(3) Before installing the rubber boots ensure that the vent holes, located towards each end of the rack near the ball housings, are clear. If necessary clear the hole with a suitable probe.

(4) Apply sealant to the large end of the rubber boot and grease to the small end. and install the boots, being careful not to damage or twist them. Secure the boots with the clamps and clips ensuring that the clips are facing downwards.

(5) Install the tie rod end locknuts and tie rod ends to the tie rod. Install the tie rod ends the same number of turns noted on removal. Tighten the locknuts to the specified torque.

Install the power steering gear assembly to the vehicle as described under the previous heading and bleed the system as described under the heading In Car Adjustments, Checks and Minor Repairs.

TO RENEW RUBBER BOOTS

The procedure to renew the rubber boots is fully covered in the Manual Steering section under the Steering Gear Assembly heading.

TO RENEW TIE ROD ENDS

The procedure to renew the tie rod ends is fully covered in the Manual Steering section under the Steering Gear Assembly heading.

FRONT SUSPENSION

SPECIFICATIONS

Type	Independent MacPherson strut with coil springs and control arms
Shock absorber	Hydraulic, non-repairable
Hub bearing end float (maximum)	0.05 mm
Ball joint axial play (maximum)	0.7 mm
Ball joint turning torque (used)	0.5-4.9 Nm
Wheel alignment:	
Toe in	0-2 mm
Camber	-0° 10' ± 45'
Caster	1° 10' ± 45'
King pin inclination	13° 55' ± 45'

TORQUE WRENCH SETTINGS

Hub bearing nut	196-235 Nm
Suspension unit to steering knuckle nut	118 Nm
Suspension unit to body nuts	29 Nm
Piston rod nut	72 Nm
Brake caliper to steering knuckle bolts	52 Nm
Ball joint to steering knuckle bolt	86 Nm
Control arm bracket bolts	98 Nm
Control arm pivot bolt	118 Nm
Stabiliser bar link nuts	44 Nm
Stabiliser bar bracket bolts	21 Nm

1. FRONT SUSPENSION TROUBLE SHOOTING

FRONT END NOISE

(1) Loose upper suspension mounting or piston rod: Tighten the mounting or piston rod nuts.

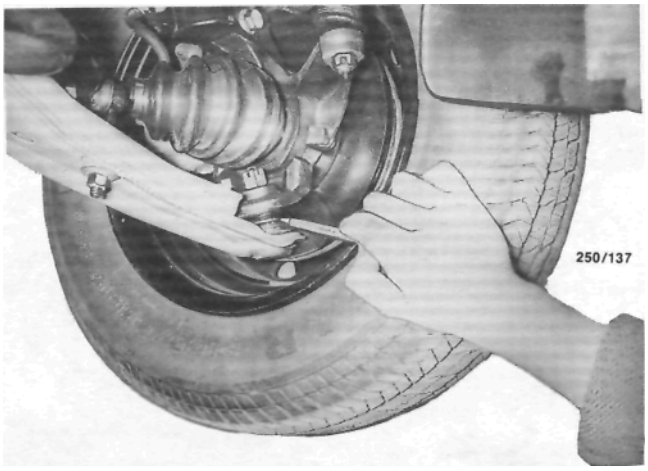
(2) Loose or worn suspension unit lower ball joint: Tighten or renew the lower ball joint.

(3) Noise in the suspension unit: Renew the faulty suspension unit, preferably in pairs.

(4) Worn or loose steering gear: Overhaul the steering gear assembly.

(5) Worn front hub bearings: Renew the hub bearings:

(6) Loose or defective stabilizer bar, control arm or mountings: Check, tighten or renew the mounting rubbers.



Check the ball joints for wear and deterioration.

(7) Worn stabilizer bar link ball joints: Renew the stabilizer bar links.

(8) Drive shafts worn or insufficiently lubricated: Check the lubricant and the dust boots and renew as necessary.

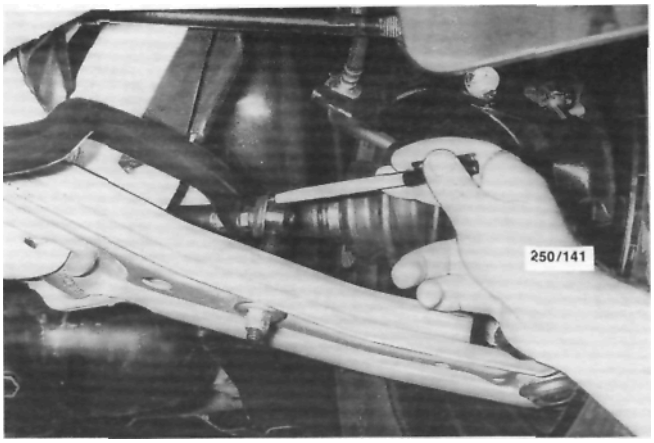
(9) Drive shaft splines in the hub or the differential worn or damaged: Check and renew as necessary.

NOTE: To check the front suspension components for wear, raise the front of the vehicle, support it on chassis stands and allow both front wheel to hang free. With an assistant pushing and pulling the front wheels in and out at the top and then at the bottom, check for excessive looseness at the front hub bearings and lower control arm inner pivot bushes. Noise or vibration in the front end can also be caused by excessive tire or wheel unbalance. Drive shaft joint noise is usually more pronounced when moving slowly with the steering on full lock.

POOR OR ERRATIC ROAD HOLDING ABILITY

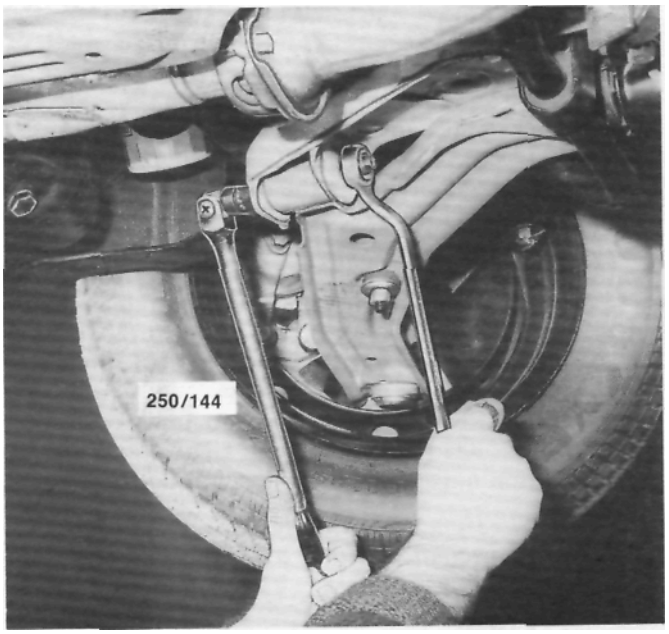
(1) Low or uneven tire pressures: Inflate the tires to the recommended pressures.

(2) Defective suspension unit: Renew the faulty unit, preferably in pairs.



Check the stabilizer bar links for wear and damage.

(3) Incorrect front end alignment: Check and adjust the alignment as necessary.
(4) Defective stabilizer bar mounting rubbers or worn link ball joints: Renew component as necessary.
(5) Weak or broken front coil spring: Renew both springs as a matching pair.
(6) Broken or weak rear coil spring: Renew both springs as matching pair.
(7) Drive shaft bent or distorted: Check and renew as necessary.
(8) Tie rod end worn or damaged: Check and renew as necessary.
(9) Control arm ball joint worn or damaged: Check and renew as necessary.
(10) Control arm mounting bolts loose: Tighten the control arm bolts.
(11) Wheel hub bearing worn: Check and renew as necessary.



Checking the control arm bolts for security.

NOTE: As a quick guide to suspension unit condition, bounce the front of the vehicle up and down (one side at a time), the vehicle should come to rest in a single movement. If it bounces two or three times before stopping, the suspension unit should be renewed. If the from of the vehicle is tower on one side than the other, remove the coil spring and check its free length against a new spring. If the spring is found to be unserviceable it is good practice to install two new springs as a matching pair. This also applies to the springs on the rear of the vehicle.

2. DESCRIPTION

The front suspension is an independent type comprising two Macpherson strut suspension units mounted vertically on each side of the vehicle. The lower end of the suspension unit is bolted to the steering knuckle, which in turn houses the front hub bearings. The steering knuckle pivots on the control arm by means of a ball joint.

The control arm pivots at its inner ends on rubber bushes.

A stabilizer bar is attached to both ends of the control arms using ball joint links. The stabilizer bar is attached to the front underbody by brackets and mounting rubbers.

Each front suspension unit assembly comprises a tubular shock absorber type suspension unit, surrounded at the upper end by a coil spring. On top of the coil spring is the upper mounting which attaches to the underside of the inner mudguard panel. The piston rod of the suspension unit is attached to the centre of the upper mounting by a rubber mounted bearing.

When a suspension unit is found to be defective it is recommended that both suspension units be renewed as a pair.

Camber is adjusted by means of a cam on the upper steering knuckle to suspension unit mounting bolt.

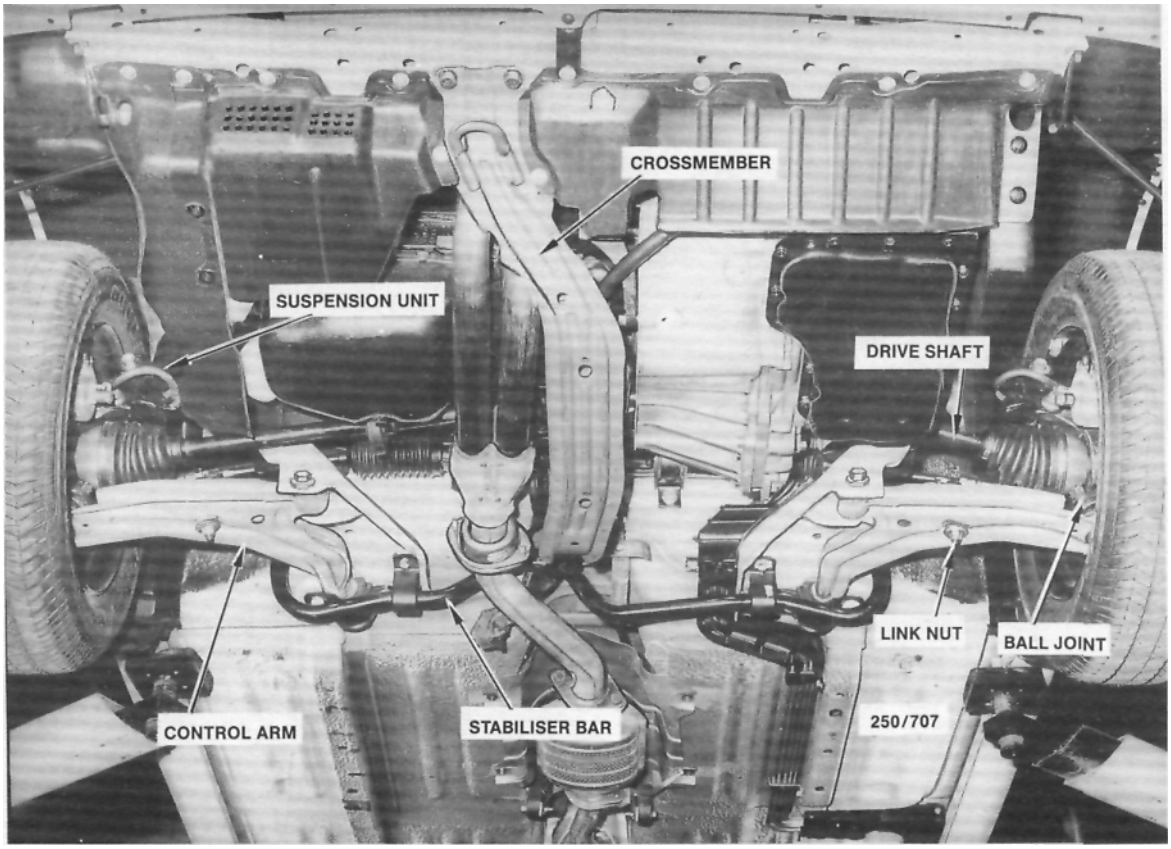
The kingpin inclination and caster are set in production and cannot be adjusted. Any variation in these angles will be caused by worn or damaged components.

3. STEERING KNUCKLE

Special Equipment Required:
To Renew Wheel Bearing — Press and press plates and suitable tubes and mandrels
To Check Hub End Float — Dial gauge

TO REMOVE AND INSTAL

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



Installed view of the front suspension. When using a floor jack locate the head of the jack on the crossmember.

(2) Remove the cap, split pin, castellated retainer and with the aid of an assistant applying the brakes, loosen and remove the hub nut.

(3) Remove the split pin and the castellated nut retaining the tie rod end to the steering knuckle.

(4) Disconnect the tie rod end from the steering knuckle using a suitable puller. Alternatively place a suitable dolly or hammer against one side of the steering knuckle eye and strike the opposite side with a hammer.

(5) Remove the brake caliper anchor plate bolts, withdraw the caliper from the disc and support it with a piece of wire inside the inner mudguard. Ensure that the brake hose is not twisted.

(6) Withdraw the brake disc from the hub.

(7) Loosely install the hub nut and tap on the nut with a soft faced hammer to separate the drive shaft from the hub.

(8) Place a mark on the suspension unit to steering knuckle cam head bolt to ensure correct wheel alignment on assembly.

(9) Remove the steering knuckle to suspension unit nuts and bolts.

(10) Remove the split pin and the castellated nut retaining the lower ball joint stud to the steering knuckle.

(11) Disconnect the ball joint stud from the steering knuckle using a suitable puller or alternatively place a suitable dolly or hammer against one side of the steering knuckle eye and strike the opposite side with a hammer.

(12) Withdraw the steering knuckle from the vehicle taking care not to drop the drive shaft or damage its boot.

(13) Clean and check the steering knuckle for wear, cracks and damage.

(14) If necessary, dismantle the hub and check the bearing assembly using the dismantling procedure described later in this section.

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

(1) Install the steering knuckle and hub assembly over the drive shaft and loosely install the ball joint stud nut and the suspension unit to knuckle bolts and nuts.

(2) Ensure that the suspension unit to steering knuckle cam head bolt marks are aligned and tighten the retaining nuts to the specified torque.

NOTE: If the cam head bolt is not installed in its original position, a wheel alignment should be performed.

(3) Tighten the ball joint to steering knuckle stud bolt to the specified torque.

(4) Install the tie rod end to the steering knuckle and tighten the castellated nut securely. Install a new split pin.

(5) Install the brake disc to the hub.

(6) Install the brake caliper to the steering knuckle and tighten the retaining bolts to the specified torque.

(7) Install the hub nut and washer to the drive shaft and with the aid of an assistant applying the brakes, tighten the hub nut to the specified torque.

(8) Install the hub nut retainer and a new split pin to the drive shaft.

(9) Check the hub end float as described later in this section.

(10) Install the front wheel and lower the vehicle to the ground.

TO DISMANTLE

NOTE: The front wheel bearing assembly is non-serviceable. If the wheel bearing is dismantled for any reason it should be renewed.

(1) Remove the steering knuckle from the vehicle as previously described.

(2) Hold the steering knuckle assembly in a vice with soft jaw guards.

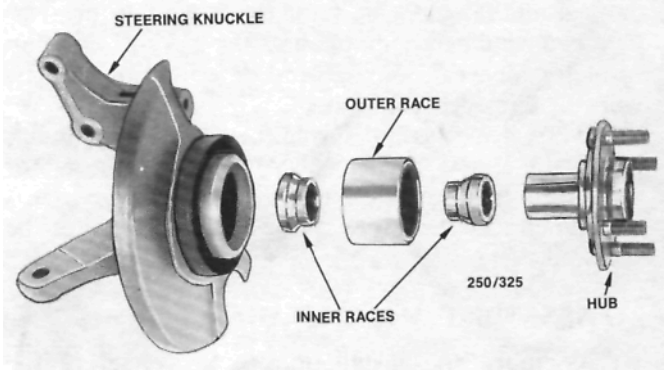
(3) Using a hammer and a suitable pipe or tube that pushes on the inside of the hub, drive out the wheel hub and outside inner race from the steering knuckle assembly.

(4) Using snap ring pliers, remove the snap ring that retains the outer bearing race from the wheel side of the steering knuckle.

(5) Using a suitable press and press plates, support the steering knuckle with the outside face downwards. To aid in dismantling, position the inside inner race in the bearing and press the assembly from the steering knuckle. Discard the bearing assembly.

(6) Using a bearing puller and a press, remove the inner race from the hub assembly.

If the inner race cannot be removed from the hub in this manner, it may be necessary to grind the race using an angle grinder and split the race using a cold chisel.



Dismantled view of the steering knuckle and hub components.

(7) Thoroughly clean and dry the steering knuckle and hub in a suitable solvent.

(8) Inspect all the components for wear, damage and cracks and renew if necessary.

TO ASSEMBLE

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

(1) Apply grease to the oil seal lips of the new bearing assembly.

NOTE: Ensure that (he inside of the outer race of the bearing is precoated with wheel bearing grease. If necessary, pack the outer race of the wheel bearing with wheel bearing grease after it is installed to the steering knuckle.

(2) Using the press and press plates, support the steering knuckle with the outside face uppermost. Using a suitable diameter steel tube that contacts on the outer race only, press the outer race full into the steering knuckle.

(3) Install the snap ring to the groove in the steering knuckle.

(4) Install the inner races to the steering knuckle and support the inner race on the press using a suitable tube or mandrel.

(5) Using the press and a suitable tube press the hub assembly into the steering knuckle. When using the press ensure that the pressing force does not exceed 29 kN.

(6) With the press exerting a force of 44.1 kN rotate the steering knuckle from side to side several turns to ensure that the wheel bearings are operating smoothly.

(7) Install the steering knuckle to the vehicle as previously described.

TO CHECK HUB END FLOAT

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

(2) Mount the dial gauge on the steering knuckle so that the dial gauge plunger is against the wheel hub.

(3) Zero the dial gauge and attempt to move the hub in and out. Total hub end float should not exceed 0.05 mm.

(4) Renew the wheel bearing as previously described if necessary.

4. SUSPENSION UNIT

Special Equipment Required:
To Dismantle — Spring compressor

TO REMOVE AND DISMANTLE

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

(2) Disconnect the flexible brake hoses from the suspension unit bracket.

(3) Using quick drying paint, place mating marks on the camber adjusting cam head bolt and the suspension unit lower mounting as an aid to installation.

(4) Remove the bolts and nuts retaining the suspension unit lower mounting to the steering knuckle.

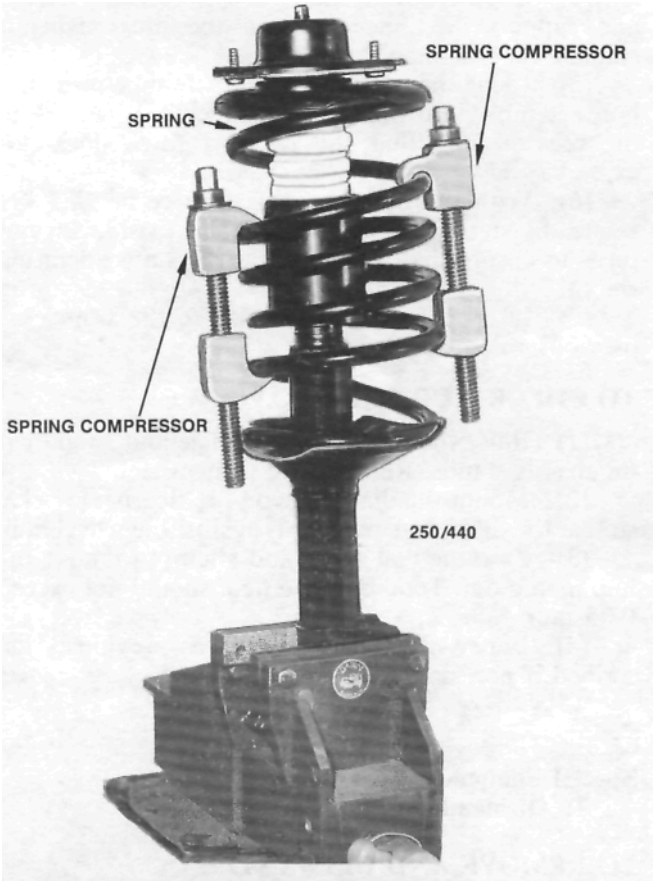
(5) Open the bonnet and remove the nuts retaining the suspension unit upper mounting to the inner mudguard panel and remove the suspension unit assembly from the vehicle. Use care when removing not to damage the drive shaft boot.

(6) Remove the dust cover and loosen the piston rod nut but do not remove it at this stage.

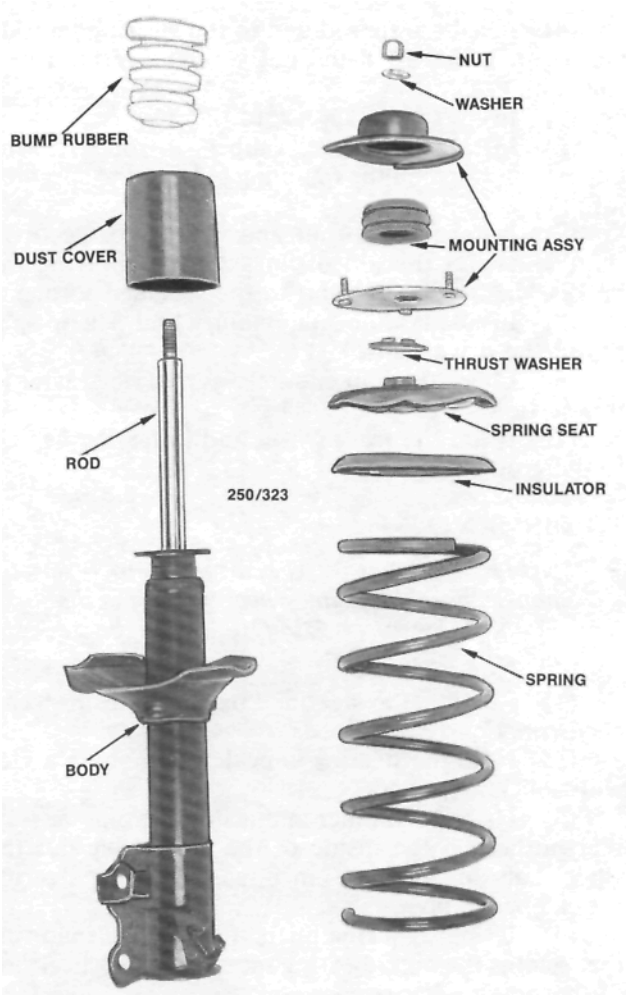
(7) Install a spring compressor to the suspension unit assembly. Compress the coil spring and remove the piston rod nut.

(8) Remove the washer, upper mounting assembly, the thrust washer, spring seat, insulator, coil spring, bump rubber and dust cover from the suspension unit.

(9) Check the operation of the suspension unit. With the suspension unit in a vertical position, move the piston rod up and down a number of times. A uniform resistance should be felt with no abnormal slack spots or noise evident. If the suspension unit is defective, it should be renewed.



View of the front suspension unit with the spring compressor installed.



Dismantled view of the front suspension unit.

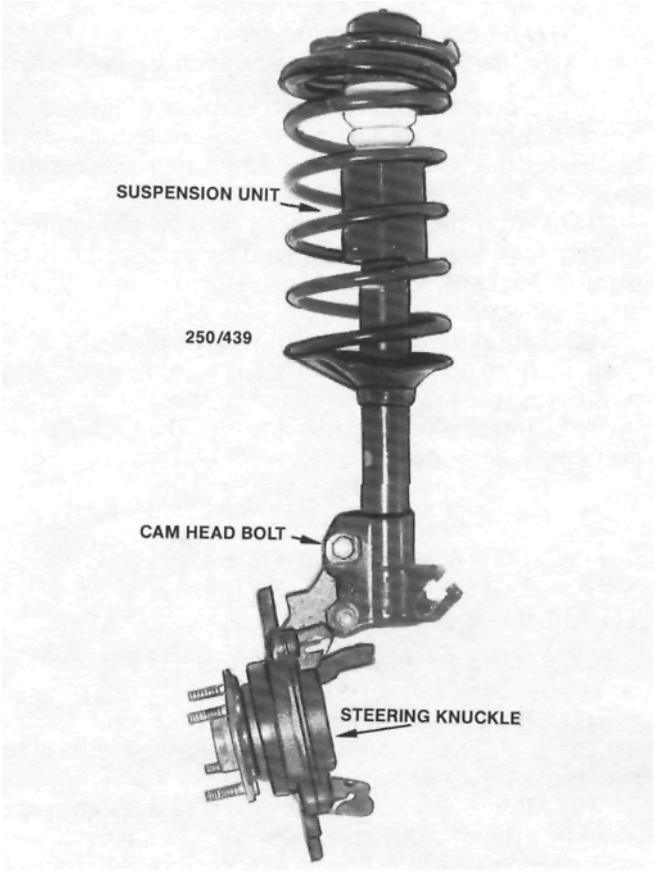
NOTE: It is recommended that the suspension unit on the opposite side be renewed at the same time.

(10) Check the upper mounting assembly for damage and fatigue. Check the thrust washer for wear. Check all rubber components, the spring seat and insulator for wear, damage and deterioration. Renew worn or damaged components.

(11) Check the coil spring for fatigue by comparison with a new spring. Also check the spring for cracks and damage. If the coil spring is defective, it is recommended that the springs on both sides be renewed.

TO ASSEMBLE AND INSTAL

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



View of the suspension unit and knuckle assembly removed as a unit to show the cam head bolt.

(1) With the piston rod fully extended, install the coil springs. Ensure that the spring compressor is tightened sufficiently.

NOTE: The flat coiled end of the spring should face the top and the lower end of the spring should be located correctly.

(2) Install the dust cover, bump rubber, insulator, spring seat, thrust washer and mounting assembly ensuring that the arrow on the spring seat will face the outside of the vehicle when the suspension unit assembly is installed.

(3) Install the piston rod nut and tighten the nut securely.

(4) Remove the coil spring compressor from the suspension unit assembly and tighten the piston rod nut to the specified torque.

(5) Install the suspension unit assembly to the vehicle, holding it in position by loosely installing the upper mounting retaining nuts.

(6) Install the suspension unit assembly lower mounting to the steering knuckle, align the mating marks on the cam head bolt and tighten the nuts and bolts to the specified torque.

NOTE: If the cam head bolt is not installed in its original position, a wheel alignment must be performed.

(7) Tighten the upper retaining nuts to the specified torque.

(8) Install the brake hoses to the suspension unit. Lower the vehicle to the ground.

(9) Check the front wheel alignment and adjust as necessary. Refer to the Suspension and Steering Angles heading in this section.

5. CONTROL ARM

Special Equipment Required:

To Renew Ball Joint and Control Arm Bushes — Press, suitable tubes and mandrels

To Test Ball Joint — Small torque wrench or preload gauge, spring scale

TO REMOVE AND INSTAL

(1) Loosen the front wheel nuts, raise the front of the vehicle and support it on chassis stands. Remove the front wheel.

(2) Remove the split pin from the ball joint retaining nut and remove the nut.

(3) Disconnect the ball joint from the control arm using a suitable puller, or alternatively place a suitable dolly against one side of the control arm eye and strike the opposite side with a hammer until the ball joint stud is free from the control arm eye.

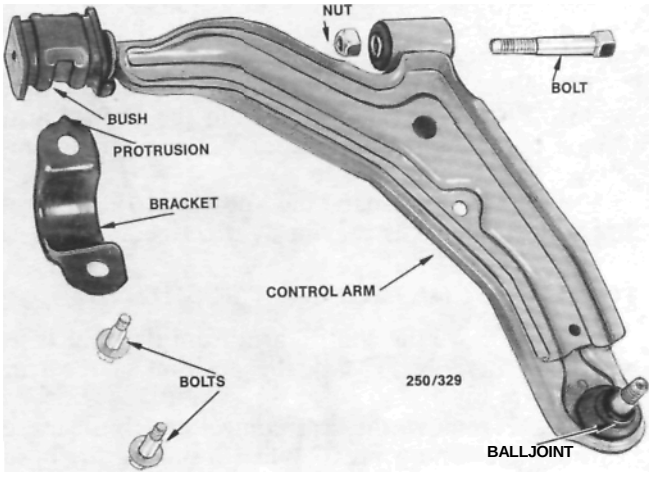
(4) Remove the nut retaining the stabilizer link to the control arm.

(5) Remove the nut and through bolt from the front control arm bush.

(6) Remove the bolts from the rear control arm bush bracket and withdraw the control arm from the vehicle.

(7) Inspect the control arm for cracks, damage and distortion and renew if necessary.

(8) Inspect the ball joint and bushes for damage, deterioration and excessive wear. If necessary renew



View of the control arm and associated components.

the ball joint or bushes as described later in this section.

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

(1) When installing the control arm bush bracket, ensure that the protrusion on the bracket is towards the inside of the vehicle.

(2) Do not fully tighten the control arm bush bolts and through bolt nut until the curb weight of the vehicle is on the suspension.

NOTE: Curb weight is with the vehicle unladen except for a full tank of fuel and normal amounts of oil and water and with the spare lyre, jack and hand tools in their normal positions.

(3) Tighten the ball joint nut to the specified torque and retain with a new split pin.

TO CHECK AND RENEW BALL JOINT

(1) Remove the control arm from the vehicle as previously described.

(2) Install the ball joint nut and turn the ball joint at least ten revolutions to ensure that the ball joint is correctly seated.

(3) Using a spring scale with the hook placed over the split pin hole, check the ball joint swinging torque. A new ball joint should measure 15.7-80.4 N and a used ball joint should measure 7.8-80.4 N. Renew the ball joint if necessary.

(4) Using a small torque wrench or preload gauge, measure the force required to rotate the ball joint. A new ball joint should measure between 1.0-4.9 Nm and a used ball joint should measure between 0.5-4.9 Nm. Renew the ball joint if necessary.

(5) To renew the ball joint, remove the snap ring from the stud end of the ball joint using snap ring pliers.

(6) Support the control arm in a press, ball joint stud uppermost, with a suitable tube that is large enough for the ball joint to pass through.

(7) Press the ball joint out from the control arm.

(8) Press a new ball joint into the control arm using a suitable tube that pushes on the outer circumference of the joint only.

(9) Install the snap ring and install the control
arm to the vehicle as previously described.

TO RENEW CONTROL ARM BUSHES

(1) Remove the control arm from the vehicle as previously described. Mark the position of the rear control arm bush.

(2) To remove the rear control arm bush use a bearing puller and a press. When installing the bush use a suitable tube that pushes on the inner edge of the bush only.

NOTE: Ensure that the bush is installed with the flat portion in its original location.

(3) To remove the front control arm bush use a suitable tube that pushes on the outer circumference of the bush and a split tube supporting the control arm.

(4) After the bush has been pressed out approximately half way, cut the protruding part of the bush using a hacksaw. Cutting the bush in this way will allow removal.

(5) Support the control arm and push the new bush in from the outside using a suitable tube that pushes on the outer circumference only.

(6) Install the control arm to the vehicle as previously described.

6. STABILISER BAR

TO REMOVE AND INSTAL

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

(2) Remove the bolts at the flexible joint retaining the front engine pipe to the exhaust pipe located below the stabilizer bar.

(3) Remove the bolt from the exhaust pipe mounting below the stabilizer bar. Disconnect the exhaust pipe at the flexible joint and allow the front of the pipe to hang down.

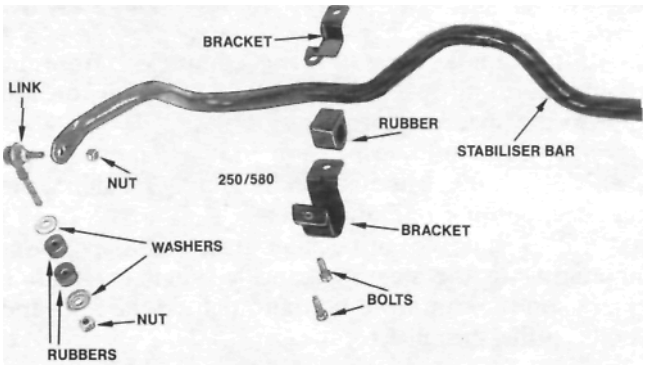
(4) Remove the stabilizer bar bracket retaining bolts and remove the stabilizer bar brackets from the vehicle.

(5) Remove the stabilizer bar lower link nuts from each control arm. When removing the lower nuts it may be necessary to hold the upper nuts with a spanner.

(6) Maneuver the stabilizer bar from the vehicle.

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

(1) Ensure that the stabilizer bar mounting rubbers are in a serviceable condition and secure in the mounting brackets.



Dismantled view of one end of the stabilizer bar.

(2) Ensure that the stabilizer bar links are in good condition. Renew if necessary.

(3) When installing the stabilizer bar ensure that the links are installed perpendicular to the control arm with the ball joint socket face parallel to the end of the stabilizer bar.

(4) Ensure that the brackets are installed with the flat portion facing towards the front of the vehicle. Tighten the retaining bolts securely.

7. SUSPENSION AND STEERING ANGLES

ADJUSTMENT

NOTE: Extensive knowledge and specialised equipment are required to measure and correct the suspension and steering angles with the exception of the front wheel toe in. Therefore, as it is not a viable proposition for the average person to carry out a complete wheel alignment, the vehicle should be taken to a wheel alignment specialist.

Prior to carrying out a wheel alignment, a thorough inspection of the steering linkage, front hub bearings, ball joints and suspension units should be carried out. Faulty components should be renewed or repaired as necessary.

The tread of the front tires should be examined for excessive or uneven wear as certain conditions of tire wear are indicative of damaged or worn components in the suspension, steering linkage and/or wheels and bearings. Refer to the heading Tire Wear Trouble Shooting in the Wheels and Tires section. If the tires are found to be defective, renew them with serviceable lyres.

TO CHECK AND ADJUST TOE IN/OUT

NOTE: The vehicle should be unladen except for the normal amount of fuel and with the tires inflated to the correct pressures.

(1) With the vehicle on a level floor, raise the front of the vehicle and support it on chassis stands.

(2) Spin each front wheel in turn and using a piece of chalk, mark a line around the periphery of each tire as near to the centre as possible.

(3) Lower the vehicle to the ground and bounce the front several times to stabilize the suspension.

(4) Set the wheels in the straight ahead position.

(5) Mark the centre chalk line on both tires at a point approximately 200 mm above the floor and forward of the suspension.

(6) Using a tape measure, measure and record the distance between the two marked points on the tire centers.

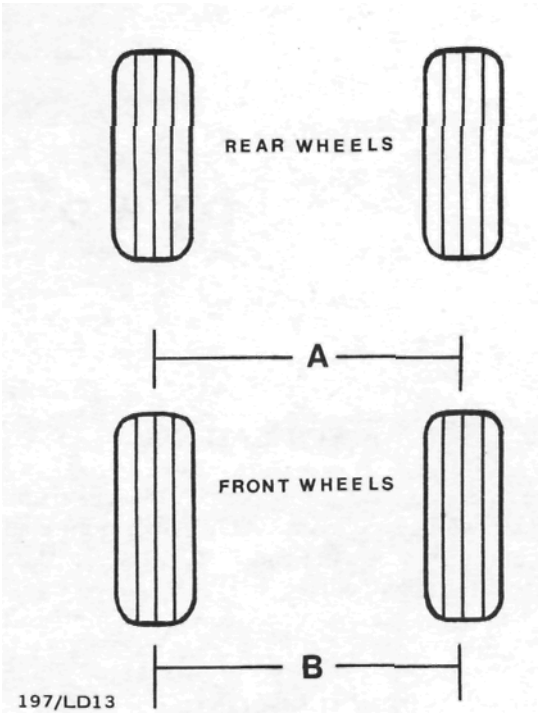


Diagram indicating the front wheel toe in. Refer to Specifications for the correct difference between measurement A and B.

(7) Maintaining the wheels in the straight ahead position, roll the vehicle forward until the marks are the same distance from the floor but to the rear of the suspension.

(8) Again using the tape measure, measure and record the distance between the marks on the tires.

(9) The difference between the front and rear measurement will give the correct toe in/out reading. If the larger measurement is at the front, the wheels are in a toe out position. If the reverse is true, the wheels are in toe in position. Compare the reading obtained with the figure given in Specifications.

(10) If adjustment of the toe in/out is necessary, loosen the tie rod locknuts on both sides.

(11) Remove the retaining clips from the small end of the steering rack rubber boots.

(12) Turn the tie rods as required until the correct toe in/out reading is obtained.

NOTE: It is important to turn each tie rod equally to maintain the central position of the steering gear. Ensure that the lengths of the tie rods are the same.

(13) Tighten the tie rod locknuts to the specified torque without changing the positions of the adjusters.

(14) Install the retaining clips to the small end of
the steering rack rubber boots, ensuring that the boots are not twisted.

REAR SUSPENSION

SPECIFICATIONS

Type	Independent MacPherson strut
Shock absorber	Oil filled, non-repairable
Maximum hub bearing end float	0.05 mm
Rear wheel alignment:	
Toe out	3 **mm** ± 2 mm
Camber	- 1 ° ± 45'

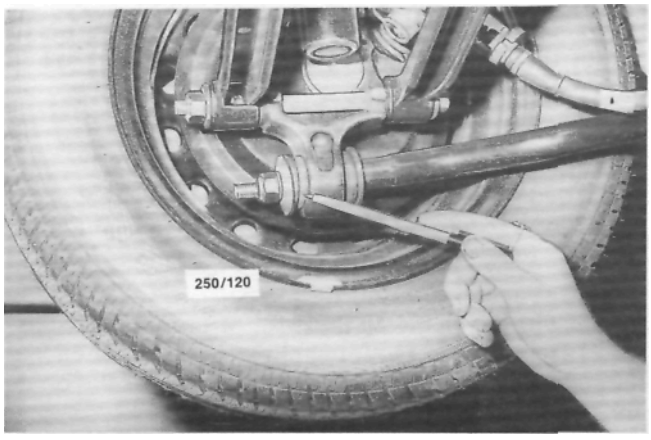
TORQUE WRENCH SETTINGS

Hub retaining nut	255 Nm
Suspension unit retaining nuts	29 Nm
Upper mounting retaining nut	72 Nm
Suspension unit to knuckle nuts	118 Nm
Control arms to knuckle nut	118 Nm
Control arms to crossmember nut	118 Nm
Stabiliser bar mounting bracket bolts	108 Nm
Stabiliser bar retaining nut	83 Nm
Backing plate bolts	45 Nm

1. REAR SUSPENSION TROUBLE SHOOTING

REAR END NOISE

(1) Defective suspension unit or mounting: Renew the faulty components.



Check the stabilizer bar bushes and mounting rubbers for wear and deterioration.

(2) Loose or worn control arm bushes or pivot bolts: Check and tighten or renew the worn components.

(3) Broken coil spring: Renew the coil spring, preferably in matching pairs.

(4) Worn rear hub bearing: Check and renew the hub bearing as necessary.

(5) Loose or worn stabilizer bar bushes: Check and tighten or renew the worn components.

NOTE: As a quick guide to suspension unit condition, bounce the vehicle up and down (one side at a time) and observe if the vehicle comes to rest in a single movement If the vehicle bounces two or three times before coming to rest the suspension unit is suspect. If suspect, remove the suspension unit and check for fractures and leaks. If the suspension unit is found to be unserviceable, it is good practice to install two new suspension units as a matching pair.

To check the control arm bushes or pivot bolts, insert a lever between the suspect unit and its mounting and lever the unit back and forth checking for excessive movement.

Check the coil springs visually for breaks. If the spring is found to be unserviceable, it is good practice to install two new coil springs as a matching pair.

Rear hub bearing noise can be diagnosed by raising and supporting the rear of the vehicle, spinning one wheel at a time and listening for a rumbling noise.

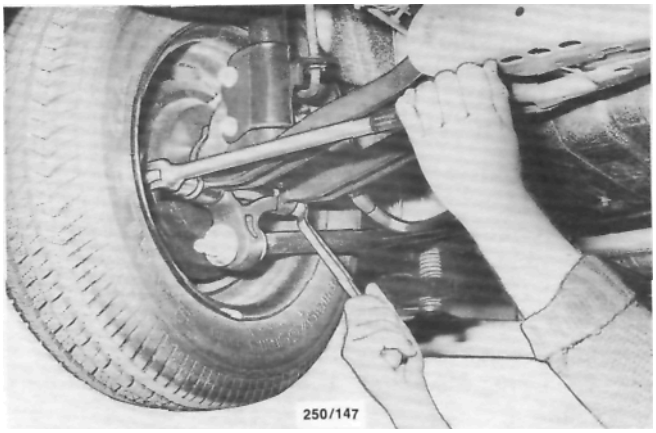
POOR OR ERRATIC ROAD HOLDING ABILITY

(1) Low or uneven tire pressure: Inflate to the recommended pressures.

(2) Incorrect rear wheel alignment: Check and adjust the rear wheel alignment as necessary.

(3) Defective suspension unit: Renew the faulty suspension unit, preferably in pairs.

(4) Loose or broken stabilizer bar: Check and tighten or renew the faulty components.



Checking the rear control arm outer pivot bolt for security.

(5) Loose or worn control arm bushes or pivot bolts: Check and tighten or renew the worn components.

NOTE: Check the serviceability of the suspension units, control arm bushes and pivot bolts as previously described.

If incorrect rear wheel alignment is suspected, it is recommended that the vehicle be taken to a wheel alignment specialist or a Nissan dealer to be checked and if necessary adjusted.

Visually inspect the stabilizer bar for damage.

2. DESCRIPTION

The independent type rear suspension consists of a suspension unit, a knuckle assembly which incorporates the stub axle, inboard control arms and a stabilizer bar.

The suspension unit consists of a sealed, oil filled shock absorber, enclosed at the upper end by a coil spring on which an upper mounting assembly is located and attached to the body.

The shock absorber piston rod is attached to the centre of the suspension unit upper mounting assembly.

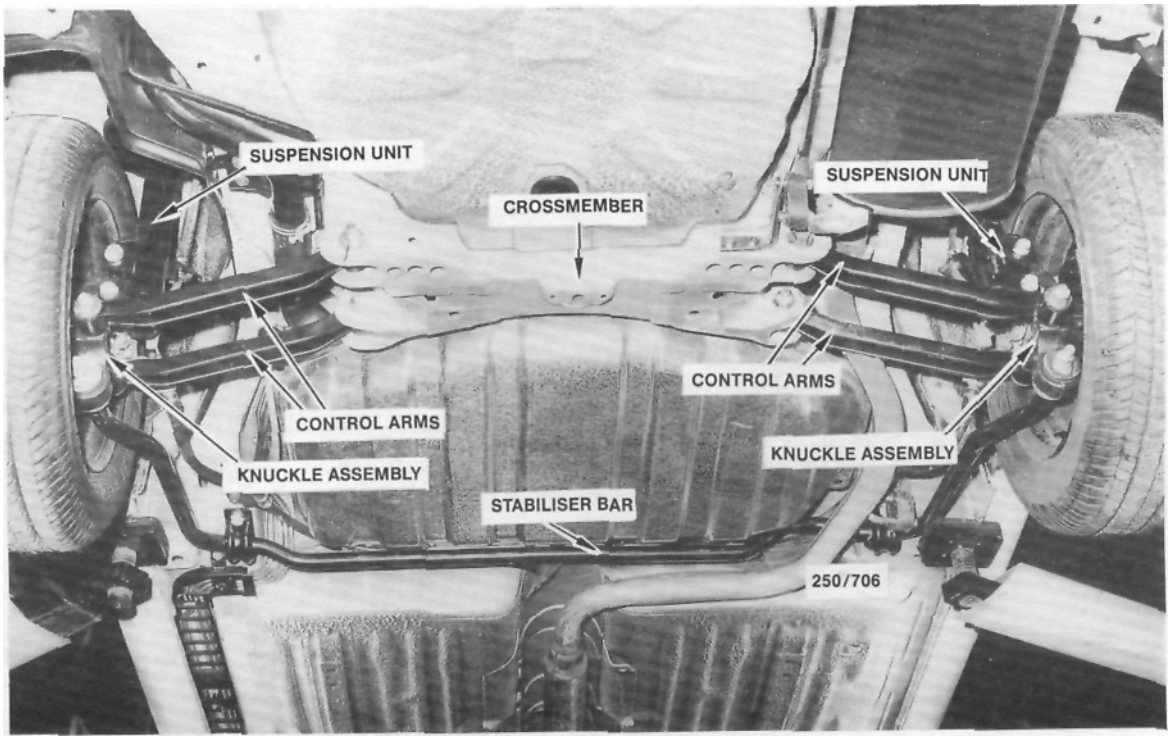
The lower end of the suspension unit is attached to the knuckle assembly to which the brake caliper and/or the brake backing plate is mounted.

The control arms are attached to the knuckle assembly at the outer end, and the crossmember at the inner end.

The stabilizer bar is attached to the knuckle assembly and mounted to the underbody. As well as reducing body roll when cornering it also secures the knuckle assembly, preventing fore and aft movement.

Adjustment of the toe out is provided by a graduated cam mounted on the rear control arm inner pivot bolt. Each graduation on the cam is equivalent to 2 mm adjustment.

Camber is set in production and cannot be adjusted. If the camber is not within Specifications, inspect the suspension components and renew the damaged or worn components as necessary.



Installed view of the rear suspension.

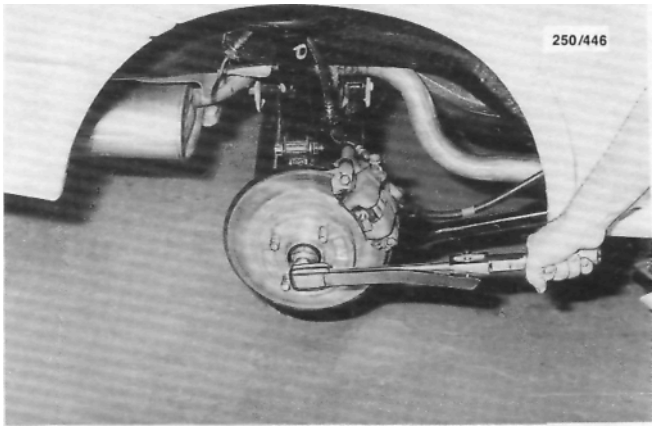
3. REAR HUB

Special Equipment Required
To Check Hub Bearing End Float — Dial gauge
To Renew Bearing — Press and suitable drift

TO REMOVE AND INSTAL

(1) Raise the rear of the vehicle and support it on chassis stands. Remove the rear wheel and release the handbrake.
(2) On models with rear drum brakes, proceed to operation (6).
(3) Remove the clip securing the brake hose to the suspension unit and disengage the hose.
(4) Remove the bolts securing the brake caliper to the knuckle assembly.
(5) Slide the caliper from the disc and support it away from the working area, ensuring that no excess strain is placed on the brake hose.
(6) Rotate the hub and check that it rotates smoothly. If it does not rotate smoothly, renew the hub bearing.
(7) Mount a dial gauge with the plunger positioned against the outer face of the hub. Move the hub back and forth in line with the stub axle and note the reading on the dial gauge. If the end float exceeds Specifications, renew the hub bearing.
(8) Remove the hub grease cap from the rear hub.
(9) Remove the split pin from the stub axle and remove the nut retainer, the hub retaining nut and washer. Remove the hub assembly from the stub axle.

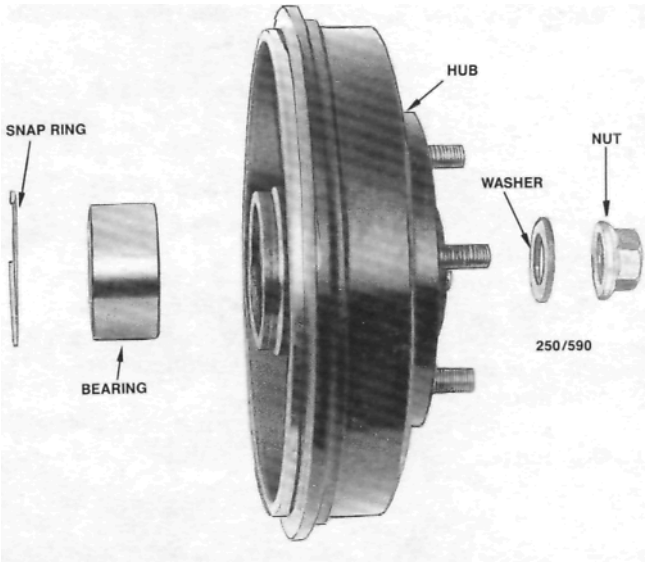
Installation is a reversal of the removal procedure with attention to the following points:
(1) Tighten the hub retaining nut to the specified torque.
(2) Check the hub bearing end float as previously described.
(3) On models with disc brakes, install the brake caliper and tighten the retaining bolts to the torque specified in the Brakes section. Install the brake hose to the suspension unit and secure with the retaining clip.



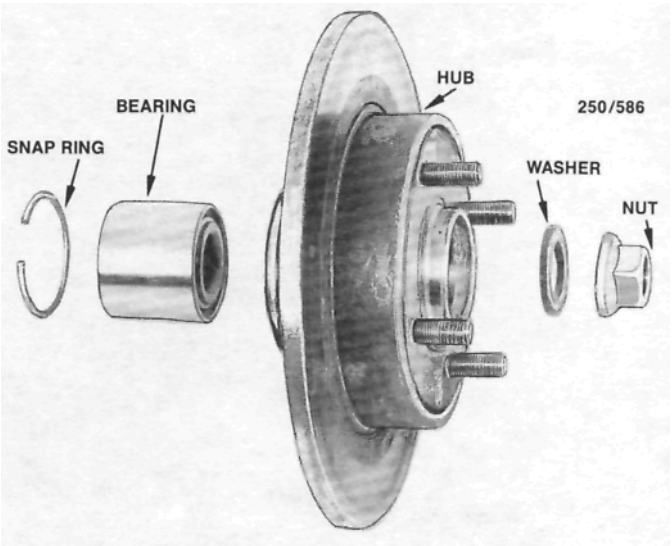
Tightening the hub retaining nut with a torque wrench.

TO RENEW BEARING

(1) Remove **the** rear hub as previously described.
(2) Remove the snap ring from the rear of the hub assembly.
(3) Support the rear of the hub around the bearing housing, ensuring that the bearing will not be obstructed when being pressed out.
(4) Using a suitable drift, press the bearing out of the hub.



Dismantled view of the rear hub assembly. Drum brake model.



Dismantled view of the rear hub assembly. Disc brake model.

NOTE: When a wheel bearing has been removed from the hub it must be renewed.

(5) Press the new bearing into the hub, ensuring that pressure is not exerted on the inner race of the bearing and that the bearing seal is not damaged. Do not apply grease or oil to the mating surfaces of the bearing and the hub.

NOTE: When installing the new bearing, the press load must not exceed 3 tonnes.

(6) Inspect the snap ring for wear or cracks and renew as necessary. Install the snap ring into the hub ensuring that it is securely located in the groove.

(7) Apply multi-purpose grease to the bearing sealing lip and install the hub as previously described.

4. SUSPENSION UNIT

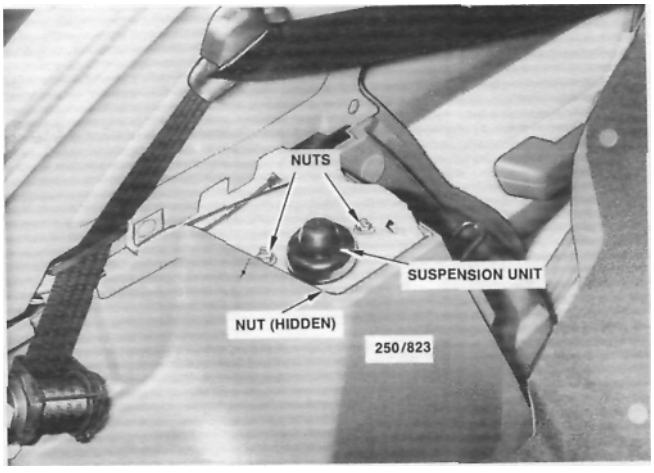
Special Equipment Required:
To Dismantle — Spring compressor

TO REMOVE AND DISMANTLE

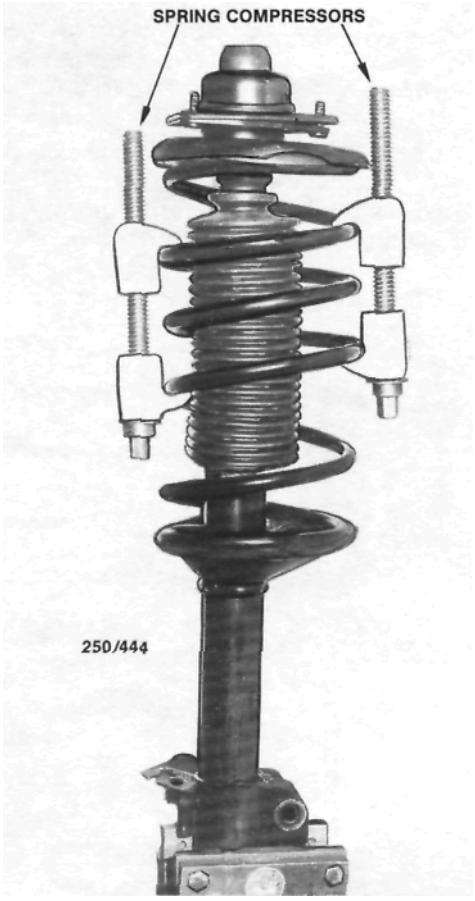
(1) On hatchback models, remove the rear parcel shelf and lower the rear seat backrests. Remove the parcel shelf side panel retaining screws and remove the relevant side panel.

(2) On sedan models, prise out the parcel shelf retaining buttons using a suitable instrument and withdraw the parcel shelf from the vehicle. If the rear radio speakers are installed, remove the speaker grille retaining screws and separate the speaker grilles from the speakers prior to withdrawing the parcel shelf from the vehicle.

(3) Raise the rear of the vehicle and support it on chassis stands as described in the Wheels and Tires section. Remove the rear wheel from the vehicle.



Location of the suspension unit retaining nuts. Hatchback model.



View of the suspension unit with the spring compressors installed.

(4) Remove the clip securing the brake hose to the suspension unit and disengage the hose from the suspension unit.

(5) Support the weight of the knuckle assembly and remove the bolts and nuts securing the suspension unit to the knuckle assembly.

(6) Remove the nuts securing the suspension unit to the body panel and maneuver the suspension unit from the vehicle.

(7) Thoroughly clean the suspension unit and secure it in a soft jawed vice.

(8) Remove the dust cap from the upper mounting and while holding the end of the piston rod with an adjustable spanner, loosen the upper mounting retaining nut. Do not remove the retaining nut.

(9) Using a suitable spring compressor, compress the coil spring and remove the upper mounting retaining nut and washer.

(10) Remove the upper mounting, insulator and spring seat from the suspension unit.

(11) Withdraw the upper insulator, coil spring, lower insulator and dust cover from the suspension unit.

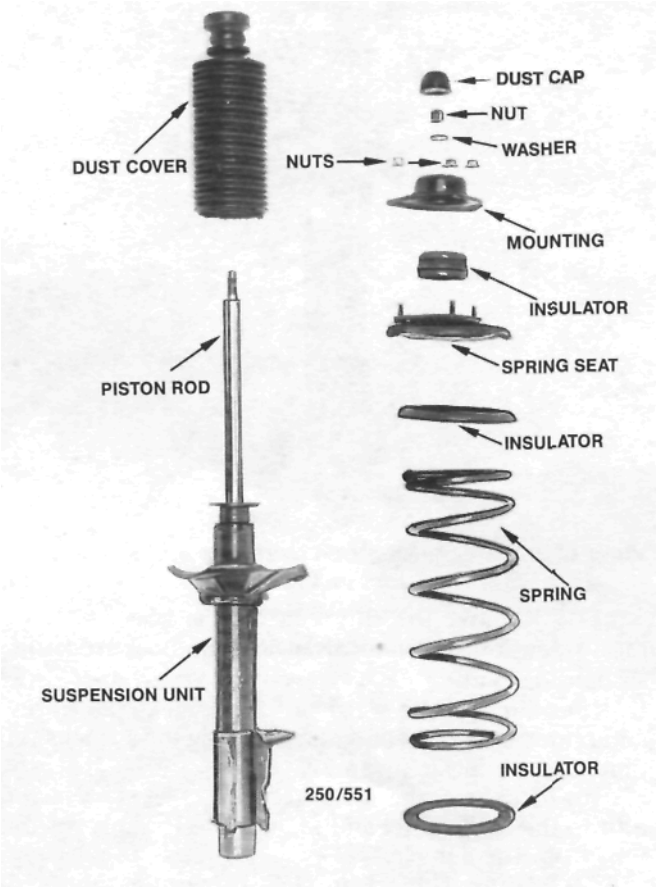
(12) Check the coil spring for cracks, deformation and damage. Compare the free length with a new coil spring and renew as necessary.

NOTE: If a coil spring is defective it is advisable to renew both coil springs as a matched set.

(13) Check the spring seat for cracks, deformation or wear and renew as necessary.

(14) Check the upper mounting and the insulator for wear, damage, signs of melting rubber or deterioration.

(15) Check that the piston rod is not cracked, bent or damaged.



Dismantled view of the suspension unit.

(16) Check the hydraulic operation of the suspension unit. With the suspension unit vertical, move the piston rod up and down several times. A firm pressure with no slack spots should be evident in both directions. Also check the suspension unit for fluid leakage. If fluid leakage is present, renew the suspension unit, preferably in pairs.

TO ASSEMBLE AND INSTAL

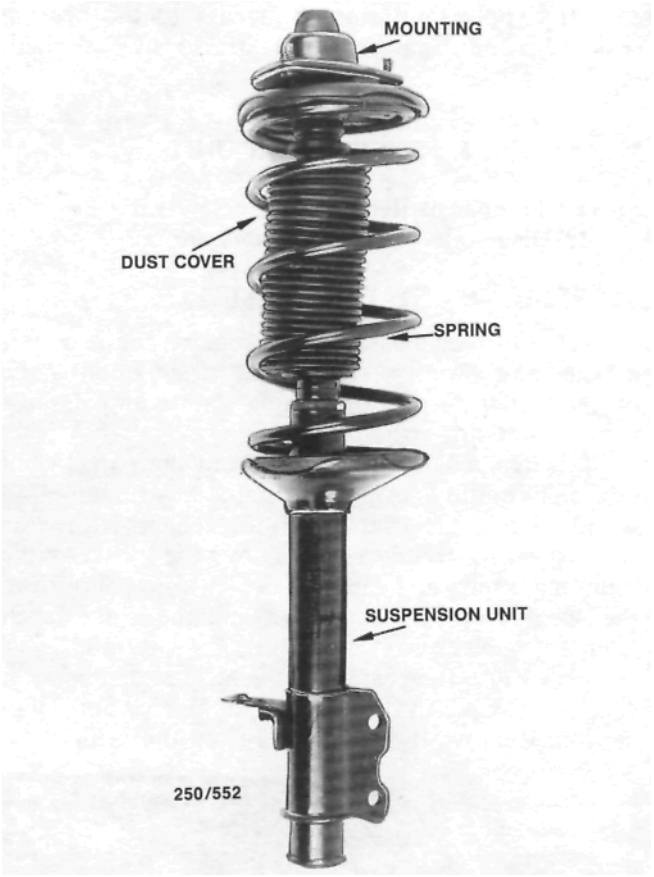
Assembly is a reversal of the dismantling procedure with attention to the following points:

(1) Install the coil spring and lower insulator to the suspension unit ensuring that the flat end of the spring is positioned at the top and the lower end of the spring is located correctly in the suspension unit.

(2) Install the remaining components to the suspension unit, ensuring that the arrow on the spring seat will be facing the stub axle when installed.

(3) Install a new upper mounting retaining nut, tighten to the specified torque and remove the spring compressor.

(4) Position the suspension unit inside the rear wheel housing and maneuver the mounting studs into position. With the aid of an assistant, install the suspension unit retaining nuts and tighten to the specified torque.



View of the suspension unit removed from the vehicle.

(5) Install the bolts securing the suspension unit to the knuckle assembly and tighten the nuts to the specified torque.

(6) Install the brake hose to the suspension unit and secure with the retaining clip.

(7) Install the rear wheel and lower the vehicle to the ground.

(8) On hatchback models, install the parcel shelf side panel and the parcel shelf.

(9) On sedan models, install the parcel shelf and insert the retaining buttons firmly. If removed, install the radio speaker grilles.

5. CONTROL ARM

Special Equipment Required:
To Renew Control Arm Bush — Press and suitable removal tool

TO REMOVE AND INSTAL

(1) Raise the rear of the vehicle and support it on chassis stands as described in the Wheels and Tires section.

(2) Suitably mark the front and rear control arms to ensure installation to the original locations.

NOTE: The front and rear control arms are identical in appearance, however, on models manufactured prior to March 1988 the compound of the rubber bushes differ.

(3) Remove the nut and bolt securing the control arms to the knuckle assembly.

(4) Suitably mark the rear inner pivot bolt cams in relation to the crossmember to ensure correct installation.

(5) Remove the rear control arm inner pivot bolt, adjusting cam, nut and control arm from the vehicle.

(6) Remove the front control arm inner pivot bolt, washer, nut and control arm from the vehicle.

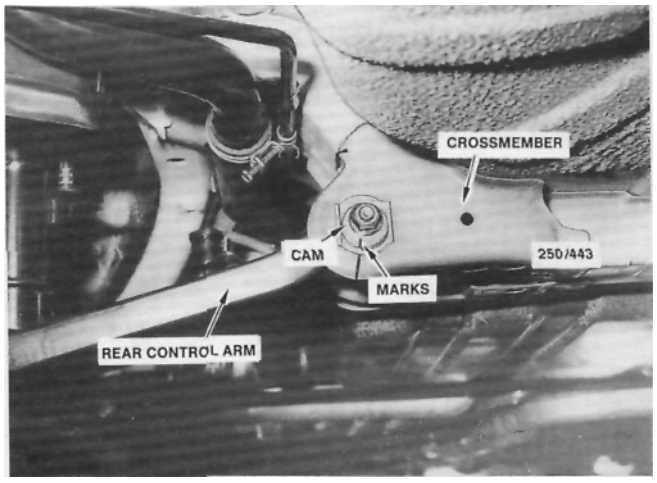
(7) Inspect the control arm bushes for wear, cracks and deterioration and renew as necessary.

(8) Inspect the control arms for cracks, damage and distortion and renew as necessary.

(9) Inspect the pivot bolts for damage and renew as necessary.

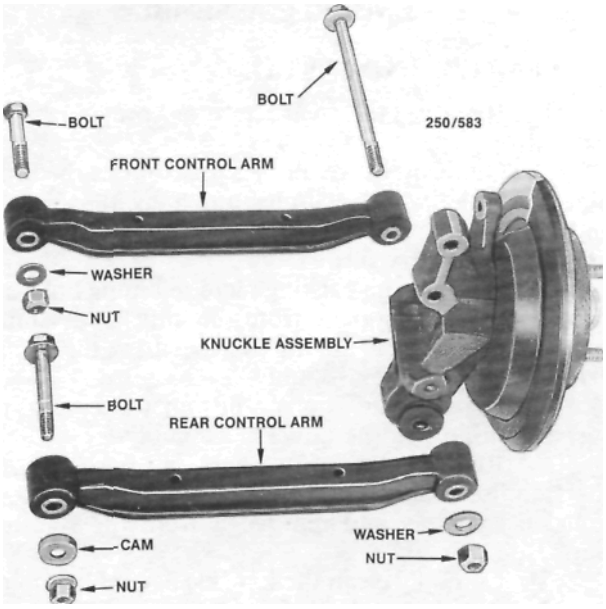
Installation is a reversal of the removal procedure with attention to the following points:

(1) Install the control arms to the original locations, ensuring that the inner pivot bolts are installed from the front of the crossmember.



Ensure that the cam and the crossmember are suitably marked prior to loosening the nut.

(2) Align the marks on the rear inner pivot bolt cams and the crossmember that were made prior to removal. Install the inner pivot bolt nuts but do not tighten.



Dismantled view of the control arms and associated components. Disc brake model.

(3) Install the bolt that secures the control arms to the knuckle assembly and tighten the nut finger tight.

(4) Lower the vehicle to the ground. With the weight of the vehicle on the rear wheels, ensure that the marks on the inner pivot bolt cams and the crossmember are aligned.

(5) Tighten the inner and outer control arm bolts and nuts to the specified torque.

(6) Check and if necessary adjust the rear wheel alignment. Refer to the Rear Wheel Alignment heading in this section.

TO RENEW CONTROL ARM BUSH

(1) Remove the control arm as previously described.

(2) Using a press and press plates or a bush removal tool, remove the bush from the control arm.

NOTE: If a press or bush removal tool is not available, a simple alternative can be made using a long bolt, large and small washers, a nut and a tubular spacer. This method is illustrated in the General Information section under the General Repair Procedures heading.

(3) Install a new bush to the control arm ensuring that it is pressed squarely into the control arm. When installed, the bush should be equidistant from either end of the control arm bore.

(4) Install the control arm as previously described.

6. KNUCKLE ASSEMBLY

TO REMOVE AND INSTAL

(1) Remove the rear hub as previously described.

(2) On drum brake models, disconnect the brake pipe from the wheel cylinder and plug the cylinder and brake pipe apertures to prevent the loss of brake fluid and the entry of dirt.

(3) Remove the backing plate retaining bolts and remove the backing plate from the knuckle assembly.

(4) Remove the nut and bolt securing the control arms to the knuckle assembly.

(5) Remove the bolts and nuts securing the suspension unit to the knuckle assembly.

(6) Remove the nut, washers and bush securing the stabilizer bar to the knuckle assembly, rotate the knuckle assembly and remove it from the stabilizer bar.

(7) Carefully clean the knuckle assembly. Do not immerse the rubber bush in solvent as damage will occur.

(8) Check the knuckle assembly for wear, cracks and damage.

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

(1) Install the knuckle assembly onto the stabiliser bar, maneuver it into position with the suspension unit and install the retaining bolts and nuts. Tighten the bolts and nuts to the specified torque.

(2) Install the control arms to the knuckle assembly and install the retaining bolt and nut. Do not tighten the retaining bolt and nut at this stage.

(3) Install the bush, washers and retaining nut to the stabilizer bar. Do not tighten the retaining nut at this stage.

(4) Install the backing plate to the knuckle assembly and tighten the retaining bolts to the specified torque.

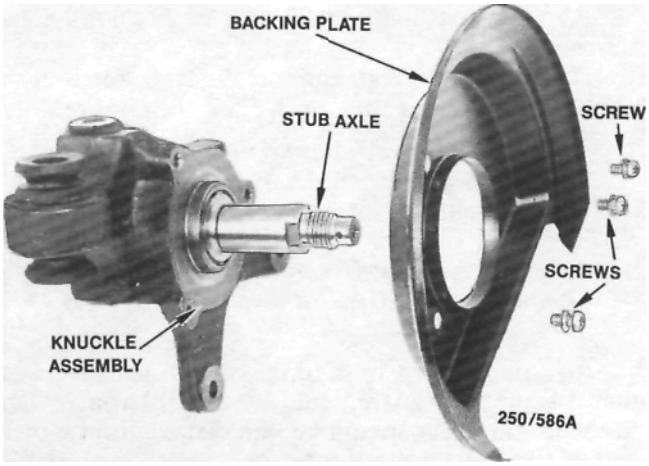
(5) On drum brake models, connect the brake pipe to the wheel cylinder and tighten the flare nut securely.

(6) Install the rear hub as previously described.

(7) On drum brake models, bleed the brake hydraulic system as described in the Brakes section.

(8) With the weight of the vehicle on the road wheels, tighten the control arms retaining bolt and nut and the stabilizer bar retaining nut to the specified torque.

(9) Check and if necessary adjust the rear wheel alignment. Refer to the Rear Wheel Alignment heading in this section.



View of the knuckle assembly removed from the vehicle. Disc brake model.

7. STABILISER BAR

TO REMOVE AND INSTAL

(1) Raise the rear of the vehicle and support it on chassis stands as described in the Wheels and Tires section. Remove the rear wheels.

(2) Remove the nut. washer and bush retaining the stabilizer bar to each knuckle assembly.

(3) Remove the bolts retaining the intermediate exhaust pipe to the rear of the catalytic converter, remove the bolt securing the exhaust mounting to the underbody and slightly lower the intermediate exhaust pipe. Support the intermediate pipe to prevent the tailpipe contacting the lower bumper panel.

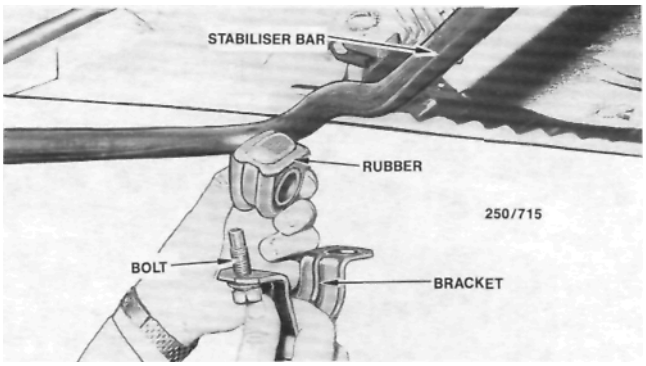
(4) Remove the bolts retaining the stabilizer bar mounting brackets to the underbody and withdraw the stabilizer bar from each knuckle assembly. Manoeuvre the stabilizer bar from the vehicle.

(5) Remove the mounting rubbers from the stabilizer bar and the rubber bush and spacer from each knuckle assembly.

(6) Inspect the stabilizer bar for cracks and damage and renew as necessary.

(7) Inspect the stabilizer bar mounting brackets for wear and damage and renew as necessary.

(8) Inspect the mounting rubbers, the rubber bushes and spacers for wear and deterioration and renew as necessary.



View of the stabilizer bar mounting bracket and rubber removed from the stabilizer bar.

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

(1) When installing the stabilizer bar to the knuckle assembly bushes, ensure that the thicker bush is installed to the front of the knuckle assembly. Install the rear bush, washers and nut but do not tighten at this stage.

(2) Install the stabilizer bar mounting brackets, ensuring that the end with the large bevel is facing the front of the vehicle. Tighten the retaining bolts to the specified torque.

(3) Using a new gasket, install the intermediate exhaust pipe to the catalytic converter, ensuring that the earth wire terminal is installed, and tighten the bolts securely. Install the exhaust mounting retaining bolt.

(4) Install the rear wheels and lower the vehicle to the ground. With the weight of the vehicle on the road wheels, tighten the stabilizer bar retaining nuts to the specified torque.

8. REAR WHEEL ALIGNMENT

Specialized equipment is required to measure the rear wheel alignment. It is therefore recommended that the vehicle be referred to a specialist suspension workshop or an authorized dealer for measurement and adjustment. The suspension components should be inspected and renewed as necessary prior to having the wheel alignment checked. If any suspension components are renewed, the rear wheel toe out may be temporarily adjusted as described below.

TO **INSPECT**

Examine the tread of the tires. Excessive or uneven wear will indicate misalignment or damaged or worn components. Refer to the Tire Wear Trouble Shooting Chart in the Wheels and Tires section for possible causes and renew the faulty components.

Badly worn tires should be renewed prior to having the wheel alignment checked.

TO CHECK AND ADJUST TOE OUT

NOTE: The following procedures are only a temporary measure. The vehicle should be referred to a specialist suspension workshop or authorized dealer for accurate measurement and adjustment.

(1) Position the vehicle on a level floor and bounce the vehicle several times to settle the suspension.

(2) Move the vehicle forward approximately 5 meters, with the front wheels straight ahead, to settle the tires and suspension to the normal running position.

(3) Place a chalk line across both tire treads at a point equivalent to the stub axle height and to the rear of the suspension.

Place a vertical mark at the chalk line in the centre of each tire.

(4) Using a telescopic gauge or tape measure, measure the distance between both vertical marks and record the measurement.

(5) Move the vehicle forward until the marks are to the front of the suspension, with the horizontal marks at the same height as in operation (3).

(6) Measure the distance between both vertical marks.

(7) The difference between the two measurements will be the amount of toe out of the rear wheels.

(8) If the toe out is not as specified, adjust the rear control arm cams as follows:

(9) Measure the distance between the inner wheel rim and the adjusting flange on the rear crossmember. Measure the distance on the other side of the vehicle in the corresponding positions.

(10) If the measurements are equal, loosen the cam nut and turn the cam bolt to move the rear control arm half the distance required to bring the rear wheel toe out to specifications. Repeat this operation on the other side of the vehicle.

(11) If the measurements obtained in operation (9) are not equal, proceed as follows:

(a) If the toe out is less than specifications, decrease the length of the shorter arm.

(b) If the toe out is greater than specifications, increase the length of the longer arm.

NOTE: The toe out will alter approximately 2 mm with each graduation of the adjusting cam.

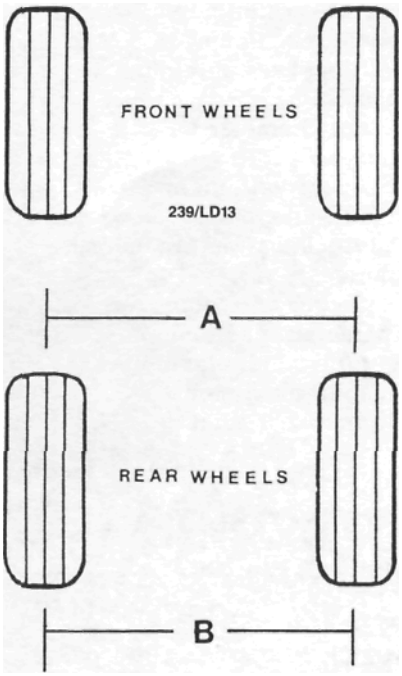


Diagram indicating rear wheel toe out. B should be less than A. Refer to Specifications.

BRAKES

SPECIFICATIONS

Type:	
Except Pulsar/Vector GL from July 1989 and Astra models	Four wheel disc
Pulsar/Vector GL from July 1989 and Astra models —	
Front	Disc
Rear	Drum
Operation:	
Footbrake	Vacuum assisted diagonally split dual hydraulic
Handbrake	Mechanical on rear wheels
Fluid type	Dot 4
Master cylinder:	
Make	Girlock
Bore diameter —	
Large	25.40 mm
Small	20.64 mm
Front disc brakes:	
Caliper bore diameter	48.1 mm
Disc diameter	240 mm
Disc thickness, minimum	16 mm
Disc runout, maximum	0.07 mm
Disc pad thickness, minimum	2 mm
Rear disc pads:	
Caliper bore diameter	30.16 mm
Disc diameter	234 mm
Disc thickness, minimum	9 mm
Disc runout, maximum	0.07 mm
Disc pad thickness, minimum	2 mm
Rear drum brakes:	
Wheel cylinder bore diameter	15.87 mm
Drum diameter, maximum	204.50 mm
Drum out of round, maximum	0.03 mm
Drum runout, maximum	0.05 mm
Brake lining wear limit	1.5 mm

TORQUE WRENCH SETTINGS

Brake pedal bracket to body	11 Nm
Brake pedal pivot bolt	11 Nm
Brake servo unit to body	II Nm
Brake servo unit to master cylinder	11 Nm
Pressure differential piston plug	12 Nm
Proportioning valve plug	27 Nm
Caliper anchor plate bolts	52 Nm
Caliper guide bolts	31 Nm
Brake hose to caliper	34 Nm
Handbrake cable bracket bolt	49 Nm
Handbrake lever to body	11 Nm
Cable clamp to body	11 Nm
Cam lever nut	49 Nm

1. BRAKES TROUBLE SHOOTING

BRAKE PEDAL HARD

(1) Seized caliper piston or wheel cylinder: Overhaul the caliper or wheel cylinder.

(2) Seized master cylinder piston: Overhaul the master cylinder.

(3) Seized pedal pivot: Rectify or renew the pedal pivot shaft and bushes.

(4) Restricted brake line: Remove the restriction or renew the brake line.

(5) Vacuum servo system inoperative: Check and repair the servo system.

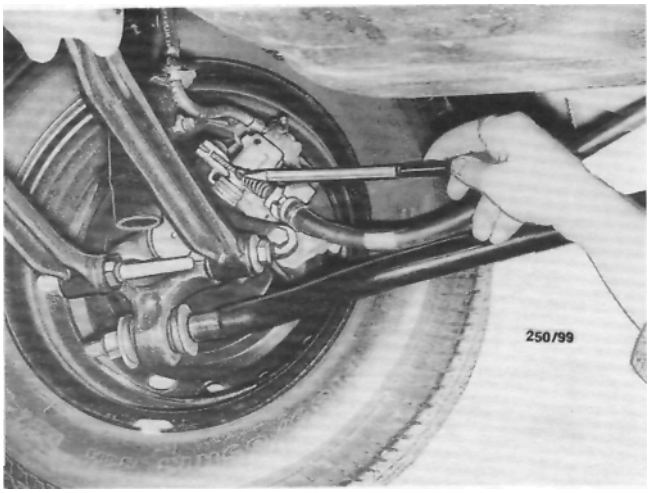
NOTE: The vacuum servo system can be checked as follows: With the engine switched off, pump the brake pedal several times to deplete any vacuum in the system. With the engine still switched off, press down firmly on the brake pedal and hold it there noting the position and pressure required. Start the engine. If the servo unit is operating correctly, the brake pedal will sink slightly and the pressure required to hold it may reduce. If the pedal does not sink slightly when the engine is started, check the vacuum supply to the servo unit. If vacuum is reaching the brake servo unit, the unit can be considered inoperative.

BRAKE DRAG

(1) Clogged master cylinder ports: Clean the master cylinder and the fluid reservoir. Renew the brake fluid.

(2) Seized caliper piston or wheel cylinder: Overhaul the caliper or wheel cylinder.

(3) Seized handbrake linkage: Free up or renew the linkage.



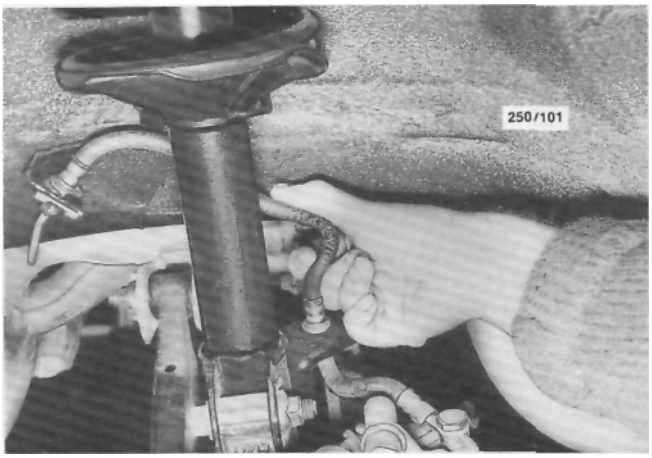
Inspect the handbrake cable for chafing or fraying.

(4) Seized handbrake cables: Renew the handbrake cables.

NOTE: Raise the vehicle and spin the wheels one at a time to check for binding. If the wheels are not binding, have an assistant apply and release the brakes. Check if the brakes release immediately. A clogged master cylinder port will cause binding on the two wheels fed by that particular circuit from the master cylinder. Open the bleeder valve on one of the offending wheels to check if pressure build up is the cause of the binding. A seized handbrake cable will usually cause binding on a rear wheel. Disconnect the handbrake cable and check if the wheel will then turn freely.

LOW SPONGY BRAKE PEDAL

(1) Incorrectly adjusted brake shoes: Check and adjust the brake shoes.



Check the brake hoses for deterioration, chafing and leaks.

(2) Insufficient fluid in the system: Check for leaks, replenish the fluid to the specified level and bleed the hydraulic system.

(3) Air in the brake hydraulic system: Bleed the hydraulic system.

(4) Master cylinder faulty: Repair or renew as necessary.

NOTE: A spongy brake pedal in most cases is caused by air in the hydraulic system. For air to enter the system one or more of the sealing rubbers or brake lines must be sucking in air. Always rectify the cause of the trouble before bleeding the hydraulic system. Faulty components usually show up as fluid leakage.

BRAKES LOCK ON APPLICATION

(1) Gummy linings or brake pads due to oil or fluid contamination: Renew the linings or brake pads and rectify the source of contamination.

(2) Scored or eccentric brake drum or warped disc: Check and machine or renew the drum or disc as necessary.

(3) Incorrect or distorted linings or disc pads: Check and renew as necessary.

(4) Brake servo unit faulty: Repair or renew the brake servo unit.

(5) Broken or stretched brake shoe return springs: Check and renew the faulty brake springs.

(6) Faulty brake pressure proportioning valve: Renew the brake pressure proportioning valve.

NOTE: If this condition arises, remove all the wheels and check the condition of the friction material for oil contamination and excessive wear. Check the shoe return springs for stretching by comparing their free length with new springs. An eccentric-brake drum or warped disc will be indicated by pulsating of the brake pedal when the brakes are lightly applied.

BRAKE PEDAL PULSATES

(1) Eccentric brake drums or warped disc: Check and machine or renew the drum or disc as required.

(2) Loose or worn hub bearings: Renew the hub bearings as necessary.

*NOTE: Brake drums or discs that are running out must be machined. This job is best entrusted to a brake specialist who **will** also be able to determine if a new disc or drum needs to be installed.*

BRAKE FADE

(1) Incorrect shoe adjustment: Check and adjust the shoe to drum clearance.

(2) Eccentric brake drum: Check and machine or renew the brake drum.

(3) Linings saturated with hydraulic fluid: Renew the linings in sets.

(4) Incorrect linings installed: Check and install the recommended linings in sets.

NOTE: In most cases brake fade is caused by overuse of the footbrake, which in turn causes a build up of heat at the friction material and drums or disc. Once this excessive build up of heat is allowed to dissipate the brakes should again function normally.

BRAKES OVERHEAT

(1) Incorrect shoe adjustment: Check and adjust the shoe to drum clearance.

(2) Broken shoe return springs: Renew any faulty springs.

(3) Faulty handbrake cables or incorrect adjustment: Check and renew or adjust the cables.

(4) Frozen wheel cylinder or caliper pistons: Overhaul the cylinders or calipers.

(5) Obstructed or damaged hydraulic hose or line: Remove the obstruction or renew the hydraulic hose or line.

(6) Obstructed master cylinder compensating port: Clean the compensating port.

(7) Blocked vent in the master cylinder reservoir cap; Check and remove the obstruction in the vent.

(8) Overuse of footbrake: Revise driving habits.

NOTE: To check for brake binding raise the vehicle and spin each wheel in turn by hand. If it is found that one wheel cylinder or caliper piston is sticking it is advisable to overhaul all the wheel cylinders and calipers.

BRAKE FAILURE

(1) Faulty master cylinder: Remove and overhaul the master cylinder.

(2) Loss of fluid due to a leaking wheel cylinder: Overhaul or renew the wheel cylinders and bleed the hydraulic system.

(3) Loss of fluid due to a leaking caliper: Overhaul or renew the caliper assemblies and bleed the hydraulic system.

(4) Loss of fluid due to a fractured pipe or faulty union: Renew the faulty components as necessary and bleed the hydraulic system.

(5) Air in the hydraulic system: Locate the source of the air leak, rectify the problem and bleed the hydraulic system.

(6) Water in the hydraulic fluid: Drain, flush, refill and bleed the hydraulic system.

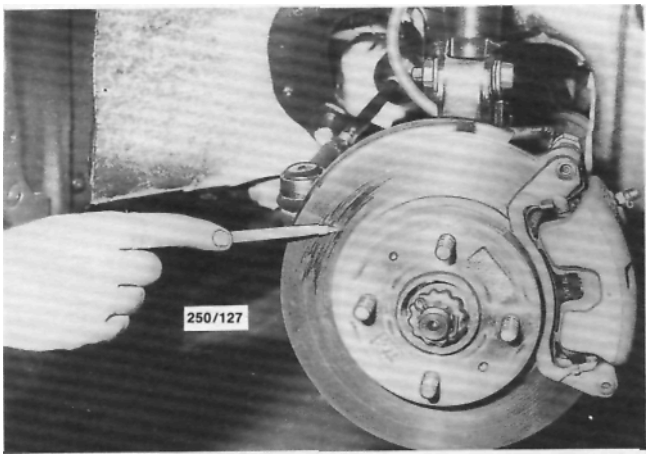
NOTE: To locate the source of a fluid leak, fill the master cylinder reservoir with fluid and check for obvious signs of external leakage while an assistant pumps the brake pedal.

Check the brake pipe unions for leaks.

BRAKE NOISE

(1) Brakes squeal on application: Glazed friction material or missing or damaged disc pad anti-squeal shims.

(2) Grinding noise on application: Friction material worn out. Check the friction material and discs/drums. Renew the brake pads/shoes and machine or renew the brake discs/drums as necessary.



Inspect the brake discs for scoring and wear.

2. DESCRIPTION

The brakes are operated by hydraulic pressure in two independent circuits by means of a tandem dual circuit master cylinder coupled to a brake servo unit mounted on the bulkhead between the brake pedal and master cylinder.

The brake circuits are split diagonally. The left hand front and right hand rear brakes are connected to the primary circuit, and the right hand front and left hand rear brakes are connected to the secondary circuit. Should a malfunction occur in one circuit, the remaining circuit is capable of stopping the vehicle.

A pressure proportioning valve is incorporated in each circuit to prevent premature locking of the rear wheels during severe braking.

The four wheel hydraulically operated brakes utilize disc brakes on each front wheel and disc brakes or leading and trailing drum brake shoes on each rear wheel.

The front disc brakes comprise a disc attached to the hub assembly and a caliper bolted to the steering knuckle.

The rear disc brakes comprise a disc and hub assembly attached to the rear stub axle and a caliper and anchor plate bolted to the backing plate.

The front and rear calipers are of the sliding type. As pad wear takes place, the caliper piston is allowed to slide outwards through the seal to take up a new position in the caliper bore. Elastic deformation of the seal takes place when the brakes are applied, which returns the piston slightly when the brakes are released. Thus a constant clearance is maintained between the pads and the disc when the brakes are in the off position.

The disc brakes do not require periodical adjustment in service to compensate for pad wear as they are self adjusting.

The leading and trailing shoe drum brakes on the rear wheels use a double ended wheel cylinder to operate both brake shoes at the top. The lower end of each brake shoe abuts a fixed anchor point. The brake shoes are automatically adjusted when the brakes are operated.

The handbrake operates the rear brakes via **a** cable arrangement.

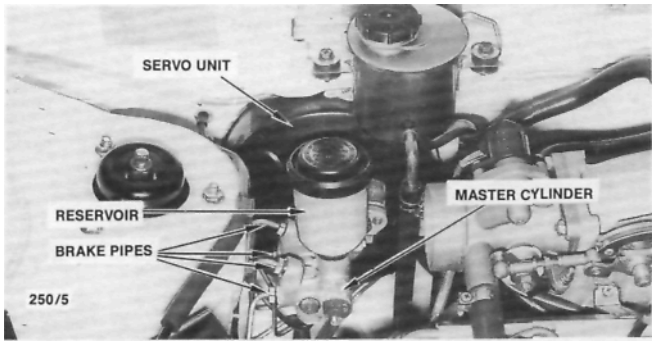
3. MASTER CYLINDER

Special Equipment Required:

To Install New Seals — Suitable machined drift

TO REMOVE

(1) Depress the brake pedal several times to deplete the vacuum from the system.



Installed view of the master cylinder and servo unit. Air duct removed for clarity. 1.8 liter model.

(2) Raise the bonnet and install covers to both
the front mudguards. Cover the areas of paintwork beneath the master cylinder with absorbent cloth.

(3) Disconnect the wiring from the pressure sensing switch.

(4) Disconnect the brake pipes from the master cylinder and plug the outlets and pipes to prevent the loss of fluid and the ingress of dirt.

(5) Remove the nuts retaining the master cylinder to the brake servo unit and remove the master cylinder from the vehicle.

TO DISMANTLE

(1) Remove the master cylinder as previously described.

(2) Remove the reservoir cap and diaphragm, drain and discard the brake fluid from the reservoir.

(3) Carefully remove the reservoir from the master cylinder by pulling it from the reservoir retainers by hand. Remove and discard the retainers from the master cylinder.

(4) Using internal snap ring pliers, remove the snap ring from the primary reservoir port.

(5) Remove the fast fill valve assembly and the O ring from the port. Remove and discard the valve washer from the fast fill valve.

(6) Remove the proportioning valve plugs and the O rings. Discard the O rings. Withdraw the springs and valve plungers from the master cylinder. Remove and discard the seals from the valve plungers.

(7) Remove the pressure sensing switch and lever assembly from the master cylinder.

{8) Remove the cylinder end plug from the master cylinder. Remove and discard the O ring from the plug.

(9) Carefully tap the front of the master cylinder vertically on a block of wood and remove the pressure differential pistons from the master cylinder. Remove and discard the O rings from the pistons.

(10) Push the primary piston forward in the cylinder with a blunt rod and while holding the pressure, remove the stop pin from the master cylinder.

(11) The primary piston may now be withdrawn from the cylinder bore. The secondary piston, retainer and spring can also be withdrawn by carefully tapping the master cylinder on a block of wood.

(12) Prise the legs of the seal retainer upwards and remove it from the primary piston. Remove the seal and guide. Discard the seal and retainer.

NOTE: The secondary piston must no! be dismantled by removing the screw. This assembly has a factory preset length and the screw must not be altered in service.

(13) Remove the main seal and the guide from the front of the secondary piston. Stretch the rear seal from the groove and remove it from the piston. Take

care not to damage the piston surfaces where the inner diameter of the piston seals locate.

(14) Remove the garter springs, back up rings, seals and the retainer from the master cylinder, noting the installed direction of the seals to aid assembly.

NOTE: It is important that care is taken not to damage the bore surface or the seal surfaces during removal of these parts. Note the order and direction during removal,

(15) Remove the external O ring from the master cylinder body.

TO CLEAN AND INSPECT

(1) Wash all components thoroughly in methylated spirits. Do not use petrol, kerosene or other cleaning solvents.

(2) Check the master cylinder bore for wear, scoring or pitting.

NOTE: Do not hone the master cylinder bore. If the bore is pitted or worn, renew the master cylinder as an assembly.

(3) Ensure that all the inlet and compensating ports between the reservoir and the cylinder bore are free of any obstructions.

(4) Discard all rubber parts and if applicable, the piston assemblies.

NOTE: Where possible use a genuine major repair kit which contains pre-assembled rubber seals and pistons when overhauling a master cylinder. The use of a major kit will ensure a thorough overhaul and long service from the unit.

TO ASSEMBLE

(1) Liberally coat the cylinder bore and all internal parts with clean brake fluid.

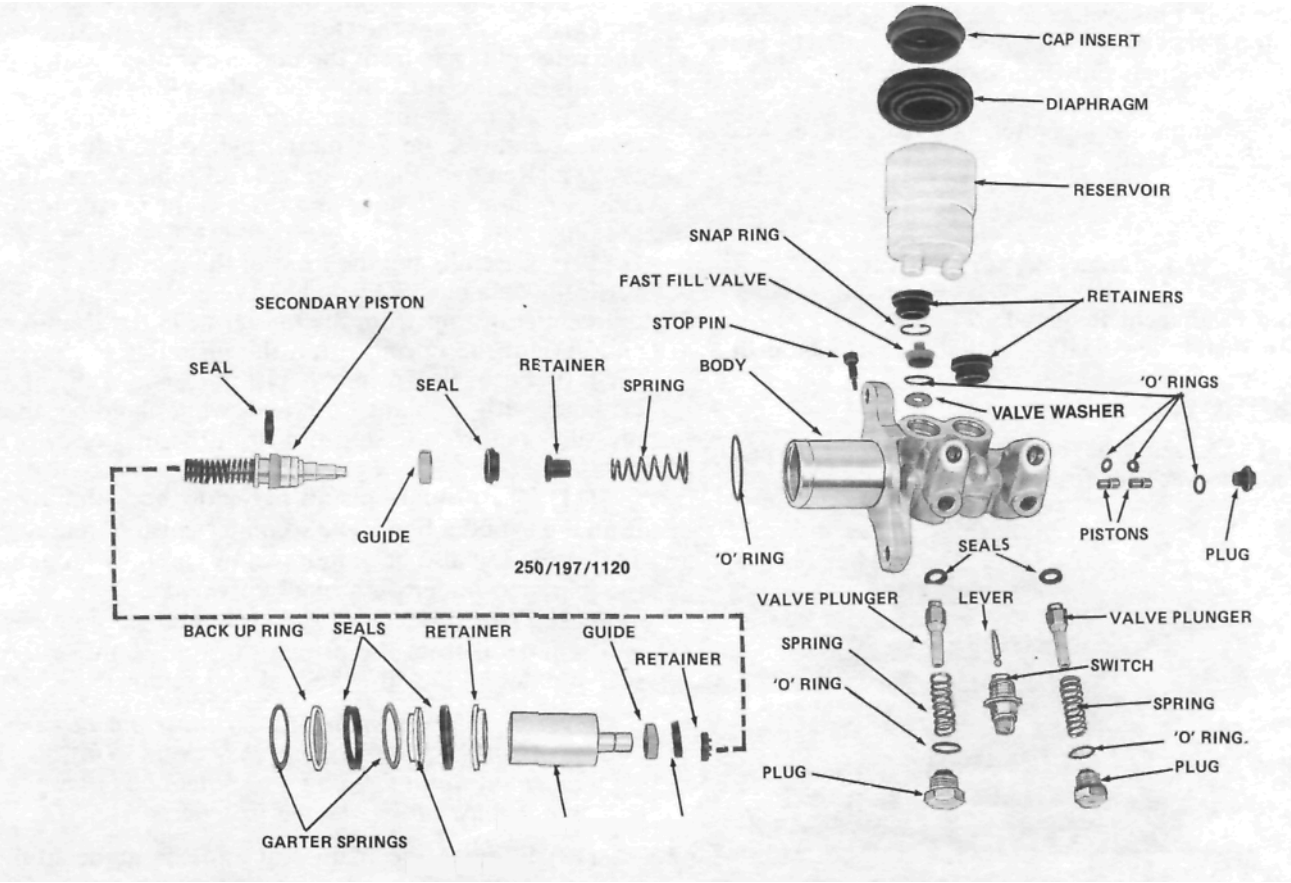
NOTE: Install all parts supplied with the repair kit.

(2) Install the seal retainer in the mouth of the
master cylinder, small diameter first.

(3) Install the seal, in the direction rioted on
removal, against the seal retainer, followed by the first back up ring, large diameter first.

(4) Install the garter spring against the back up ring. Insert a machined drift into the bore and lightly push the garter spring into its locating groove.

(5) Install the remaining seal, in the direction
noted on removal, against the garter spring already



PRIMARY PISTON SEAL

BACK UP RING

Dismantled view of the master cylinder.

installed. Install the second back up ring, large diameter first.

(6) Install the second garter spring. Insert a machined drift into the bore and lightly push the garter spring into its locating groove.

(7) Smear the secondary piston with clean brake fluid. Ease the seal over the piston body into the groove adjacent to the spring, ensuring that the seal lip faces the spring and that the nylon spacer is against the back of the seal.

(8) Install the guide onto the secondary piston, large internal diameter first, followed by the main seal with the lip facing away from the spring.

(9) Lubricate the secondary piston assembly with clean brake fluid and install the secondary spring and retainer to the piston. Install the complete assembly into the master cylinder bore.

(10) Smear the primary piston with clean brake fluid. Install the guide, large internal diameter first, followed by the main seal with the lip facing towards the small end of the piston.

(11) Install the retainer to the spigot on the front end of the primary piston ensuring that the legs of the retainer engage with the groove on the piston.

(12) Lubricate the primary piston assembly with clean brake fluid and install the assembly into the master cylinder bore. With a blunt rod, push the assembly down the bore sufficiently to preload the pistons. While holding the preload, install the stop pin and valve assemblies into the master cylinder body and tighten securely.

(13) Install a new O ring to the groove on the boss of the mounting flange of the master cylinder.

(14) Install new O rings to the pressure differential pistons, smear them with clean brake fluid and install them into the master cylinder body.

(15) Install a new O ring to the pressure differential end plug, install the plug to the master cylinder body and tighten to the specified torque.

(16) Using a blunt probe entered through the sensing switch location hole, separate the pressure differential pistons and install the switch actuating lever between them.

(17) Screw the sensing switch into its locating hole until the detents on the switch body just contact the locating hole facing (with the radial grooves). Screw the switch assembly in a further half to one full turn ensuring that the detents locate in the grooves.

(18) Install new valve seals to the proportioning valve plungers, with the serrations of the seals facing away from the hexagons of the plungers.

(19) Install the new O rings to the proportioning valve plugs.

(20) Install the valve springs over the stems of the proportioning valves, insert the install the valve plugs. Tighten the plugs to the specified torque.

(21) Install a new O ring to the base of the fast fill valve assembly. Install a new valve washer to the base of the valve.

(22) Install the fast fill valve assembly in the primary reservoir port (nearest to the mounting flange of the master cylinder) and install the snap ring to retain the assembly. Ensure that the snap ring is correctly seated in the groove.

(23) Smear the new reservoir retainers with clean brake fluid and install them into the reservoir ports. Carefully press the brake fluid reservoir into position, ensuring that the outlet extensions are fully inserted in the reservoir retainers.

(24) Install the reservoir cap insert to the diaphragm and press the cap assembly onto the reservoir.

TO INSTAL

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

(1) Pour a small amount of clean brake fluid into the reservoir and pump the master cylinder pistons with a blunt rod until fluid begins to emerge from the outlets.

(2) Install the master cylinder to the brake servo unit and loosely install the master cylinder retaining nuts.

(3) Connect the brake pipes to the master cylinder outlets, but do not tighten at this stage.

(4) Securely tighten the nuts retaining the master cylinder to the brake servo unit.

(5) Securely tighten the brake pipes and connect the wiring to the pressure sensing switch.

(6) Fill the master cylinder reservoir with clean brake fluid and bleed the brakes as described under the Hydraulic System heading.

(7) Check and if necessary adjust the brake pedal height and free play as described under the Brake Pedal heading.

4. BRAKE SERVO UNIT

TO CHECK OPERATION

(1) With the engine switched off, apply the footbrake several times to exhaust all vacuum from the system.

(2) Apply the footbrake and hold the brake pedal fully depressed.

(3) Start the engine. If the servo unit is functioning satisfactorily a distinct downward movement of the brake pedal should be noticed.

Should the pedal fail to move downward when the engine has been started, the vacuum system can be considered inoperative.

NOTE: If the pedal continues to fall away there is a fault in the hydraulic system.

(4) Ensure that the brake pedal is fully released, start the engine and run it at medium speed. Stop the engine.

Let the vehicle stand for 1-2 minutes, press the brake pedal two or three times and check its operation.

If there is no vacuum assistance, the vacuum system has developed a leak or the one way check valve is defective.

NOTE: Before removing the servo unit from the vehicle for inspection, disconnect the hose from the servo unit, start the engine and check that the manifold vacuum is in fact reaching the servo unit. Also test the one way check valve as described below,

TO TEST ONE WAY CHECK VALVE

(1) Disconnect the hose and remove the check valve from the servo unit.

(2) Check the valve for sticking. Suction on the manifold side should allow air to flow freely. Air blown into the valve from the manifold side should not be able to flow through the valve.

(3) Install the valve and check the operation of
the servo unit as previously described.

NOTE: Check that there are no air leaks at the hose connections and that the hose clips are tight. Also check that the hose is not bulged or collapsed due to deterioration.

Checking for vacuum at the servo unit. The engine must be running for this test.

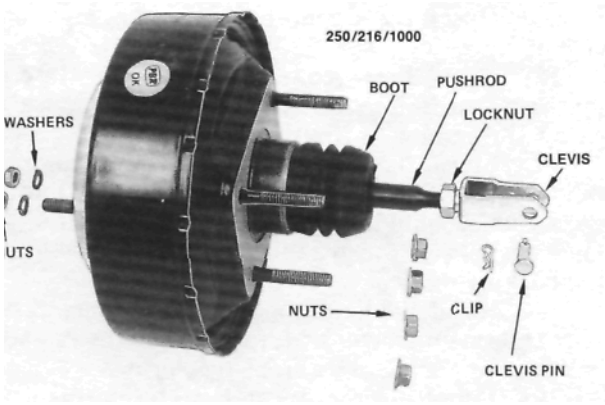
TO REMOVE

(1) Raise the bonnet and install covers to both front mudguards.

(2) On 1.6 liter models, remove the air cleaner assembly from the vehicle. If necessary refer to the Fuel System section.

(3) On vehicles equipped with power steering, remove the reservoir from the bulkhead and move it to one side. If necessary refer to the Steering section.

(4) Disconnect the vacuum supply hose from the servo unit.



View of the brake servo unit and associated components.

(5) Remove the master cylinder as described under the Master Cylinder heading.

(6) Working inside the vehicle, remove the clip and clevis pin connecting the pushrod to the brake pedal.

(7) Remove the nuts retaining the servo **unit** to the bulkhead and maneuver the servo unit and spacer block from the vehicle.

TO INSTAL

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

(1) With the servo unit and master cylinder installed to the vehicle, bleed the hydraulic system as described under the Hydraulic System heading.

(2) Check and if necessary adjust the brake pedal height and free play as described under the Brake Pedal heading.

5. FRONT BRAKES

Special Equipment Required:
To Check Disc Runout — Dial gauge
To Check Disc Thickness — Micrometer

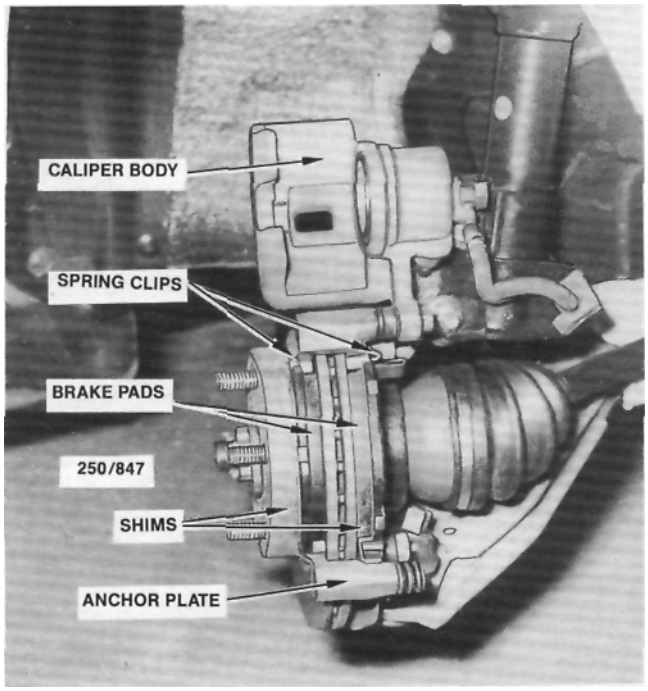
TO CHECK AND RENEW BRAKE PADS

(1) Raise the front of the vehicle and place it on chassis stands. Remove the front wheels.

(2) Inspect the brake pads on both sides of the vehicle. If the friction material on one or more of the pads is less than *2* mm thick or contaminated with fluid or grease, renew the brake pads as a set as follows.

NOTE: If the brake pads are contaminated, trace and rectify the cause prior to installing the new set of pads.

(3) Drain approximately two thirds of the brake fluid from the master cylinder reservoir. This can be done by loosening the bleeder valve on the caliper and allowing the fluid to drain into a container. Discard this fluid.



Installed view of the front brake pads, spring clips and shims.

NOTE: Do not drain all the fluid from the reservoir or it will be necessary to bleed the hydraulic system. The fluid is drained from the reservoir to prevent overflow when the caliper piston is pushed back into the caliper bore to facilitate pad renewal.

(4) Remove the lower guide bolt and rotate the caliper body upwards, pivoting on the upper guide bolt.

(5) Remove the brake pad assemblies from the anchor plate.

(6) Noting the installed positions, remove the spring clips from the anchor plate and the shims from the brake pads.

(7) Squarely push the piston into its bore in the caliper body. If necessary, use a G clamp to push the piston into the caliper body. Check for fluid leaks from the caliper body.

(8) If necessary, check the disc runout and thickness as described under the Brake Disc heading.

(9) Ensure that the guide bolts move freely in the anchor plate and that the dust boots are in good condition.

(10) Install the brake pads, shims and spring clips
in the position noted on removal.

(11) Rotate the caliper body downwards, to return to its original position. Lubricate the lower guide bolt with suitable grease. Install and tighten the guide bolt to the specified torque.

(12) Repeat the procedure on the opposite front brake assembly.

(13) Replenish the master cylinder reservoir with the recommended fluid to the correct level and pump the brake pedal several times to locate the disc pads.

(14) Install the front wheels and lower the vehicle
to the ground.

(15) Road lest the vehicle and check for correct brake operation.

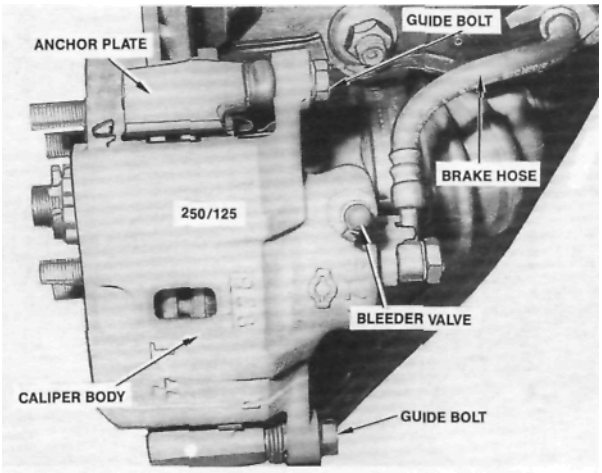
CALIPER

To Remove and Install

(1) Raise the front of the vehicle and place it on chassis stands. Remove the relevant front wheel.

(2) Remove the brake hose retaining bolt and plug the hose to prevent the loss of fluid and the ingress of dirt.

(3) Remove the bolts retaining the caliper anchor plate to the steering knuckle and slide the caliper off the disc.



Installed view of the front brake caliper.

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

(1) Tighten the caliper anchor plate bolts to the specified torque.

(2) Install the brake hose to the caliper body
ensuring that new seal washers are installed.

NOTE: Ensure that the brake hose is correctly located against the protrusion on the caliper body.

(3) Bleed the brake hydraulic system as described under the Hydraulic System heading.

(4) Install the front wheel and lower the vehicle to the ground.

(5) Road test the vehicle and check for correct brake operation.

To **Dismantle**

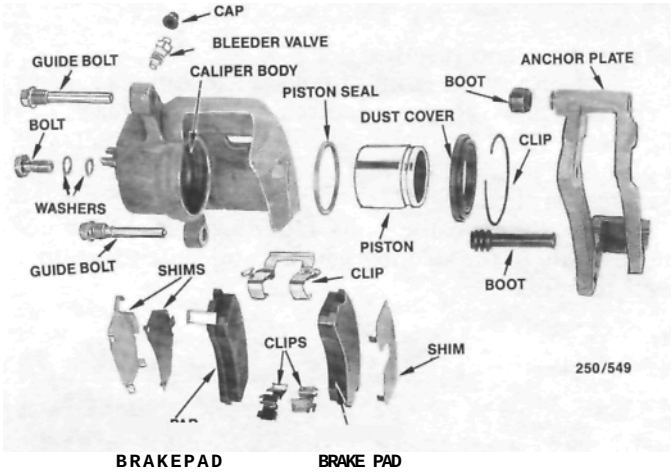
(1) Raise the front of the vehicle and place it on chassis stands. Remove the relevant front wheel.

(2) Remove the brake hose retaining bolt from

the caliper body. Plug the brake hose to prevent the loss of fluid and the ingress of dirt. Remove and discard the sealing washers.

(3) Remove the guide bolts and slide the caliper body from the anchor plate and pad assembly.

(4) Remove the piston dust cover retaining clip. Remove and discard the dust cover.



Dismantled view of the front brake caliper.

(5) Place a piece of wood in front of the piston and using low air pressure applied to the brake hose aperture, gently force the piston from the caliper bore.

(6) Using a thin blunt probe, preferably made from wood or plastic, remove and discard the piston seal from the groove in the caliper bore.

(7) Clean all the caliper components in methylated spirits and arrange the components in order, on a clean, dry surface to aid in assembly.

To Inspect

(1) Inspect the caliper bore and piston for pitting, wear or damage. Renew the caliper assembly or piston if damage is evident.

> *NOTE: Slight rust spots in the caliper bore may he removed with fine emery paper. The piston must not be polished as the plated surface wilt be damaged.*

(2) Inspect the guide bolts for wear or damage. Renew as necessary.

To Assemble

(1) Dip a new piston seal in clean hydraulic brake fluid. Insert the seal into the groove in the caliper bore ensuring that the seal is correctly seated and not twisted.

(2) Install a new dust cover to the piston prior to installing the piston to the caliper bore.

(3) Coat the piston and caliper bore with clean hydraulic brake fluid and insert the piston squarely into the caliper bore.

(4) Locate the dust seal in the groove of the caliper body and install the retaining clip.

(5) Lubricate the guide bolts using a suitable grease. Install the caliper body to the anchor plate and install and tighten the guide bolts to the specified
torque.

(6) Replenish the master cylinder reservoir with the recommended fluid and bleed the brakes as described under the Hydraulic System heading.

(7) Install the front wheels and lower the vehicle to the ground.

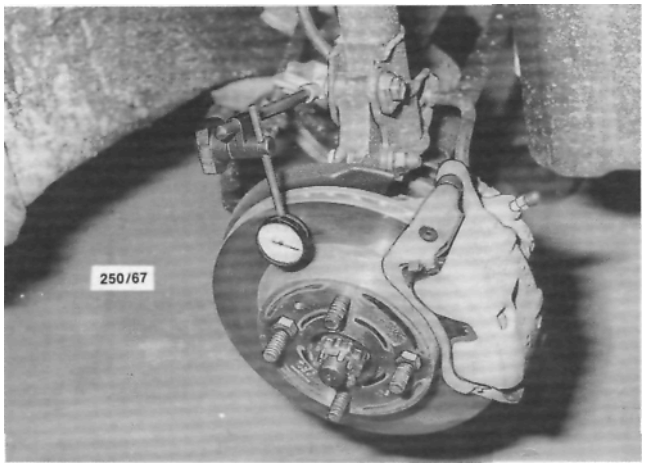
(8) Road test the vehicle and check for correct brake operation.

BRAKE DISC

To Check Runout

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

(2) Install the wheel nuts with the flat side of the
wheel nut towards the disc. Lightly tighten the nuts to secure the disc against the hub.



Rotate the hub and check for disc runout.

(3) Mount a dial gauge stand to a suspension component and position the dial gauge plunger against the wheel hub. Check that the end float is less than 0.05 mm. Excessive end float will necessitate renewal of the hub bearing.

(4) Position the dial gauge plunger against the centre of the brake disc. Rotate the hub and measure the runout. Maximum allowable runout is 0.07 mm.

(5) If the runout exceeds Specifications, machine or renew the brake disc.

(6) Install the front wheel and lower the vehicle to the ground.

To Remove and Install

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

(2) Remove the bolts retaining the caliper an-

chor plate to the steering knuckle and slide the caliper off the brake disc. Suspend the caliper clear of the work area using wire or cord.

(3) Suitably mark the location of the disc in relation to the hub.

(4) Slide the disc off the hub. If the disc is difficult to remove, install two M8 x 1.25 mm bolts in the disc and by alternatively tightening the bolts, remove the disc.

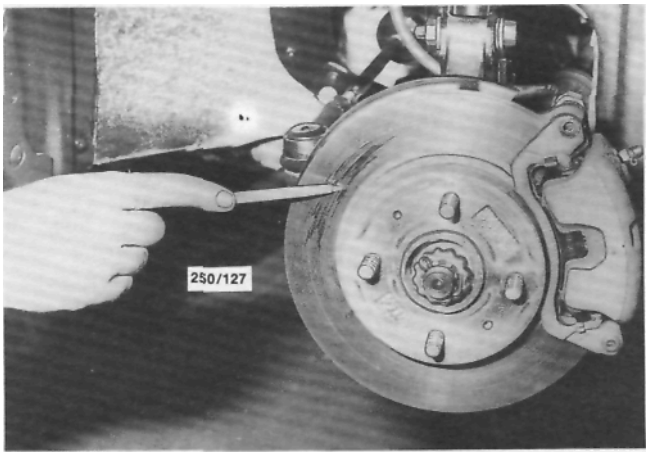
Do not use a hammer to remove the disc.

Installation is a reversal of the removal procedure ensuring that the mating faces of the disc and hub are clean and free from burrs and that the marks made on removal are aligned.

To Inspect

(1) Inspect the machined faces of the disc for scores, cracks, wear and signs of overheating.

(2) Using a micrometer, measure the thickness of the disc at several positions around the face of the disc. Renew the disc if the minimum thickness is below Specifications.



Inspect the brake discs for scoring and wear.

(3) If the disc thickness is satisfactory but the disc is scored, machine equal amounts from the machined face on each side of the disc, to restore the serviceability of the disc.

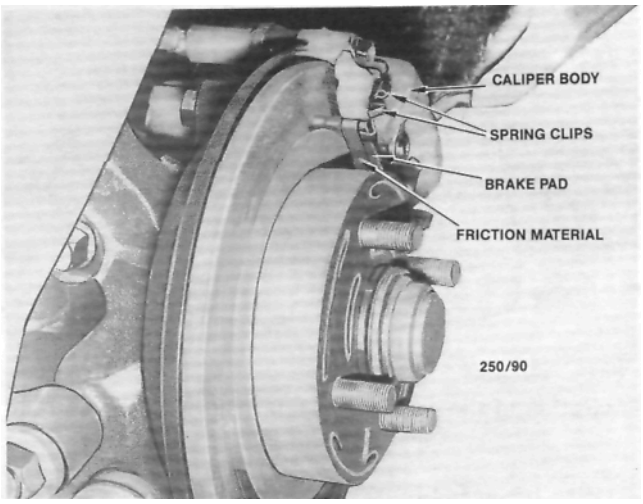
NOTE: Disc machining is best entrusted to a reliable brake specialist who can advise on disc serviceability.

6. REAR DISC BRAKES

Special Equipment Required:
To Check Disc Runout — Dial gauge
To Check Disc Thickness — Micrometer

TO CHECK AND RENEW BRAKE PADS

(1) Raise the rear of the vehicle and place it on chassis stands. Remove the rear wheels.



Renew the rear brake pads if the friction material is less than 2 mm thick.

(2) Inspect the brake pads on both sides of the vehicle. If the friction material on one or more of the pads is less than 2 mm thick or contaminated with fluid or grease, renew the brake pad as a set as follows.

NOTE: If the brake pads are contaminated trace and rectify the cause prior to installing the new set of pads.

(3) Drain approximately two thirds of the brake fluid from the master cylinder reservoir. This can be done by loosening the bleeder valve on the caliper and allowing the fluid to drain into a container. Discard this fluid.

NOTE: Do not drain all the fluid from the reservoir otherwise it will be necessary to bleed the hydraulic system. The fluid is drained from the reservoir to prevent overflow when the caliper piston is pushed back into the caliper bore to facilitate pad renewal.

(4) Remove the guide bolts and lift the caliper body clear of the disc.

NOTE: Do not allow the caliper to hang on the brake hose.

(5) Noting the installed positions, remove the brake pads, shims and spring clips from the anchor plate.

(6) Using a pair of long nosed pliers with the nose located in the recesses of the piston, rotate the piston clockwise to retract it into the cylinder body. Align the recesses between the brake pad retaining lugs on the caliper body. Refer to the illustration.

(7) If necessary, check the disc runout and thickness as described under the Brake Disc heading.

(8) Ensure that the guide bolts move freely in the caliper body and that the dust boots are in good condition.

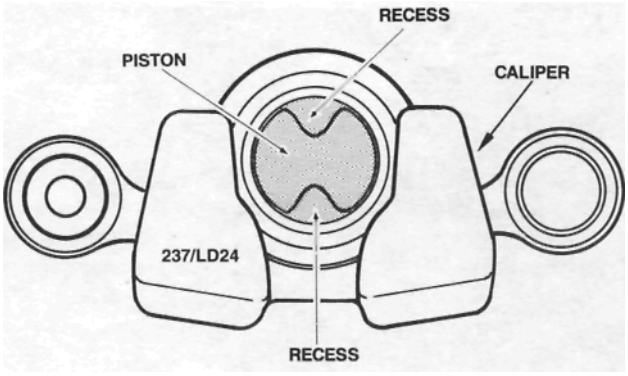


Illustration of the rear disc caliper showing the correct piston alignment.

(9) Install the brake pads, shims and spring clips
in the position noted on removal.

(10) Install the caliper body to its original position. Lubricate the guide bolts with suitable grease. Install and tighten the guide bolts to the specified torque.

(11) Repeat the procedure on the opposite rear brake assembly.

(12) Replenish the master cylinder reservoir with the recommended fluid to the correct level and pump the brake pedal several times to locate the disc pads.

(13) Install the rear wheels and lower the vehicle to the ground.

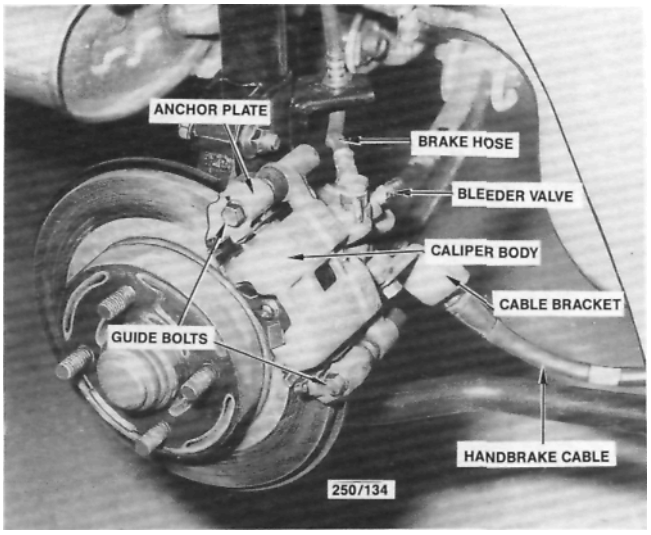
(14) Road test the vehicle and check for correct brake operation.

CALIPER

To Remove and Install

(1) Raise the rear of the vehicle and place it on chassis stands. Remove the relevant rear wheel.

(2) Remove the brake hose retaining bolt from the caliper body and plug the hose to prevent the loss of fluid and the ingress of dirt.



Installed view of the rear brake caliper.

(3) Remove the handbrake cable bracket retaining bolts and disconnect the handbrake cable from the cam lever.

(4) Remove the bolts retaining the caliper anchor plate. Remove the caliper from the disc.

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

(1) Tighten the caliper anchor plate bolts to the specified torque.

(2) Install the brake hose to the caliper body ensuring that new seal washers are installed.

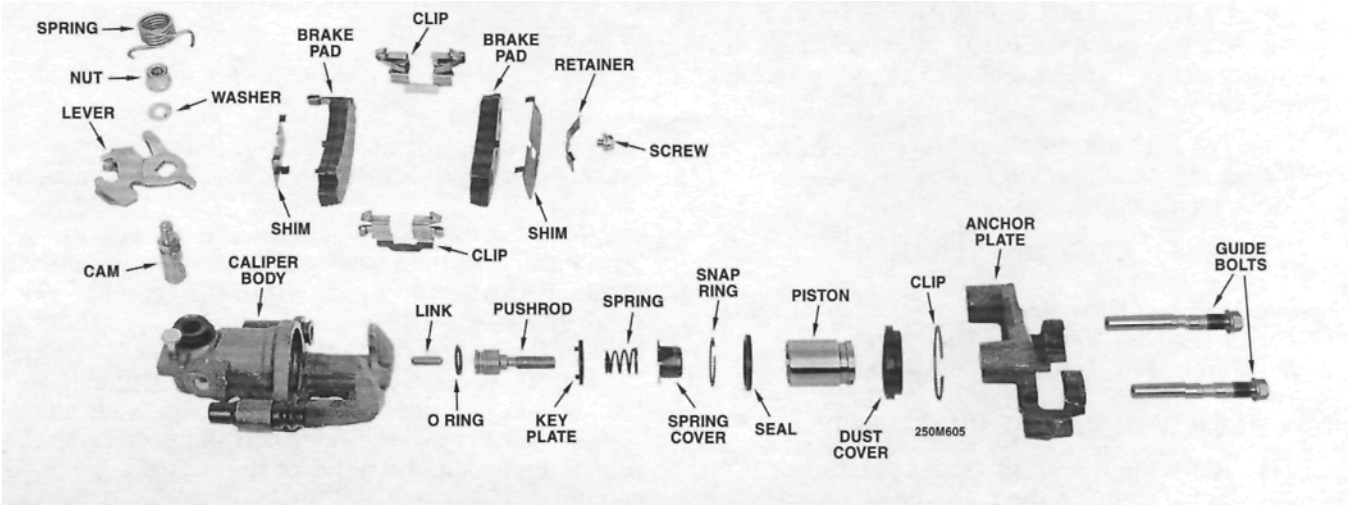
NOTE: Ensure that the brake hose locating pin is correctly installed in the caliper body.

de-

(3) Bleed the brake hydraulic system as scribed under the Hydraulic System heading.

(4) Install the rear wheel and lower the vehicle to the ground.

(5) Road test the vehicle and check for correct brake operation.



Dismantled view of the rear brake caliper

To Dismantle

(1) Raise the rear of the vehicle and place it on chassis stands. Remove the relevant rear wheel.

(2) Remove the brake hose retaining bolt from the caliper body and plug the hose to prevent the loss of fluid and the ingress of dirt.

(3) Remove the handbrake cable bracket retaining bolt and disconnect the handbrake cable from the cam lever.

(4) Remove the guide bolts and slide the caliper body off the pads.

(5) Using a pair of long nose pliers with the nose located in the recesses of the piston, rotate the piston anticlockwise to remove it from the caliper body.

(6) Remove the dust cover retaining clip and dust cover. Discard the dust cover.

(7) Using a thin blunt probe, preferably made from wood or plastic, remove and discard the piston seal from the groove in the caliper bore.

(8) Using internal snap ring pliers, remove the snap ring from the caliper bore.

(9) Withdraw the spring cover, spring, key plate, pushrod and link from the caliper bore. Do not mix these components from the left and right hand sides as they differ.

(10) Remove and discard the O ring from the pushrod.

(11) Remove the spring, nut and washer from the cam lever. Remove the cam lever and cam from the caliper body.

(12) Remove the cam seal from the caliper using a screwdriver.

(13) Clean all the caliper components in methylated spirits and arrange the components in order on a clean dry surface to aid assembly.

To Inspect

(1) Inspect the caliper bore and piston for pitting, wear or damage. Renew the caliper assembly or piston if damage is evident.

> *NOTE: Slight rust spots in the caliper bore may be removed with fine emery paper. The piston must not be polished as the plated surface will be damaged.*

(2) Inspect the guide bolts for wear or damage and renew as necessary.

(3) Inspect the threads of the pushrod for wear or damage and renew as necessary.

(4) Inspect the nut inside the piston for wear, damage and security. Renew the piston if any damage is evident.

(5) Inspect the cam for wear, damage or pitting, renew as necessary.

(6) Inspect the cam bearing in the caliper body for wear, damage or pitting and renew the seal and bearing as necessary.

(7) Inspect the guide bolt rubbers for deterioration, wear or damage. Renew as required.

To Assemble

(1) Lubricate the cam bearing with multipurpose grease and install the seal.

(2) Install the cam and cam lever to the caliper
body. Install the cam lever spring, washer and nut, and tighten the nut to the specified torque.

(3) Install a new O ring to the pushrod and install
the link, pushrod, key plate, spring and spring cover to the caliper body. The key plate must engage the caliper body. Secure the assembly with the snap ring.

(4) Dip a new piston seal in clean hydraulic brake fluid. Insert the seal into the groove in the caliper bore ensuring that the seal is correctly seated and not twisted.

(5) Install a new dust cover to the piston prior to
installing the piston to the caliper bore.

(6) Coat the piston and caliper bore with clean hydraulic brake fluid and using long nose pliers rotate the piston clockwise into the caliper bore.

(7) Locate the dust seal in the groove of the caliper body and install the retaining clip.

(8) Lubricate the guide bolts using a suitable grease. Install the caliper body and tighten the guide bolts to the specified torque.

(9) Replenish the master cylinder reservoir with the recommended fluid and bleed the brakes as described under the Hydraulic System heading.

(10) Install the rear wheel and lower the vehicle to the ground.

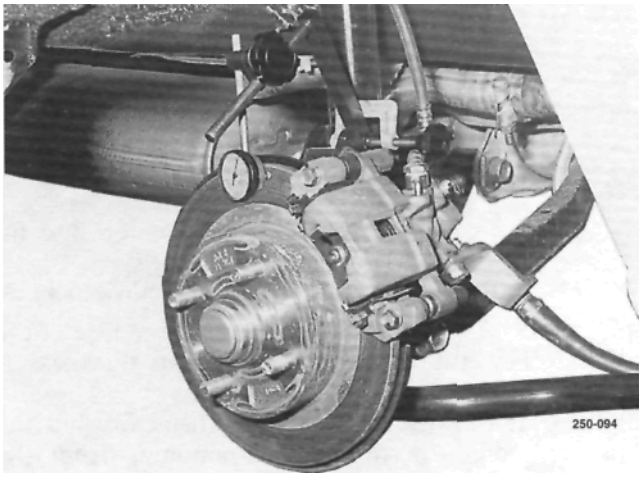
(11) Road test the vehicle and check for correct brake operation.

BRAKE DISC

To Check Runout

(1) Raise the rear of the vehicle and support it on chassis stands. Remove the relevant rear wheel.

(2) Mount a dial gauge stand to a suspension component and position the dial gauge plunger against the wheel hub. Check that the end float is less



Using a dial gauge to measure the rear disc runout.

than 0.05 mm. If the wheel hub end float exceeds Specifications, the bearing must be renewed as described in the Rear Suspension section.

(3) Position the dial gauge plunger against the centre of the brake disc contact area. Rotate the hub and measure the runout. Maximum allowable runout is 0.07 mm.

(4) If the runout exceeds the specified amount, machine or renew the brake disc.

(5) Install the rear wheel and lower the vehicle to the ground.

(6) Road test the vehicle and check for correct brake operation.

To Remove and Install

(1) Raise the rear of the vehicle and support it on chassis stands. Remove the relevant rear wheel.

(2) Remove the clip securing the brake hose to the suspension unit and disengage the hose.

(3) Remove the bolts retaining the caliper anchor plate.

(4) Slide the caliper from the brake disc and suspend the caliper clear of the work area using wire or cord.

NOTE: Do not allow the caliper to hang on the brake hose.

(5) Remove the grease cap from the rear hub.

(6) Remove the split pin, nut retainer, hub nut and washer from the stub axle.

(7) Remove the hub assembly from the stud axle.

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

(1) Tighten the rear hub to the specified torque.

(2) Install the brake caliper and tighten all the bolts to the specified torque.

(3) Rotate the hub and check for roughness. If the hub does not rotate smoothly, renew the hub bearing as described in the Rear Suspension section.

(4) Install the rear wheel and lower the vehicle to the ground.

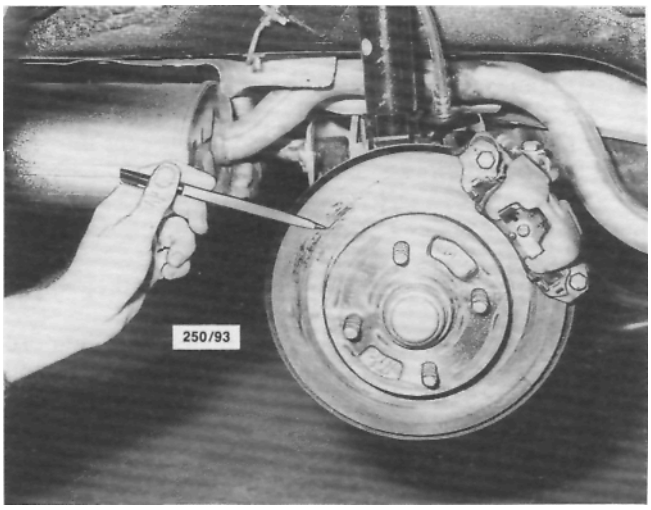
(5) Road test the vehicle and check for correct brake operation.

To Inspect

(1) Inspect the machined faces of the disc for scores, cracks, wear and signs of overheating.

(2) Using a micrometer, measure the thickness of the disc at several positions around the face of the disc. Renew the disc if the minimum thickness is below Specifications.

(3) If the disc thickness is satisfactory but the disc is scored, machine equal amounts from the machined face on each side of the disc, to restore the serviceability of the disc.



Inspect the machined faces of the disc for scores, cracks, wear and signs of overheating.

NOTE: Disc machining is best entrusted to a reliable brake specialist who can advise on disc serviceability.

7. REAR DRUM BRAKES

TO REMOVE AND DISMANTLE

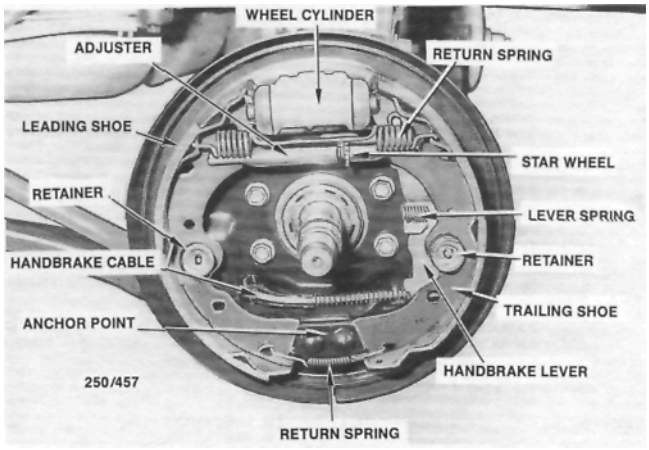
(1) Raise the rear of the vehicle and support it on chassis stands. Remove the rear wheels and release the handbrake.

(2) Remove the grease cap from the rear hub.

(3) Remove the split pin, nut retainer, hub nut and washer from the stub axle. Remove the brake drum and hub assembly.

(4) Mark each brake shoe and spring to ensure correct assembly.

(5) Rotate the star wheel until the adjuster assembly is at its shortest length.



Installed view of the left hand side rear drum brake components.

(6) Using a suitable pair of pliers, disengage the upper and lower return springs from the leading shoe, and then remove them from the trailing shoe.

(7) Using a pair of pliers, compress the leading shoe retainer, turn through ninety degrees and remove the retainer, spring and pin. Remove the leading shoe from the backing plate.

(8) Using the same procedure, remove the trailing shoe retainer.

(9) Lift the trailing shoe from the backing plate and disconnect the handbrake cable from the handbrake lever. Remove the trailing shoe assembly from the backing plate.

(10) If the brake shoes are to be renewed, remove the C clip from the trailing shoe and remove the handbrake lever assembly.

(11) If the wheel cylinder is to be overhauled, proceed as follows:

(a) Disconnect the brake pipe from the rear of the wheel cylinder and plug the pipe to prevent the loss of fluid and the ingress of dirt.

(b) Remove the bolts retaining the wheel cylinder to the backing plate and withdraw the wheel cylinder from the vehicle.

(c) Remove the rubber boots, pistons and spring from the wheel cylinder bore. Remove the seals from the pistons. Discard the rubber boots and seals.

(d) Remove the rubber boot and bleeder valve from the wheel cylinder.

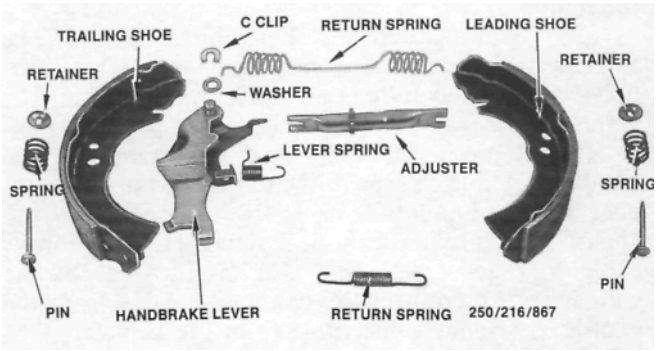
TO CLEAN AND INSPECT

(1) Thoroughly clean all the brake components, except the brake shoes in methylated spirits.

(2) Inspect the brake shoe linings. If the thickness of the lining on one or more of the shoes is less than 1.5 mm thick or contaminated with fluid or grease, the brake shoes must be renewed as a set.

(3) Inspect the wheel cylinder bore and piston for pitting, wear or damage. Renew the wheel cylinder assembly if any damage is evident.

(4) Check the brake drums for cracks, scoring or out of round. Renew or machine the brake drums as necessary.



Dismantled view of the right hand rear drum brake components.

(5) Inspect the springs and handbrake lever for fatigue and distortion. Renew as required.

(6) Operate the handbrake lever and check for. smooth operation of the handbrake cable. Renew as required under the Handbrake Cable and Lever Assembly heading.

(7) Check the bleeder valve for blockage.

(8) Clean and lubricate the adjuster rod.

(9) Clean and inspect the backing plate for cracks, damage and wear. Renew as required.

TO ASSEMBLE AND INSTAL

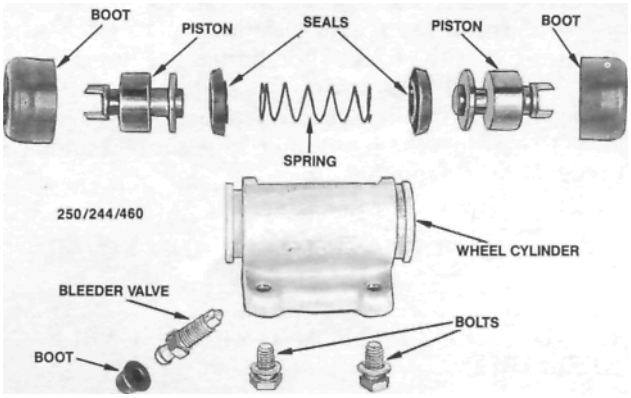
(1) If the wheel cylinder was overhauled, proceed as follows:

(a) Lubricate the pistons and seats with brake fluid and install the seals onto the pistons so that the lip on the seals will be facing towards the centre of the cylinder.

(b) Install the spring, pistons and rubber boots to the wheel cylinder ensuring that the rubber boots are securely located in the cylinder. If necessary, use a clamp to hold the pistons in the cylinder.

(c) Position the wheel cylinder in the backing plate and install the brake pipe to the cylinder. Do not fully tighten the pipe at this stage.

(d) Install the wheel cylinder retaining bolts and tighten the retaining bolts and brake pipe securely. Install and tighten the bleeder valve. Install the valve
boot.



Dismantled view of the rear wheel cylinder.

(2) Sparingly lubricate the brake shoe moving contact surfaces on the backing plate and the adjuster assembly with a high melting point grease.

(3) If necessary, position the adjusting lever on
the handbrake lever.

(4) If necessary, position the handbrake lever assembly and washer on the trailing shoe and secure it with the C clip.

(5) Ensure that the adjuster assembly is adjusted to its shortest length.

(6) Install the adjusting lever return spring to the
trailing shoe.

(7) Using a pair of pliers, compress the handbrake cable spring and install the cable to the handbrake lever.

(8) Position the trailing shoe on the backing plate with the upper end located on the wheel cylinder piston and the lower end on the anchor plate.

(9) Install the adjuster assembly to the trailing shoe ensuring that the adjuster fork is correctly located on the upper end of the shoe.

(10) Install the pin, spring and retainer to the trailing shoe, turn the retainer through 90 degrees and secure the brake shoe to the backing plate.

(11) Connect the upper and lower return springs to the trailing shoe as noted on removal.

(12) Position the leading shoe on the backing plate with the upper end located on the wheel cylinder piston and the lower end on the anchor plate. Ensure that the adjuster assembly is correctly located on the upper end of the shoe.

(13) Install the pin, spring and retainer to the leading shoe, turn the retainer through 90 degrees and secure the shoe to the backing plate.

(14) Connect the upper and lower return springs to the leading shoe.

(15) By alternatively adjusting the automatic adjuster manually and sliding the brake drum on and off the brake shoe assembly, adjust the brakes until the brake drum will just slide over the brake shoes. Ensure that the adjuster lever contacts the adjuster star wheel. Install the brake drum and operate the handbrake several times to adjust the brake shoes.

(16) Install the rear wheels and rotate each wheel to ensure that the brake shoe linings are not dragging.

(17) Bleed the hydraulic system as described under the Hydraulic System heading.

(18) Adjust the handbrake as described under the Brake Adjustments heading.

8. HANDBRAKE CABLE AND LEVER ASSEMBLY

HANDBRAKE LEVER AND FRONT CABLE ASSEMBLY

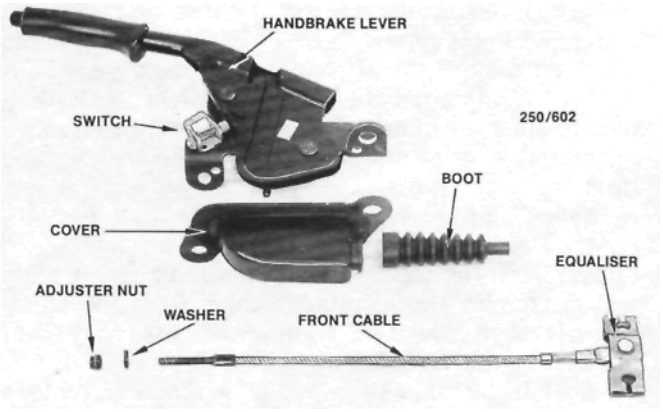
To Remove and Install

(1) Raise the vehicle and support it on chassis stands. Release the handbrake.

(2) Working beneath the vehicle, remove the exhaust pipe centre heat shield retaining bolts and maneuver the shield from the vehicle.

(3) Remove the rear handbrake cable front clamp retaining nuts and disconnect the rear handbrake cable from the equalizer.

(4) Working within the vehicle, remove the carpet square from the rear of the console. Remove the retaining screw from the front and rear of the rear console section and maneuver the rear console from the vehicle.



Dismantled view of the handbrake lever components.

(5) Disconnect the handbrake warning lamp switch wiring.

(6) Remove the handbrake lever assembly retaining bolts and remove the handbrake lever and front cable assembly.

(7) If necessary slide the boot and cover towards the equalizer, straighten the tang on the lower edge of the lever and remove the adjuster nut and washer.

(8) Withdraw the front cable from the lever and remove the boot and cover. Inspect the cable for chafing or broken strands. Renew the cable if damage is evident.

(9) Check the handbrake lever ratchet and pawl for wear and renew as necessary.

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

(1) Apply lubricant to all the working parts prior to installation.

(2) Ensure that the handbrake cable clamp is correctly installed.

(3) Adjust the handbrake cable as described under the Brake Adjustments heading.

REAR HANDBRAKE CABLES

To Remove and Install

(1) Raise the rear of the vehicle and support it on chassis stands. Remove the rear wheels and release the handbrake.

(2) Working beneath the vehicle, remove the exhaust pipe centre and rear heat shield retaining bolts and maneuver the heat shields from the vehicle.

(3) Remove the bolts and nuts retaining the handbrake cable clamps to the underbody and disconnect the rear handbrake cable from the equalizer.

(4) On disc brake models, remove the handbrake cable to bracket retaining clip on the rear of the caliper and disconnect the handbrake cable from the cam lever. Remove the cable from the vehicle.

(5) On drum brake models, proceed as follows:

(a) Remove and dismantle the rear brakes as previously described.

(b) Disengage the handbrake cable return spring from the backing plate.

<c) Using a hammer and punch, carefully tap the handbrake cable flange from the rear of the backing plate and remove the cable from the vehicle.

(6) Inspect the rear handbrake cables for chafing or broken strands. Renew the cables if damage is evident.

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

(1) Ensure that the handbrake cable clamps are correctly installed.

(2) On drum brake models, install the handbrake
cable to the backing plate by carefully tapping the flange on the handbrake cable. Ensure that the cable is not damaged.

(3) Adjust the handbrake cable as described under the Brake Adjustments heading.

9. BRAKE ADJUSTMENTS

FRONT AND REAR DISC BRAKES

The disc brakes are self adjusting and no manual adjustment is required or provided.

REAR DRUM BRAKES

Depress the handbrake lever button, apply and release the handbrake lever several times to adjust the rear brake shoes.

HANDBRAKE

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

(2) Remove the carpet square from the rear of the console. Remove the retaining screws from the front and rear of the rear console section and manoeuvre the rear console from the vehicle.

(3) Tighten the adjusting nut until the handbrake lever pull is between 7-11 notches.

(4) Check that the rear wheels are not binding. If the rear wheels do not rotate freely refer to the Brakes Trouble Shooting for possible causes.

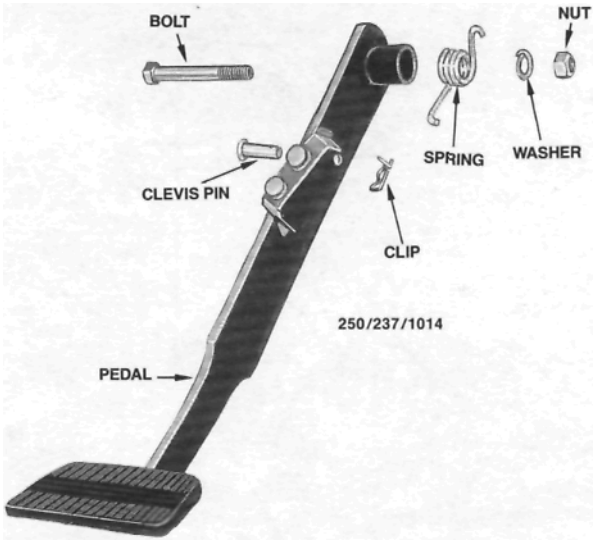
(5) With the ignition switched On, check that the handbrake warning lamp is extinguished when the lever is fully released.

(6) Lower the vehicle to the ground and test the handbrake on an incline.

10. BRAKE PEDAL

TO REMOVE AND INSTAL

(1) Working inside the vehicle remove the retaining clip from the clevis pin and remove the clevis pin connecting the brake pedal to the pushrod.



Dismantled view of the brake pedal components.

(2) Remove the nut from the pivot bolt and withdraw the brake pedal pivot bolt.

(3) Maneuver the brake pedal from the mounting bracket.

(4) Remove the spring from the brake pedal.

(5) Inspect the return spring for breakage or fatigue. Renew as required.

(6) Inspect the pedal pivot bolt for damage or wear. Renew as required.

(7) Inspect the brake pedal for wear, cracks or fatigue. Renew as required.

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

(1) Sparingly lubricate the pedal pivot bolt and clevis pin with a suitable grease.

(2) Ensure that the brake pedal pivot bolt is correctly located in the pedal bracket.

(3) Ensure that the clevis pin is inserted fully through the clevis and the retaining clip is correctly installed.

(4) Check and if necessary adjust the brake pedal height and stop lamp switch as described below.

TO ADJUST PEDAL HEIGHT

The dimension for the pedal height is measured at right angles from the floor, with the carpet pulled back, to the centre of the pedal pad.

(1) Working inside the vehicle, disconnect the wiring from the stop lamp switch.

(2) Loosen the stop lamp switch locknut and position the switch away from the brake pedal.

(3) Loosen the locknut on the brake pedal pushrod and adjust the pushrod to achieve a pedal height of 155-165 mm on manual transaxle models or 164-174 mm on automatic transaxle models. Tighten the locknut.

(4) Adjust the stop lamp switch as described under the following heading.

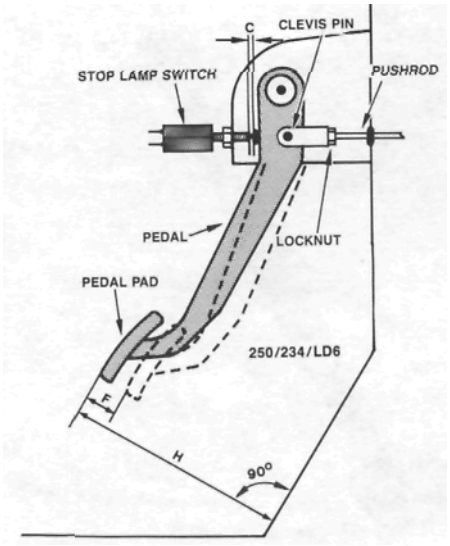


Illustration showing the brake pedal adjustments. Dimension H = brake pedal height, Dimension C = stop lamp switch clearance, Dimension F - brake pedal free play.

TO ADJUST STOP LAMP SWITCH

(1) Loosen the stop lamp switch locknut and disconnect the wiring from the switch.

(2) Adjust the stop lamp switch to achieve a clearance of 0.3-1.0 mm between the pedal stop and the threaded end of the switch.

(3) Tighten the locknut and connect the wiring to the switch. Ensure that the stop lamps are off when the pedal is released.

(4) Ensure that the pedal free play is 1.0-3.00 mm after adjustments have been completed.

11. HYDRAULIC SYSTEM

TO BLEED

Bleeding the hydraulic system should only be necessary when some portion of the hydraulic system has been disconnected or fluid has been drained, allowing air to enter the system.

The brake fluid in the hydraulic system should be changed every 30 000 km or 18 months. The procedure for changing the brake fluid and bleeding the hydraulic system are similar with attention to the notes in the text.

There are four points in the system where bleeder valves are installed, one on each front caliper and one on each rear wheel cylinder or rear caliper.

14. Fill the fluid reservoir with clean hydraulic brake fluid and maintain at least one third full throughout the entire operation.

15. Attach a transparent hose to the bleeder valve on the left rear caliper and immerse the other

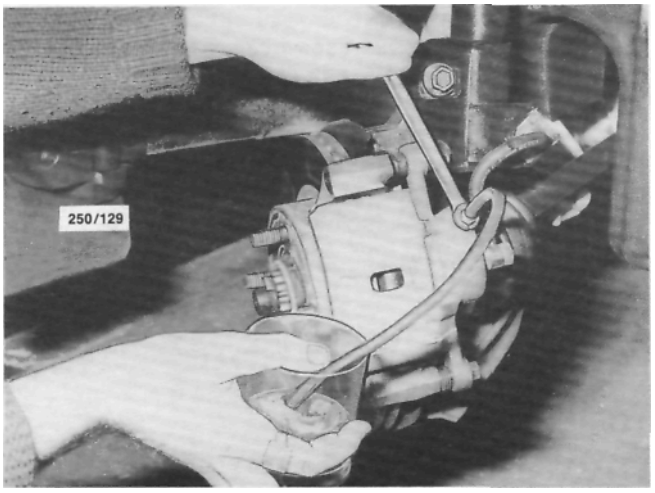
Bleeding the right hand rear brake caliper.

end of the hose in a small amount of clean brake fluid contained in a clean glass jar held higher than the bleeder valve.

14. Unscrew the bleeder valve one complete turn.

15. Have an assistant depress the brake pedal slowly to the full extent of its travel. Close the bleeder valve and allow the brake pedal to return without assistance.

16. Repeat operations (3) and (4) until a con stant stream of fluid, without any air bubbles, is being discharged into the glass jar, hold the brake pedal down and tighten the bleeder valve.



Bleeding the right hand front brake caliper.

NOTE: If changing the brake fluid, continue bleeding the system until clean new fluid flows from the bleeder hose.

Do not allow the fluid level in the reservoir to fall below the one third full level at any time during the operation or air will enter the system and a fresh start will have to be made. Always use new brake fluid for topping up the reservoir.

(6) Carry out the operation on the right front, right rear, right rear and left front brake in that order.

(7) Replenish the reservoir with the specified brake fluid to the indicated level and install the reservoir cap.

ELECTRICAL SYSTEM

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. See the text for precautionary notes.

SPECIFICATIONS

BATTERY

Type ..... 12 volt lead acid
Polarity to earth ..... Negative (-)
Specific gravity:
Fully charged ..... Above 1.250
Fully discharged ..... Below 1.130

ALTERNATOR

Make ..... Bosch or Hitachi
Maximum output ..... 70 amps
Polarity to earth ..... Negative (-)
Stator windings ..... Star wound
Regulator type ..... Integral
Brush length minimum:
Bosch ..... 5.0 mm
Hitachi ..... 6.0 mm or limit mark

STARTER MOTOR

Make ..... Hitachi or Bosch
Type ..... 4 pole 4 brush reduction gear
Operation control ..... Solenoid and overrunning clutch
Undercut of commutator (maximum):
Hitachi ..... 0.8 mm
Brush length (minimum):
Bosch ..... 8.0 mm
Hitachi ..... 11 mm
Brush spring tension;
Hitachi ..... 15.7-19.6 N
Hitachi:
Drive pinion stopper clearance ..... 0.3-1.5 mm
Selective fit adjuster plates ..... 0.5 and 0.8 mm

IGNITION SYSTEM

The ignition system is an integral part of the engine management system. The Specifications, testing and overhaul procedures are fully covered in the Fuel and Engine Management section.

TORQUE WRENCH SETTINGS

Alternator pulley retaining nut:
Bosch ..... 50 Nm
Hitachi ..... 59 Nm

1. BATTERY AND CHARGING SYSTEM TROUBLE SHOOTING

BATTERY UNDERCHARGED

3. Loose or broken drive belt: Adjust or renew the drive belt.
4. Faulty alternator regulator; Renew the regulator unit.
5. Faulty battery: Install a new battery of the recommended type and capacity.
6. Faulty alternator: Overhaul or renew the alternator.
7. Fault in the charging circuit wiring: Check and repair or renew the wiring harness.
8. Faulty connections in the charging circuit: Check and repair the connections.
9. Fusible link blown; Rectify the fault and renew as necessary.

NOTE: Check the state of charge (specific gravity) of the battery- as described under the Battery heading in this section. If the battery is undercharged, check the possible causes in the order given.

BATTERY OVERCHARGED

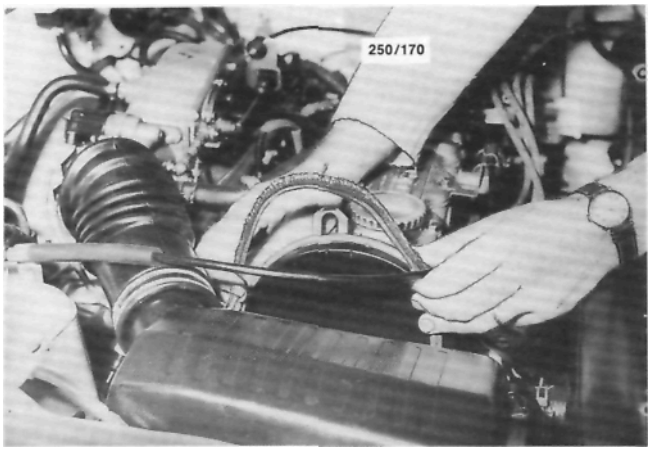
- Faulty alternator regulator unit: Renew the regulator unit.
- Faulty alternator: Overhaul or renew the alternator.
- Faulty charging circuit wiring or connections: Check and renew or repair the faulty components.

NOTE: An overcharged battery is indicated by continual loss of water through boiling.

This is usually accompanied by discolouration of the electrolyte.

CHARGE INDICATOR LAMP REMAINS ON

- Loose or broken alternator drive belt: Adjust or renew the drive belt.
- Faulty regulator unit: Check and renew the regulator unit.
- Faulty alternator: Check and overhaul the alternator.
- Short to earth in the warning lamp circuit: Check and repair the circuit.



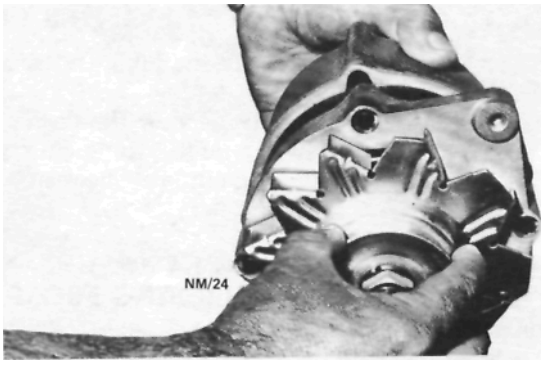
Checking the alternator drive belt for deterioration.

CHARGE INDICATOR LAMP DOES NOT OPERATE

- Lamp bulb blown: Check and renew the faulty bulb.
- Open circuit in the wiring or bulb socket: Check and rectify the open circuit.
- Faulty alternator diode: Overhaul the alternator.

NOISE IN DRIVE BELT OR ALTERNATOR

(1) Drive belt frayed or out of alignment with the pulleys: Renew the drive bell or align the pulleys.



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

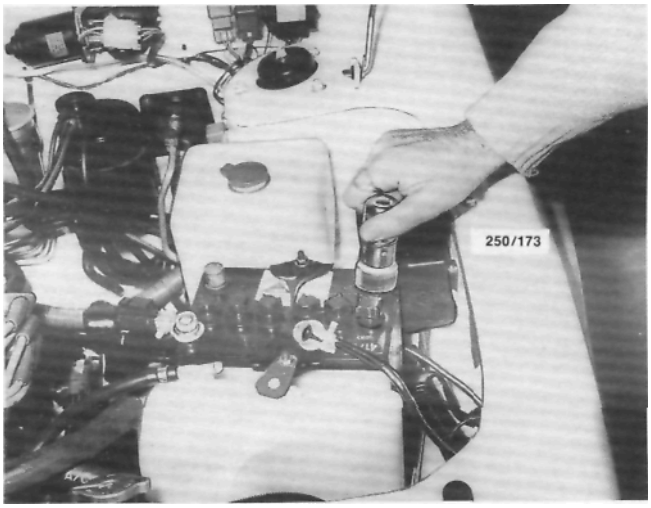
- Loose alternator mounting bolts or worn bearings: Tighten the mounting bolts or renew the bearings.
- Loose alternator pulley: Tighten the pulley retaining nut.
- Faulty alternator: Overhaul or renew the alternator.
- Faulty diodes in the alternator: Overhaul the alternator, install a new heat sink.

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

2. BATTERY AND STARTING SYSTEM TROUBLE SHOOTING

STARTER LACKS POWER TO CRANK ENGINE

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



Cleaning the battery terminals using a battery post cleaner.

- Battery faulty, will not hold charge: Check and renew the battery.
- Battery leads or terminals loose or corroded: Clean and tighten the leads or terminals.
- Faulty starter motor: Check and overhaul the starter motor.
- Faulty starter solenoid switch or contacts: Check and renew the solenoid as necessary.

STARTER WILL NOT ATTEMPT TO CRANK ENGINE

(1) Open circuit in the starting system : Check for dirty or loose leads or terminals, dirty commutator, faulty solenoid or faulty switch. On automatic

transaxle models, check for a faulty or incorrectly adjusted neutral safety switch.

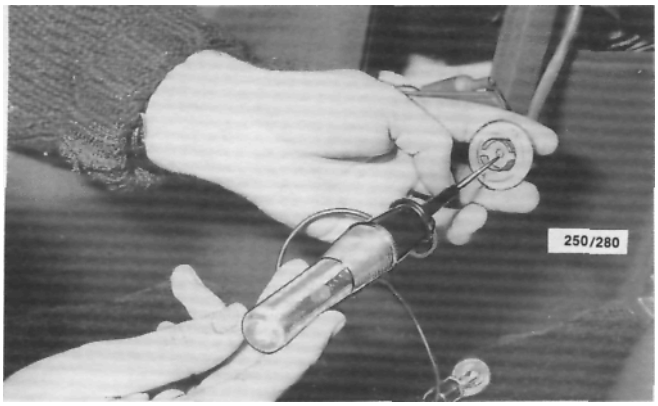
1. Discharged battery: Check for a fault or short circuit in the system.
2. Battery fully charged but will not crank engine. Check for a locked drive and ring gear, internal starter fault or seized engine.
3. Fusible link blown: Check and repair the cause and renew as necessary.

NOTE: Rotate the engine 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 key is turned off before rotating the engine.

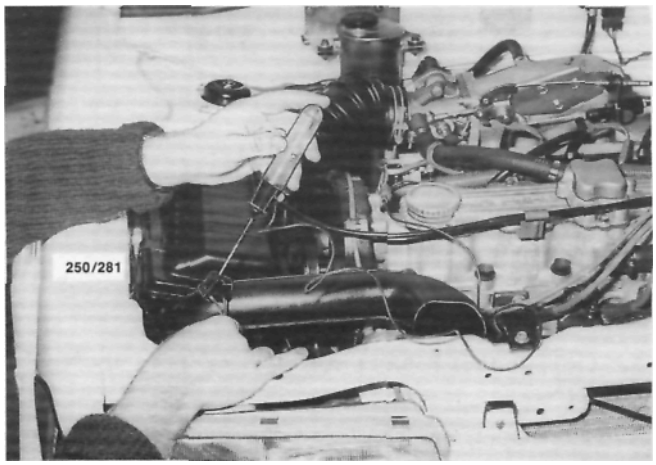
3. LIGHTING SYSTEM TROUBLE SHOOTING

LAMP OR LAMPS FAIL TO LIGHT

1. Faulty bulb(s): Check and renew the faulty bulb(s).
2. Open circuit in the wiring or connections: Check the lamp circuits and rectify as necessary.



Checking the rear combination lamp circuit using a test lamp.



Checking the headlamp circuit using a test lamp.

1. Faulty lamp switch: Check and if necessary renew the lamp switch.
2. Faulty fuse or fuse connection: Repair the fuse connection or renew the fuse.
3. Lamp relay faulty: Check and renew as necessary.

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 the lamp earth for looseness or clean the contact, either at the lamp body or wire.
2. Incorrect bulbs installed: Check the bulb wattage and voltage and renew with the correct type if necessary.
3. Dirty or damaged lamp reflector: Clean or renew the lamp reflector.
4. Faulty bulb: Check with a known serviceable bulb and renew if necessary.
5. Dirty lamp lens: Clean or renew the lamp lens.
6. High resistance or faulty connections between the alternator and battery: Check the circuit and rectify the condition.
7. Poor earth connection between the battery and the engine or alternator: Check the battery earth lead and the strap between the engine and the body.
8. Voltage regulator faulty: Check and renew the voltage regulator.

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

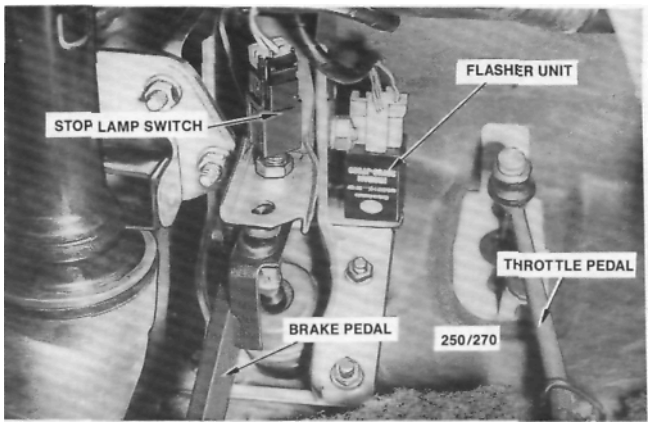
4. TURN SIGNAL LAMP TROUBLE SHOOTING

TURN SIGNAL LAMP DOES NOT LIGHT AND NO AUDIBLE NOISE FROM FLASHER UNIT

(1) Fuse blown: Rectify the fault and renew the fuse.
(2) The Flasher unit is faulty: Renew the unit
(3) Turn signal switch faulty: Renew the switch
(4) Fault in the wiring circuit: Check and repair the fault.

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

(1) Warning lamp bulb blown: Check and renew the bulb.



Installed view of the stop lamp switch and the flasher unit.

(2) Fault in the warning lamp wiring: Check and repair the fault.

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

TURN SIGNAL LAMPS FLASH WEAKLY AND AT GREATER THAN NORMAL SPEED

1. Faulty flasher unit: Check and renew the flasher unit.

2. Front or rear bulb blown on the turn side: Check and renew the bulb.

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

HAZARD WARNING LAMPS DO NOT OPERATE

Fuse blown: Rectify the fault and renew as necessary.

Flasher unit faulty: Renew the flasher unit.

Hazard warning switch faulty: Renew the switch.

Fault in the wiring circuit: Check and repair the fault.

5. TEST EQUIPMENT AND SOME APPLICATIONS

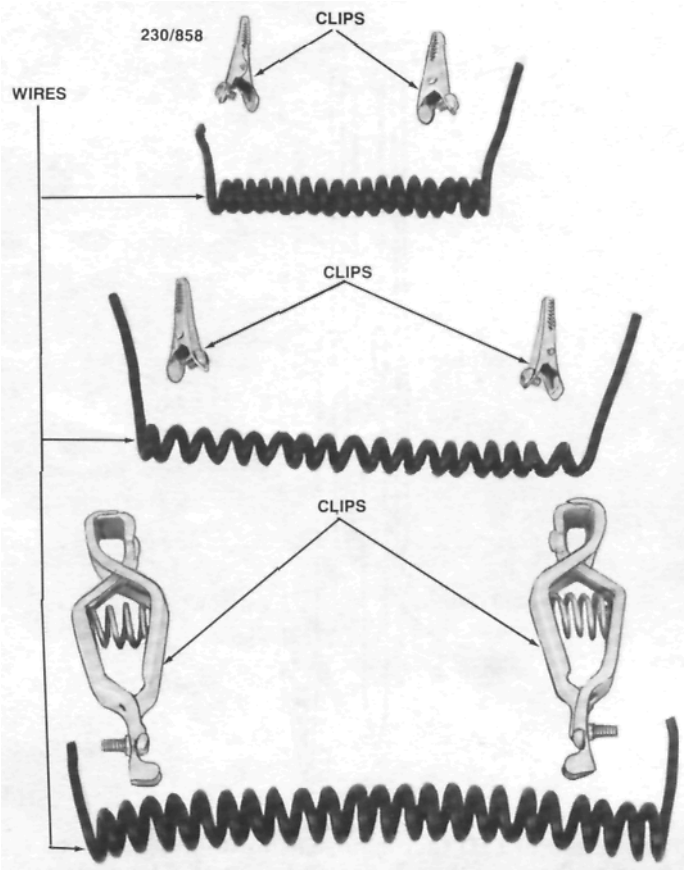
Special Equipment Required:

To Make Test Lamp or Jumper Lead — Soldering iron

When working on the electrical system, a test lamp and jumper leads can be very useful to check circuits.

TO MAKE A JUMPER LEAD

The minimum materials required to make a jumper lead are one length of 4 mm wire and two small alligator clips.



Grouping of materials to construct jumper leads of various sizes.

Bare both ends of a suitable length of 4 mm wire.

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

Test the jumper lead for continuity by removing one battery cable and connecting the lead between the cable and the battery terminal. Turn the ignition On and the dashboard warning lamps should operate indicating a completed circuit through the jumper lead.

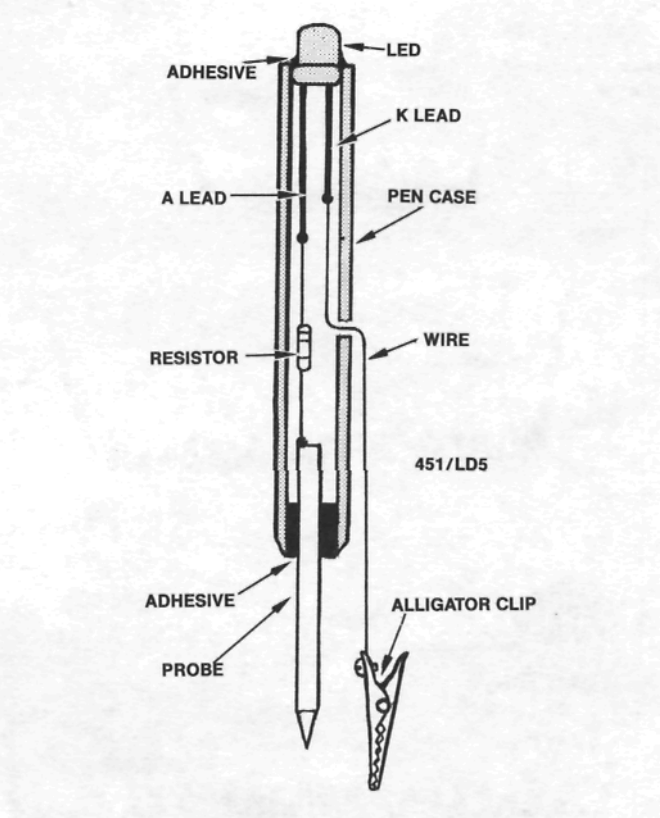
Remove the jumper lead from the circuit and reconnect the battery.

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

TO MAKE A TEST LAMP

Due to the extensive use of electronic components in the electrical system, an LED (light emitting diode) test lamp can be made from a suitable length of 3 mm wire, an alligator clip, an LED, a 1/4 watt 560 ohm resistor, a suitable case such as an old ball point pen case and a length of rod or wire sharpened to form a probe.

(1) Solder the length of wire to the K (cathode)



Schematic of LED test lamp. Ensure that the connections to the K (cathode) lead and A (anode) lead of the LED are as illustrated.

lead of the LED. The K lead is the shorter of the two leads and is adjacent to the flat on the LED.

Solder the 560 ohm resister to the A (anode) lead of the LED.

Solder a short length of wire to the other lead of the resistor and to the probe.

Drill a hole in the side of the case to accept the wire attached to the K lead of the LED.

Mount the probe in the case. If using a pen case, push the probe through the lower end of the pen after removing the refill.

Push the lead attached to the K lead of the LED through the hole made in the side of the case and solder the alligator clip to the lead.

Mount the LED to the case. If using a pen case, the LED may be mounted in the plug at the top of the pen after drilling the plug to accept the LED.

Suitably attach the probe to the case using adhesive or tape.

TO TEST SWITCHES

Disconnect the wires from the switch.

Using a test lamp, test each wire to locate the power wire. It may be necessary to turn the ignition On as the switch may be wired through the ignition circuit.

Disconnect the test lamp and connect a jumper lead between the power wire and the wire from the other side of the switch.

If the circuit functions, the switch can be considered faulty and should be renewed. Refer to the heading Switches and Controls.

TO TEST BULBS

Remove the bulb from the bulb holder.

Connect a jumper lead between the positive terminal of a battery and the base of the bulb.

Connect another jumper lead between the negative battery terminal and the contact on the base of the bulb. The bulb should illuminate.

If the bulb has two filaments, connect the jumper lead to the second contact on the base of the bulb. The second filament should illuminate.

If the bulb fails to illuminate, it should be renewed with a bulb of the correct voltage and wattage.

TO TEST CIRCUITS

Turn the circuit switch On.

Using a test lamp, check for power at one of the circuit connections. A fuse is a good starting point.

If power is available, reconnect the connector and continue checking towards the motor or bulb end of the circuit.

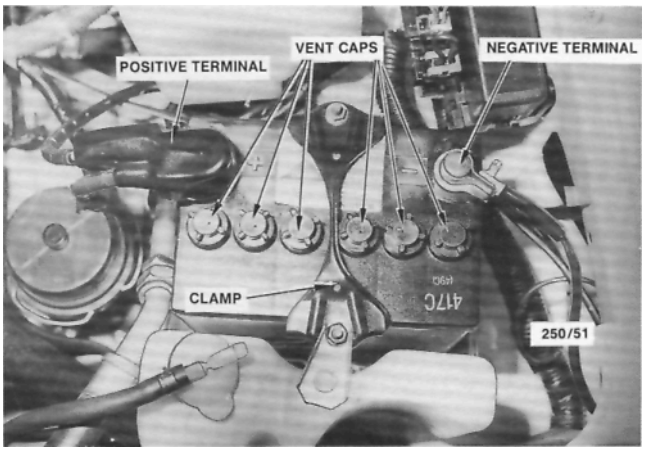
If power is not available, continue checking towards the battery or switch end of the circuit.

6. BATTERY

Special Equipment Required:
To Test — Hydrometer
To Charge — Battery charger

TO REMOVE AND INSTAL

(1) Disconnect the negative and positive battery terminals.



Installed view of the battery.

(2) 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:

Ensure that the terminals and posts are clean.

When connecting the leads to the battery, ensure that the polarity is correct. Connect the positive lead first.

Do not over tighten the terminal clamp nuts.

Apply petroleum jelly to the battery terminals to prevent corrosion.

MAINTENANCE

Battery maintenance should be performed at the scheduled services.

NOTE: Keep naked flames away from the battery as the battery gases are highly explosive.

(1) Keep the battery and the surrounding area clean and dry. In particular, ensure that the top of the battery is free from dirt and moisture to prevent a voltage drop between the terminals.

If necessary, clean the battery case as follows:

Remove the battery from the vehicle as previously described.

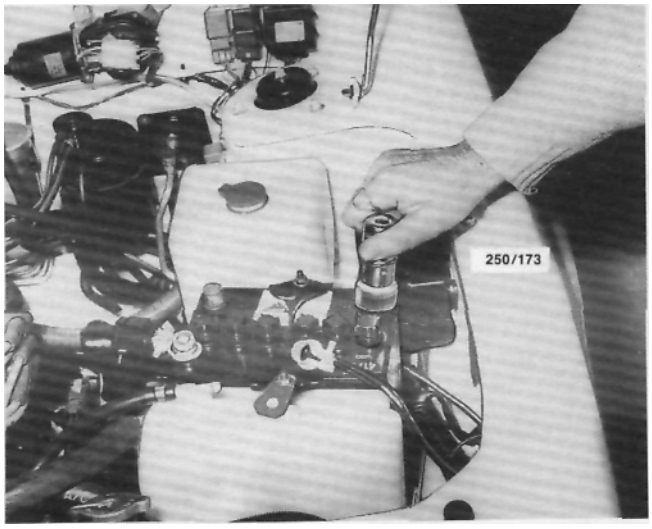
Pour hot water over the battery being careful not to allow any water to enter the battery through the filler cap vent holes.

Wipe the battery case clean.

Clean the battery terminals and posts using a battery post cleaner, wire brush or emery cloth. Remove all dirt and corrosion.

Remove the filler caps and check that the vent holes are clear.

Check the electrolyte level and replenish with distilled water as necessary. The correct level is just above the top of the plates. Do not overfill the battery. Do not transfer electrolyte from one cell to another.



Cleaning the battery terminals using a battery post cleaner.

(5) If the battery electrolyte requires frequent replenishing, check the battery case for cracks. If the case is damaged, renew the battery.

Check for overcharging by measuring the output of the alternator as described later in this section.

Apply petroleum jelly to the battery terminals to prevent corrosion.

If the electrolyte has overflowed and contaminated the battery carrier and surrounding body panels, proceed as follows:

With the battery removed from the vehicle, sprinkle bicarbonate of soda over the contaminated areas.

Pour hot water over the bicarbonate of soda. The bicarbonate of soda will react with the water and begin to foam.

When the bicarbonate of soda has stopped foaming, rinse the area with clean water and allow to dry.

Remove any blistered paint from the conlaminated areas.

Paint the contaminated areas with a corrosion inhibiting paint.

TO TEST AND CHARGE

(1) Using a hydrometer, test the specific gravity of the battery electrolyte. Refer to the following chart which shows charge conditions for various specific gravity readings.

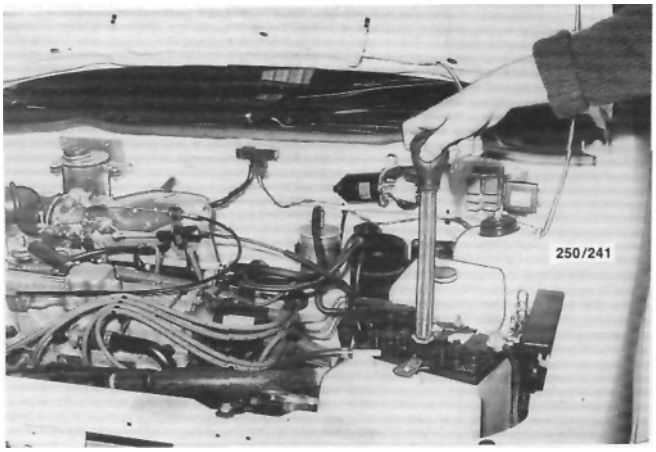
1.110-1.130	Fully discharged
1.140-1.160	Nearly discharged
1.170-1.190	Approximately one quarter charged
1.200-1.220	Half charged
1.230-1.250	Approximately three quarters charged
1.250-1.280	Fully charged

These readings are for electrolyte at a temperature of 20 deg C. For every 10 deg above 20 deg C, add 0.007. For every 10 deg below 20 deg C, subtract 0.007.

NOTE: An accurate specific gravity reading cannot be obtained if distilled water has recently been added to the electrolyte. If the electrolyte level is below the battery plates, replenish with distilled water and charge the battery before testing the specific gravity.

(2) If a low state of charge is indicated, or if the specific gravity readings vary more than 0.030 between cells, the battery should be 'charged, using a battery charger, with attention to the following points:

(a) Disconnect the negative and positive battery terminals.



Check the specific gravity in each cell with a hydrometer.

Check the battery electrolyte level and replenish as necessary.

Remove the filler caps from the battery.

Follow the battery charger manufacturers instructions.

(3) Should the battery fail to operate satisfactorily after charging, it is recommended that it be taken to a workshop with the necessary equipment to perform a load test. Load testing, when performed in conjunction with the specific gravity tests described above will give an accurate indication of the serviceability of the battery.

7. ALTERNATOR

Special Equipment Required

To Test On Vehicle - Voltmeter, 100-0-100 amp ammeter, ohmmeter
To Dismantle — 200 watt soldering iron, bearing
puller, press
To Assemble — 200 watt soldering iron

DESCRIPTION

Two types of alternator are installed to the range of vehicles covered by this manual, either Hitachi or Bosch.

In the alternator, the field and pole shoe assembly is the moving part and it 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 the brushes and slip rings is very slight and maintenance is reduced to a minimum.

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

As it is not possible to charge a storage battery with alternating current, it is necessary 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 the built in characteristics of the alternator.

The regulator and brush holder assembly on Hitachi alternators is mounted within the alternator on the slip ring end bracket side. On Bosch alternators
the regulator and brush holder unit is mounted to the outside of the slip ring end bracket.

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

SERVICE PRECAUTIONS

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

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

Always disconnect the battery before connecting a battery charger.

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.

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

Regularly check that the alternator drive belt tension is as specified. Refer to the Engine Tune-up section.

Keep the battery terminals clean and all electrical connections tight.

Disconnect the battery and alternator when electric welding on the vehicle.

TO TEST ON VEHICLE

If the charge indicator lamp stays on after the engine has been started and run at approximately 1 000 rpm, carry out the following tests.

Stop the engine.

Check the condition and adjustment of the alternator drive belt.

Clean the battery terminals, tighten all electrical connections, check the wiring for shorts to earth and/or bridged circuits. Ensure that the battery is fully charged. If the battery **is** discharged charge it or replace it with one fully charged.

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

Stop the engine and disconnect the negative battery terminal.

Remove the nut and washer from the alternator output terminal (B +) and disconnect the alternator output lead.

Connect one lead of an ammeter to the alternator output terminal and the other lead to the lead removed from the output terminal.

Connect the negative battery terminal and connect a voltmeter across the battery terminals.

Switch on all lamps and allow them to illuminate for approximately five minutes to reduce the charge of the battery and to apply a load to the circuit.

Start the engine and gradually increase the speed to approximately 2 500 rpm. The reading on the ammeter should be approximately 75% of the rated output of the alternator. See Specifications.

Switch off all the lamps and run the engine at 1 500-2 000 rpm until the indicated charge is below 10 amps. The voltmeter should now read in excess of 13.6 volts.

NOTE: Should the alternator fail to reach the specific output, the unit will have to be removed and overhauled or a replacement unit installed.

Should the voltage reading be above or below Specifications, the regulator will have to be renewed.

TO REMOVE AND INSTAL

Disconnect the negative battery terminal.

On 1.8 liter engines, remove the bolt securing the air cleaner intake duct and remove the air cleaner intake duct.

Drain the radiator by releasing the radiator drain plug, located at the bottom of the radiator and allow the coolant level to fall below the thermostat housing level.

NOTE: Refer to the Cooling and Heating Systems section when refilling the radiator coolant to its correct level, failure to do so could result in severe damage to engine components.

Remove the retaining bolts securing the thermostat housing, disconnect the hose from the radiator and remove the thermostat housing and radiator hose from the vehicle.

Using a socket and extension bar, remove the bolt securing the alternator to the drive belt tensioning bar located under the alternator.

On vehicles not equipped with air conditioning, remove the front splash guard from under the front of the vehicle and remove the bolt securing the alternator to the drive belt tensioning bar.

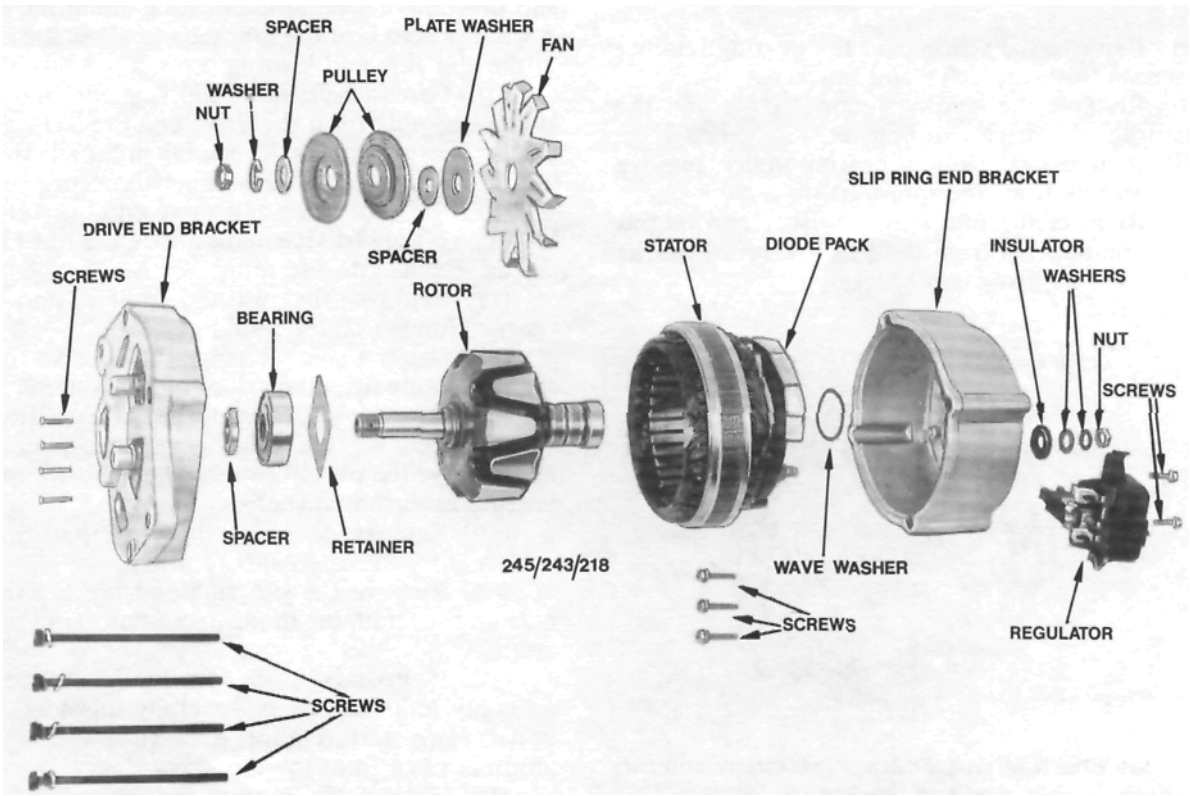
Loosen the upper mounting bolts, slacken the alternator drive belt and remove it from the alternator pulley.

While supporting the alternator, remove the upper mounting bolts and remove the alternator from the vehicle.

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

Do not over tension the drive belt. Refer to the Engine Tune-up section for the correct belt adjusting procedure.

Ensure that the wiring and connectors are securely located on the alternator.



Dismantled view of the Bosch alternator.

(3) Replenish the coolant in the radiator. Refer to the Cooling and Heating Systems section for the correct procedure.

TO DISMANTLE

Bosch Alternator

Remove the alternator from the vehicle as previously described.

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

Remove the screws and washers securing the regulator and brush holder assembly. Withdraw the regulator and brush holder assembly from the alternator.

Remove the long screws securing the drive end bracket to the slip ring end bracket and withdraw the drive end bracket, rotor and pulley assembly.

NOTE: Ensure that the wave washer behind the rotor shaft rear bearing in the slip ring end bracket is not mislaid.

Holding the rotor in a soft jawed vice, remove the split drive pulley retaining nut, washer and spacer from the rotor shaft.

Remove the split drive pulley, spacer, plate washer and fan from the rotor shaft.

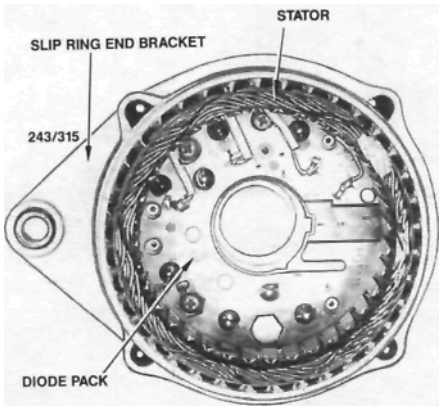
Using a suitable press and press plates, support the drive end bracket with the pulley end of the rotor shaft uppermost and carefully press the rotor shaft from the spacer, bearing and the drive end bracket.

Remove the spacer and the bearing retainer plate screws from the drive end bracket.

Remove the bearing retainer plate and the bearing from the drive end bracket.

If necessary, using a bearing puller, remove the rear bearing from the rotor shaft.

Remove the nut, spring washer and output terminal components from the {B +) terminal on the outside of the slip ring end bracket.



View of the Bosch alternator stator assembly and the slip ring end bracket.

(12) 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. Remove the insulating spacer and washer from the (B +) terminal.

NOTE: The diode pack is supplied as an assembly and in the event of a component 'failure, must be renewed as a complete unit.

Mark all wiring connections prior to removal to aid assembly.

Where necessary, unsolder the stator leads from the connector terminals to separate the diode pack.

NOTE: When soldering or unsoldering the stator leads from the diodes, grip the leads with a pair of long nosed pliers. This will safeguard the diodes by transferring any ***excess*** *heat to the jaws of the pliers.*

Hitachi Alternator

Remove the alternator from the vehicle as previously described.

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

Remove the through bolts retaining the drive end bracket to the slip ring end bracket.

Apply a heated 200 watt soldering iron to the slip ring end bracket at the bearing mounting boss for 3-4 minutes to heat the bracket and allow the removal of the slip ring end bearing.

Carefully prise the slip ring end bracket and stator assembly from the drive end bracket and rotor assembly using suitable levers. Do not insert the levers too far or damage to the stator will occur.

Hold the rotor and drive end bracket assembly in a soft jawed vice and remove the nut retaining the drive pulley to the rotor.

Remove the washer, pulley and spacer washer from the rotor shaft.

Using a soft faced hammer, drive the rotor shaft assembly from the drive end bracket and remove the inner spacer washer from the rotor shaft.

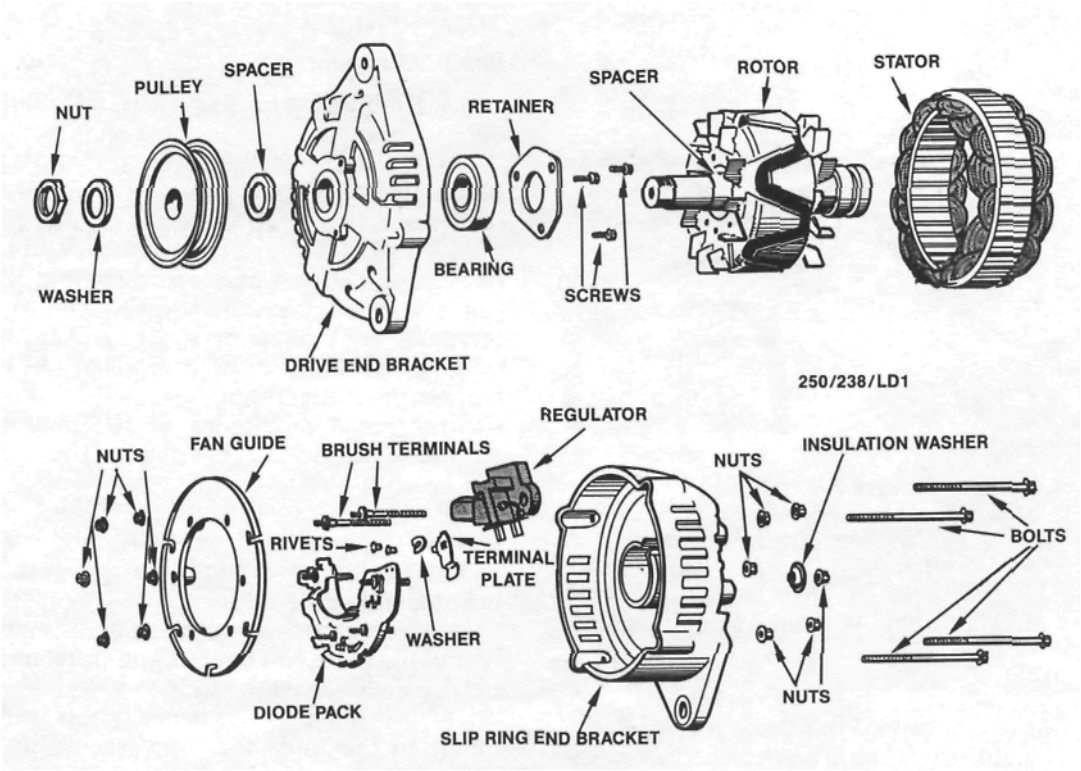
Remove the bearing retainer plate screws and remove the plate. Using a suitable drift, drive the bearing from the bracket.

Remove the retaining nut and insulator washer from the alternator terminal.

Remove the slip ring end bracket retaining nuts and separate the diode pack, stator and regulator assembly.

If necessary, file the ends of the brush assembly retaining rivets, carefully unsolder the terminal plate and remove the brush assembly and terminal plate from the diode pack.

If necessary, remove the fan guide retaining



Dismantled view of the Hitachi alternator.

nuts, remove the fan guide and unsolder the diode pack and regulator from the stator.

NOTE: When soldering or unsoldering the stator leads or bridges from the diodes or regulator, grip the leads with a pair of long nosed pliers. This will safeguard the diodes by transferring any excess heat to the jaws of the pliers.

TO CLEAN PARTS

Do not immerse components of the alternator in cleaning solvents as damage to the windings will result.

Thoroughly clean and dry the end brackets in a suitable solvent after they have been completely dismantled from the unit.

Compressed air can be carefully used to blow the dust from the stator windings and the field winding on the rotor.

Slip rings that are burned or scored should be polished using very fine glass paper.

Clean the brushes and the brush holders using a petrol dampened rag. Check and remove any burrs from the holder.

Check the rotor shaft bearings for wear and roughness and renew as necessary.

TO CHECK AND TEST COMPONENT PARTS

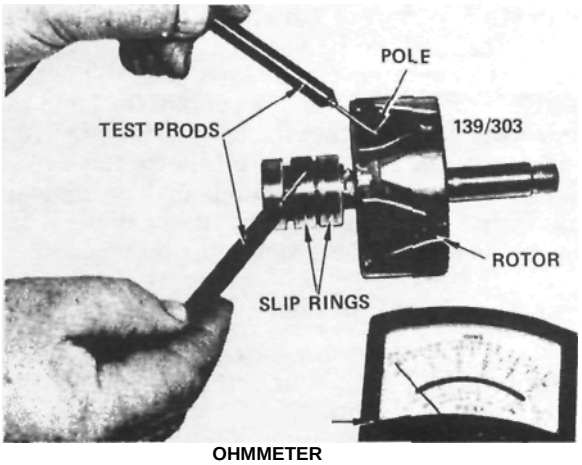
All parts being electrically tested should be resting on a non-conductive pad.

Field Windings and Rotor Assembly

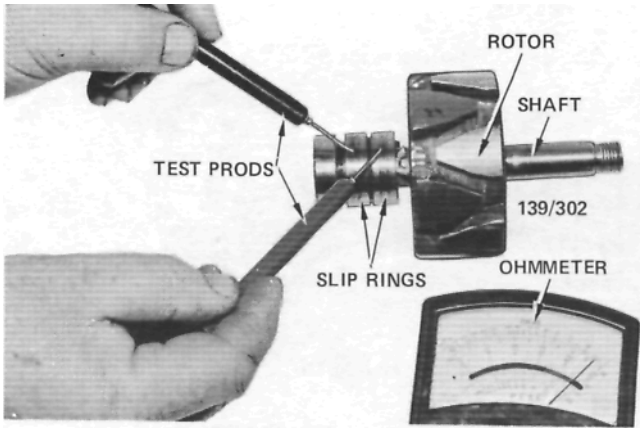
The insulation to earth test is done with an ohmmeter. Connect one of the test prods to one of the field wires or slip rings and the other test prod to one pole piece of the rotor.

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

To check for bridged or internal shorting of the field coils, connect the test prods of an ohmmeter across the slip rings and check the resistance of the rotor windings. Compare the readings with Specifications. A low reading indicates a bridged circuit



Checking the rotor windings for shorts to earth.



Using an ohmmeter to test for bridging or internal shorting of the rotor fields.

internally, while a high reading indicates an open circuit or high resistance in the windings. In both cases a new rotor assembly will have to be installed.

Stator Windings

The stator test is carried out using a test lamp.

The stator leads must be detached from the diode pack.

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 lead, one at a time.

Should the test lamp illuminate, however dimly, a short circuit is indicated and the stator assembly must be renewed.

Diodes

On some models the diodes may be tested after disconnection. Testing can be done by using a 12 volt battery and a 1.5 watt bulb in series with a jumper lead.

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

Connect one end of a 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 on the battery.

If the lamp was illuminated in both directions or was not illuminated at all, the diode is faulty and the diode pack/heat sink must be renewed.

Brush Springs and Brushes

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

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

TO ASSEMBLE

Bosch Alternator

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

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

Install the insulating washer and spacer to the (B +) terminal post and position the diode pack and stator assembly onto the slip ring end bracket. Install the diode pack retaining screws and tighten securely.

Working on the exterior of the slip ring end bracket, install the output terminal components to the (B +) terminal and secure the retaining nut.

Position the bearing retainer, bearing and spacer on the rotor shaft.

Using a suitable press and press plates, support the rotor shaft on the front face of the spacer and carefully press the rotor shaft fully into the bearing and spacer.

Position the rotor shaft assembly into the rear of the drive end bracket and install and tighten the bearing retainer plate screws.

Install the fan, plate, spacer and split drive pulley to the rotor shaft and secure them with the retaining washer and nut.

If necessary, using a suitable press and press plates, support the rotor shaft rear bearing and carefully press the rotor shaft fully into the bearing.

NOTE: Ensure that pressure is applied only to the inner race of the bearing.

Ensure that the rotor shaft bearing wave washer is located in the slip ring end bracket and insert the rotor in the stator and slip ring end bracket assembly.

Align the marks made on dismantling and install and tighten the long securing screws.

Position the regulator and brush holder assembly to the slip ring end bracket and install and tighten the retaining screws.

Install the alternator to the vehicle and test the operation as previously described.

Hitachi Alternator

If necessary, position the new brush terminals in the brush assembly and install the brush assembly and terminal plate to the diode pack. Carefully solder the terminal plate to the diode pack and secure the brush assembly by installing and staking new rivets.

If necessary, solder the diode pack and regulator to the stator and install the fan guide and retaining nuts. Tighten the retaining nuts securely.

NOTE: When soldering or unsoldering the stator leads or bridges from the diodes or regulator, grip the leads with a pair of long

nosed pliers. This will safeguard the diodes by transferring any excess heat to the jaws of the pliers.

Using a suitable drift, install the bearing into the drive end bracket, install the retainer plate and screws. Tighten the screws securely.

Using a suitable press and press plates, install the bearing to the slip ring end of the rotor shaft. Ensure that pressure is exerted only on the inner race and that the stop ring groove is nearest to the slip rings.

Ensure that the rotor shaft rear bearing stop ring is positioned so that the protruding part of the ring is located in the deepest part of the groove.

Install the stator, diode pack and regulator assembly to the slip ring end bracket. Install the retaining nuts and washers and tighten securely.

Install the nut and insulator to the terminal and tighten securely.

Using a piece of wire, hold the brushes in a retracted position.

Hold the drive end bracket in a soft jawed vice and install the rotor shaft assembly to the drive end bracket.

Install the pulley, retaining nut and washer to the rotor shaft and tighten the retaining nut to the specified torque.

Apply a heated 200 watt soldering iron to the slip ring end bracket at the bearing mounting boss for 3-4 minutes to heat the bracket and allow the installation of the rotor shaft rear bearing.

Aligning the marks made on dismantling and ensuring that the rotor shaft rear bearing retaining ring protrusion is located in the deepest part of its groove, install the rotor/stator assembly to the slip ring end bracket.

Remove the brush retracting wire from the alternator, ensure that the alternator component marks are aligned, install the retaining through bolts and tighten them securely.

Check the alternator rotor for smooth operation and install the alternator to the vehicle as previously described.

Check the alternator operation on the vehicle as previously described.

8. STARTER MOTOR

Special Equipment Required:
To Renew Brushes — Soldering iron
To Renew Armature Bearings — Bearing puller

DESCRIPTION

Two types of starter **motors** are installed to the range of vehicles covered by this manual, either Hitachi or Bosch.

The starter motor is the induced pole type with four brushes and four pole shoes with field coils.

A solenoid switch is attached to the starter drive end bracket. The solenoid plunger is connected to the overrunning clutch and drive pinion assembly through a lever and pivot arrangement.

When the solenoid windings are energized, the plunger acting on the lever and pivot engages the drive pinion with the flywheel ring gear and at the same time closes the switch supplying power from the positive lead of the battery to the starter motor field coils and armature to operate the motor.

As the engine fires, the over-running 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-energized by releasing the ignition key.

The starter solenoid switch windings are energized by the ignition switch.

TO TEST ON VEHICLE

Should the starter motor fail to operate when the ignition switch is turned to the Start position, check the following points:

Check the battery condition and state of charge. Refer to the Battery heading for the correct procedure.

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

Check the earth connection for tightness and cleanliness.

Switch on the headlamps and turn the ignition switch to Start. If the lamps dim but the starter motor does not operate, it could indicate that a short circuit has developed in the starting system.

Check that the engine is not seized or that the starter motor drive pinion and ring gear are not locked as these conditions would -give the same indications as above.

(5) If the lamps do not dim and the starter motor 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 equipped with an automatic transaxle, turn the ignition switch to Start and move the selector lever through all the gear selection range. If the starter motor operates in any position other than N or P, the neutral safety switch is faulty.

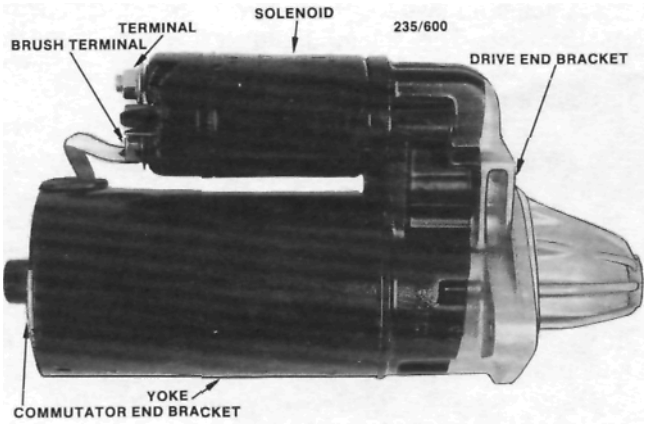
(6) Check all the external wiring to ensure that the fault is not external. If the external circuit proves satisfactory, indicating that the problem is in the starter motor, the unit will have to be removed and tested.

TO REMOVE AND INSTAL

Disconnect the negative battery terminal.

Disconnect the wiring from the starter motor solenoid.

Remove the starter motor mounting bolts,



View of the Bosch starter motor removed from the vehicle.

noting the position of the earth cable, and maneuver the starter motor out of the engine compartment.

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

Replace the earth cable to the position noted on removal.

Tighten the starter motor mounting bolts securely.

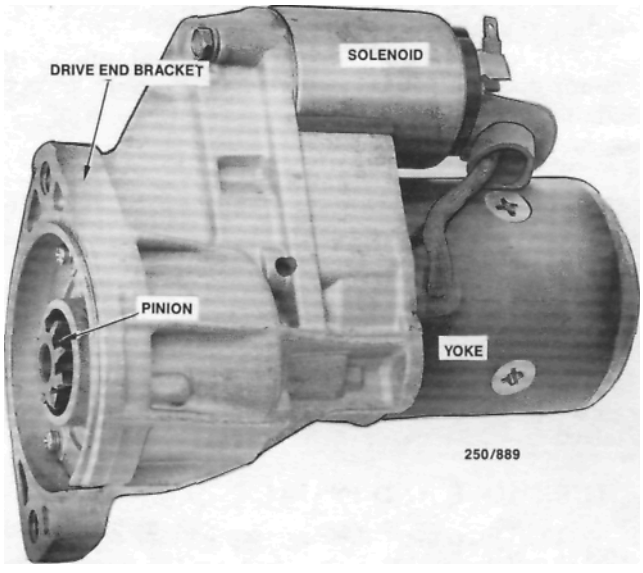
HITACHI STARTER MOTOR

To Dismantle

Remove the starter motor from the vehicle as previously described.

Mount the starter motor upright in a soft jawed vice gripping the drive end bracket.

Loosen the solenoid field coil terminal nut and disconnect the cable from the solenoid.



View of the Hitachi starter motor removed from the vehicle.

Scribe a line across the drive end bracket, yoke and end cover to facilitate correct alignment during assembly.

Remove the bolts retaining the end cover and yoke to the drive end bracket and remove the end cover from the yoke.

Remove the yoke, armature and brush holder as an assembly from the drive end bracket. Note the position of the O ring sealing the yoke.

Release the brush springs and separate the brushes from the brush holder.

Remove the brush holder from the yoke.

Separate the armature from the yoke.

Scribe a line across the solenoid and the drive end bracket to facilitate correct alignment during assembly.

Remove the solenoid retaining bolts and lift the solenoid, spring, lever and rubber seal out of the drive end bracket. Note the installed position of the components.

Mount the drive end bracket in the vice with the pinion uppermost and Remove the screws retaining the pinion housing to the drive end bracket.

Remove the pinion housing from the drive end bracket,

Remove the pinion assembly from the drive end bracket,

Mount the pinion in the vice, hold the collar down and remove the snap ring from the end of the pinion.

Remove the collar and spring from the pinion and slide the pinion out of the clutch assembly.

If necessary, prise the bearings off the clutch assembly using two screwdrivers. Note the location of the larger bearing.

If necessary, remove the bearings from the armature using a bearing puller.

To Check and Inspect

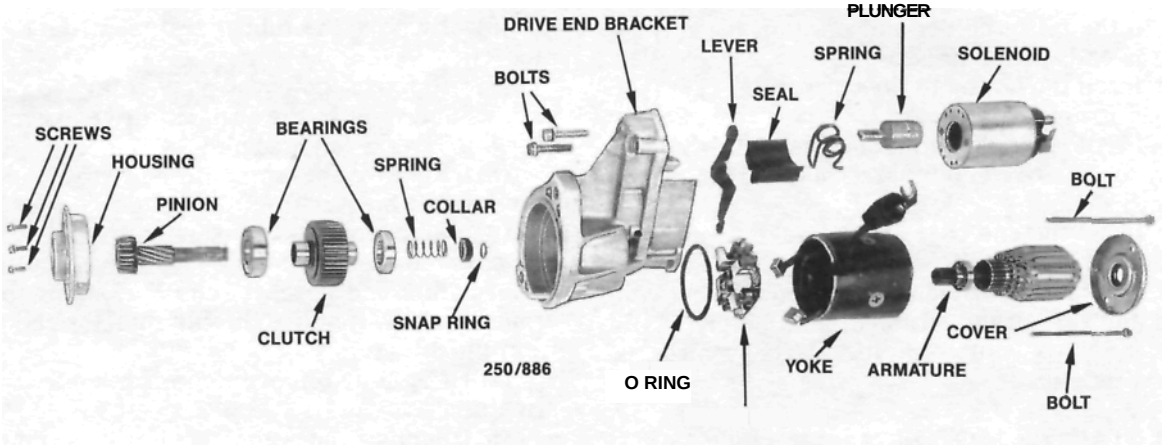
Clean all the starter motor components thoroughly but do not immerse the yoke, armature or clutch assembly in cleaning solvent.

Check the brush holder insulation using an ohmmeter.

Connect one test probe to the brush holder positive side and the other test probe to the negative side. If continuity exists, renew the brush holder.

Check the brushes for adequate length. Renew the brushes if they are worn to less than the length listed in Specifications. The brushes should be a free sliding fit in the brush holders. Check the brush springs for adequate tension.

Check the field coil continuity using an ohmmeter. Connect one test probe to the positive brush and the other test probe to the solenoid cable terminal. If continuity does not exist, renew the field coils.



Dismantled view of the Hitachi starter motor.

Check the field coil insulation using an ohmmeter. Connect one test probe to the solenoid cable terminal and the other test probe to the body of the yoke. If continuity exists, renew the field coils.

Check that the commutator is free from pitting and burning. Clean the commutator with a petrol moistened cloth and polish with a strip of fine glass paper.

A badly worn commutator may be repaired by mounting in a lathe and taking a light cut using a very sharp tool with the lathe rotating at high speed. After machining, undercut the insulation between the segments to Specifications. Do not machine the commutator to below 29 mm diameter. Check the armature gear teeth for wear and damage.

Check the armature for short circuit using an ohmmeter. Place one of the test probes on the armature shaft or core and move the other test probe around the periphery of the commutator. If continuity exists at any point, the armature is faulty and should be renewed.

Check the pinion for wear and damage. The pinion should move smoothly along the clutch assembly helical splines. Check the spring, collar and snap ring for serviceability.

Check that the clutch assembly locks in one direction and rotates smoothly in the opposite direction. Check for wear and damage to the reduction gear teeth on the outside of the clutch assembly.

Check that continuity exists between the solenoid spade terminal and the solenoid body and between the solenoid spade terminal and the solenoid field coil terminal. Renew the solenoid if continuity does not exist.

Renew all the components found to be unserviceable in the above checks.

To Assemble

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

(1) If removed, install new bearings to the clutch assembly and the armature. Lubricate the armature bearings with high temperature grease.

The sealed bearings on the clutch assembly are lubricated during manufacture and further lubrication is unnecessary.

Apply high temperature grease to the yoke end cover bearing recess, the drive end bracket and pinion housing bearing recesses, the clutch assembly reduction gear teeth, the armature gear teeth, the pinion helical splines, the solenoid plunger and the spring and lever.

Install the pinion to the clutch assembly and install the spring and collar to the pinion.

Hold the collar down and install the snap ring to the end of the pinion.

Position the collar over the snap ring. If necessary, squeeze the snap ring into the groove using multigrip pliers to enable the collar to be clipped over the snap ring.

Install the pinion and clutch assembly to the drive end bracket.

Install the pinion housing to the drive end bracket. Install and tighten the retaining screws securely. Check that the pinion rotates freely.

Assemble the lever and spring to the solenoid in the position noted on dismantling.

Install the solenoid assembly and rubber seal to the drive end bracket.

Install and tighten the solenoid retaining bolts securely.

Connect 12 volts between the solenoid spade terminal and the solenoid field coil terminal and measure the distance that the end of the pinion protrudes from the pinion housing.

Pull the pinion by hand until it contacts the stop and measure the pinion end protrusion.

If necessary, add or subtract shims between the solenoid mounting face and the drive end bracket until the difference between the above measurements is 0.3-1.5 mm.

Install the armature to the yoke.

Install the brush holder to the yoke. Install the

brushes to the brush holder and position the springs against the ends of the brushes.

Install the O ring to the yoke taking care that the O ring is not twisted.

Install the yoke, armature and brush holder assembly to the drive end bracket, aligning the marks made on dismantling.

Install the end cover to the yoke. Install and tighten the retaining bolts securely.

Connect the cable to the solenoid field coil terminal and tighten the terminal nut securely.

Install the starter motor to the vehicle as previously described.

BOSCH STARTER MOTOR

To Dismantle

Disconnect the brush connector strap from the lower terminal on the solenoid switch.

Remove the screws retaining the solenoid to the drive end bracket and remove the solenoid from the drive end bracket.

Loosen, but do not remove the screws retaining the armature end cover to the commutator end bracket.

Remove the through bolts retaining the drive end bracket to the commutator end bracket.

Remove the yoke, armature and commutator end bracket from the drive end bracket as an assembly. Hold the rubber seal in place in the drive end bracket to keep the engaging lever in position.

Remove the rubber seal from the drive end bracket.

Remove the cover plate from the planetary gear set and remove the gear set, drive assembly and engaging lever as an assembly.

Remove the armature end cover and commutator end bracket from the yoke.

Remove the screws retaining the armature end cover to the commutator end cover and remove the armature end cover, C clip and shims from the armature shaft. Remove the commutator end bracket from the armature.

Carefully remove the brush holder from the armature.

Support the gear set and drive assembly in a vertical position with the drive assembly uppermost.

Using a suitable drift, tap the stop collar towards the drive assembly and remove the snap ring from the drive shaft.

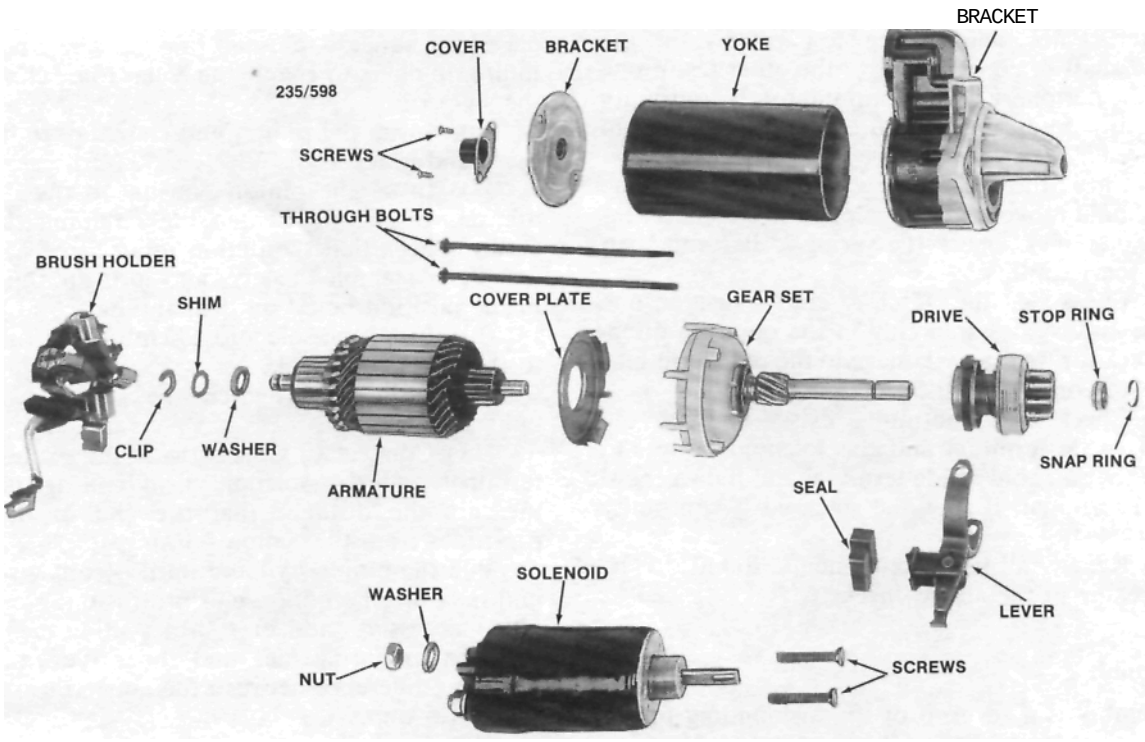
Remove any burrs from the drive shaft and withdraw the drive assembly and stop ring from the drive shaft.

Clean all parts thoroughly but do not immerse the armature, solenoid or drive assembly in cleaning solvent.

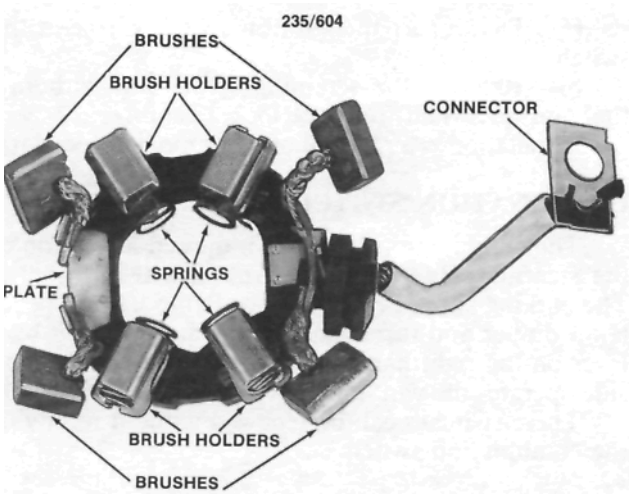
To Check and Inspect

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

Connect one test lead to the brush holder positive



Dismantled view of the Bosch starter motor.



Dismantled view of the brush holder assembly. Bosch starter motor.

side and the other lead to the negative side. If there is any indication of leakage the ohmmeter will show a reading other than infinity. Repair or renew the brush holder if leakage 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.

NOTE: Due to the difficulty involved in removing and installing the brushes in the Bosch starter motor, it is recommended that the brush holder be renewed as an assembly.

(3) 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 repaired by mounting in a lathe, spinning at high speed, and taking a light cut with a very sharp tool. After turning, undercut the insulation between the segments.

(4) Check the armature for short circuit using an 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.

Check the drive assembly clutch pinion teeth for wear, scoring or chipping. A clutch in good condition should take up the drive in one direction only. It should rotate easily and smoothly in the non-drive direction and the assembly should move smoothly along the armature or drive shaft helical splines.

Check the armature shaft bushes for wear and renew as necessary. The old bushes must be removed and the new ones pressed into the end brackets using a polished mandrel of the exact diameter of the armature shaft.

NOTE: The new bushes must not be reamed to size, as reaming will impair the porosity of the bushes and cause early failure. New bushes should be allowed to stand immersed in clean light engine oil for one hour before installation.

To Assemble

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

Lubricate the helix of the drive shaft lightly with graphite grease and install the drive assembly to
the drive shaft.

Install the stop collar and snap ring, slide the stop collar over the snap ring to lock the snap ring in position.

Lubricate the bushes in both end brackets sparingly with engine oil.

Install the engaging lever and gear set into the drive end bracket.

Install the centre rear bracket and the engaging lever seal into the drive end bracket.

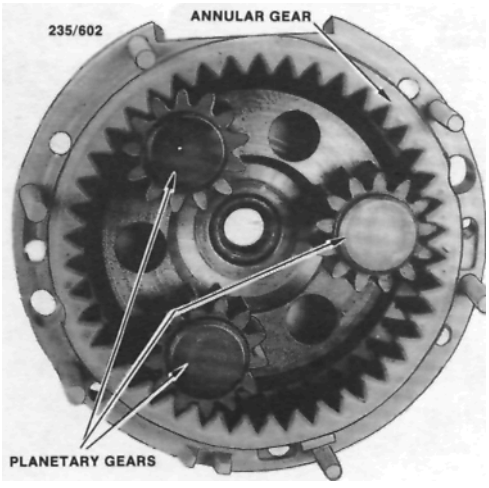
Slide the brush holder assembly into position on the commutator ensuring that the brush holders are correctly positioned in the anchor points.

Install the commutator end bracket to
the
armature, install the shims and C clip.

Check that the armature end float is satisfactory and adjust as necessary using shims of the correct thickness.

Align the slot in the commutator end bracket with the cut out on the wiring seal and install the armature end cover to the commutator end bracket. Install the cover retaining screws but do not tighten.

Ensure that the permanent magnets in the yoke have not picked up any debris and slide the yoke over the armature ensuring that the wiring seal locates correctly in the slot in the yoke.



View showing the planetary gear set. Bosch starter motor.

Install the armature and yoke to the drive end bracket rotating the drive to align the reduction gears. Do not use force.

Install the retaining through bolts to the commutator end bracket and lighten the through bolts and armature end cover retaining screws securely.

Install the solenoid to the drive end bracket, install the retaining screws and tighten them securely.

Install the brush connector strap and install
the retaining nut and washer and tighten securely.

9. IGNITION SYSTEM

The testing and repair procedures for the ignition system are fully covered in the Fuel and Engine Management section.

10. STEERING WHEEL

The removal and installation procedures for the steering wheel and horn pad are fully covered in the Steering section.

11. SWITCHES AND CONTROLS

IGNITION SWITCH

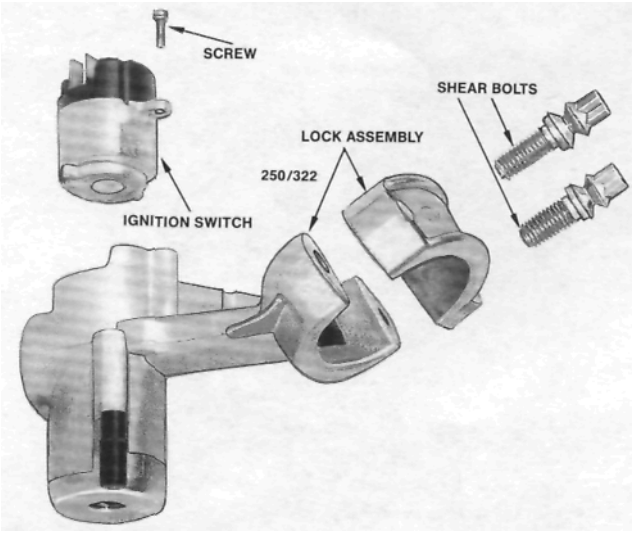
To Remove and Install

Disconnect the negative battery terminal.

Remove the retaining screws from the steering column cover.

Unclip and separate the upper and lower steering column covers and remove the upper cover.

Release the column adjusting lever and remove the lower cover by guiding the column adjusting lever through the hole in the upper end of the cover.



Dismantled view of the steering lock and ignition switch assembly

Disconnect the ignition switch wiring at the switch.

Remove the retaining screw and withdraw the ignition switch from the lock assembly.

Installation is a reversal of the removal procedure.

COMBINATION SWITCH

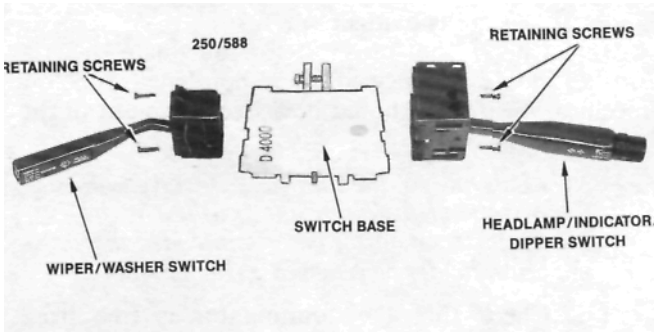
The combination switch is mounted at the top of the steering column and incorporates two switches. The parking lamp, headlamp, headlamp flasher, headlamp dipper and turn signal lamps are operated by a lever on the right hand side. A lever on the left hand side operates the windscreen washer and wiper switch.

These switches can be renewed without removing the combination switch.

To Remove and Install Switches

Remove the retaining screws from the steering column cover.

Unclip and separate the upper and lower steering column covers and remove the upper cover.



View of the combination switch removed from the vehicle.

Release the column adjusting lever and remove the lower cover by guiding the column adjusting lever through the hole in the upper end of the cover.

Disconnect the wiring connectors from the applicable switch.

Remove the retaining screws located at the top and bottom of the applicable switch and remove the switch.

Installation is a reversal of the removal procedure.

To Remove and Install Combination Switch Base

Disconnect the negative battery terminal.

Remove the steering wheel as described in the Steering section

Remove the retaining screws from the steering column cover.

Unclip and separate the upper and lower steering column covers and remove the upper cover.

Release the column adjusting lever and remove the lower cover by guiding the column adjusting lever through the hole in the upper end of the cover.

Disconnect the wiring connectors from the rear of the combination switch.

Loosen the clamping screw located at the left hand side of the combination switch.

Push, turn and slide the combination switch from the steering column.

Installation is a reversal of the removal procedure.

REAR WINDOW DEMISTER SWITCH/HAZARD WARNING LAMP SWITCH

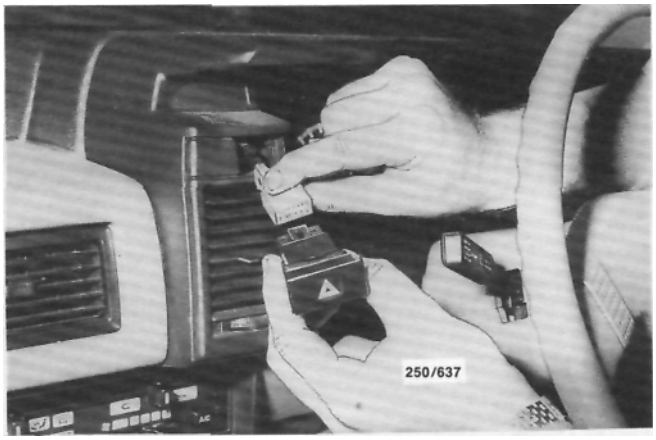
To Remove and Install

Disconnect the negative battery terminal.

Using two small flat bladed screwdrivers, carefully lever the edges of the switch forward to release it from the instrument cluster surround.

Withdraw the switch from the surround and disconnect the switch wiring at the connectors.

Installation is a reversal of the removal procedure.



View of the hazard warning switch removed from the instrument cluster surround.

DOOR LOCKS AND POWER WINDOW SWITCHES

To Remove and Install

Disconnect the negative battery terminal.

Loosen the retaining screws securing the armrest to the door.

Using a small flat bladed screwdriver, carefully lever the front edge of the switch panel up and maneuver the switch forward and away from the armrest.

Disconnect the wiring connector and remove the switch from the armrest.

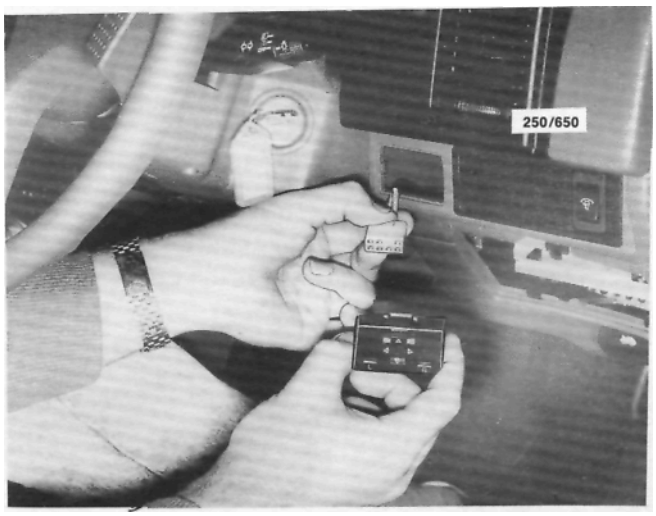
Installation is a reversal of the removal procedure.

POWER MIRRORS AND INSTRUMENT ILLUMINATION SWITCHES

To Remove and Install

Disconnect the negative battery terminal.

Using two small flat bladed screwdrivers,



View of the power mirror switch removed from the vehicle.

carefully lever the edges of the switch forward to release it from the fascia located directly above the fuse box.

(3) Withdraw the switch from the fascia and disconnect the wiring.

Installation is a reversal of the removal procedure.

REAR WINDOW WIPER/WASHER SWITCH

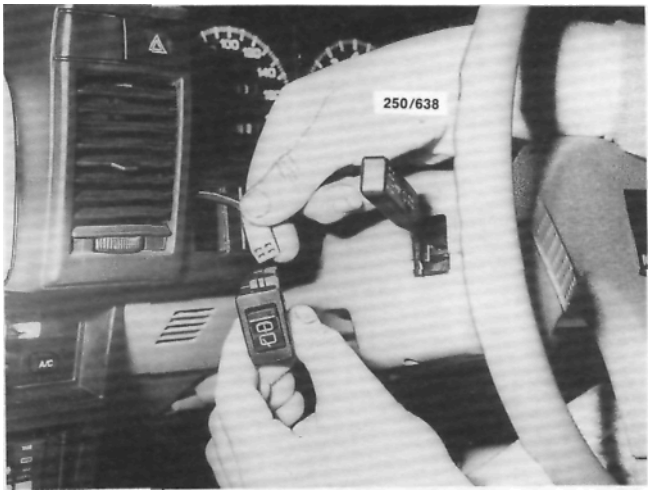
To Remove and Install

Disconnect the negative battery terminal.

Using two small flat bladed screwdrivers, carefully lever the edges of the switch forward to release it from the instrument cluster surround.

Withdraw the switch from the surround and disconnect the wiring.

Installation is a reversal of the removal procedure.



View of the rear window wiper/washer switch removed from the vehicle.

STOP LAMP SWITCH

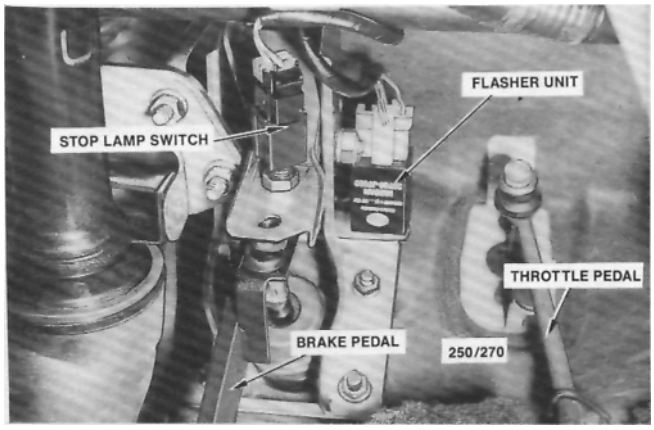
To Remove and Install

Disconnect the switch wiring at the connectors.

Loosen the switch locknut and unscrew the switch from the pedal bracket.

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

The stop lamp switch is also the return stop for the brake pedal. Adjust the pedal free play as described in the Brakes section.



Installed view of the stop lamp switch and the flasher unit.

HANDBRAKE WARNING LAMP SWITCH

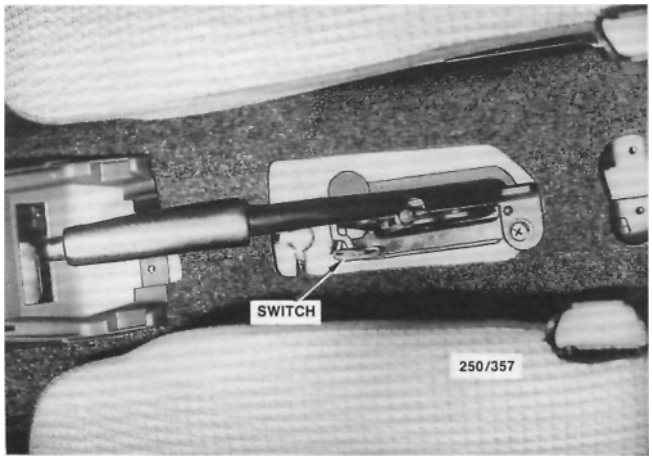
To Remove and Install

Lift the small plastic cover directly under the handbrake and remove the screws.

Remove the carpet at the rear of the centre console and remove the screws.

Carefully remove the console from the handbrake assembly.

Remove the retaining screw and withdraw the switch from the handbrake lever.



Installed view of the handbrake warning lamp switch.

To Test

Remove the handbrake console as described in the previous text.

Disconnect the switch wiring at the connector.

Connect an ohmmeter between the switch terminal and a suitable earth.

Pull the handbrake lever up.

If no reading is displayed on the ohmmeter, the switch is faulty and should be renewed using the procedure previously described.

Installation is a reversal of the removal procedure.

COURTESY LAMP DOOR SWITCH

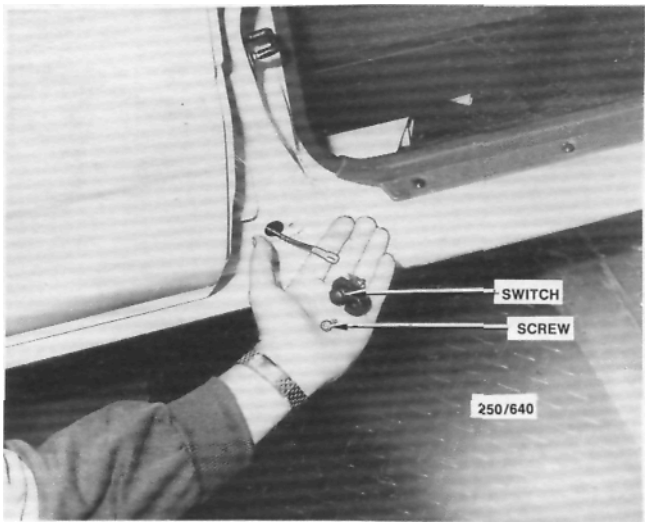
To Remove and Install

With the door fully open, remove the retaining screw from within the rubber cover of the switch.

Withdraw the switch from the centre door pillar.

Disconnect the wiring from the switch and remove the switch from the vehicle.

Installation is a reversal of the removal procedure.



View of the courtesy lamp door switch removed from the vehicle.

REVERSE LAMP SWITCH

On automatic transaxle models, a combined neutral safety switch and reverse lamp switch is installed on the side of the transaxle. The test and renewal procedures are described in the Automatic Transaxle section.

To Remove and Install

Disconnect the wiring connector terminals at the reverse lamp switch.

Remove the reverse lamp switch from the transaxle housing.

Installation is a reversal of the removal procedure.

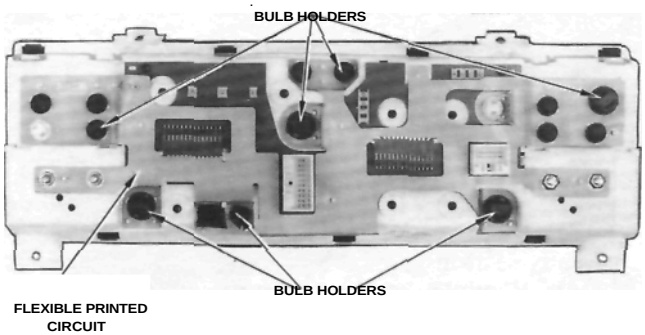
12. INSTRUMENT CLUSTER

TO REMOVE AND INSTAL

Disconnect the negative battery terminal.

Remove the retaining screws from the instrument cluster surround.

Carefully withdraw the instrument cluster surround from the instrument panel sufficiently to enable the wiring to be disconnected. Remove the surround from the vehicle.



Rear view of the instrument cluster removed from the vehicle.

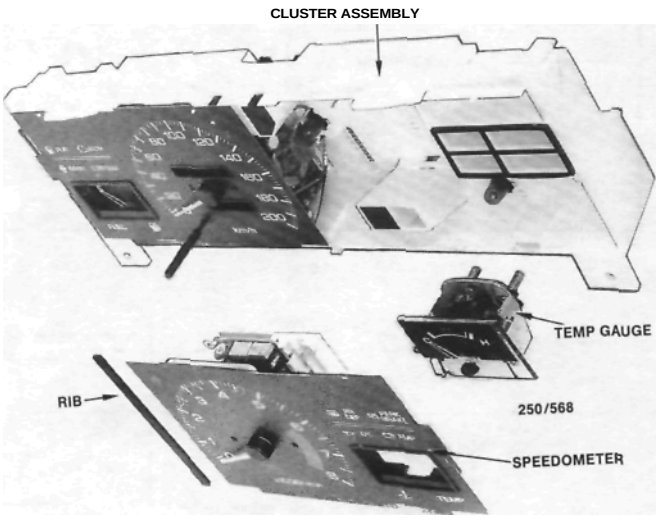
(4) Remove the instrument cluster assembly retaining screws and gently ease the assembly from the instrument panel sufficiently to enable the wiring to be disconnected.

If necessary, remove the instruments as follows:

Carefully depress the retaining clips on the front lens and remove the front lens.

On models equipped with a tachometer, slide the plastic rib from between the speedometer and the tachometer.

Remove the screws retaining the speedometer and the tachometer or fuel/temperature gauges from the rear of the instrument cluster.



Dismantled view of the instrument cluster.

(d) Withdraw both instruments from the front of the instrument cluster being careful as these instruments are held by protruding pin terminals.

NOTE: Do not touch the faces of the instrument dials as they mark easily.

(e) On models equipped with a tachometer, remove the retaining nuts and remove the temperature and/or the fuel gauge from the cluster assembly.

Installation is a reversal of the removal procedure ensuring that all electrical connectors are correctly installed.

13. BLOWER FAN

The removal and installation procedure for the blower fan is described in the Cooling and Heating Systems section.

14. RADIO/CASSETTE

TO REMOVE AND INSTAL

Disconnect the negative battery terminal.

Remove the release hole covers on each side of the radio/cassette.

Removing the release hole covers from the radio/cassette.

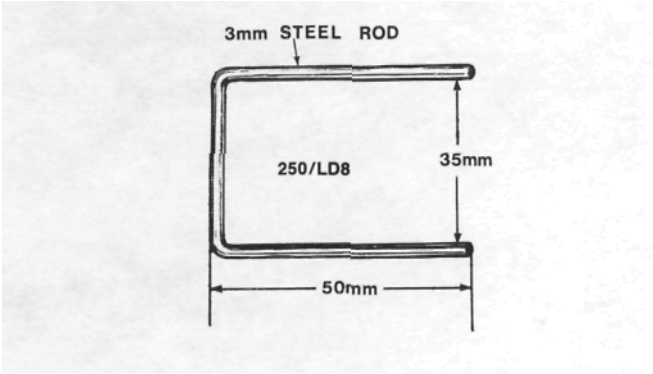
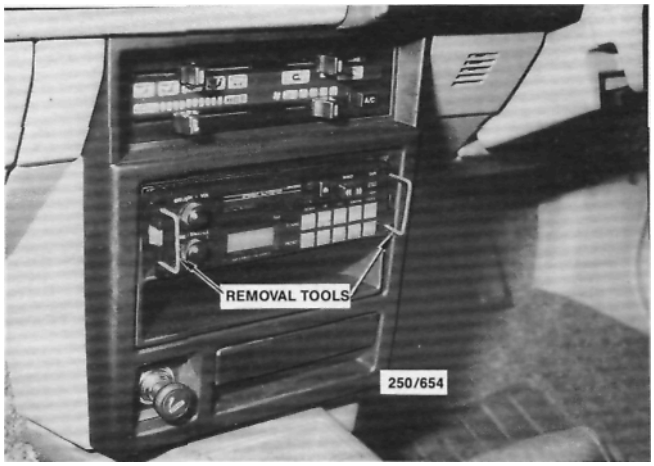


Illustration of the radio/cassette removal tool showing the required dimensions.



Using the radio/cassette removal tools during removal of the unit.

Construct the special tools as illustrated, insert both tools into the release holes on the radio/cassette and carefully withdraw the radio/cassette from the mounting bracket.

Disconnect the wiring harness terminal plug and remove the radio/cassette.

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

Remove the special tools from the radio/cassette, connect the wiring harness terminal and push the radio/cassette into the mounting bracket.

Install the release hole covers on each side of
the radio/cassette.

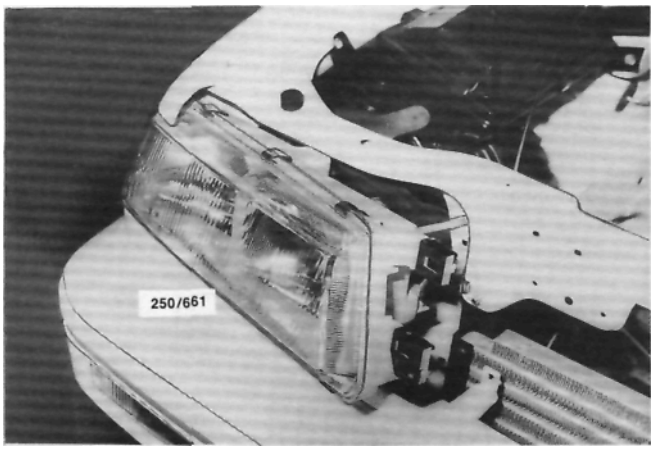
15. LAMP UNITS

HEADLAMPS

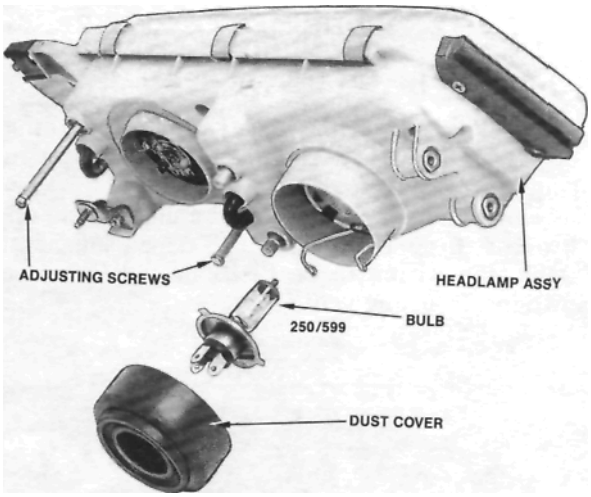
To Remove and Install

Disconnect the negative battery terminal.

If removing the drivers side headlamp on 1.8 liter engines, remove the bolt securing the air cleaner intake duct and remove the air cleaner intake duct.



Partially removed view of the headlamp assembly.



Dismantled view of the headlamp assembly.

Remove the radiator grille as described in the Body section.

Remove the bolt and nut from the front and rear of the inner headlamp.

Remove the side indicator lamp assembly and remove the bolts from the side of the headlamp.

Maneuver the headlamp inner side out first and remove the headlamp from the vehicle.

Installation is a reversal of the removal procedure.

To Adjust Headlamp Aim

Ensure that the tires are inflated to the correct pressure and that the vehicle is positioned on level ground.

The vehicle should be unladen, with a full fuel tank and the driver sitting in the vehicle.

When using a headlamp aiming machine, refer to the manufacturers instructions for equipment being used.

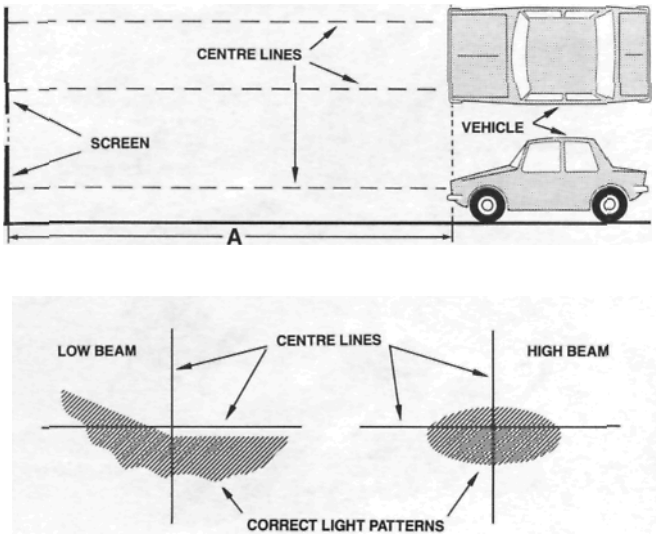


Diagram showing the correct light patterns using an aiming board. Dimension A = 5 meters.

When using an aiming board, position the vehicle five meters from and square to the aiming board. Gently rock the vehicle and allow the suspension to stabilize.

Mark a reference line on the board to correspond with the horizontal centre line of the headlamp low beam bulbs.

Mark two reference lines on the board to correspond with the vertical centre lines of the headlamp low beam bulbs.

Switch on the headlamps and select low beam.

Adjust the headlamps by turning the adjusting screws located at the rear of the headlamp assemblies.

Adjust the headlamps to comply with local regulations. As a guide, adjust the lamps so that the low beam pattern strikes the aiming board with the horizontal cut off point 50 mm below the headlamp bulb horizontal centre line and the point where the beam raises from the horizontal is on the headlamp low beam bulb vertical centre line.

To Renew Low Beam Bulb (Pulsar)

Remove the dust cover from the rear of the headlamp assembly.

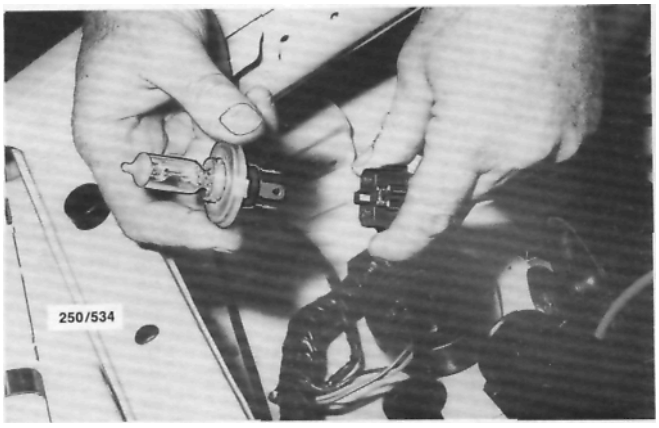
Disconnect the wiring from the end of the bulb.

Remove the cover from the rear of the headlamp housing.

Release the retaining clip from the bulb holder and withdraw the bulb from the headlamp.

Installation is a reversal of the removal procedure ensuring that the new bulb is correctly located in the bulb holder.

NOTE: Care must be taken not to handle the glass portion of the bulb as this will shorten the life of the bulb. Accidental fingerprints can be removed by applying methylated spirits to the bulb and drying with clean tissue or cloth.



Renewing the low beam bulb.

To Renew High Beam Bulb (Pulsar) or High/Low Beam Bulb (Astra)

Disconnect the wiring connector and remove the dust cover from the rear of the headlamp.

Release the retaining clip and remove the bulb from the bulb holder.

Install the new bulb to the headlamp ensuring that the metal plate is correctly located in the bulb holder.

NOTE: Care must be taken not to handle the glass portion of the bulb as this will shorten the life of the bulb.

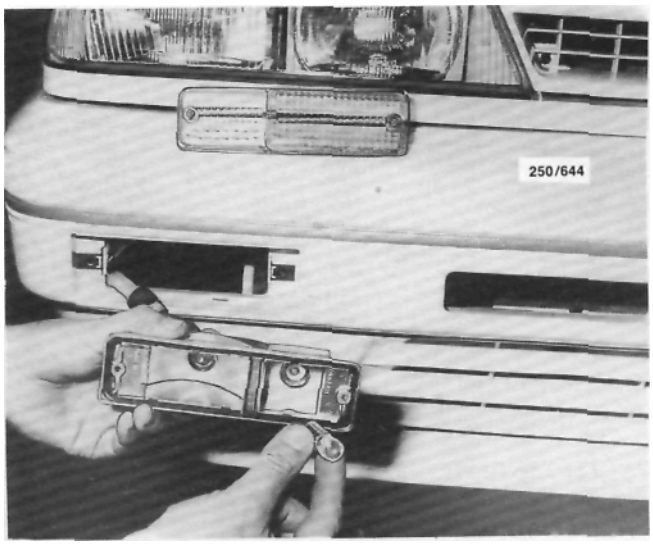
Accidental fingerprints can be removed by applying methylated spirits to the bulb and drying with clean tissue or cloth.

(4) Secure the retaining clip, install the cover to the headlamp and connect the wiring to the end of the bulb.

FRONT COMBINATION LAMP (PULSAR) OR TURN SIGNAL LAMP (ASTRA)

To Renew Bulb

(1) Remove the retaining screws from the front combination lamp and remove the lens.



Renewing the front combination lamp bulb. Pulsar models.

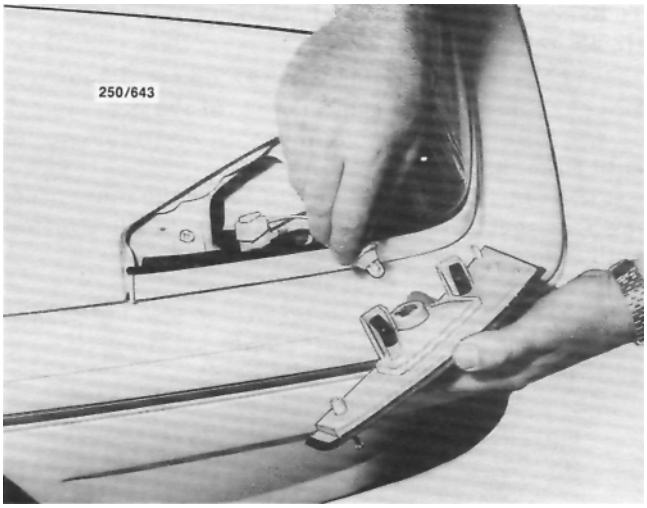
(2) Push the bulb inwards, turn it anti-clockwise and remove it from the holder.

Installation is a reversal of the removal procedure.

SIDE INDICATOR LAMP (PULSAR) OR FRONT COMBINATION LAMP (ASTRA)

To Renew Bulb

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



Renewing the side indicator lamp bulb.

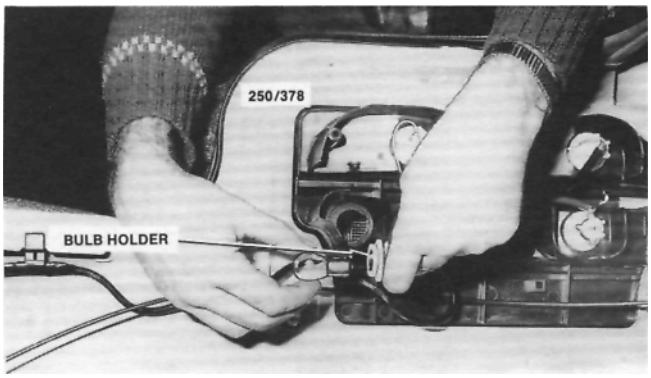
(2) Push the bulb inwards, turn it anti-clockwise and remove it from the holder.

Installation is a reversal of the removal procedure.

REAR COMBINATION LAMP

To Renew Bulb

(1) Working inside the luggage compartment, remove the combination lamp trim cover.



Renewing the rear combination lamp bulb.

Remove the desired bulb holder from the combination lamp by twisting it anti-clockwise and withdrawing it from the lamp body.

Push the bulb inwards, turn it anti-clockwise and remove it from the holder.

Installation is a reversal of the removal procedure.

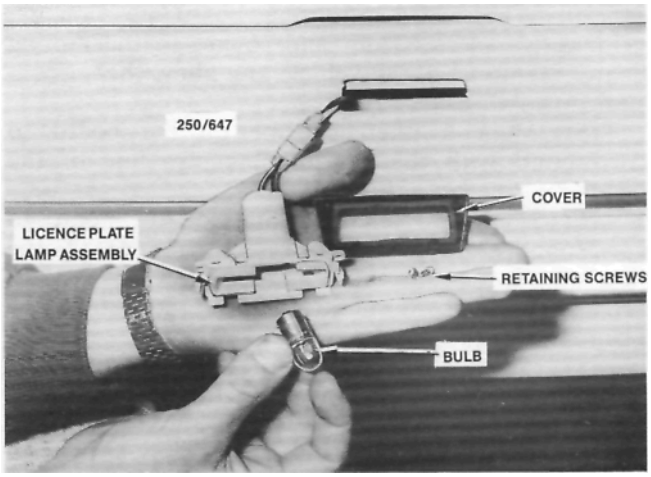
NUMBER PLATE LAMP

To Renew Bulb

(1) On Pulsar models, proceed as follows:

Carefully prise the number plate lamp unit from the rear bumper bar.

Remove the retaining screws and remove the lens cover and lens.



Renewing the number plate lamp bulb.

(2) On Astra models, remove the retaining screws and remove the lamp unit from the bumper bar. Remove the bulb holder from the lamp unit.

(3) Remove the bulb from the lamp.

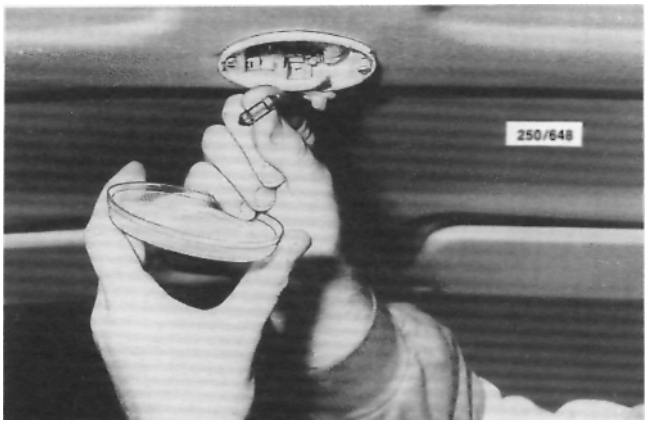
Installation is a reversal for the removal procedure.

COURTESY LAMP

To Renew Bulb

Turn the lamp lens anti-clockwise and lower it from the lamp.

Grip and remove the bulb from between the bulb contacts.



Renewing the courtesy lamp bulb.

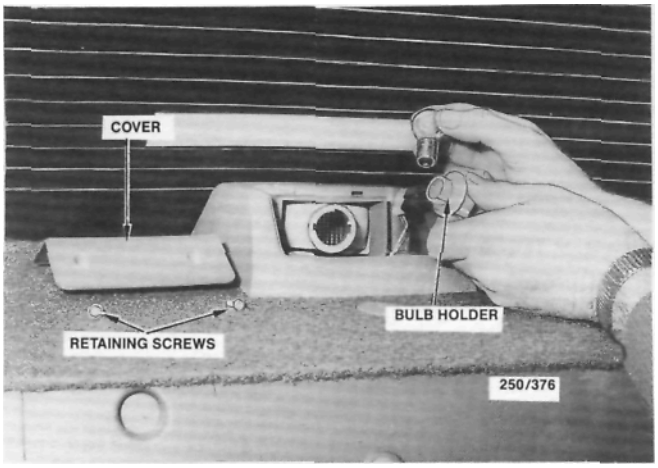
Installation is a reversal of the removal procedure with attention to the following points:

Ensure that when the bulb is installed, the contacts hold the bulb with enough tension to provide a good electrical contact.

HIGH MOUNTED STOP LAMP

To Renew Bulb

(1) Remove the retaining screws from the cover on the high mounted stop lamp and remove the cover.



Renewing the high mounted stop lamp bulb.

Remove the bulb holder from the lamp by twisting it anti-clockwise and removing it from the lamp body.

Push the bulb inwards, turn it anti-clockwise and remove it from the holder.

Installation is a reversal of the removal procedure.

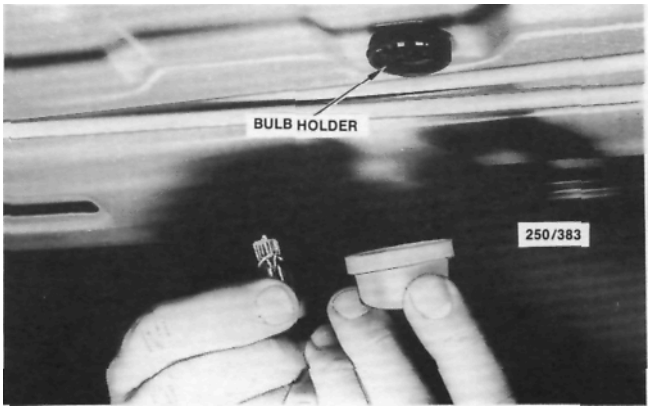
LUGGAGE COMPARTMENT LAMP

To Renew Bulb

Working inside the luggage compartment, carefully prise the lens from the luggage compartment lamp.

Remove the lamp bulb by gripping it firmly and pulling it from the lamp socket.

Installation is a reversal of the removal procedure.



Renewing the luggage compartment lamp bulb.

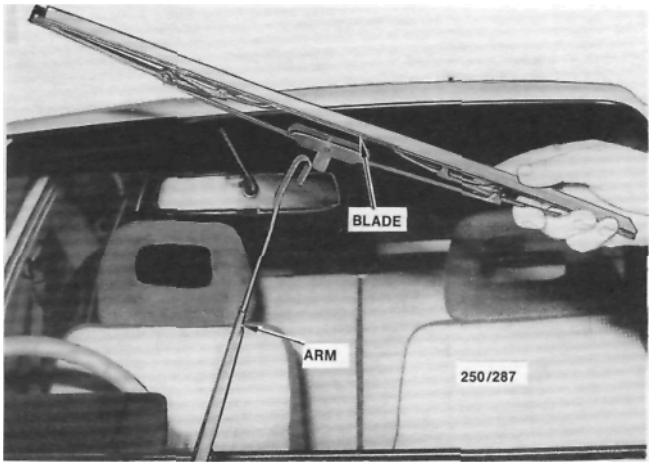
16. WINDSCREEN WIPER

WIPER BLADE

To Remove and Install

Pull the wiper arm away from the windscreen until it locks in the vertical position.

Push the pin retaining the wiper blade to the arm and slide the wiper blade along the arm towards the pivot to allow the blade to be maneuvered from the arm.



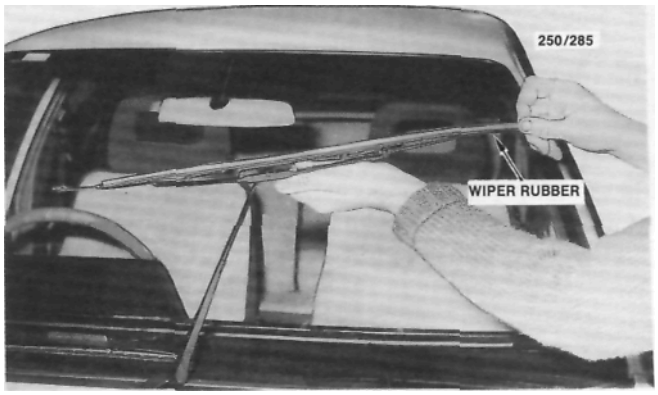
Removing the wiper blade.

Installation is a reversal of the removal procedure ensuring that the blade snaps into place as it is installed to the wiper arm.

WIPER RUBBER

To Renew

(1) Remove the wiper blade from the vehicle as previously described.



Renewing the wiper rubber.

Squeeze the sides of the clip retaining the wiper rubber and spine assembly to the wiper blade and slide the rubber and spine assembly from the blade.

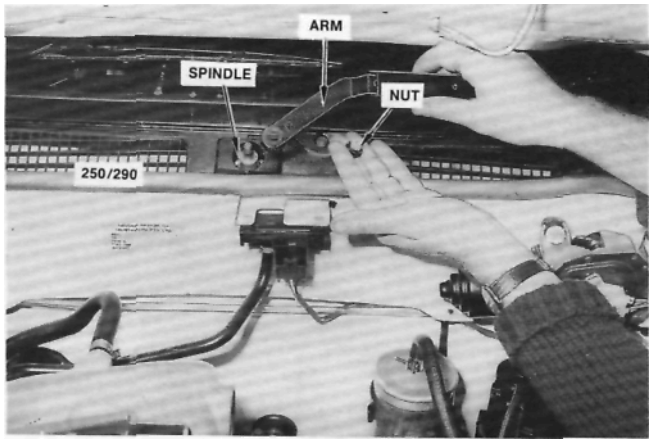
Slide the new rubber and spine assembly into the wiper blade ensuring that the spine is engaged with all the lugs in the blade.

Install the wiper blade to the wiper arm.

WIPER ARM

To Remove and Install

(1) Remove the nut retaining the wiper arm to the drive spindle.



Removing the wiper arm.

(2) Using a suitable lever, carefully prise the wiper arm from the drive spindle, taking care not to damage the paintwork.

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

Ensure that the wiper arms are installed so that the wiper blades sweep within 10-20 mm of the windscreen lower moulding.

WIPER LINKAGE

To Remove and Install

Remove both windscreen wiper arms as previously described.

Carefully prise the wiper arm drive linkage from the ball stud on the wiper motor driving crank.

Remove the retaining nuts and metal spacers from the wiper arm drive spindle housings.

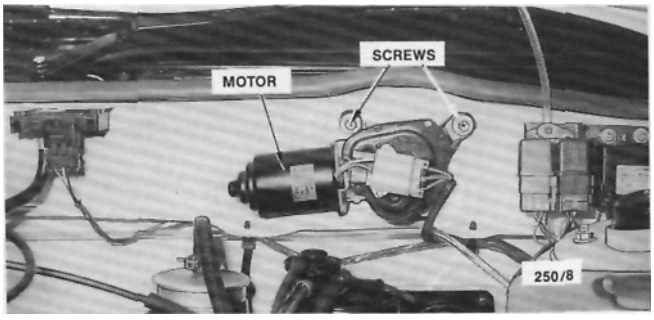
Maneuver both drive spindle housings into the plenum chamber taking care not to damage the paintwork. Ensure that the water seals on the spindle housings arc not lost during the removal procedure. Remove the assembly from the vehicle.

Installation is a reversal of the removal procedure.

WINDSCREEN WIPER MOTOR

To Remove and Install

(1) Disconnect the negative battery terminal.



Installed view of the windscreen wiper motor.

Carefully prise the wiper arm drive linkage from the ball stud on the wiper motor driving crank.

Disconnect the wiring from the wiper motor at the connector socket.

Remove the wiper motor retaining screws and remove the wiper motor from the vehicle.

Installation is a reversal of the removal procedure.

REAR WIPER MOTOR

To Remove and Install

Remove the wiper arm and blade assembly from the pivot as previously described.

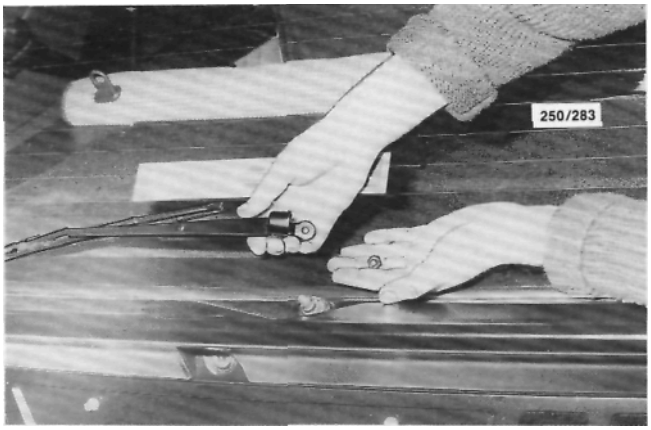
Remove the nut retaining the pivot to the rear window.

Using a flat bladed screwdriver, prise out the clips retaining the trim pane! to the interior of the tailgate and carefully withdraw the trim panel from the vehicle.

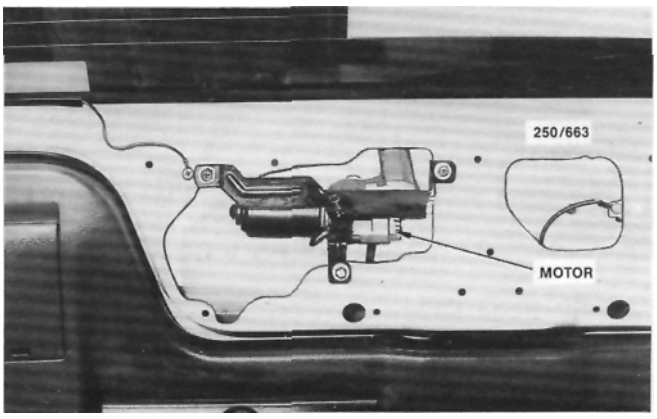
Depress the lock tab and disconnect the wiring connector.

Remove the bolts retaining the wiper motor mounting bracket to the tailgate and withdraw the wiper motor and mounting bracket from the vehicle.

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



Removing the rear wiper arm.



Installed view of the rear wiper motor.

Ensure that the wiper motor is in the Park position before installing the wiper arm. If in doubt, turn the wiper switch to the Off position and turn the ignition switch to the On position until the wiper motor stops.

Install the wiper arm to the pivot so that the wiper blade is horizontal to the lower edge of the edge of the rear window when in the Park position.

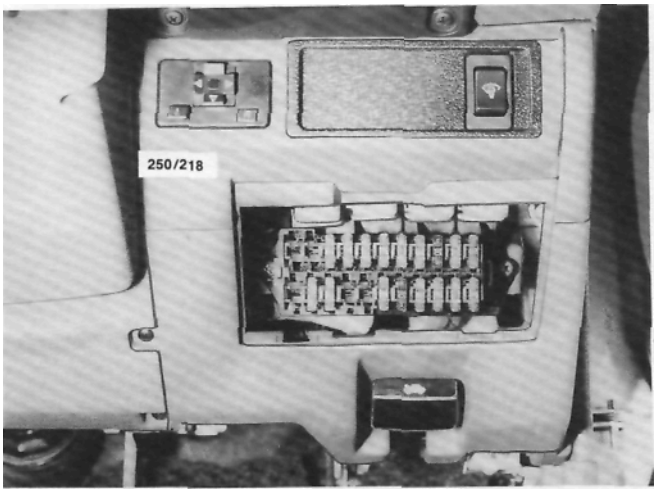
17. FUSES, FUSIBLE LINKS AND RELAYS

TO CHECK AND RENEW FUSE

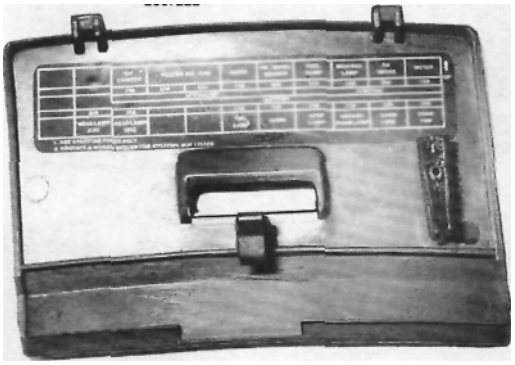
NOTE: If a fuse is found to be faulty or burnt out, use a replacement fuse of the specified amperage only. The specified amperage is marked on the fuse.

The use of a higher amperage fuse than that specified could cause damage to the vehicle wiring harness.

The fuses are mounted in a fuse box located in the lower right hand corner of the dashboard.



View of the fuse box.



View of the fuse box cover showing the fuse identification label.

Remove the cover from the lower right hand corner of the dashboard and using the information marked on the fuse box, locate the fuse protecting the circuit at fault.

Pull the fuse out of the fuse box and inspect it for serviceability.

Should the fuse appear to be in a serviceable condition, test its continuity with an ohmmeter or test lamp.

Should the fuse be faulty or burnt out, install a new fuse of the same amperage.

If the circuit is still inoperative or the fuse burns out again, test the circuit as previously described in this section or refer the problem to an automotive electrician.

TO CHECK AND RENEW FUSIBLE LINK

NOTE: If a fusible link is found to be faulty or burnt out, use a genuine 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.

A new fusible link should never be installed until the fault which caused the original link to fail has been repaired.

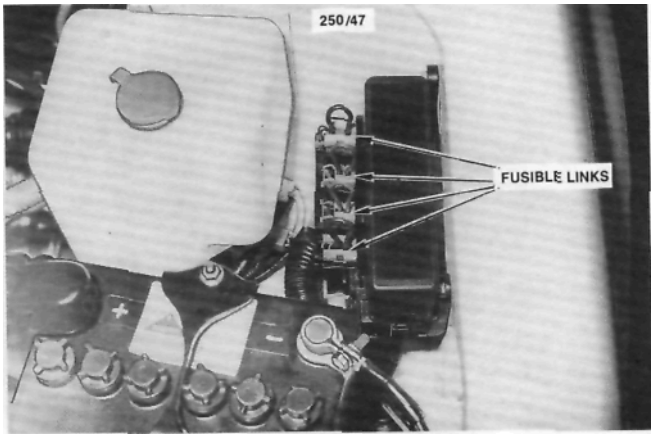
The fusible links installed to protect the vehicles wiring system are located adjacent to the washer bottle on the right hand inner mudguard.

Disconnect the negative battery terminal

Check the fusible link visually for serviceability.

Should the fusible link appear to be in a serviceable condition, test its continuity using an ohmmeter or a test lamp.

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



Installed view of the fusible links.

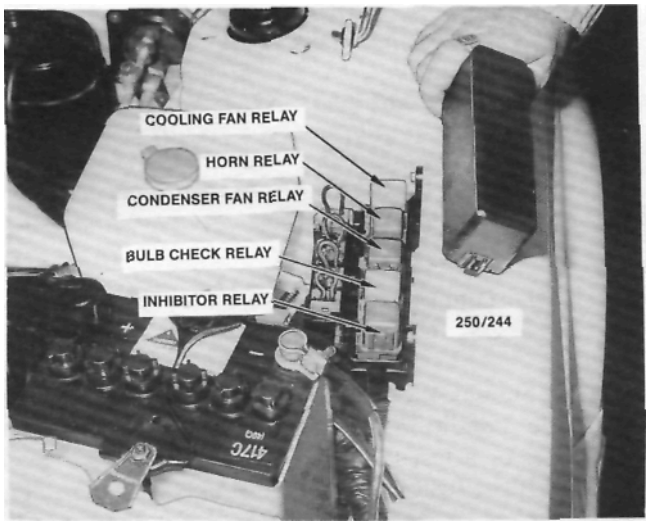
NOTE: While checking the operation of the fusible link, loosely connect the battery-terminal only, to safeguard against damage to the wiring harness.

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

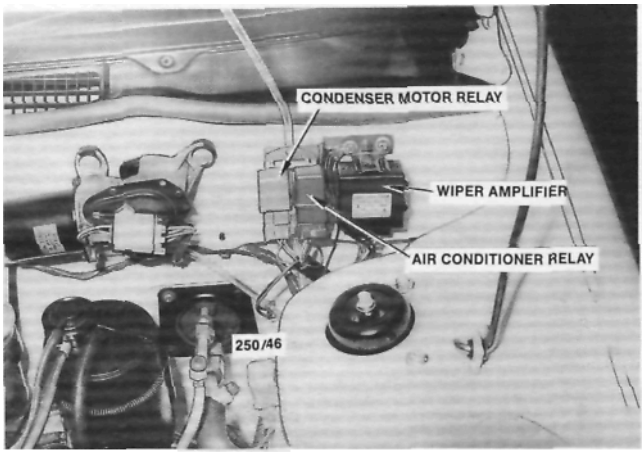
RELAY LOCATIONS

The various relays employed in the vehicle electrical system are located behind the fusible links adjacent to the washer bottle in the engine compartment, on the engine compartment bulkhead, under the windscreen wiper motor and in the fuse box at the lower right hand side of the dashboard.

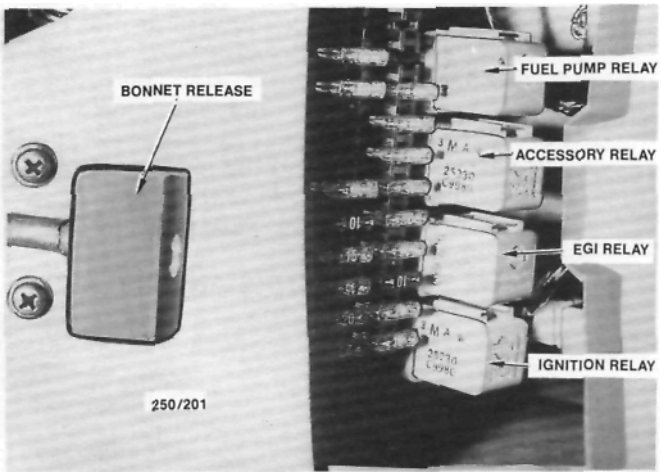
The engine compartment relays power the radiator fan, horn, condenser fan, bulb check, automatic transaxle neutral safety switch, air conditioner and condenser motor.



Installed view of the engine compartment relays.



Installed view of the engine compartment relays.

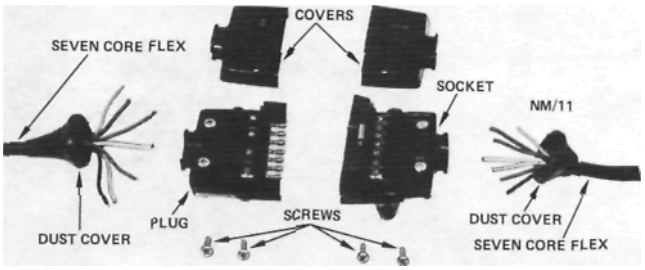


Installed view of the fuse box relays.

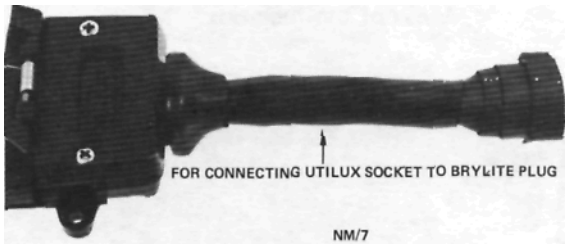
The fuse box relays power the fuel pump, ignition, some accessories and the electronic control module.

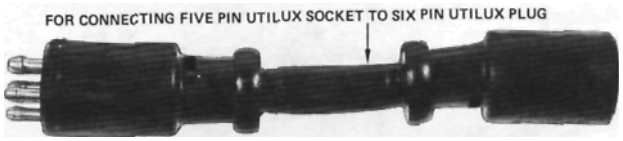
18. TRAILER WIRING

There are several brands of trailer wiring connectors available with a variety of pin configurations. The most common is the seven pin type which provides for two auxiliary circuits, usually used for reverse lamps and electric trailer brakes.



Brylite seven pin trailer plug and socket.





Useful connections which can be used if the trailer to be towed is fitted with different type plug to the towing vehicle socket

When installing a trailer socket, it may be necessary to replace the original vehicle flasher unit with a heavy duty unit to maintain the flash rate in accordance with local regulations. Local regulations may also require the installation of a dashboard mounted repeater lamp.

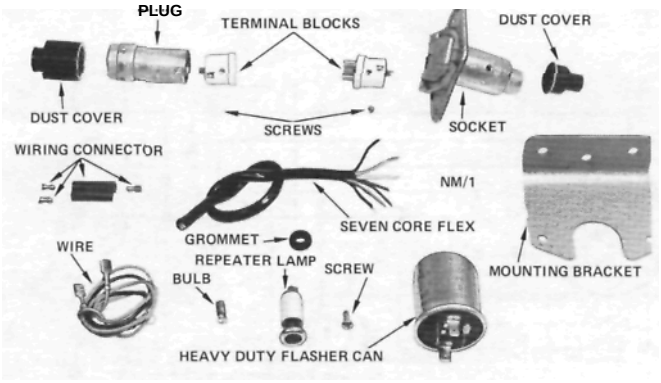
Should the trailer socket and plug not be matched, adaptors can be made or obtained to facilitate connection.

TO INSTAL TRAILER SOCKET.

The minimum materials required are a trailer socket, mounting bracket, seven core flex, insulated wiring connectors and a rubber grommet.

(1) Disconnect the negative battery terminal.

(2)Locate the wiring harness for the lamps at the rear of the vehicle.



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

(3) Identify the wires for the right turn signal lamp, left turn signal lamp, tail lamp, stop lamp, reverse lamp and earth. Use the vehicle wiring diagram in this section to determine the wire color for each lamp circuit.

(4)Connect the seven core flex to the various lamp wires using insulated connectors.

For seven pin sockets and plugs, use the following standard trailer wiring code:

Terminal No.	Circuit	Color
1	Left turn signal lamp	Yellow
2	Reversing lamp	Black
3	Earth	White
4	Right turn signal lamp	Green
5	Electric brakes	Blue
6	Stop lamp	Red
7	Tail lamp	Brown

For six pin sockets and plugs, use the following standard trailer wiring code:

Terminal No.	Circuit	Color
1	Tail Lamp	Brown
2	Left Turn Signal Lamp	Yellow
3	Right Turn Signal Lamp	Green
4	Stop Lamp	Red
5	Auxilary	Blue
6	Earth	White

For five pin sockets and plugs, use the following standard trailer wiring code:

Terminal No.	Circuit	Color
2	Left turn signal lamp	Yellow
3	Earth	White
5	Right turn signal lamp	Green
6	Stop lamp	Red
7	Tail lamp	Brown

(5) Drill a suitably sized hole through the vehicle floor and install a rubber grommet to the hole.

NOTE: Before drilling the hole, check whether there is an existing hole which maybe used. Ensure that a rubber grommet is installed to prevent chafing of the wires.

Pass the seven core flex through the rubber grommet.

Cut the seven core flex to the required length and slide the dust cover onto the flex.

Remove approximately 15 mm of insulation from each wire in the flex.

Connect the wires of the seven core flex to the terminals of the socket, using the standard wiring code and following the socket manufacturers connection procedure.

Assemble the socket and install the dust cover to the rear of the socket.

Install the mounting bracket as close as possible to the tow bar ball and high enough to maintain vehicle ground clearance.

Install the socket to the mounting bracket.

Connect a trailer plug to the socket and test for correct lamp operation.

TO INSTAL TRAILER PLUG

The minimum materials required are a trailer plug, seven core flex and insulated wiring connectors.

The installation procedure for the trailer plug is similar to that for the socket with attention to the following points:

Connect the trailer wiring to the plug according to the standard wiring color code and the plug manufacturers instructions. Use a suitable length of seven core flex and insulated connectors should the trailer wiring not be long enough.

If the trailer wiring does not conform to the standard color code, identify each circuit as follows:

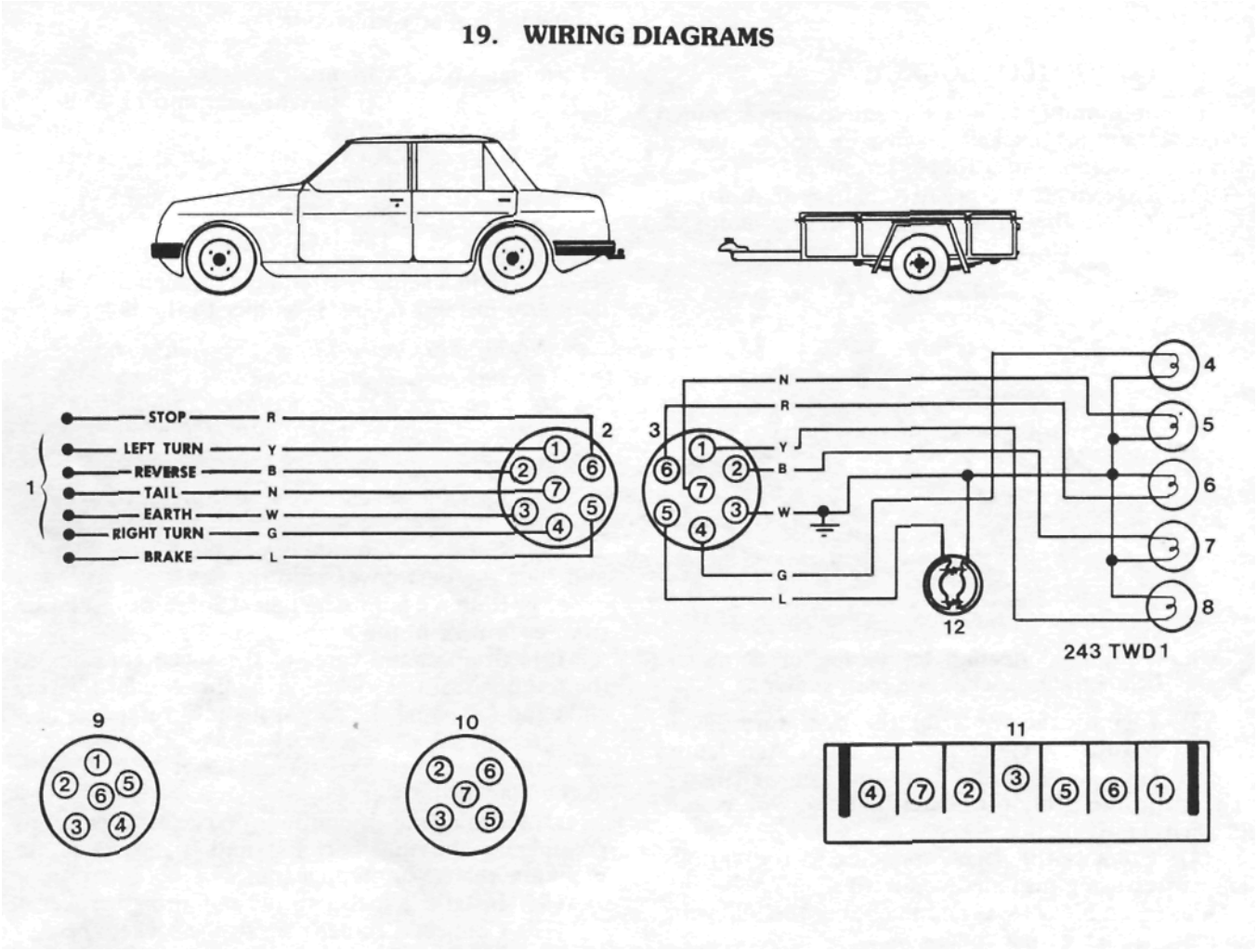
(a) Locate the trailer earth wire.

Connect a jumper lead from the negative terminal of a 12 volt battery to the earth wire.

Connect a jumper lead from the positive terminal of a 12 volt battery and connect each of the trailer lamp wires in turn to the positive battery terminal jumper lead, noting the color of the wire and the lamp circuit operated.

(3) After installation, connect the trailer plug to the socket on the vehicle and check for correct lamp operation.

19. WIRING DIAGRAMS

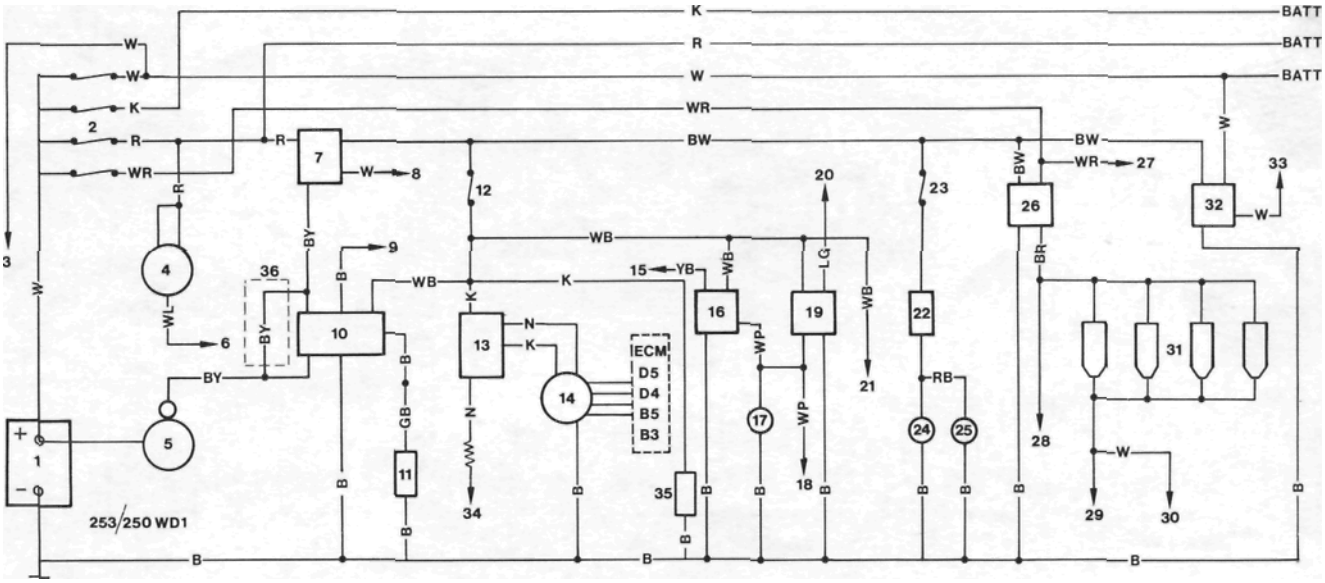


Vehicle and trailer wired to conform to Australian Standard AS2513. Sockets and plug shown are as viewed from the terminal side of the component. Refer to the text for the correct terminal applications when using a 5 or 6 pin socket and plug.

COLOUR CODE

B - Black
G - Green
L - Blue
N - Brown
R - Red
W - Whlte
Y -Yellow

1 To vehicle wiring harness
2. 7 pin socket — Bosch. Hella. Utilux
3 7 pin plug - Bosch, Hella, Utilux
4. Trailer R H turn signal lamp
5. Trailer tail lamp
6. Trailer stop lamp
7. Trailer reverse lamp
8. Trailer L H turn signal lamp
9. 6 pin socket - Utilux
10. 5 pin socket - Bosch Hella
11. 7 pin socket - Brylite
12. Trailer electric brakes



Wiring diagram (WDI) for the starting, charging and engine management systems.

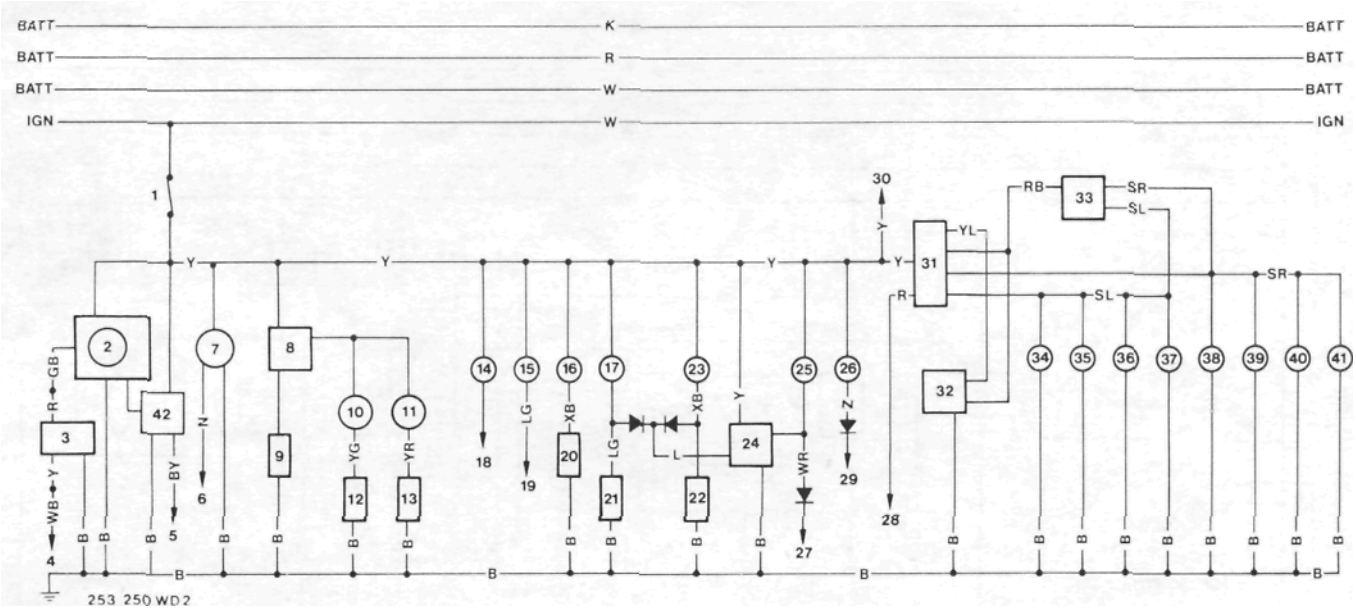
COLOUR CODE

The first letter of the code represents the main wire color, the other letters represent the trace colors.

B - BLACK
L - BLUE
G - GREEN
R - RED
Y - YELLOW
W - WHITE
N - BROWN
O - ORANGE
K - PINK
S - GREY
V - VIOLET
P - PURPLE
X - LIGHT GREEN
Z - LIGHT BLUE
M - DARK GREEN
T - DARK BLUE
A - LIGHT BROWN
E - SLATE
D - TAN

KEY

1. Battery
2. Fusible links
3. To BATT WD4
4. Alternator
5. Starter motor
6. To No 27 WD2
7. Ignition switch
8. To No.10 WD4
9. To ECU BIO
10. Inhibitor relav
11. Neutral safety switch
12. Fuse No.8 Ignition
13. Ignition coil
14. Distributor
15. To ECU A1
16. Fuel pump relay
17. Fuel pump
18. ALDL connector - Terminal G
19. Oil pressure switch
20. To No. 19 WD2
21. To No. 4 WD2
22. Reverse lamp switch
23. Fuse No. 9 Ignition
24. L H reverse lamp
25. R H reverse lamp
26. EGI relay
27. ECU C16 and B1
28. ECU A6
29. To ECU D16
30. To ECU D15
31. Injectors
32. Ignition relay
33. To No. 1 WD2
34. To tachometer
35. Condensor
36. Bypass circuit (manual transaxle)



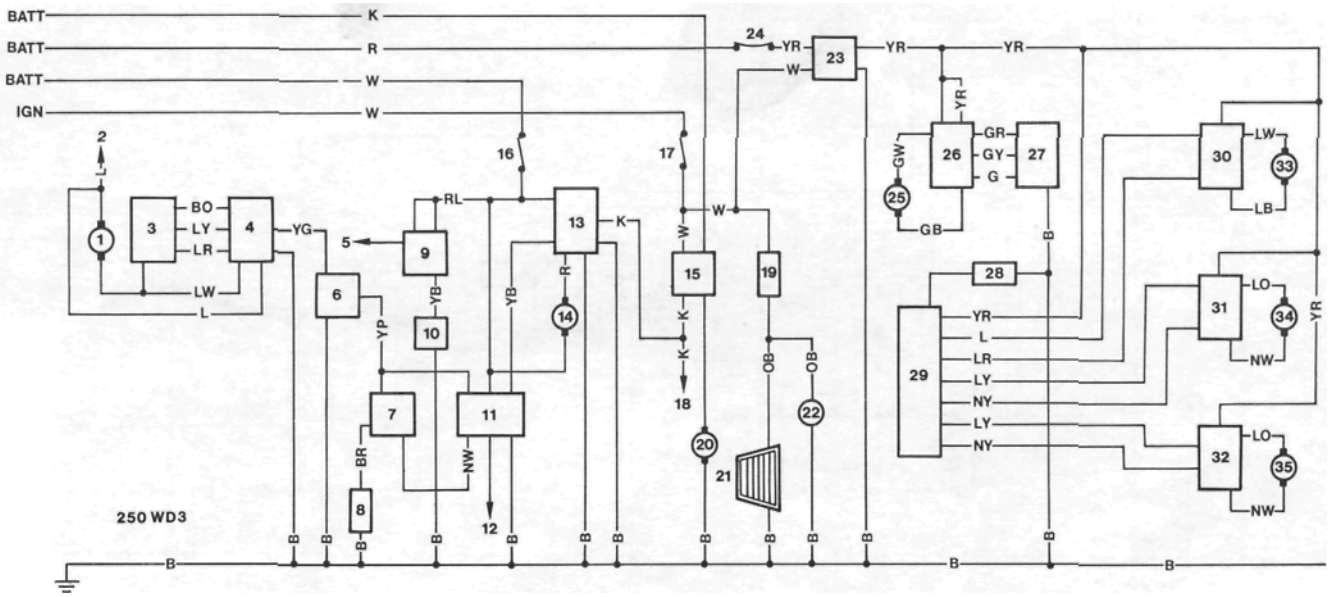
Wiring diagram (WD2) for the instruments, hazard and turning signal systems.

COLOUR CODE

The first letter of the code represents the main wire color, the other letters represent the trace colors.

B - BLACK
L - BLUE
G - GREEN
R - RED
Y - YELLOW
W- WHITE
N - BROWN
O - OHANGE
K - PINK
S - GREY
V -VIOLET
P - PURPLE
X - LIGHT GREEN
Z - LIGHT BLUE
M - DARK GREEN
T - DARK BLUE
A - LIGHT BROWN
E - SLATE
D - TAN

KEY
1. Fuse 11 Ignition
2. Speedometer
3. Vehicle speed sensor
4. To No. 21 WD1
5. To ECU A10
6. To No. 13 WD1
7. Tachometer
8. Voltage regulator
9. Resistor
10. Temperature gauge
11. Fuel gauge
12. Temperature sender
13. Fuel sender
14. To ECM lamp
15. Oil lamp
16. Park brake lamp
17. Low fuel lamp
18. To ECU A5
19. To No. 20 WD1
20. Park brake switch
21. Low fuel switch
22. Brake switch
23. Brake fail lamp
24. Bulb check relay
25. Charge lamp
26. Door ajar lamp
27. To No. 6 VWD1
28. To No. 8 WD4
29. To No. 18 WD6
30. To No. 17 WD6
31. Hazard switch
32. Flasher unit
33. Turn signal switch
34. L H front combination lamp
35. L H side indicator lamp
36. L H rear combination lamp
37. L H instrument warning lamp
38. R H instrument warning lamp
39. R H rear combination lamp
40. R H side indicator lamp
41. R H front combination lamp
42. Divider circuit



Wiring diagram (WD3) for the fan switch, blower, air conditioning, rear demister and power window circuits.

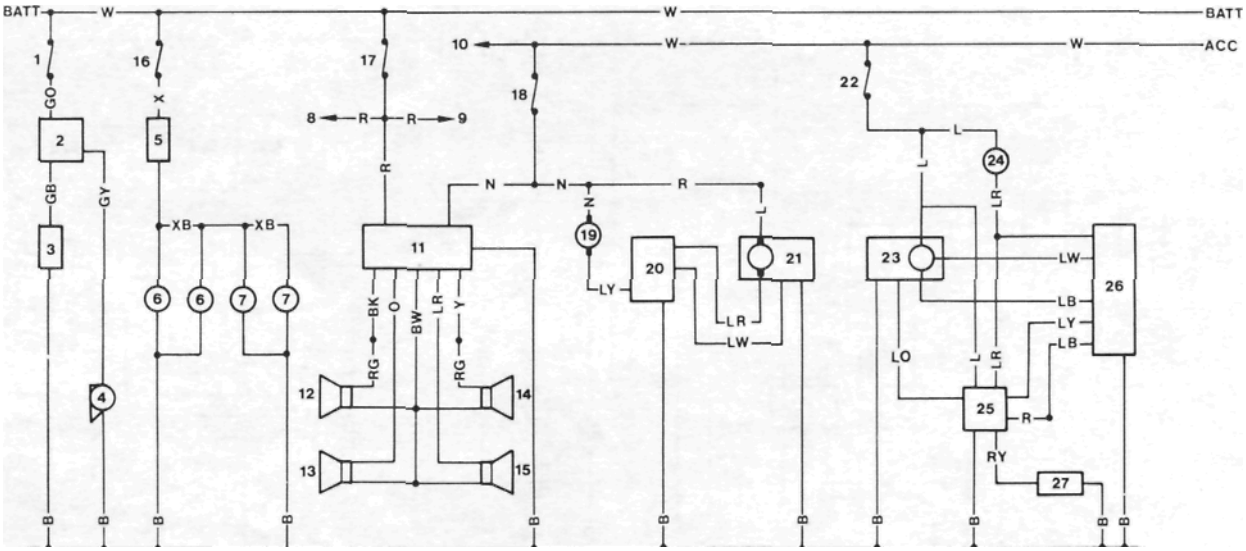
COLOUR CODE

The first letter of tha code represents the main wire color, the other letters represent the trace colours.

B - BLACK
L - BLUE
G - GREEN
R - BED
Y - YELLOW
W - WHITE
N - BROWN
0 - ORANGE
K - PINK
S - GREY
V - VIOLET
P - PURPLE
X - LIGHT GREEN
Z - LIGHT BLUE
M - DARK GREEN
T - DARK BLUE
A - LIGHT BROWN
E - SLATE
D - TAN

KEY

1. Blower fan motor
2. To No. 11 WD5
3. Resistors
4. Blower fan switch
5. To ECU C2
6. Air conditioning switch
7. Thermo amplifier
8. Pressure switch
9. Air conditioning relay No. 2
10. Compressor
11. Air conditioning relay No. 1
12. To ECU B8
13. Air conditioning relav No. 3
14. Condenser fan
15. Cooling Ian relay
16. Fuse 22 BATT
17. Fuse 10 Ignition
18. To ECU C1
19. Rear demister switch
20. Cooling fan motor
21. Rear demister
22. Rear demister warning lamp
23. Power window relay
24. Circuit breaker
25. R H front power window motor
26. Power window amplifier
27. R H front power window switch
28. Door lock switch
29. Main power window switch
30. L H front power window switch
31. R H rear power window switch
32. L H rear power window switch
33. L H front power window motor
34. R H rear power window motor
35. L H rear power window motor



Wiring diagram (WD4) for the horn, audio, front wiper/washer and rear wiper/washer circuits.

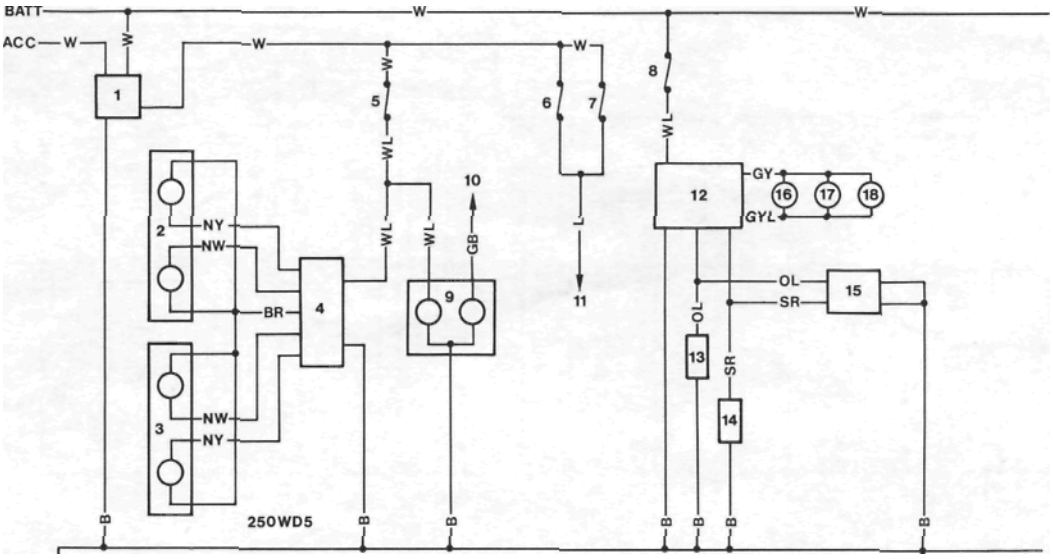
COLOUR CODE

The first letter of the code represents the main wire color. the other letters represent the trace colors.

B - BLACK
L - BLUE
G - GREEN
R - RED
Y - YELLOW
W - WHITE
N - BROWN
O - ORANGE
K - PINK
S - GREY
V - VIOLET
P - PURPLE
X - LIGHT GREEN
Z - LIGHT BLUE
M - DARK GREEN
T - DARK BLUE
A - LIGHT BROWN
E - SLATE
D - TAN

KEY

1. Fuse No. 18 Batt
2. Horn relay
3. Horn switch
4. Horn
5. Stop lamp switch
6. L H stop lamp
7. R H stop lamp
8. To No. 28 WD2
9. To No. 14 WD6
10. To No. 8 WD1
11. Radio cassette and clock
12. L H front speaker
13. L H rear speaker
14. R H front speaker
15. R H rear speaker
16. Fuse No. 19 Batt
17. Fuse No. 20 Batt
18. Fuse No. 6 ACC
19. Rear washer motor
20. Rear wiper/washer motor
21. Rear wiper motor
22. Fuse No. 7 ACC
23. Front wiper motor
24. Front washer motor
25. Intermittent wiper relay
26. Front wiper/washer switch
27. Variable intermittent switch



Wiring diagram (WD5) for the mirrors, cigarette lighter and door lock circuits.

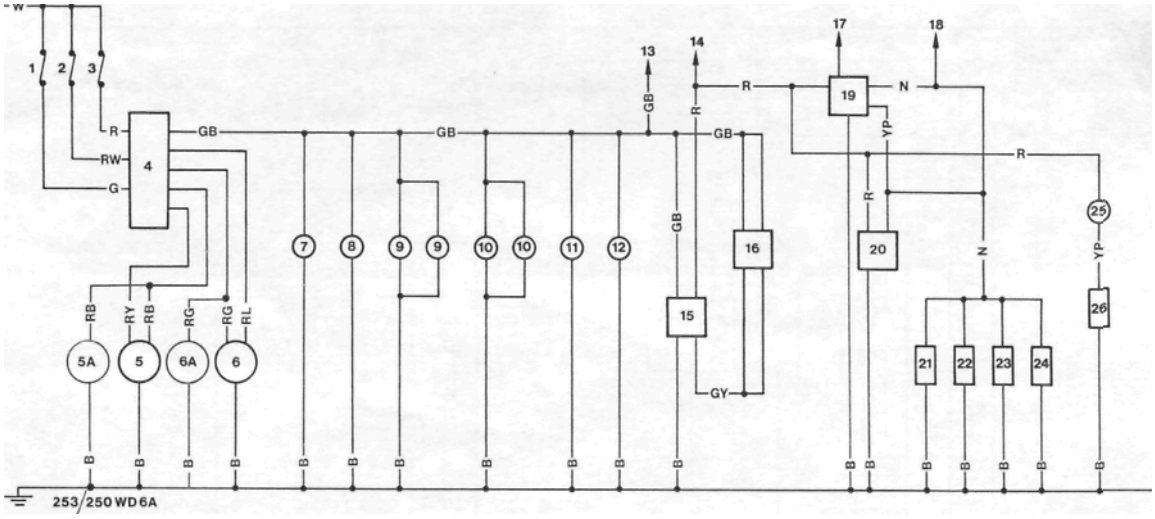
COLOUR CODE

The first letter of the code represents the main wire color, the other letters represent the trace colors.

B - BLACK
L - BLUE
G - GREEN
R - RED
Y - YELLOW
W - WHITE
N - BROWN
O - ORANGE
K - PINK
S - GREY
V - VIOLET
P - PURPLE
X - LIGHT GREEN
Z - LIGHT BLUE
M - DARK GREEN
T - DARK BLUE
A - LIGHT BROWN
E - SLATE
D - TAN

KEY

1. Accessories relay
2. R H power mirror
3. L H power mirror
4. Power mirror switch
5. Fuse No. 3 ACC
6. Fuse No. 4 ACC
7. Fuse No. 5 ACC
8. Fuse No 21 B
9. Cigarette lighter
10. To No. 13 WD6
11. To No. 2 WD3
12. Door lock timer
13. Front door lock switch
14. Key lock switch
15. Door lock switch
16. L H front door lock solenoid
17. R H rear door lock solenoid
18. L H rear door lock solenoid



Wiring diagram (WD6) for the lighting systems.

COLOUR CODE

The first letter of the code represents the main wire color, the other letters represent the trace colors.

B - BLACK
L - BLUE
G - GREEN
R - RED
V - YELLOW
W - WHITE
N - BROWN
O - ORANGE
K - PINK
S - GREY
V - VIOLET
P - PURPLE
X - LIGHT GREEN
Z - LIGHT BLUE
M - DARK GREEN
T - DARK BLUE
A - LIGHT BROWN
E - SLATE
D - TAN

KEY

1. Fuse No. 17 Batt
2. Fuse No. 13 Batt
3. Fuse No. 14 Batt
4. Combination lamp switch
5. RH headlamp
5A. RH high beam
6. LH headlamp
6A. LH high beam
7. L H front clearance lamp
8. R H front clearance lamp
9. LH tail lamp
10. R H tail lamp
11. Licence plate lamp
12. Automatic transaxle indicator lamp
13. To No. 10 WD5
14. To No. 9 WD4
15. Illumination control
16. Combination meter
17. To No. 30 WD2
18. To No. 29 WD2
19. Interior lamp timer
20. Interior lamp switch
21. R H rear door switch
22. L H rear door switch
23. L H front door switch
24. R H front door switch
25. Luggage compartment lamp
26. Luggage compartment switch

BODY

1. WINDSCREEN AND REAR GLASS

The renewal or replacement of the windscreen and the rear glass follows the same basic procedure.

The successful installation and sealing of the windscreen or rear glass will depend to a large extent on the technical knowledge and experience of the operator and it is not recommended that rear glass or windscreen replacement be attempted by anyone lacking in previous experience.

2. FRONT DOORS

INTERIOR HANDLES AND TRIM PANEL

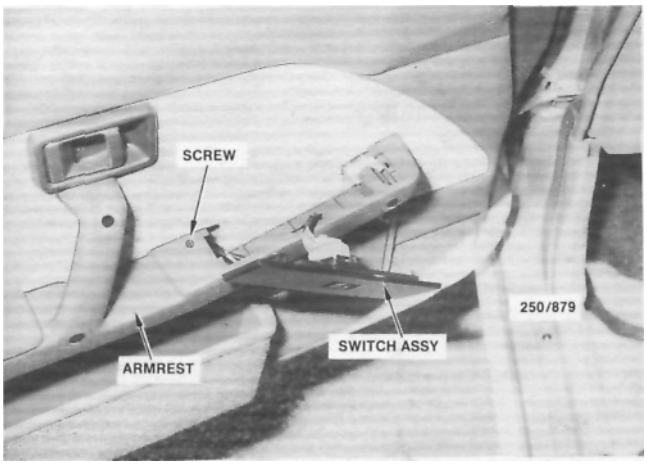
TO Remove and Install

On models with manual windows, carefully prise out the armrest trim plugs and remove the retaining screws. Withdraw the armrest from the vehicle.

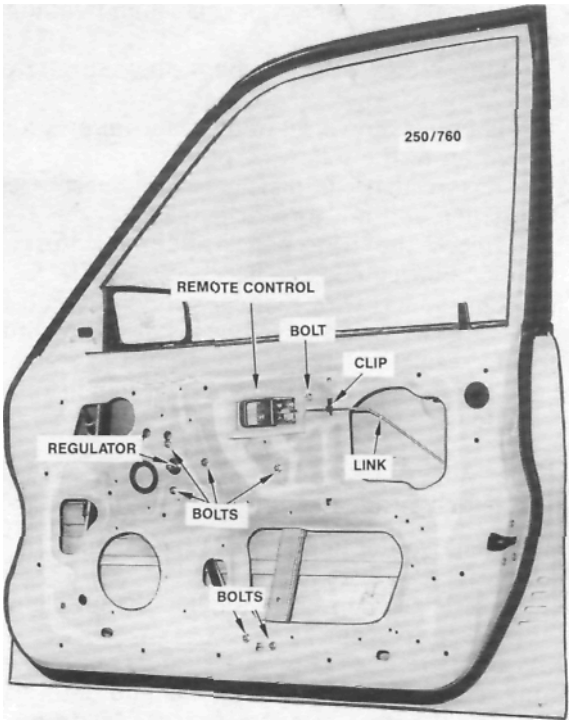
On models with power windows, proceed as follows:

Carefully prise out the armrest trim plugs and remove the retaining screws.

Hold the armrest away from the door trim panel as much as possible and lever the window switches from the armrest, front end first.



View of the armrest on models with power windows showing the hidden screw.



Front door with the trim panel and plastic sealing sheet removed.

Lift the switch assembly and disconnect the wiring connector.

Remove the hidden screw working through the switch aperture. Withdraw the armrest from the vehicle.

Remove the screw retaining the remote control assembly escutcheon to the door and remove the escutcheon.

On models with manual windows, lever back the regulator handle escutcheon and using a suitable wire hook withdraw the handle retaining clip and remove the handle and escutcheon.

Alternatively, a piece of sturdy cloth can be used to remove the regulator handle by sliding the cloth behind the handle and pulling on each end of the cloth in a see-saw action to release the retaining clip.

Remove the screws retaining the speaker to the trim panel, withdraw the speaker slightly and disconnect the wiring connector at the rear. Place the speaker to one side clear of the work area.

On models with a step lamp located in the door trim panel, remove the screws, withdraw the step lamp and disconnect the wiring connector.

Using a broad bladed screwdriver, carefully lever the trim panel outwards and disengage all the retaining clips. When all the clips have been disengaged maneuver the trim panel from the door.

Remove the screw retaining the speaker water deflector to the inner door panel and withdraw the water deflector.

Carefully remove the plastic sealing sheet from the inner door panel.

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

Ensure that the plastic sealing sheet is correctly installed and not torn or damaged.

Check the trim panel retaining clips and renew any damaged clips as necessary.

On models with manual windows, wind the door glass to the closed position, install the retaining clip to the regulator handle and install the regulator handle to correspond with the regulator handle on the opposite door.

DOOR GLASS AND REGULATOR

To Remove and Install

Remove the interior trim panel and handles as previously described.

Lower the door glass to align the lift channel with the lower aperture.

Support the door glass and remove the retaining screws from the lift channel and door glass.

Tilt the door glass to disengage it from the run channel, then lift the door glass out through the door glass opening.

Remove the retaining bolts securing the regulator assembly to the door panel. On models with power windows, disconnect the wiring connector. Maneuver the regulator assembly from the door through the lower aperture.

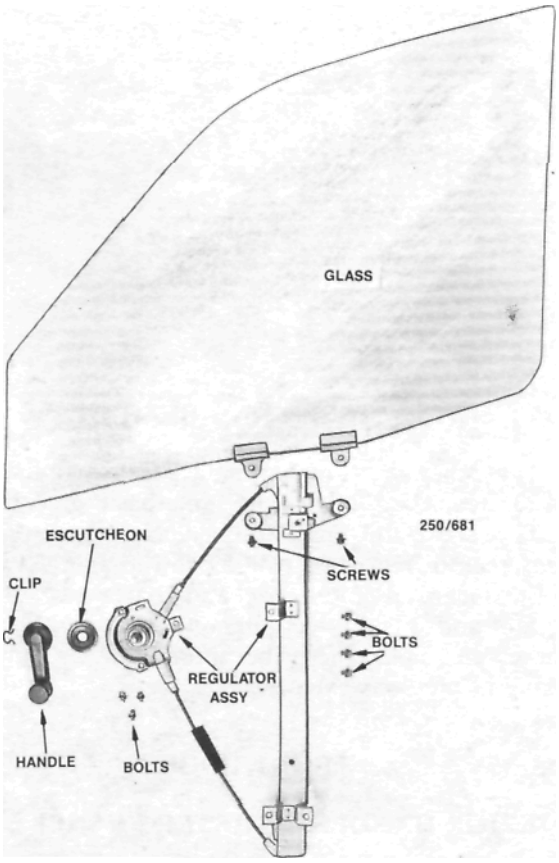
Installation is a reversal of the removal procedure with attention to the following points:

Ensure that the sliding surfaces are adequately lubricated with a zinc oxide grease.

Loosely install the regulator assembly to the inner door panel.

Install the door glass through the door glass opening, engage the door glass in the run channel and loosely install the retaining screws.

Tighten the regulator retaining bolts and operate the door glass a few times up and down to ensure that the glass is centralized. Tighten the lift channel screws and check the operation of the door glass. Adjust as required.



Dismantled view of the manually operated front door

window regulator and glass components.

(5) Install the plastic sealing sheet, the trim panel and the interior handles as previously described.

REMOTE CONTROL AND DOOR LOCK

To Remove and Install

Remove the interior handles, the trim panel and the plastic sealing sheet as previously described.

Remove the screws retaining the door lock to the door frame.

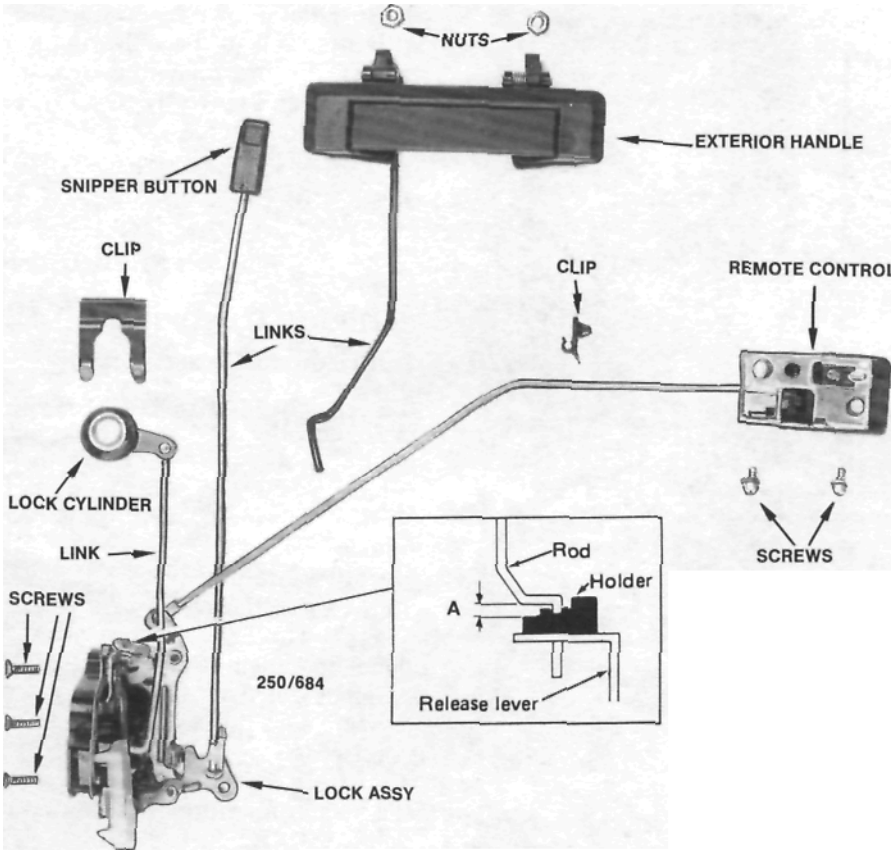
Disconnect the operating links at the door lock from the snipper button and the lock cylinder. The remote control link can be left connected. On models with central locking, disconnect the link from the lock actuator.

Remove the screws securing the remote control to the inner door panel, release the link from the inner door panel clip and withdraw the remote control and door lock assembly from the door.

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

Ensure that the exterior handle operates correctly and has 0.5-2.0 mm free play at the stepped adjuster holder. Adjust the stepped adjuster holder if necessary.

Check the operation of the door lock assembly before installing the plastic sealing sheet, the trim panel and the interior handles as previously described.



Dismantled view of the front door lock components. Dimension A at the stepped adjuster holder should be 0.5-2.0 mm. Turn the stepped adjuster holder to give the correct free play.

EXTERIOR DOOR HANDLE

To Remove and Install

Remove the interior handles, the trim panel and the plastic sealing sheet as previously described.

Remove the retaining nuts from inside the door panel. Withdraw the handle slightly while ensuring that the link is sliding out of the lock assembly. Maneuver the exterior handle from the vehicle.

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

Ensure that the exterior handle and seal are in a serviceable condition and installed correctly to prevent the entry of dust and water.

Ensure that the exterior handle operates correctly and has 0.5-2.0 mm free play at the stepped adjuster holder. Adjust the stepped adjuster holder if necessary.

Check the operation of the door lock assembly before installing the plastic sealing sheet, the trim panel and the interior handles as previously described.

LOCK CYLINDER

To Remove and Install

(1) Remove the interior handles, the trim panel and the plastic sealing sheet as previously described.

Wind the door glass up fully and disconnect the operating link between the door lock and the lock cylinder.

Using a suitable screwdriver, remove the lock cylinder retaining clip and withdraw the lock cylinder from the outer door panel.

Installation is a reversal of the removal procedure.

LOCK STRIKER PLATE

To Remove, Install and Adjust

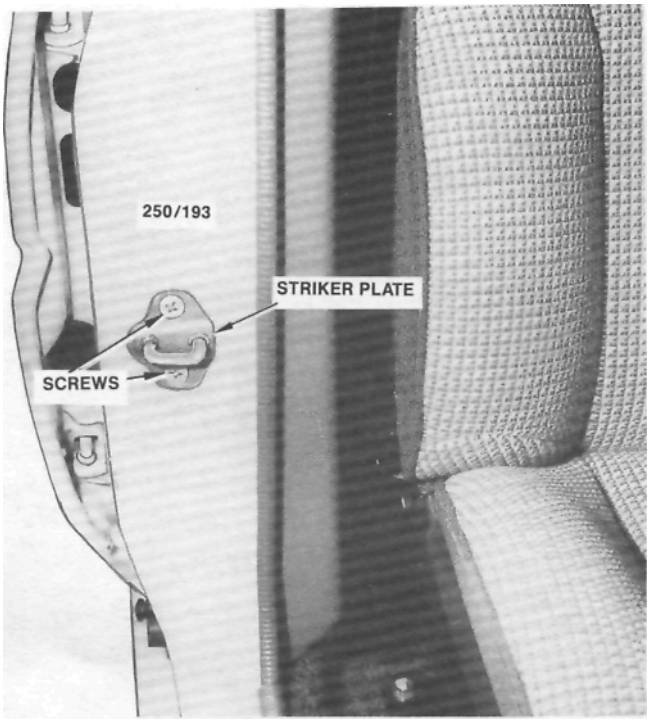
Mark the position of the striker plate on the door pillar with a soft lead pencil to facilitate correct replacement of the striker plate.

Remove the retaining screws from the striker plate to the door pillar and remove the striker plate. Inspect the striker plate for wear and renew as necessary.

Install the striker plate to the door pillar according to the pencil marks made on removal.

Close the door and observe the alignment with the body panel or rear door. If necessary, loosen the striker plate retaining screws and move the striker plate in or out to achieve a flush fit.

If the door lifts or drops when the lock



Installed view of the front door lock striker plate.

engages the striker plate, loosen the retaining screws and move the striker plate up or down to eliminate the lift or drop.

EXTERNAL MIRROR

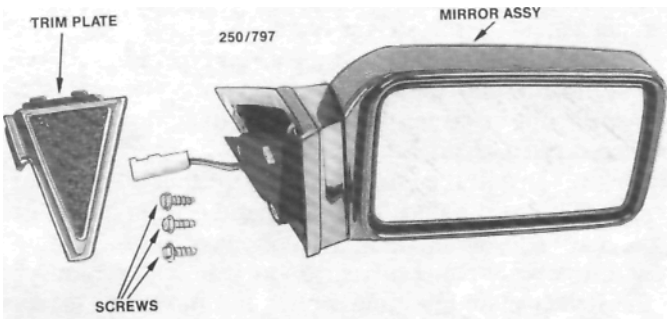
To Remove and Install

On models with manual mirrors, remove the screw retaining the adjuster arm handle and withdraw the handle.

Carefully prise out the cover trim plate and remove the retaining screws securing the mirror body to the door.

On models with power mirrors, disconnect the mirror wiring connector.

Withdraw the external mirror and seal from the door.



Dismantled view of the power door mirror.

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

Ensure that the seal is in a serviceable condition and correctly installed to prevent the entry of dust and water.

Tighten all the screws securely.

3. REAR DOORS

INTERIOR HANDLES AND TRIM PANEL

To Remove and Install

On models with manual windows, carefully prise out the armrest trim plugs and remove the retaining screws. Withdraw the armrest from the vehicle.

On models with power windows, proceed as follows:

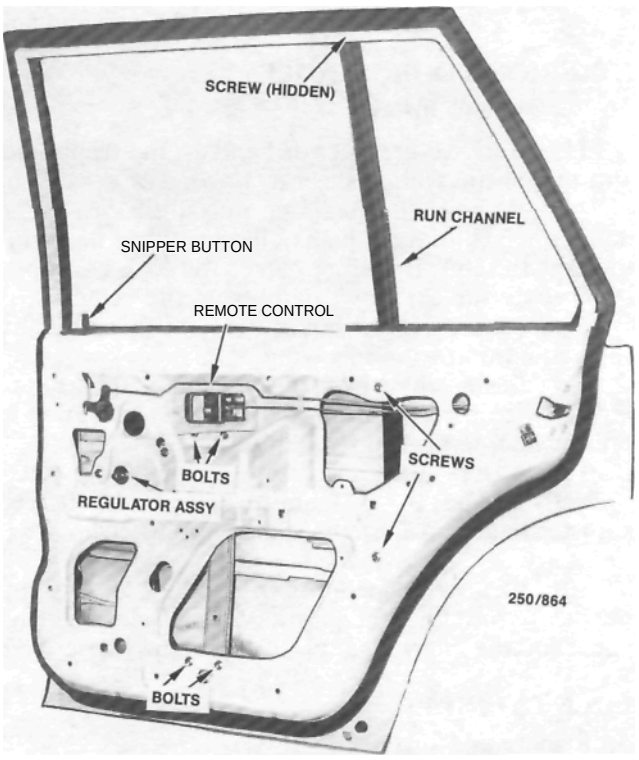
Carefully prise out the armrest trim plugs and remove the retaining screws.

Hold the armrest away from the door trim panel as much as possible and lever the window switches out from the armrest, front end first.

Lift the switches and disconnect the wiring connector.

Remove the hidden screw, working through the switch aperture. Withdraw the armrest from the vehicle.

(3) Remove the screw retaining the remote con-



Rear door with the trim panel and plastic sealing sheet removed.

trol assembly escutcheon to the door and remove the escutcheon.

(4) On models with manual windows, lever back the regulator handle escutcheon and using a suitable wire hook, withdraw the handle retaining clip and remove the handle and escutcheon.

Alternatively, a piece of sturdy cloth can be used to remove the regulator handle by sliding the cloth behind the handle and pulling on each end of the cloth in a see-saw action to release the retaining clip.

On models with a step lamp located in the door trim panel, remove the screws, withdraw the lamp and disconnect the wiring connector.

Using a broad bladed screwdriver, carefully lever the trim panel outwards and disengage all the retaining clips. When all the clips have been disengaged maneuver the trim panel from the door.

Carefully remove the plastic sealing sheet from the inner door panel.

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

Ensure that the plastic sealing sheet is correctly installed and not torn or damaged.

Check the trim panel retaining clips and renew any damaged clips as necessary.

On models with manual windows, wind the door glass to the closed position, install the retaining
clip to the regulator handle and install the regulator handle to correspond with the regulator handle on the opposite door.

DOOR GLASS, REGULATOR AND QUARTER GLASS

To Remove and Install

Remove the interior handles, the trim panel and the plastic scaling sheet as previously described.

Lower the door glass to align the lift channel with the lower aperture.

Support the door glass and remove the retaining screws from the lift channel.

Remove the screws retaining the rear run channel to the door.

> *NOTE: To gain access to the upper screw carefully ease a small section of the door rubber from the upper door flange.*

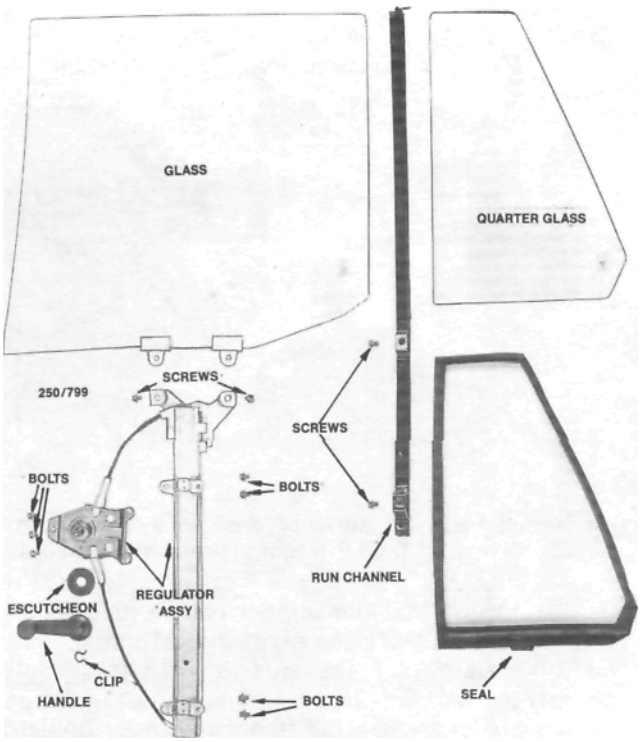
Maneuver the run channel from the door using care not to chip the door paintwork or the glass.

Withdraw the door glass through the door glass aperture.

Slide the quarter glass and seal assembly towards the front top corner of the door and withdraw the quarter glass from the vehicle.

Remove the regulator retaining bolts and withdraw the regulator from the door through the lower aperture.

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



Dismantled view of the manually operated rear window regulator and glass components.

Ensure that the regulator sliding surfaces are adequately lubricated with a zinc oxide grease.

Ensure that the door glass slides freely in the run channels. The rear channel lower bolts and the lift channel screw are adjustable in slotted holes to achieve this.

Install the plastic sealing sheet, the trim panel and the interior handles as previously described.

REMOTE CONTROL AND DOOR LOCK

To Remove and Install

Remove the interior handles, the trim panel and the plastic sealing sheet as previously described.

Remove the retaining screws from the remote control assembly.

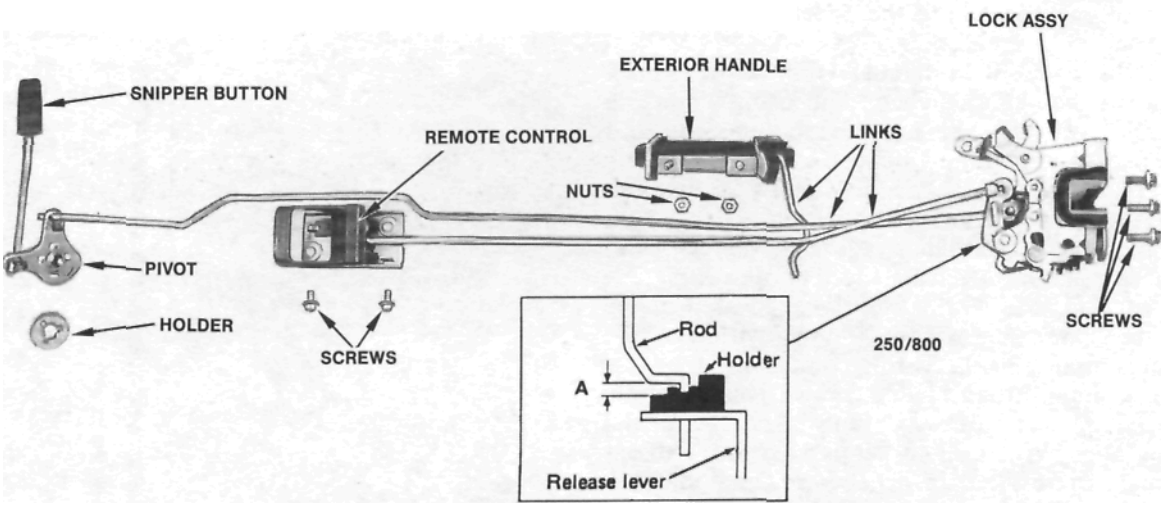
Remove the retaining screws from the door lock assembly.

On models with central door locking, disconnect the lock actuator link from the lock assembly by releasing the snap clip.

Withdraw the door lock assembly from the door at the same time turning the snipper button pivot holder to release the pivot from the door.

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

(1) Ensure that the exterior handle link enters the door lock stepped adjuster when maneuvering the door lock into position.



Dismantled view of the rear door lock components. Dimension A at the stepped adjuster holder should be 0.5—2.0 mm. Turn the stepped adjuster holder to give the correct free play.

Ensure that the snipper button pivot holder is turned back to lock the pivot in position.

Ensure that the exterior handle operates correctly and has 0.5-2.0 mm free play at the stepped adjuster holder. Adjust the stepped adjuster holder if necessary.

Check the operation of the door lock assembly before installing the plastic sealing sheet, the trim panel and the interior handles as previously described.

EXTERIOR DOOR HANDLE

To Remove and Install

Remove the interior handles, the trim panel and the plastic sealing sheet as previously described.

Remove the exterior door handle retaining nuts from inside the inner door panel.

(3) Withdraw the door handle from the door.

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

Ensure that the exterior handle operates correctly and has 0.5-2.0 mm free play at the stepped adjuster holder. Adjust the stepped adjuster if necessary.

Check the operation of the door lock assembly before installing the plastic sealing sheet, the trim panel and the interior handle as previously described.

LOCK STRIKER PLATE

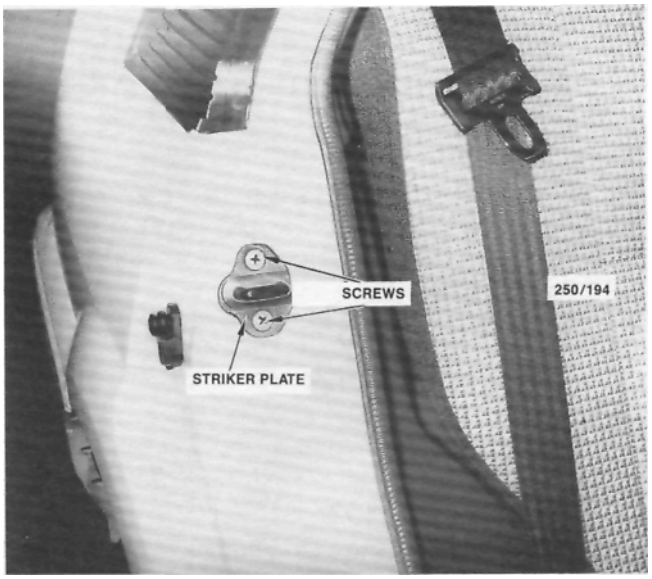
To Remove, Install and Adjust

Mark the rear door pillar around the striker plate with a soft lead pencil to aid assembly.

Remove the retainer screws from the striker plate and remove the striker plate. Inspect the striker plate for wear or damage and renew as necessary.

Install the striker plate to the door pillar according to the pencil marks made on removal.

Close the door and observe the alignment with the body panel. If necessary, loosen the striker plate retainer screws and move the striker plate in or out to achieve a flush fit between the door and the body panel.



Installed view of the rear door lock striker plate.

(5) If the door lifts or drops when the lock engages the striker plate, loosen the screws and move the striker plate up or down to eliminate the lift or drop.

NOTE: After each adjustment tighten the striker plate screws and check the adjustment. Readjust as necessary.

4. ENGINE BONNET

TO REMOVE, INSTAL AND ADJUST

Raise the engine bonnet and place covers on both front mudguards. Mark the hinge mountings on the bonnet with a soft lead pencil to aid assembly.

Place a quantity of soft rag folded several times under each rear corner of the bonnet on the scuttle panel.

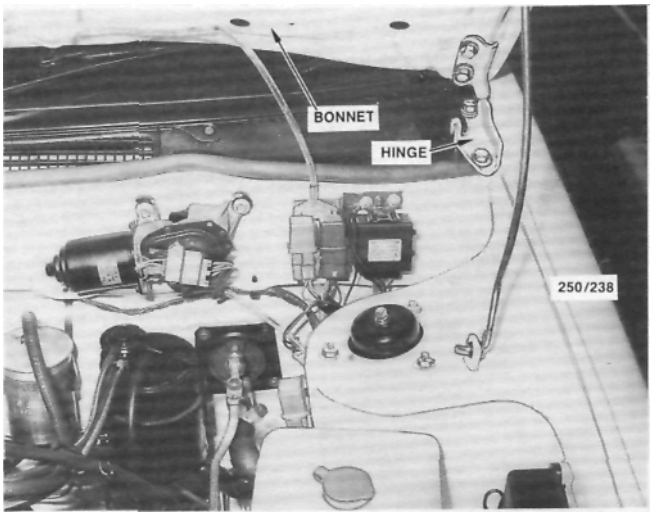
Disconnect the windscreen washer hose from the bonnet at the tee piece.

With the aid of an assistant supporting the bonnet, remove the retaining bolts and lift the bonnet from the vehicle.

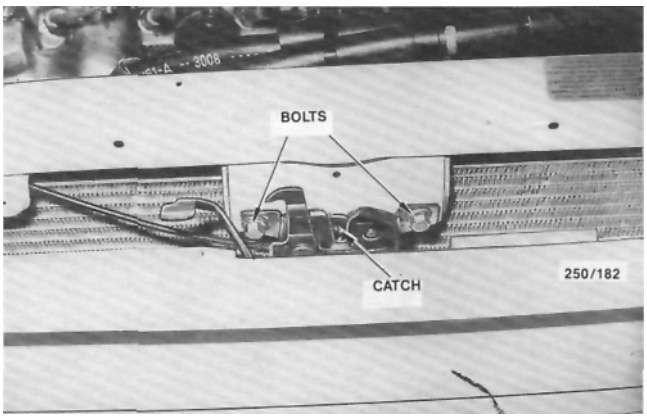
Installation is a reversal of the removal procedure with attention to the following points:

Holding the bonnet in the position previously marked, install the bonnet hinge bolts and
tighten to just over finger tight.

Close the bonnet and by pushing with the hand, position the bonnet evenly in its opening.



View of the bonnet hinge showing the retaining/adjusting bolts.



Installed view of the bonnet catch.

Open the bonnet carefully and tighten the mounting bolts.

Check for correct positioning and adjust again if necessary.

Check the adjustment of the bonnet catch. When the bonnet is closed the bonnet should align with the front panels. When the catch is released the bonnet should pop up sufficiently to enable the safety catch to be released.

If adjustment is necessary, mark the base position with a pencil, loosen the retaining bolts and move the catch in the desired direction. Tighten the bolts and recheck.

NOTE: When adjusting the bonnet catch ensure that the bonnet striker plate is entering centrally into the catch. Adjust the catch or the bonnet lunges if necessary.

(7) When adjustment is complete, adjust the bump rubbers on the radiator support panel up or down by turning them to support the outer edges of the bonnet.

5. TAILGATE AND LOCK - HATCHBACK

TAILGATE

To Remove

Raise the tailgate and place protective covers over the surrounding paintwork.

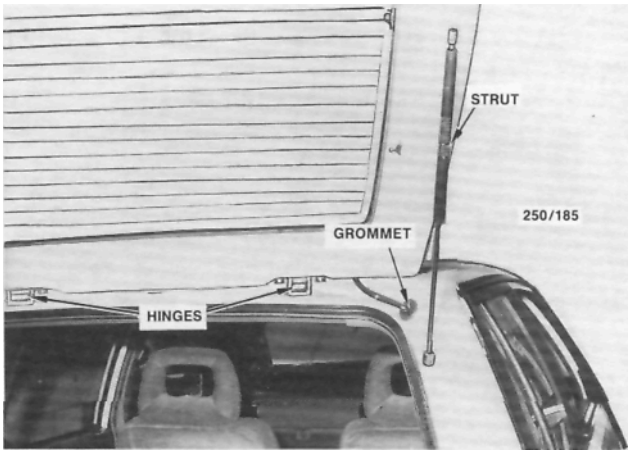
Using a soft lead pencil, mark around the tailgate hinges to aid assembly.

Remove the sealing grommets from the tailgate and disconnect the rear window washer hose.

Prise out the tailgate trim panel retaining clips and maneuver the tailgate interior trim panel from the tailgate.

Disconnect the wiring connectors) inside the tailgate and tie a piece of string to the connector(s).

Pull the tailgate wiring from the tailgate,



View showing the right hand side tailgate components.

leaving the ends of the string protruding from the tailgate. Untie the string.

NOTE: The string will be used to pull the wiring through the tailgate on installation. If the wiring is pulled from the tailgate without the string attached, installation will be very difficult.

With the aid of an assistant supporting the tailgate, prise out the ball joint stud snap locks from each upper strut ball joint using a small screwdriver.

Remove the bolts retaining the hinges to the tailgate and carefully withdraw the tailgate from the vehicle.

To Install and Adjust

With the aid of an assistant, install the tailgate in position on the hinges according to the marks made on removal and install the retaining bolts.

Install the tailgate support struts and retain the ball joints with the snap locks.

Pull the tailgate wiring through using the piece of string. Connect the wiring and install the tailgate trim panel.

Close the tailgate and check the vertical and lateral alignment of the tailgate in relation to the body.

If adjustment is required, loosen the tailgate hinge retaining bolts one hinge at a time and adjust the tailgate as required.

If vertical adjustment is required, it will be necessary to remove or install washers under the tailgate hinges.

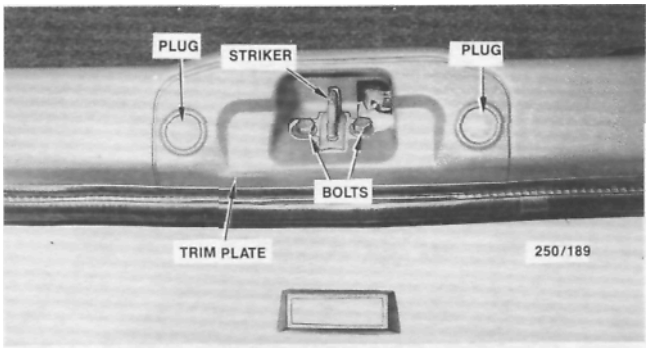
If required, adjust the striker plate using the procedure that follows.

STRIKER PLATE

To Remove, Install and Adjust

Using a flat bladed screwdriver, prise out the trim plugs and remove the trim plate from above the striker.

Using a soft lead pencil, scribe a line around the striker plate.



Installed view of the striker plate assembly. Hatchback models.

Remove the striker plate retaining bolts and partially remove the striker plate.

Disconnect the remote tailgate release cable from the striker plate and remove the striker plate from the vehicle.

Inspect the striker plate for wear and renew it if necessary.

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

Install the striker plate ensuring that it is in the position marked on dismantling and that the remote tailgate release cable is connected. Tighten the retaining bolts.

Close the tailgate ensuring that the striker has actuated the locking mechanism.

Check the alignment of the tailgate in its opening and adjust the locking action by moving the striker plate in the required direction. Tighten the retaining bolts securely.

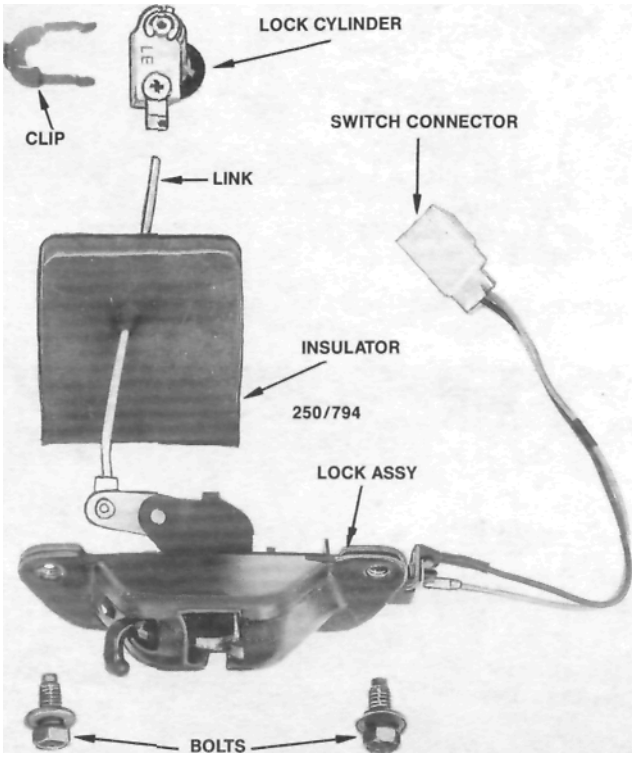
LOCK AND LOCK CYLINDER

To Remove and Install

Prise out the tailgate trim panel retaining clips and carefully maneuver the tailgate interior trim panel from the tailgate.

Disconnect the actuating rod from the lock cylinder assembly.

Disconnect the interior lamp switch wiring connector.



Dismantled view of the Hatchback lock and lock cylinder.

Remove the lock assembly retaining bolts and withdraw the lock assembly, insulator and link from the tailgate.

Using a suitable screwdriver, remove the lock cylinder retaining clip and withdraw the lock cylinder from the vehicle.

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

Ensure that the positioning of the lock is correct in relation to the striker plate.

Ensure that the interior lamp switch wiring connector is connected.

6. LUGGAGE COMPARTMENT LID AND LOCK — SEDAN

LUGGAGE COMPARTMENT LID

To Remove

Raise the luggage compartment lid and place protective covers over the surrounding paintwork.

Using a soft lead pencil, mark around the luggage compartment lid hinges to aid assembly.

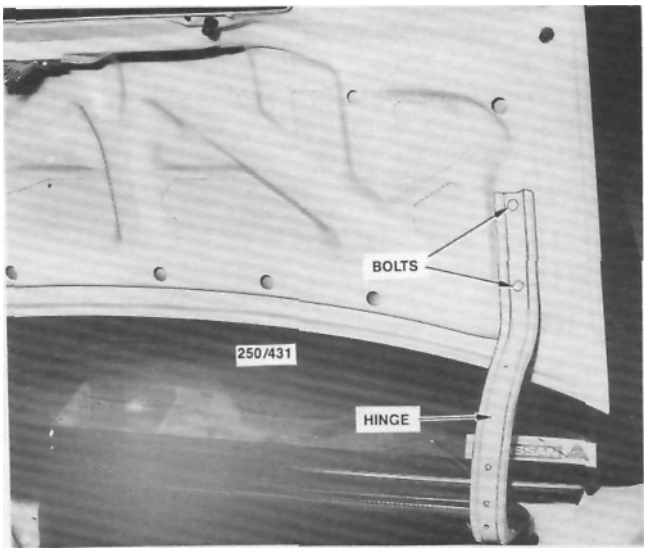
With the aid of an assistant supporting the lid, remove the hinge retaining bolts and withdraw the luggage compartment lid from the vehicle.

To Install and Adjust

With the aid of an assistant, install the luggage compartment lid in position on the hinges according to the marks made on removal. Install the retaining bolts.

Close the lid and check the vertical and lateral alignment of the lid in relation to the body.

If adjustment is necessary, loosen the lid hinge retaining bolts on one hinge at a time and adjust the lid as required.



Installed view of the luggage compartment lid hinge.

If vertical adjustment is required, loosen the lid hinge retaining bolts and increase or decrease the number of washers under the bolts.

If required, adjust the striker plate using the procedure that follows.

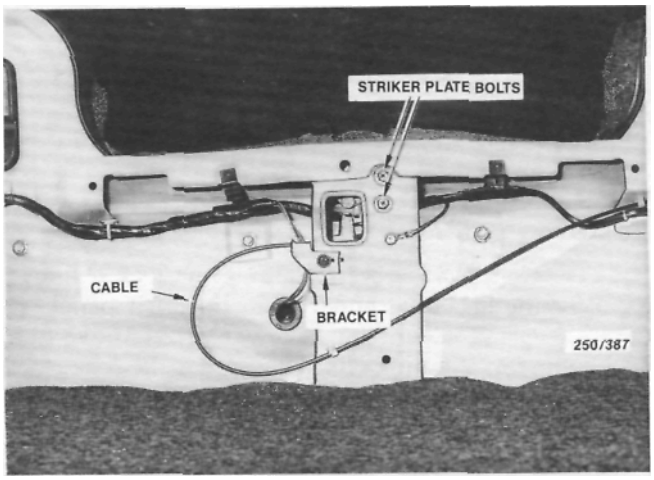
STRIKER PLATE

To Remove, **Install** and **Adjust**

Fold back the trim material from inside the luggage compartment.

Using a soft lead pencil, scribe a line around the outside of each striker plate retaining bolt washer.

Remove the striker plate bolts and washers and the screw retaining the remote release cable bracket.



Installed view of the luggage compartment lid striker with the trim material folded back.

(4) Slide the striker assembly towards the right hand side of the vehicle and disconnect the remote release cable. Withdraw the striker plate from the vehicle.

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

(1) Install the remote release cable to the striker plate and install the striker plate retaining bolts and washers to the lines made on dismantling.

Tighten the retaining bolts to just over finger tight.

Close the lid ensuring that the striker has actuated the locking mechanism.

Check the alignment of the luggage compartment lid in its opening and adjust the locking action by moving the striker plate. Tighten the retaining bolts securely.

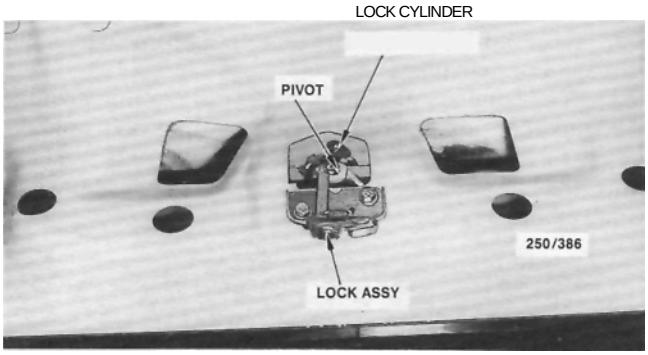
When the striker plate is adjusted correctly pull the remote release cable towards the right hand side of the vehicle until the cable end has 0.5-1.5 mm clearance and tighten the retaining screws. Check the operation of the remote release cable and readjust if necessary.

LOCK ASSEMBLY

To Remove and Install

(1) Remove the retaining bolts and withdraw the lock assembly from the luggage compartment lid.

Installation is a reversal of the removal procedure ensuring that the actuating arm on the lock is under the lock cylinder pivot.



Installed view of the lock and lock cylinder.

LOCK CYLINDER

To Remove and Install

Remove the bolt retaining the lock cylinder pivot to the luggage compartment lid inner panel.

Using a suitable screwdriver, remove the lock cylinder retaining clip from under the lock.

Withdraw the lock cylinder and pivot from the vehicle.

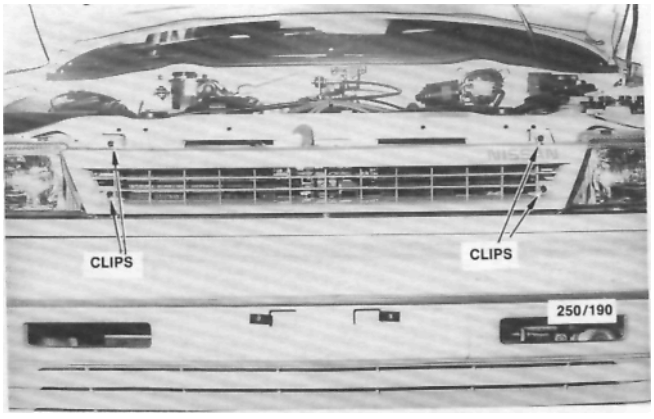
Installation is a reversal of the removal procedure.

7. RADIATOR GRILLE

TO REMOVE AND INSTAL

Astra Models and Pre July 1989 Pulsar Models

(1) Using a flat bladed screwdriver, turn the grille clips slightly to allow removal of the grille.



Installed view of the radiator grille on pre July 1989 models showing the retaining clip locations.

(2) When the clips have been released, pull the grille forward and remove it from the vehicle ensuring that care is taken not to damage the grille.

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

Remove the grille retaining clips from the radiator support panel and install them to the grille.

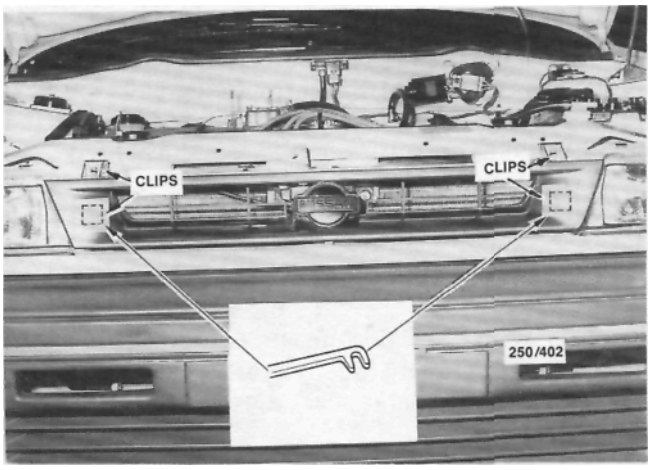
Renew any damaged clips.

Install the grille to the vehicle being careful to align the grille clips before pushing the grille inwards.

Post July 1989 Pulsar Models

Fabricate a tool to engage the radiator grille clips from the inside; an old spanner of suitable dimensions can be ground down if necessary.

Using the above tool, turn the lower radiator clips slightly to allow removal of the grille.



Installed view of the radiator grille on post July 1989 models showing the retaining clip locations and the special tool required to release the lower clips.

Using a flat bladed screwdriver, turn the upper grille clips slightly to allow removal of the grille.

When all the clips have been released, pull the grille forward and remove it from the vehicle ensuring that care is taken not to damage the grille.

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

Remove the grille clips from the radiator support panel and install them to the grille. Renew any damaged clips.

Install the grille to the vehicle being careful to align the grille clips before pushing the grille inwards.

8. CENTRE CONSOLE

TO REMOVE AND INSTAL

Remove the carpet square from the rear part of the console and remove the screws underneath.

Prise out the trim piece below the handbrake

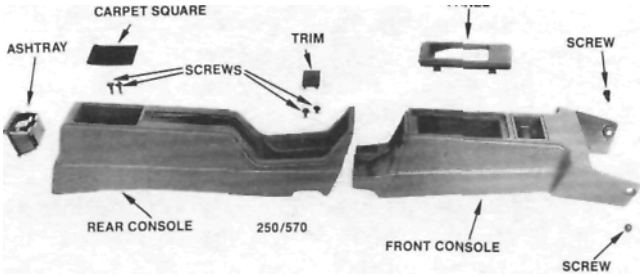
lever and remove the screws underneath. Withdraw the rear console.

On manual transaxle models, unscrew the gear lever knob and prise out the gear lever rubber boot.

On automatic transaxle models, prise out the panel around the selector lever and maneuver the panel over the lever.

Remove the screws retaining the front of the console to the floor panel and withdraw the console from the vehicle.

Installation is a reversal of the removal procedure.



Dismantled view of the centre console assembly. Automatic transaxle model.

9, DASHBOARD

TO REMOVE AND INSTAL

Disconnect the negative battery terminal.

Remove the centre console as previously described in this section.

Remove the steering wheel as described in the Steering section.

Remove the upper and lower steering column shrouds and remove the combination switch. Refer to the Electrical System section if necessary.

Remove the retaining screws and withdraw the lower trim panel from underneath the steering column.

Remove the screws from underneath the bonnet lock handle and slide the bonnet lock handle downwards out of the dashboard.

Remove the screws retaining the centre fascia panel, two upper and two lower, withdraw the fascia panel slightly and disconnect the wiring to the cigarette lighter.

Remove the radio/cassette bracket retaining screws. Disconnect the aerial and the wiring and withdraw the radio/cassette from the centre bracket.

Remove the heater control knobs and remove the heater fascia panel screws. Carefully remove the heater fascia panel leaving the heater controls in place.

Loosen the bolt retaining the large wiring connector at the lower right hand side of the dashboard. As the bolt is loosened it will force the connector apart.

Using a screwdriver, carefully prise out the demister ducts from the top of the dashboard.

Using a suitable socket, remove the bolts from underneath the demister ducts.

Remove the bolts from the outer lower edges and the lower part of the centre bracket assembly.

NOTE: Refer to the illustration for the location of the dashboard retaining bolts.

(14) With the aid of an assistant lift the dashboard straight up at the door pillar brackets. Tilt the

View of the dashboard removed from the vehicle. The arrows indicate the location of the retaining bolts.

top of the dashboard rearwards and maneuver the dashboard through the front door opening.

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

With the aid of an assistant, ensure that the outer edges of the dashboard engage properly with the door pillar brackets.

Hold the dashboard in position and loosely install all retaining bolts. Align the dashboard and
tighten all screws and bolts securely.

10. SEAT BELTS

The front and outer rear seats are equipped with lap/sash inertia reel seat belts, which are designed to lock with any sudden change in vehicle motion.

The centre rear seat is equipped with a manually adjustable lap seat belt.

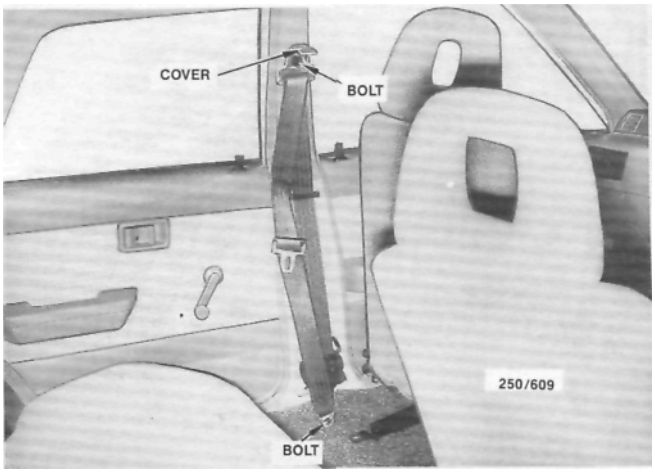
Child restraint anchorages are located on the parcel shelf behind the rear seat on Sedan models and at the rear of the luggage compartment floor on Hatchback models. These anchorages must be used if a child's seat or capsule is installed to the vehicle. The anchorages should not be used for adult scat bells or harnesses.

The seat belts should be periodically inspected as described below. Any seat belt assembly that is worn or damaged, or has been subjected to abnormal loadings in a collision, should be renewed as a complete assembly.

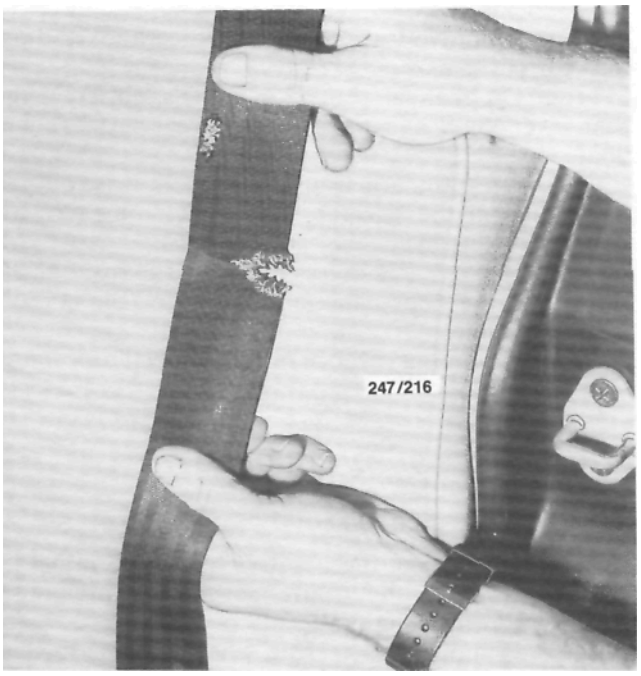
Only mild soap and water should be used to clean the webbing. Contamination with polish, oil, bleaches and other chemicals should be avoided.

TO INSPECT

(1) Check the seat belt webbing for fraying, cuts, burns or other damage. On inertia reel belts, slowly pull the belt from the reel to allow the entire length to be examined. If the webbing is damaged or worn, renew the seat belt assembly.



Installed view of the front seat belt with the door pillar trim removed showing the mounting points.



Check the seat belt webbing for fraying, cuts, burns or other damage.

Ensure that the belts are not twisted.

Check all retaining nuts and bolts for security.

Inspect the belt buckles for correct and secure engagement. If the buckles are damaged or do not function correctly, renew the seat belt assembly.

On inertia reel seat belts, check the retractor mechanism as follows:

Pull the belt slowly from the reel and check for smooth operation. Release the belt and ensure that it retracts fully.

Pull the belt rapidly from the reel. The reel should lock.

Drive the vehicle at walking pace and attempt to withdraw the belt slowly while braking sharply. The reel should lock.

If the retractor mechanism does not function correctly, renew the seat belt assembly.

11. SEATS

FRONT SEAT

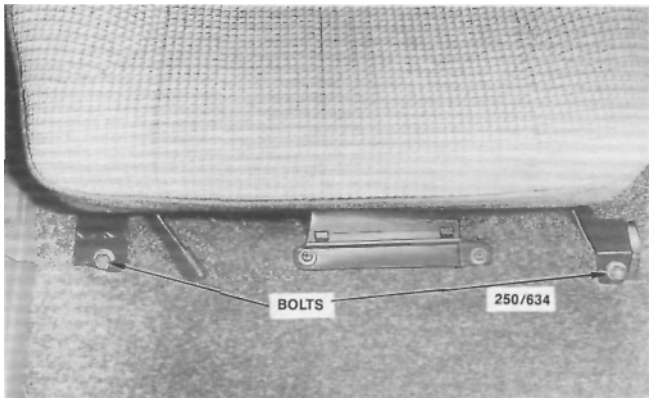
To Remove and Install

Adjust the seat to the most forward position.

Remove the mounting bolts from the rear of the seat.

Adjust the seat to allow access to the mounting bolts at the front of the seat.

Remove the mounting bolts and withdraw the seat from the vehicle.



Installed view of the front seat mounting bolts.

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

Lubricate the seat slides with multi-purpose grease prior to installation of the seat.

Install all mounting bolts by hand prior to tightening the mounting bolts securely.

REAR SEAT CUSHION

To Remove and Install

Firmly bump the lower front of the seat cushion rearwards and up lo release the retaining clips from the vehicle floor panel.

With the retaining clips released, lift the front of the seat cushion and release the rear mounting wires.

(3) Lift the rear seat cushion out of the vehicle.

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

Position the centre seat belts on top of the rear seat cushion prior to installation of the cushion.

Ensure that the clips at the forward edge of the seat cushion are properly engaged in the floor panel.

REAR SEAT BACKREST

To Remove and Install

Fold the rear seat backrest forward.

Remove the outer seat backrest hinge bolts.

Pull each backrest towards the door and off the centre hinge pins.

Remove the rear seat backrest from the vehicle.

Installation is a reversal of the removal procedure.

12. VEHICLE CLEANING

CLEANING THE EXTERIOR

In order to remove dirt and road grime and thus preserve paint finish, vehicles in continuous use should be washed at least once a week.

Before washing the paintwork, it is good policy to first hose all dirt from the underbody and clean out the drain holes in the doors and sill panels.

Hose the vehicle to remove as much grit as possible and wash using a clean chamois or sponge, ensuring that the chamois or sponge is free from dirt or grit which could scratch the paint surface.

Avoid washing the vehicle in bright sunlight with high temperature as this will give the paintwork a streaky watermarked finish.

If necessary, wash the vehicle using a reputable brand Wash and Wax liquid. The Wash and Wax liquid will restore the paint luster and leave the paintwork with a protective coating of wax.

After a period it may become necessary to polish the vehicle in order to remove built up foreign matter and give the paintwork maximum protection from industrial fall-out and salt from sea air etc. Before polishing the paintwork, always wash the surface to remove as much road grime as possible. When polishing follow the polishing instructions which come with the polish.

NOTE: Grease, oil or tar on the paint surface can be removed with a little kerosene or white spirits. To prevent staining, wash and polish the affected area as soon as the grease, oil or tar is removed.

CLEANING VINYL TRIM

To maintain the vinyl interior trim in good condition it should be regularly vacuumed to remove loose dirt and then wiped with a dry or damp cloth.

If the trim is soiled or stained, the following cleaning procedure is recommended:

Using warm water, cheese cloth and a mild soap, thoroughly wash the affected areas.

Repeat the operation using damp cheese cloth only.

To complete the cleaning operation wipe the trim over with a dry piece of cheese cloth.

NOTE: If the interior trim is badly soiled or stained, wash with a reputable brand of upholstery cleaner carefully following the makers instructions.

CLEANING CLOTH TRIM

Loose dirt and dust on cloth trim should be removed with a vacuum cleaner or a very soft brush. Do not use a whisk brush or any other type of coarse brush or damage to the cloth could result. If the fabric is soiled the following cleaning procedure is recommended.

Sponge the fabric lightly with warm water containing a little detergent and household ammonia.

After sponging, rub the fabric lightly. If soiling is still apparent, repeat the sponging operation.

Use a clean dry cloth to soak up excess fluid.