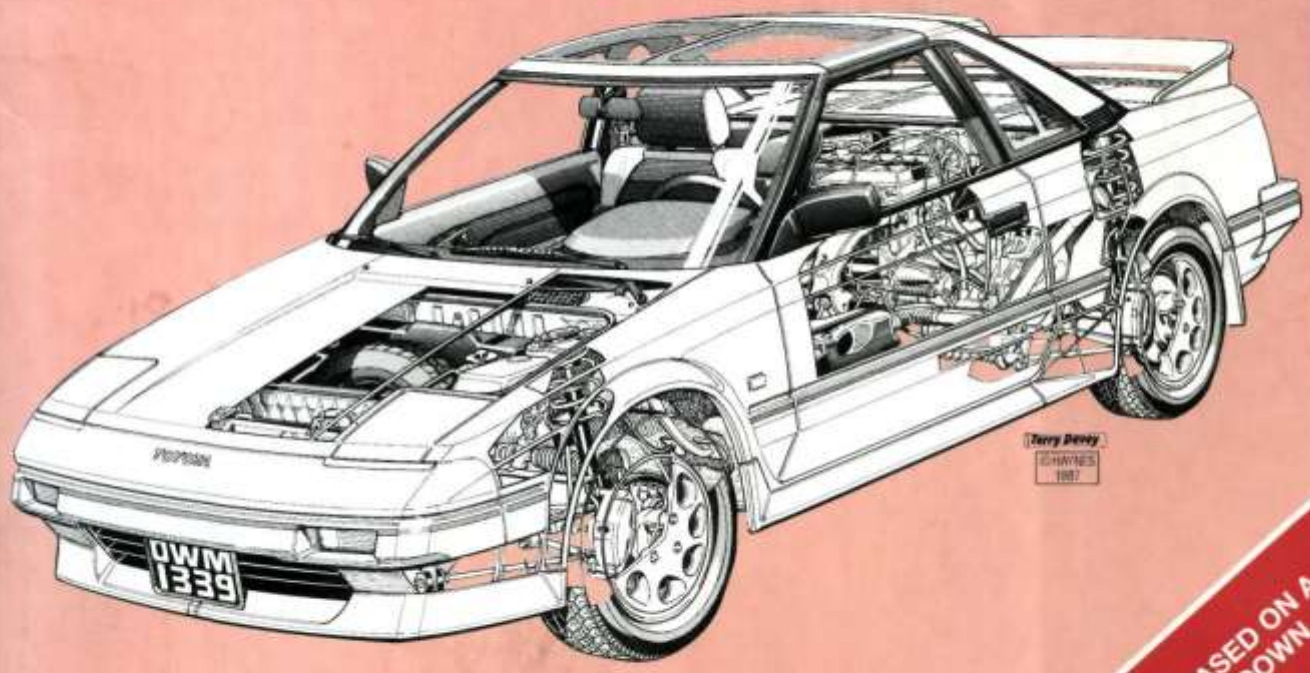
TOYOTA MR2

92065 (1339)

Haynes

1985 thru 1987 □ All models

Automotive Repair Manual



PRINTED ON RECYCLED PAPER

EVERY MANUAL BASED ON A COMPLETE TEARDOWN AND REBUILD

Toyota MR2 Automotive Repair Manual

by Mike Stubblefield,
Olaf Wolff
and John H Haynes
Member of the Guild of Motoring Writers

Models covered:
All Toyota MR2 models 1985 through 1987

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About this manual

Its purpose

The purpose of this manual is to help you get the best value from your vehicle. It can do so in several ways. It can help you decide what work must be done, even if you choose to have it done by a dealer service department or a repair shop; it provides information and procedures for routine maintenance and servicing; and it offers diagnostic and repair procedures to follow when trouble occurs.

It is hoped that you will use the manual to tackle the work yourself. For many simpler jobs, doing it yourself may be quicker than arranging an appointment to get the vehicle into a shop and making the trips to leave it and pick it up. More importantly, a lot of money can be saved by avoiding the expense the shop must pass on to you to cover its labor and overhead costs. An added benefit is the sense of satisfaction and accomplishment that you feel after having done the job yourself.

Using the manual

The manual is divided into Chapters. Each Chapter is divided into numbered Sections, which are headed in bold type between horizontal lines. Each Section consists of consecutively numbered paragraphs.

At the beginning of each numbered section you will be referred to any illustrations which apply to the procedures in that section. The reference numbers used in illustration captions pinpoint the pertinent Section and the Step within that section. That is, illustration 3.2 means the illustration refers to Section 3 and Step (or paragraph) 2 within that Section.

Procedures, once described in the text, are not normally repeated. When it is necessary to refer to another Chapter, the reference will be given as Chapter and Section number i.e. Chapter 1/16). Cross references given without use of the word "Chapter" apply to Sections and/or paragraphs in the same Chapter. For example, "see Section 8" means in the same Chapter.

Reference to the left or right side of the vehicle is based on the assumption that one is sitting in the driver's seat, facing forward.

Even though extreme care has been taken during the preparation of this manual, neither the publisher nor the author can accept responsibility for any errors in, or omissions from, the information given.

NOTE

A Note provides information necessary to properly complete a procedure or information which will make the steps to be followed easier to understand.

CAUTION

A Caution indicates a special procedure or special steps which must be taken in the course of completing the procedure in which the **Caution** is found which are necessary to avoid damage to the assembly being worked on.

WARNING

A Warning indicates a special procedure or special steps which must be taken in the course of completing the procedure in which the **Warning** is found which are necessary to avoid injury to the person performing the procedure.

Introduction to the Toyota MR2

The Toyota MR2, which was introduced in 1985, is the first mid-engined production sports car from Japan. It is powered by a fuel-injected, DOHC, 16-valve four-cylinder engine mated to either a five-speed manual or a four-speed automatic transaxle. The engine, which is mounted amidships between the passenger compartment and the rear wheels, has an iron block and aluminum cylinder head. The electronically-controlled, port fuel injection system is based on the Bosch L-Jetronic system. The MR2 is equipped with fully independent suspension and disc brakes at all four wheels.

Vehicle Identification Numbers

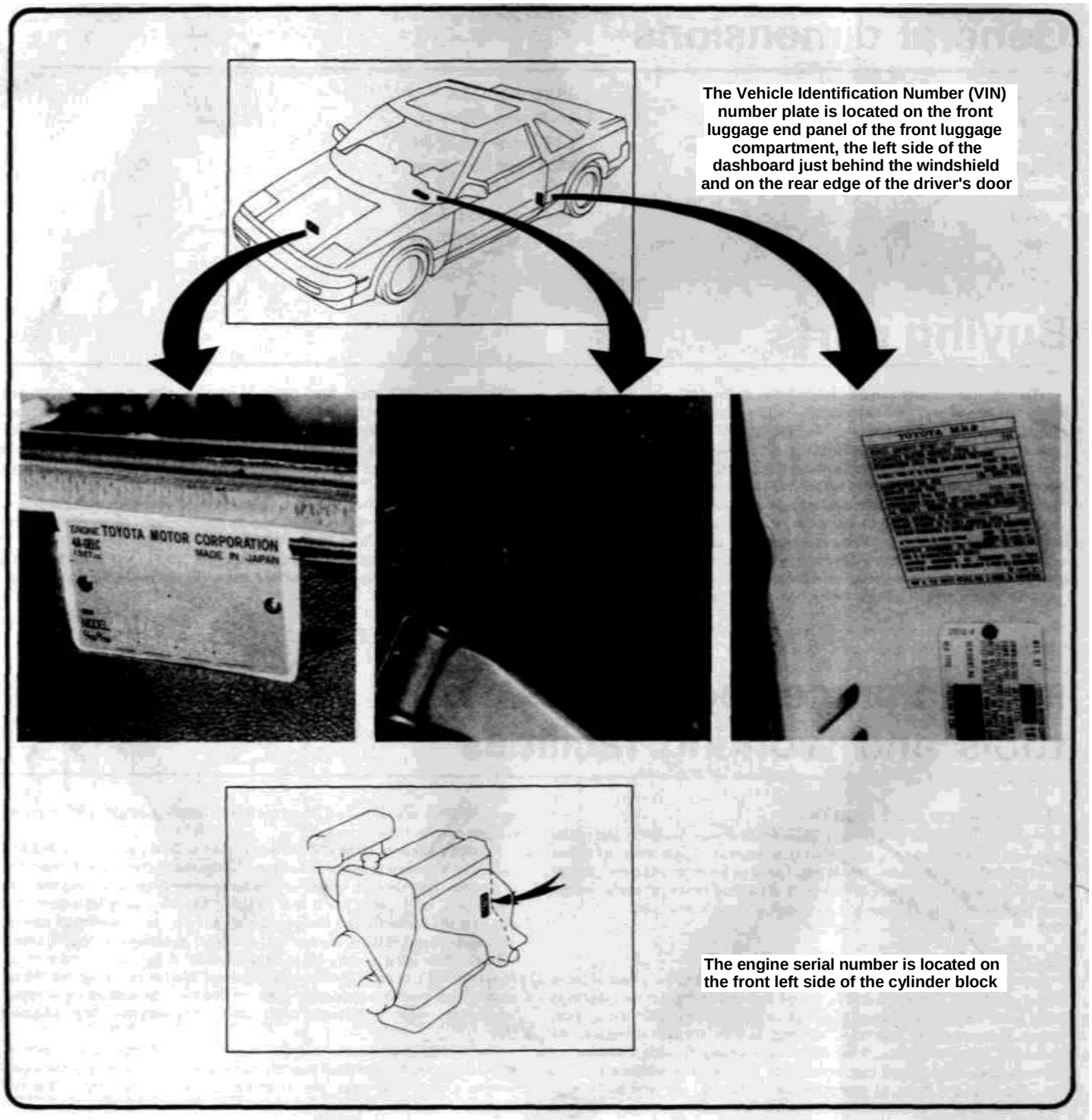
Modifications are a continuing and unpublicized process in automotive manufacturing. Because spare parts manuals and lists are compiled on a numerical basis, the individual vehicle numbers are essential to correctly identify the component required.

Vehicle Identification Number (VIN)

This very important identification number is located three different places on the MR2. It's located in the front luggage compartment, on the backside of the radiator crossmember **(see illustration),** on a plate attached to the driver's side of the dashboard **(see illustration)** and on the rear edge of the driver's door **(see illustration).** The VIN also appears on the Vehicle Certificate of Title and Registration. It contains valuable information such as the vehicle's manufacturing location and the date of its completion.

Engine identification number

The engine identification number is located on a machined pad on the left end of the front side of the block **(see illustration).**



The Vehicle Identification Number (VIN) number plate is located on the front luggage end panel of the front luggage compartment, the left side of the dashboard just behind the windshield and on the rear edge of the driver's door

The engine serial number is located on the front left side of the cylinder block

General dimensions

Overall length	3925 mm (1 54.5 in)
Overall width	1665 mm (65.6 in)
Overall height	**1** 235 mm **(48.6** in)
Wheelbase	2320 mm (91.3 in)
Tread	
front	1440 mm (56.7 in)
rear	1440 mm (56.7 in)

Buying parts

Replacement parts are available from many sources, which generally fall into one of two categories - authorized dealer parts departments and independent retail auto parts stores. Our advice concerning these parts is as follows:

Retail auto parts stores: Good auto parts stores will stock frequently needed components which wear out relatively fast, such as clutch components, exhaust systems, brake parts, tune-up parts, etc. These stores often supply new or reconditioned parts on an exchange basis, which can save a considerable amount of money. Discount auto parts stores are often very good places to buy materials and parts needed for general vehicle maintenance such as oil, grease, filters, spark plugs, belts, touch-up paint, bulbs, etc. They also usually sell tools and general accessories, have convenient hours, charge lower prices and can often be found not far from home.

Authorized dealer parts department: This is the best source for parts which are unique to the vehicle and not generally available elsewhere (such as major engine parts, transmission parts, trim pieces, etc.).

Warranty information: If the vehicle is still covered under warranty, be sure that any replacement parts purchased - regardless of the source - do not invalidate the warranty!

To be sure of obtaining the correct parts, have engine and chassis numbers available and, if possible, take the old parts along for positive identification.

Maintenance techniques, tools and working facilities

Maintenance techniques

There are a number of techniques involved in maintenance and repair that will be referred to throughout this manual. Application of these techniques will enable the home mechanic to be more efficient, better organized and capable of performing the various tasks properly, which will ensure that the repair job is thorough and complete.

Fasteners

Fasteners are nuts, bolts, studs and screws used to hold two or more parts together. There are a few things to keep in mind when working with fasteners. Almost all of them use a locking device of some type, either a lockwasher, locknut, locking tab or thread adhesive. All threaded fasteners should be clean and straight, with undamaged threads and undamaged corners on the hex head where the wrench fits. Develop the habit of replacing all damaged nuts and bolts with new ones. Special locknuts with nylon or fiber inserts can only be used once. If they are removed, they lose their locking ability and must be replaced with new ones.

Rusted nuts and bolts should be treated with a penetrating fluid to ease removal and prevent breakage. Some mechanics use turpentine in a spout-type oil can, which works quite well. After applying the rust penetrant, let it work for a few minutes before trying to loosen the nut or bolt. Badly rusted fasteners may have to be chiseled or sawed off or removed with a special nut breaker, available at tool stores.

If a bolt or stud breaks off in an assembly, it can be drilled and removed with a special tool commonly available for this purpose. Most automotive machine shops can perform this task, as well as other repair procedures, such as the repair of threaded holes that have been stripped out.

Flat washers and lockwashers, when removed from an assembly, should always be replaced exactly as removed. Replace any damaged washers with new ones. Never use a lockwasher on any soft metal surface (such as aluminum), thin sheet metal or plastic.

Maintenance techniques, tools and working facilities

Fastener sizes

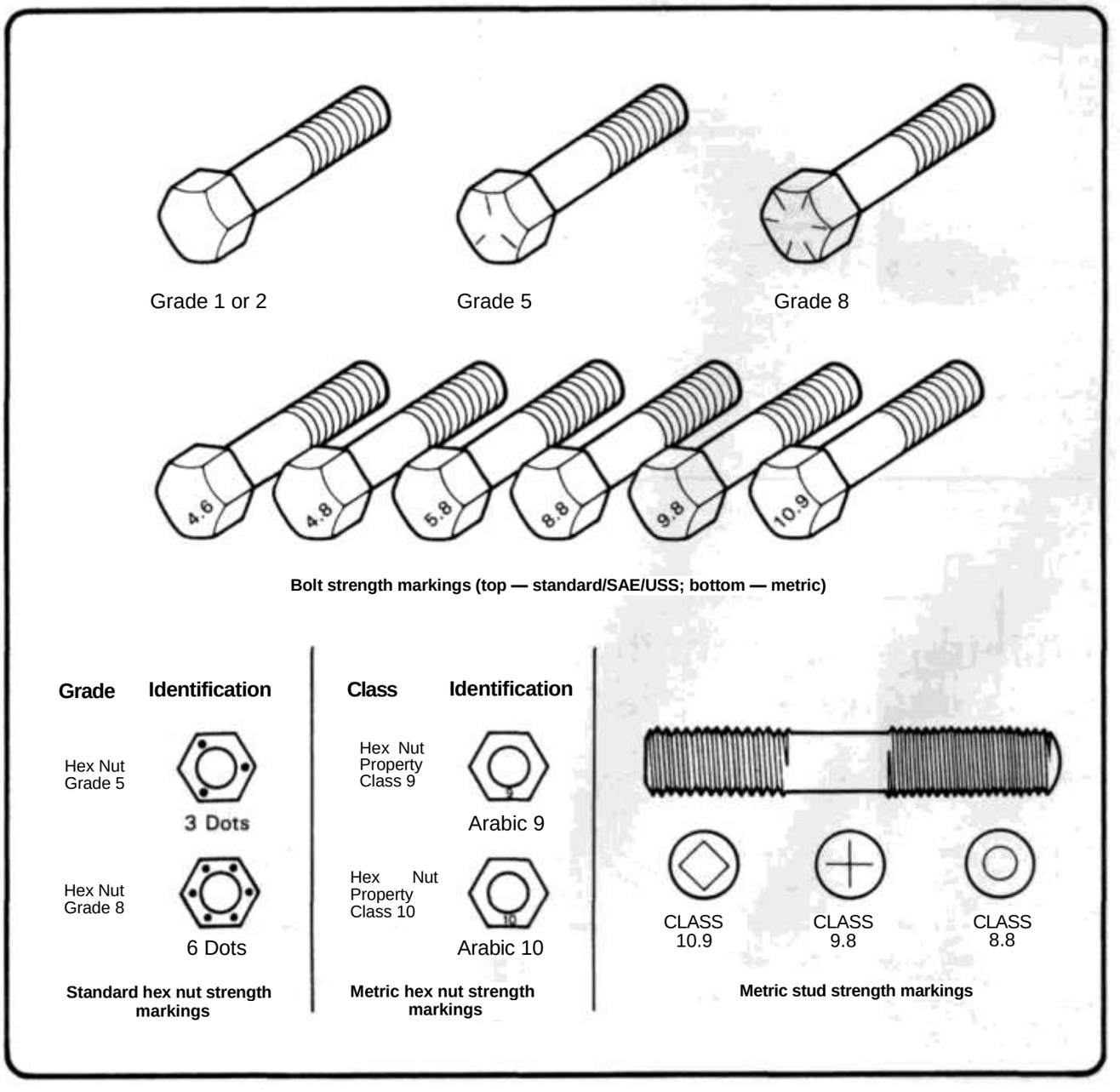
For a number of reasons, automobile manufacturers are making wider and wider use of metric fasteners. Therefore, it is important to be able to tell the difference between standard (sometimes called U.S. or SAE) and metric hardware, since they cannot be interchanged.

All bolts, whether standard or metric, are sized according to diameter, thread pitch and length. For example, a standard 1/2—13 x 1 bolt is 1/2 inch in diameter, has 13 threads per inch and is 1 inch long. An M 12 — 1.75 x 25 metric bolt is 12 mm in diameter, has a thread pitch of 1.75 mm (the distance between threads) and is 25 mm long. The two bolts are nearly identical, and easily confused, but they are not interchangeable.

In addition to the differences in diameter, thread pitch and length, metric and standard bolts can also be distinguished by examining the bolt heads. To begin with, the distance across the flats on a standard bolt head is measured in inches, while the same dimension on a metric bolt is sized in millimeters (the same is true for nuts). As a result, a standard wrench should not be used on a metric bolt and a metric wrench should not be used on a standard bolt. Also, most standard bolts have slashes radiating out from the center of the head to denote the grade or strength of the bolt, which is an indication of the amount of torque that can be applied to it. The greater the number of slashes, the greater the strength of the bolt. Grades 0 through 5 are commonly used on automobiles. Metric bolts have a property class (grade) number, rather than a slash, molded into their heads to indicate bolt strength. In this case, the higher the number, the stronger the bolt. Property class numbers 8.8, 9.8 and 10.9 are commonly used on automobiles.

Strength markings can also be used to distinguish standard hex nuts from metric hex nuts. Many standard nuts have dots stamped into one side, while metric nuts are marked with a number. The greater the number of dots, or the higher the number, the greater the strength of the nut.

Metric studs are also marked on their ends according to property class (grade). Larger studs are numbered (the same as metric bolts),



Bolt strength markings (top — standard/SAE/USS; bottom — metric)

while smaller studs carry a geometric code to denote grade.

It should be noted that many fasteners, especially Grades 0 through 2, have no distinguishing marks on them. When such is the case, the only way to determine whether it is standard or metric is to measure the thread pitch or compare it to a known fastener of the same size.

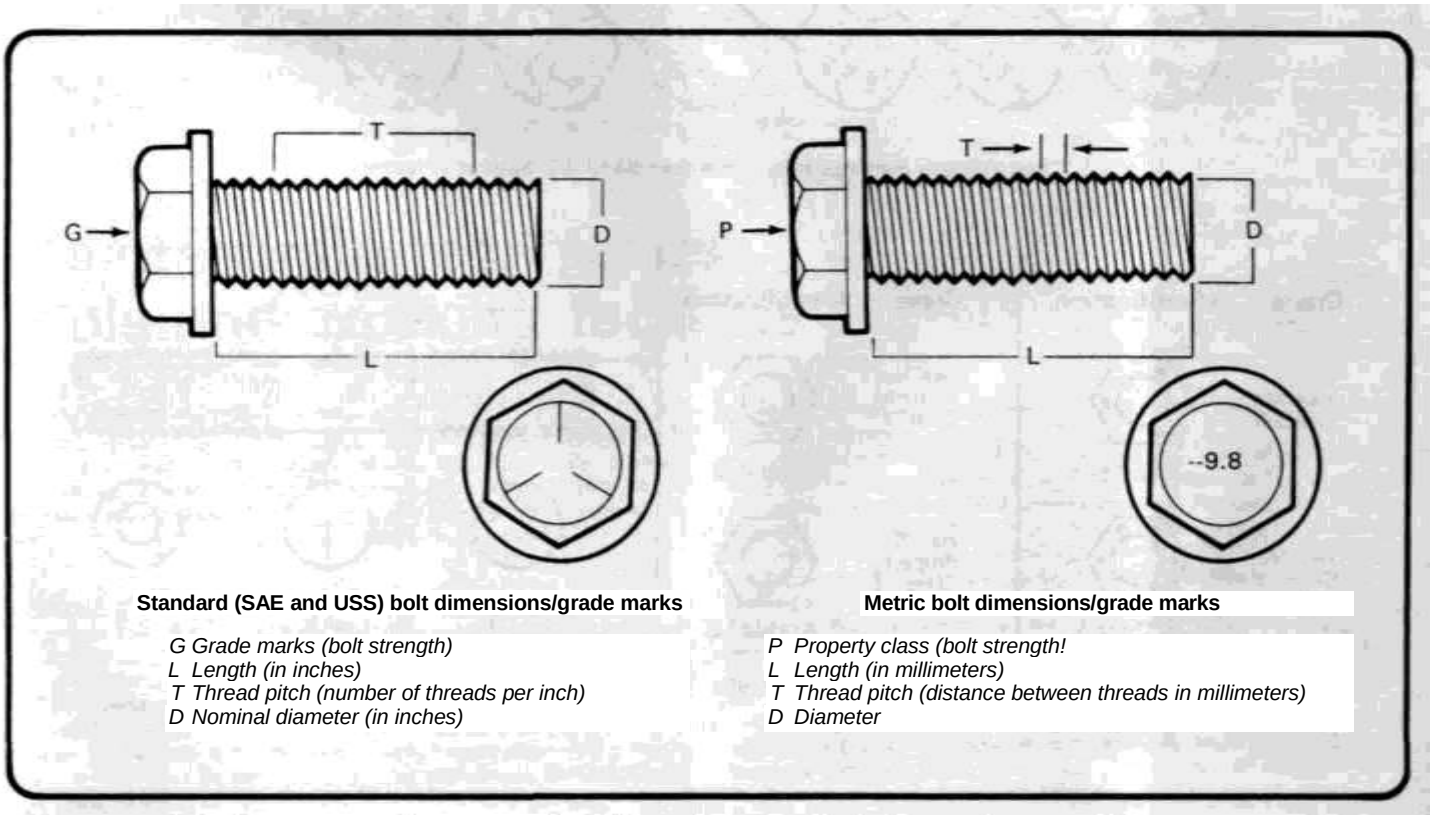
Standard fasteners are often referred to as SAE, as opposed to metric. However, it should be noted that SAE technically refers to a non-metric *fine thread* fastener only. Coarse thread non-metric fasteners are referred to as USS sizes.

Since fasteners of the same size (both standard and metric) may have different strength ratings, be sure to reinstall any bolts, studs or nuts removed from your vehicle in their original locations. Also, when replacing a fastener with a new one, make sure that the new one has a strength rating equal to or greater than the original.

Tightening sequences and procedures

Most threaded fasteners should be tightened to a specific torque value (torque is the twisting force applied to a threaded component such as a nut or bolt). Overtightening the fastener can weaken it and cause it to break, while undertightening can cause it to eventually come loose. Bolts, screws and studs, depending on the material they are made of and their thread diameters, have specific torque values, many of which are noted in the Specifications at the beginning of each Chapter. Be sure to follow the torque recommendations closely. For fasteners not assigned a specific torque, a general torque value chart is presented here as a guide. These torque values are for dry (unlubricated) fasteners threaded into steel or cast iron (not aluminum). As was previously mentioned, the size and grade of a fastener determine the amount of torque that can safely be applied to it. The figures listed here are approximate

Metric thread sizes	Ft-ib	Nm/m
M-6	6 to 9	9 to 12
M-8	14 to 21	19 to 28
M-10	28 to 40	38 to 54
M-12	50 to 71	68 to 96
M-14	80 to 140	109 to 154
Pipe thread sizes		
1/8	**5** to **8**	**7** to **10**
1/4	**12** to **18**	**1 7** to **24**
3/8	**22** to **33**	**30** to 44
1/2	**25** to **35**	**34** to **47**
U. S. thread sizes		
1/4-20	6 to 9	9 to 12
5/16-18	12 to 18	17 to 24
5 / 1 6 - 2 4	14 to 20	19 to 27
3/8-16	22 to 32	30 to 43
3 / 8 - 2 4	27 to 38	37 to 51
7/16-14	40 to 55	55 to 74
7/16 - 20	40 to 60	55 to 81
1/2-13	55 to 80	75 to 108



Standard (SAE and USS) bolt dimensions/grade marks

G Grade marks (bolt strength)
L Length (in inches)
T Thread pitch (number of threads per inch)
D Nominal diameter (in inches)

Metric bolt dimensions/grade marks

P Property class (bolt strength!
L Length (in millimeters)
T Thread pitch (distance between threads in millimeters)
D Diameter

for Grade 2 and Grade 3 fasteners. Higher grades can tolerate higher torque values.

Fasteners laid out in a pattern, such as cylinder head bolts, oil pan bolts, differential cover bolts, etc., must be loosened or tightened in sequence to avoid warping the component. This sequence will normally be shown in the appropriate Chapter. If a specific pattern is not given, the following procedures can be used to prevent warping.

Initially, the bolts or nuts should be assembled finger-tight only. Next, they should be tightened one full turn each, in a criss-cross or diagonal pattern. After each one has been tightened one full turn, return to the first one and tighten them all one-half turn, following the same pattern. Finally, tighten each of them one-quarter turn at a time until each fastener has been tightened to the proper torque. To loosen and remove the fasteners, the procedure would be reversed.

Component disassembly

Component disassembly should be done with care and purpose to help ensure that the parts go back together properly. Always keep track of the sequence in which parts are removed. Make note of special characteristics or marks on parts that can be installed more than one way, such as a grooved thrust washer on a shaft. It is a good idea to lay the disassembled parts out on a clean surface in the order that they were removed. It may also be helpful to make sketches or take instant photos of components before removal.

When removing fasteners from a component, keep track of their locations. Sometimes threading a bolt back in a part, or putting the washers and nut back on a stud, can prevent mix-ups later. If nuts and bolts cannot be returned to their original locations, they should be kept in a compartmented box or a series of small boxes. A cupcake or muffin tin is ideal for this purpose, since each cavity can hold the bolts and nuts from a particular area (i.e. oil pan bolts, valve cover bolts, engine mount bolts, etc.). A pan of this type is especially helpful when working on assemblies with very small parts, such as the carburetor, alternator, valve train or interior dash and trim pieces. The cavities can be marked with paint or tape to identify the contents.

Whenever wiring looms, harnesses or connectors are separated, it is a good idea to identify the two halves with numbered pieces of masking tape so they can be easily reconnected.

Gasket sealing surfaces

Throughout any vehicle, gaskets are used to seal the mating surfaces between two parts and keep lubricants, fluids, vacuum or pressure contained in an assembly.

Many times these gaskets are coated with a liquid or paste-type gasket sealing compound before assembly. Age, heat and pressure can sometimes cause the two parts to stick together so tightly that they are very difficult to separate. Often, the assembly can be loosened by striking it with a soft-face hammer near the mating surfaces. A regular hammer can be used if a block of wood is placed between the hammer and the part. Do not hammer on cast parts or parts that could be easily damaged. With any particularly stubborn part, always recheck to make sure that every fastener has been removed.

Avoid using a screwdriver or bar to pry apart an assembly, as they can easily mar the gasket sealing surfaces of the parts, which must remain smooth. If prying is absolutely necessary, use an old broom handle, but keep in mind that extra clean up will be necessary if the wood splinters.

After the parts are separated, the old gasket must be carefully scraped off and the gasket surfaces cleaned. Stubborn gasket material can be soaked with rust penetrant or treated with a special chemical to soften it so it can be easily scraped off. A scraper can be fashioned from a piece of copper tubing by flattening and sharpening one end. Copper is recommended because it is usually softer than the surfaces to be scraped, which reduces the chance of gouging the part. Some gaskets can be removed with a wire brush, but regardless of the method used, the mating surfaces must be left clean and smooth. If for some reason the gasket surface is gouged, then a gasket sealer thick enough to fill scratches will have to be used during reassembly of the components. For most applications, a non-drying (or semi-drying) gasket sealer should be used.

Hose removal tips

Warning: *If the vehicle is equipped with air conditioning, do not disconnect any of the A/C hoses without first having the system depressurized by a dealer service department or an air conditioning specialist.*

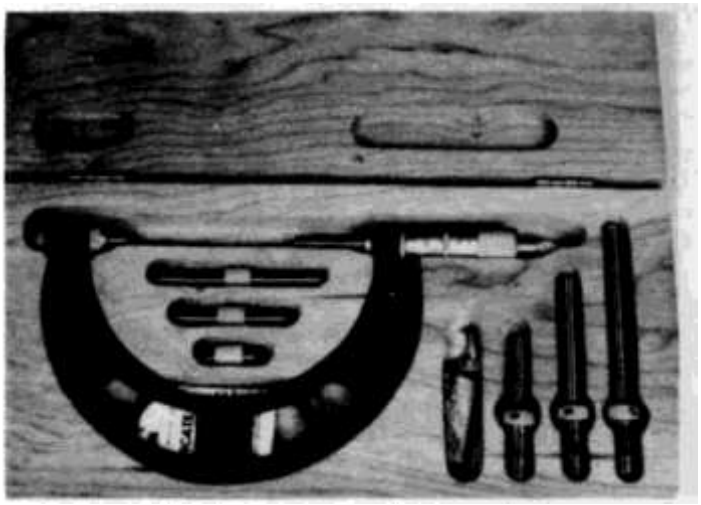
Hose removal precautions closely parallel gasket removal precautions. Avoid scratching or gouging the surface that the hose mates against or the connection may leak. This is especially true for radiator hoses. Because of various chemical reactions, the rubber in hoses can bond itself to the metal spigot that the hose fits over. To remove a hose, first loosen the hose clamps that secure it to the spigot. Then, with slip-joint pliers, grab the hose at the clamp and rotate it around the spigot. Work it back and forth until it is completely free, then pull it off. Silicone or other lubricants will ease removal if they can be applied between the hose and the outside of the spigot. Apply the same lubricant to the inside of the hose and the outside of the spigot to simplify installation.

As a last resort (and if the hose is to be replaced with a new one anyway), the rubber can be slit with a knife and the hose peeled from the spigot. If this must be done, be careful that the metal connection is not damaged.

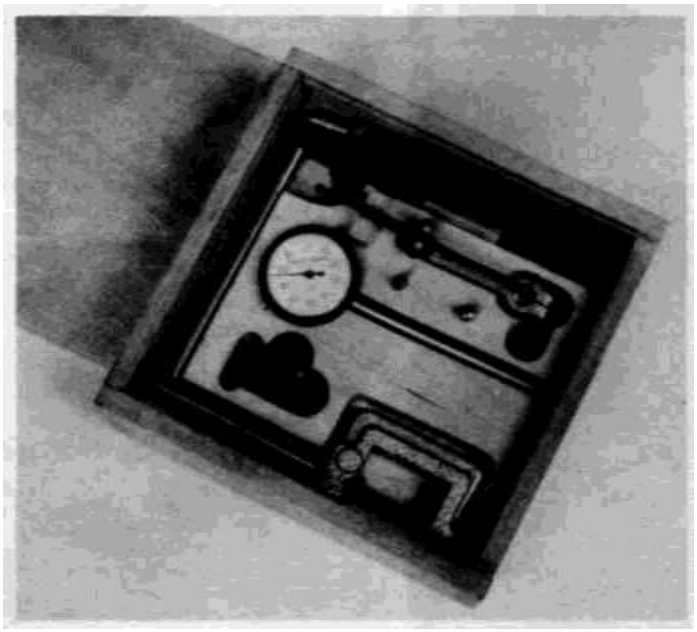
If a hose clamp is broken or damaged, do not reuse it. Wire-type clamps usually weaken with age, so it is a good idea to replace them with screw-type clamps whenever a hose is removed.

Tools

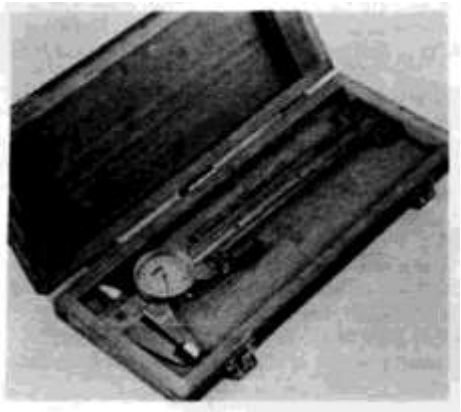
A selection of good tools is a basic requirement for anyone who plans to maintain and repair his or her own vehicle. For the owner who has few tools, the initial investment might seem high, but when compared to the spiraling costs of professional auto maintenance and repair, it is a wise one.



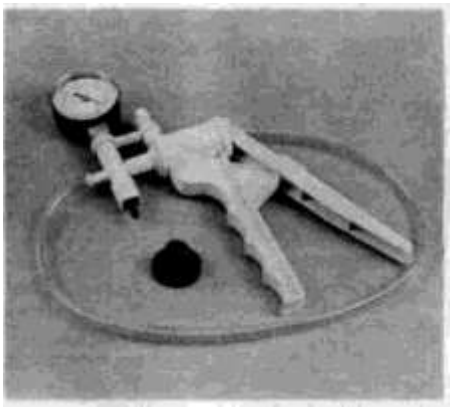
Micrometer set



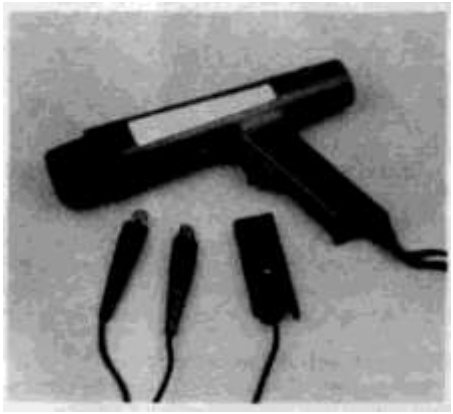
Dial indicator set



Dial caliper

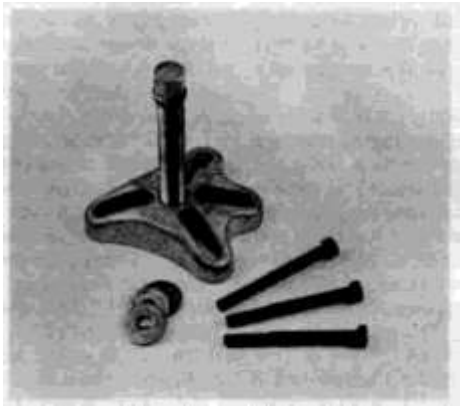


Hand-operated vacuum pump

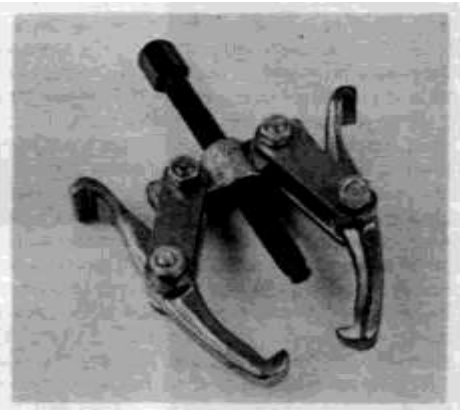


Timing light

Compression gauge with spark plug hole adapter

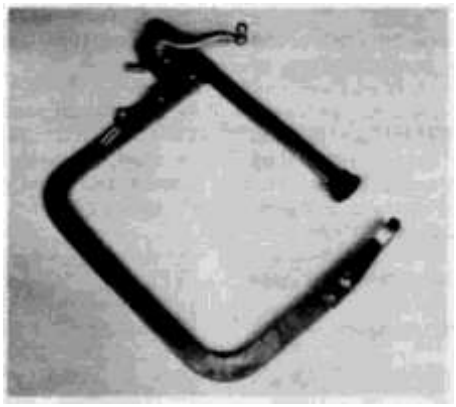


Damper/steering wheel puller

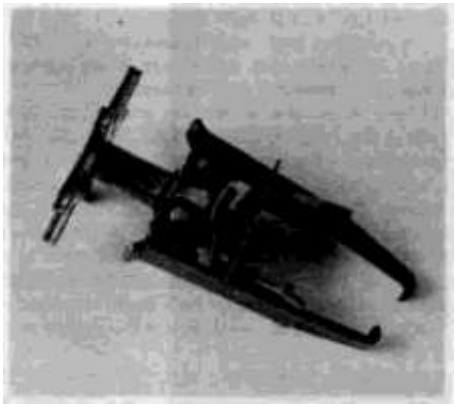


General purpose puller

Hydraulic lifter removal tool

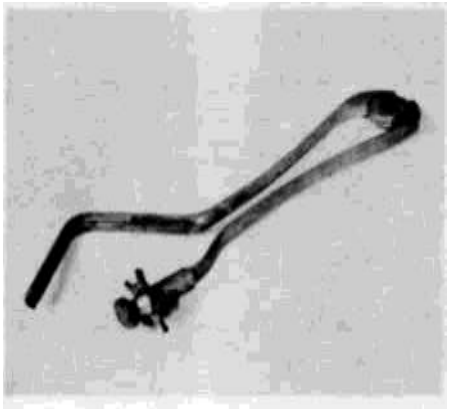


Valve spring compressor

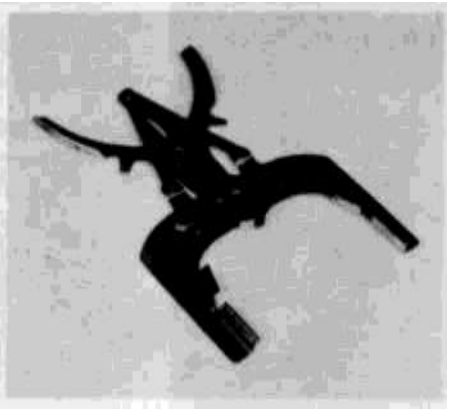


Valve spring compressor

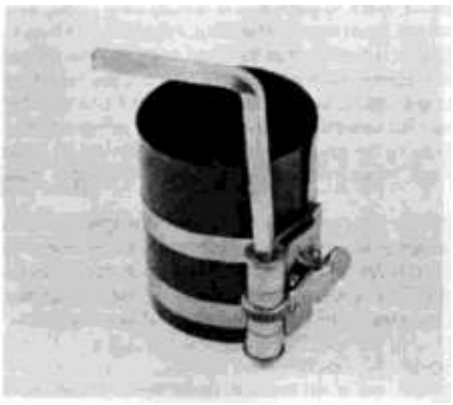
Ridge reamer



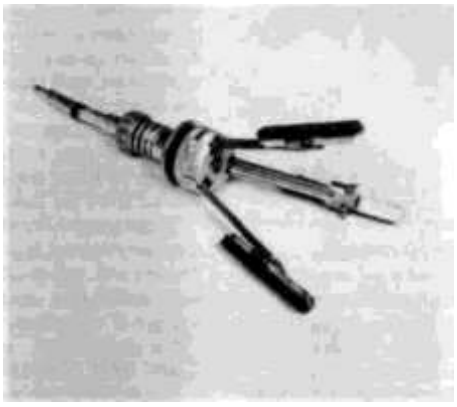
Piston ring groove cleaning tool



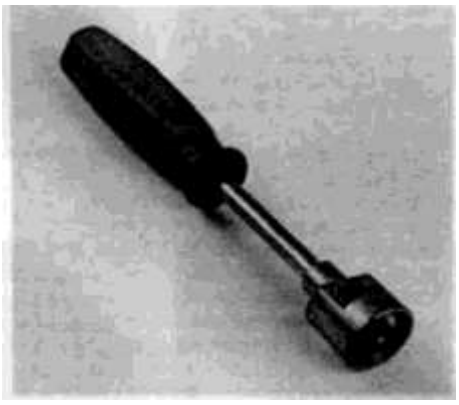
Ring removal/installation tool



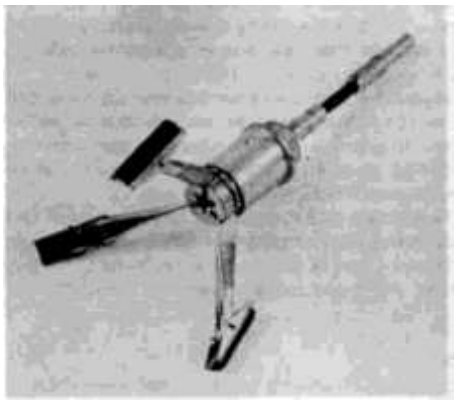
Ring compressor



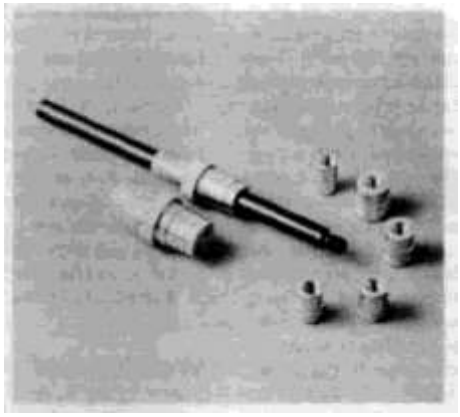
Cylinder hone



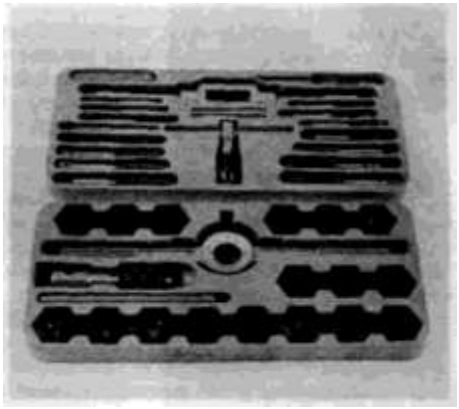
Brake hold-down spring tool



Brake cylinder hone



Clutch plate alignment tool



Tap and die set

To help the owner decide which tools are needed to perform the tasks detailed in this manual, the following tool lists are offered: *Maintenance and minor repair, Repair/overhaul* and *Special.*

The newcomer to practical mechanics should start off with the maintenance and minor repair tool kit, which is adequate for the simpler jobs performed on a vehicle. Then, as confidence and experience grow, the owner can tackle more difficult tasks, buying additional tools as they are needed. Eventually the basic kit will be expanded into the repair and overhaul tool set. Over a period of time, the experienced do-it-yourselfer will assemble a tool set complete enough for most repair and overhaul procedures and will add tools from the special category when it is felt that the expense is justified by the frequency of use.

Maintenance and minor repair tool kit

The tools in this list should be considered the minimum required for performance of routine maintenance, servicing and minor repair work. We recommend the purchase of combination wrenches (box-end and open-end combined in one wrench). While more expensive than open end wrenches, they offer the advantages of both types of wrench.

Combination wrench set (1/4-inch to 1 inch or 6 mm to 19 mm)
Adjustable wrench, 8 inch
Spark plug wrench with rubber insert
Spark plug gap adjusting tool
Feeler gauge set
Brake bleeder wrench
Standard screwdriver 15/16-inch x 6 inch)
Phillips screwdriver (No. 2x6 inch)
Combination pliers — 6 inch
Hacksaw and assortment of blades
Tire pressure gauge
Grease gun
Oil can
Fine emery cloth
Wire brush
Battery post and cable cleaning tool
Oil filter wrench
Funnel (medium size)
Safety goggles
Jackstands (2)
Drain pan

Note: *If basic tune-ups are going to be part of routine maintenance, it will be necessary to purchase a good quality stroboscopic timing light and combination tachometer/dwell meter. Although they are included in the list of special tools, it is mentioned here because they are absolutely necessary for tuning most vehicles properly.*

Repair and overhaul tool set

These tools are essential for anyone who plans to perform major repairs and are in addition to those in the maintenance and minor repair tool kit. Included is a comprehensive set of sockets which, though expensive, are invaluable because of their versatility, especially when various extensions and drives are available. We recommend the 1 /2-inch drive over the 3/8-inch drive. Although the larger drive is bulky and more expensive, it has the capacity of accepting a very wide range of large sockets. Ideally, however, the mechanic should have a 3/8-inch drive set and a 1/2-inch drive set.

Socket set(s)
Reversible ratchet
Extension — Winch
Universal joint
Torque wrench (same size drive as sockets)
Ball peen hammer — 8 ounce
Soft-face hammer (plastic/rubber)
Standard screwdriver (1/4-inch x 6 inch)
Standard screwdriver (stubby — 5/16-inch)
Phillips screwdriver (No. 3x8 inch)
Phillips screwdriver (stubby — No. 2)

Pliers — vise grip
Pliers — lineman's
Pliers — needle nose
Pliers — snap-ring (internal and external)
Cold chisel - 1/2-inch
Scribe
Scraper (made from flattened copper tubing)
Centerpunch
Pin punches (1/16, 1/8, 3/16-inch)
Steel rule/straightedge — 12 inch
Allen wrench set (1/8 to 3/8-inch or 4 mm to 10 mm)
A selection of files
Wire brush (large)
Jackstands (second set)
Jack (scissor or hydraulic type)

Note: *Another tool which is often useful is an electric drill motor with a chuck capacity of 3/8-inch and a set of good quality drill bits.*

Special tools

The tools in this list include those which are not used regularly, are expensive to buy, or which need to be used in accordance with their manufacturer's instructions. Unless these tools will be used frequently, it is not very economical to purchase many of them. A consideration would be to split the cost and use between yourself and a friend or friends. In addition, most of these tools can be obtained from a tool rental shop on a temporary basis.

This list primarily contains only those tools and instruments widely available to the public, and not those special tools produced by the vehicle manufacturer for distribution to dealer service departments. Occasionally, references to the manufacturer's special tools are inluded in the text of this manual. Generally, an alternative method of doing the job without the special tool is offered. However, sometimes there is no alternative to their use. Where this is the case, and the tool cannot be purchased or borrowed, the work should be turned over to the dealer service department or an automotive repair shop.

Valve spring compressor
Piston ring groove cleaning tool
Piston ring compressor
Piston ring installation tool
Cylinder compression gauge
Cylinder ridge reamer
Cylinder surfacing hone
Cylinder bore gauge
Micrometers and/or dial calipers
Hydraulic lifter removal tool
Balljoint separator
Universal-type puller
Impact screwdriver
Dial indicator set
Stroboscopic timing light (inductive pick-up)
Hand operated vacuum/pressure pump
Tachometer/dwell meter
Universal electrical multimeter
Cable hoist
Brake spring removal and installation tools
Floor jack

Buying tools

For the do-it-yourselfer who is just starting to get involved in vehicle maintenance and repair, there are a number of options available when purchasing tools. If maintenance and minor repair is the extent of the work to be done, the purchase of individual tools is satisfactory. If, on the other hand, extensive work is planned, it would be a good idea to purchase a modest tool set from one of the large retail chain stores. A set can usually be bought at a substantial savings over the individual tool prices, and they often come with a tool box. As additional tools are needed, add-on sets, individual tools and a larger tool box can be purchased to expand the tool selection. Building a tool set gradually allows the cost of the tools to be spread over a longer period of time and gives the mechanic the freedom to choose only those tools that will actually be used.

Tool stores will often be the only source of some of the special tools that are needed, but regardless of where tools are bought, try to avoid cheap ones, especially when buying screwdrivers and sockets, because they won't last very long. The expense involved in replacing cheap tools will eventually be greater than the initial cost of quality tools.

Care and maintenance of tools

Good tools are expensive, so it makes sense to treat them with respect. Keep them clean and in usable condition and store them properly when not in use. Always wipe off any dirt, grease or metal chips before putting them away. Never leave tools lying around in the work area. Upon completion of a job, always check closely under the hood for tools that may have been left there so they won't get lost during a test drive.

Some tools, such as screwdrivers, pliers, wrenches and sockets, can be hung on a panel mounted on the garage or workshop wall, while others should be kept in a tool box or tray. Measuring instruments, gauges, meters, etc. must be carefully stored where they cannot be damaged by weather or impact from other tools.

When tools are used with care and stored properly, they will last a very long time. Even with the best of care, though, tools will wear out if used frequently. When a tool is damaged or worn out, replace it. Subsequent jobs will be safer and more enjoyable if you do.

Working facilities

Not to be overlooked when discussing tools is the workshop. If anything more than routine maintenance is to be carried out, some sort of suitable work area is essential.

It is understood, and appreciated, that many home mechanics do not have a good workshop or garage available, and end up removing an engine or doing major repairs outside. It is recommended, however, that the overhaul or repair be completed under the cover of a roof.

A clean, flat workbench or table of comfortable working height is an absolute necessity. The workbench should be equipped with a vise that has a jaw opening of at least four inches.

As mentioned previously, some clean, dry storage space is also required for tools, as well as the lubricants, fluids, cleaning solvents, etc. which will soon become necessary.

Sometimes waste oil and fluids, drained from the engine or cooling system during normal maintenance or repairs, present a disposal problem. To avoid pouring them on the ground or into a sewage system, pour the used fluids into large containers, seal them with caps and take them to an authorized disposal site or recycling center. Plastic jugs, such as old antifreeze containers, are ideal for this purpose.

Always keep a supply of old newspapers and clean rags available. Old towels are excellent for mopping up spills. Many mechanics use rolls of paper towels for most work because they are readily available and disposable. To help keep the area under the vehicle clean, a large cardboard box can be cut open and flattened to protect the garage or shop floor.

Whenever working over a painted surface, such as when leaning over a fender to service something under the hood, always cover it with an old blanket or bedspread to protect the finish. Vinyl covered pads, made especially for this purpose, are available at auto parts stores.

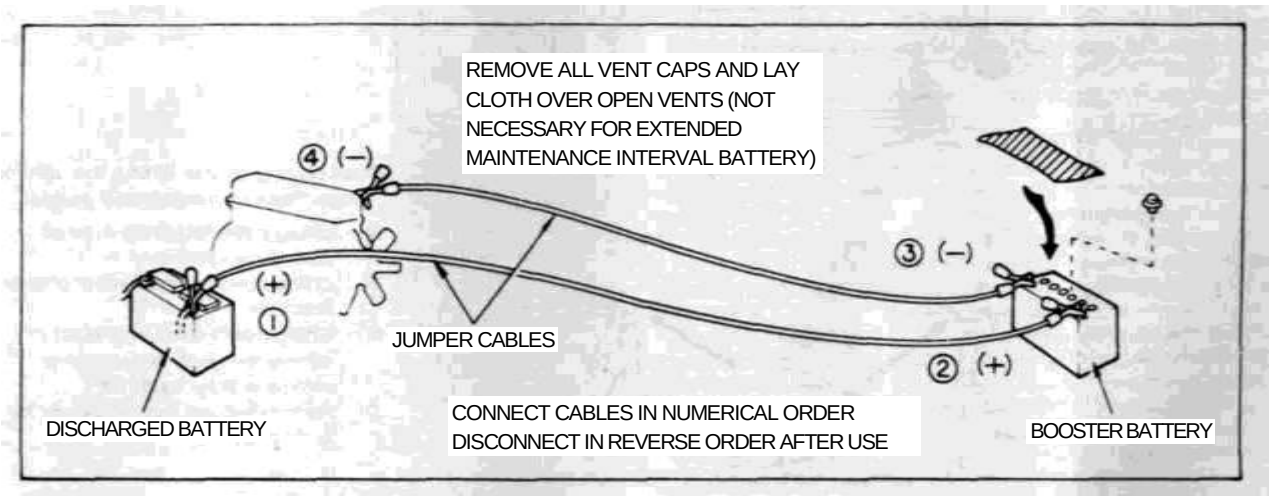
Booster battery (jump) starting

Certain precautions must be observed when using a booster battery to jump start a vehicle.

a) The booster battery must be the same voltage (1 2-volts) as the dead one in the vehicle.
b) If the booster battery is installed in another vehicle, the two vehicles must not be touching one another.
c) The lights, heater, air conditioner and all other electrical components must be turned off.
d) The transaxle must be in Neutral (manual) or Park (automatic).
e) The ignition switch must be turned to the Off position before the jumper cables are hooked up.
f) Batteries contain sulfuric acid, which is poisonous and corrosive. Protect your eyes with safety glasses or goggles. Avoid spilling acid on your skin, clothing or the vehicle. Should you accidentally get acid on your skin or in your eyes, remove any contaminated clothing immediately and flush the exposed area with water for at least 1 5 minutes, then get immediate medical attention. If possible, continue to apply water to the affected area with a sponge or damp cloth enroute to the medical office.
g) The vent caps must be removed and the vent holes must be covered by a cloth. h) There must be no smoking or open flames in the vicinity of the battery. The hydrogen gas produced by the battery will explode if exposed to a flame or spark. If the engine in the vehicle with the booster battery is not running, start it and let it run for a few minutes. Once it is warmed up, turn it off. Connect the jumper cables exactly as shown **(see illustration).** Connect the red (positive) jumper cable to the *Positive* (+) terminals of each battery.

Connect one end of the black jumper cable to the *negative* (-) terminal of the booster battery. The other end of this cable should be connected to a good ground on the vehicle to be started, such as a bolt or bracket on the engine block (the engine removal hook on the front left corner of the cylinder head is a good ground). Make sure that the cable does not come into contact with any moving parts of the engine.

Start the engine in the vehicle with the booster battery and, during jump starting, run it at about 2000 rpm. Start the engine with the dead battery. Let it idle, then disconnect the jumper cables in the reverse order of connection.



Before hooking up jumper cables, carefully read the precautions and the procedure provided in the accompanying text and then attach the cables in the exact order shown above

Jacking and towing

Jacking

The jack supplied with the vehicle, which is located in the right front corner of the front luggage compartment, should only be used for raising the vehicle when changing a tire or placing jackstands under the frame. **Caution:** *Never work under the vehicle or start the engine while this jack is being used as the only means of support.*

The vehicle should be on level ground with the wheels blocked and the transaxle in Park (automatic) or Reverse (manual). If the wheel is being replaced, break the wheel nuts loose but do not remove them until the vehicle is jacked up.

Block the front and rear of the wheel opposite the one being removed before operating the jack. Place the jack head at the proper jacking point nearest the wheel you intend to remove **(see illustrations). Caution:** *Improper placement of the jack head can cause vehicle damage. Refer to your owner's manual for instructions regarding the operation of the jack in your vehicle.*

Unless you are in an emergency situation, such as by the side of the road with a flat tire, always raise the vehicle with a floor jack or, if you have access to one, a hydraulic hoist. When using a floor jack or a hydraulic hoist, be sure to raise the vehicle only at the indicated points **(see illustration).** If you use a floor jack, be sure to use jackstands at the recommended points. Do not place a jack or jackstand in the vicinity of the fuel tank, filler neck, exhaust system or underbody.

Towing

Should your vehicle break down and require towing, contact any Toyota dealer or commercial tow truck service. They have the proper equipment to ensure that your vehicle is not damaged while being towed. Commercial operators are also aware of the local and state laws pertinent to towing.

Even though most operators know the correct procedure for towing your vehicle, they can make mistakes. So, instead of risking damage to your vehicle, make sure that you are aware of the following basic precautions.

A safety chain system specifically designed for towing must be used and must be attached to the main structural members of the vehicle- not the bumper or brackets.

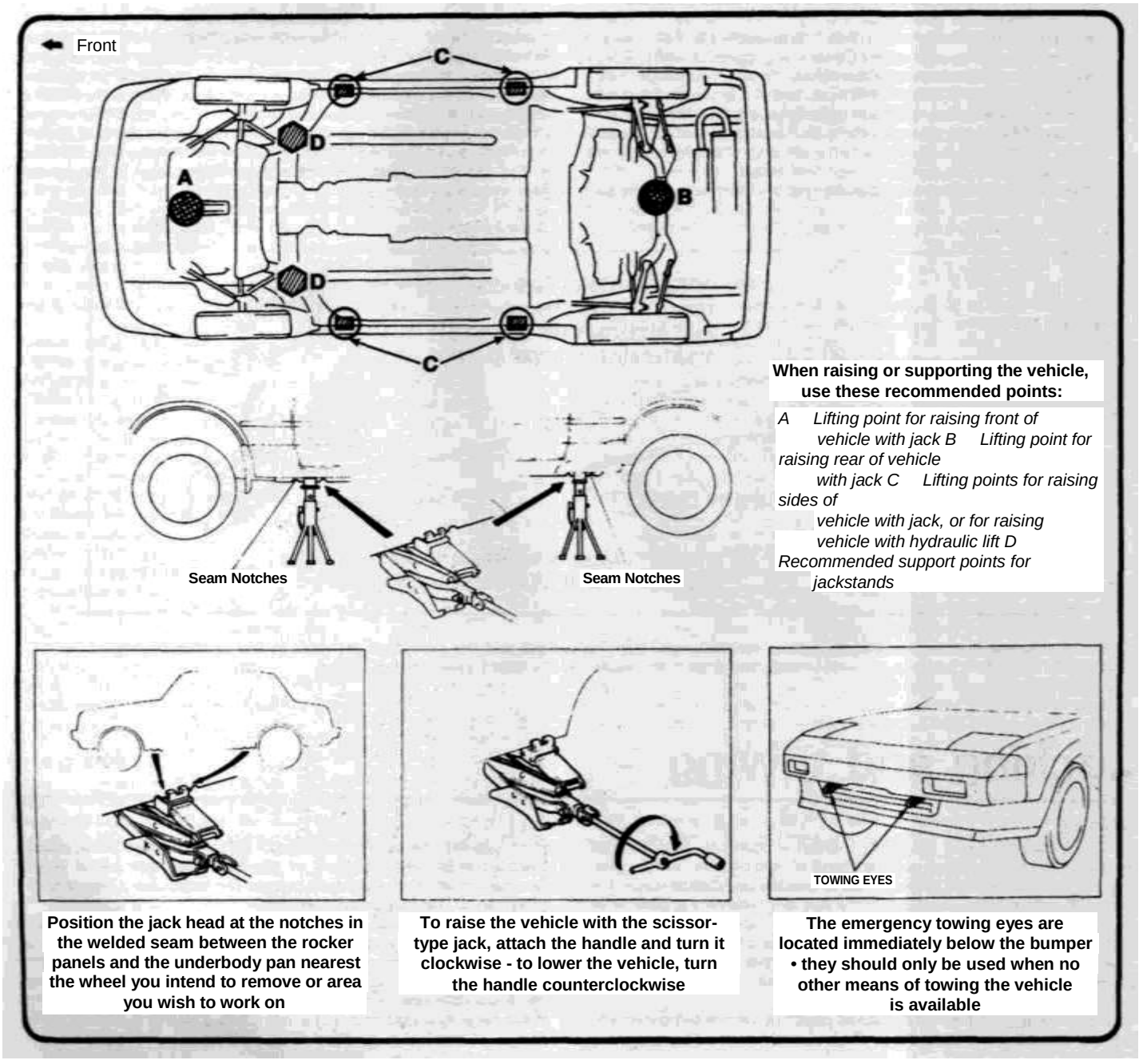
The vehicle can be towed from the rear only. The wheels and axle on the ground must be in good condition. If they are damaged, use a towing dolly.

If the vehicle is towed with the front wheels on the ground, the ignition key must be in the Acc position - the steering lock mechanism is not strong enough to hold the front wheels straight while towing. If necessary, use a dolly.

Never tow a vehicle with the front end raised - it may damage the front bumper.

In an emergency situation in which no commercial towing service is available, the vehicle can be attached to a towing chain with one, or both, of the towing eyes (see illustration) under the front bumper. This method can be employed only on hard surfaced roads. A driver must be in the vehicle to steer it and operate the brakes. If the engine is not running, the power assist for the brakes will not work, so braking will be much harder than usual. Towing in this manner is impossible if the wheels, axles, drivetrain or brakes are damaged. Before towing, release the parking brake and place the transaxle in Neutral. Turn the key to the Acc (engine off) or On (engine running) position.

Remember that safety is the major consideration when towing and all applicable state and local laws must be obeyed. Never attempt to tow this vehicle without the proper equipment.



Automotive chemicals and lubricants

A number of automotive chemicals and lubricants are available for use during vehicle maintenance and repair. They include a wide variety of products ranging from cleaning solvents and degreasers to lubricants and protective sprays for rubber, plastic and vinyl.

Cleaners

Carburetor cleaner and choke cleaner is a strong solvent for gum, varnish and carbon. Most carburetor cleaners leave a dry-type lubricant film which will not harden or gum up. Because of this film it is not recommended for use on electrical components.

Brake system cleaner is used to remove grease and brake fluid from the brake system where clean surfaces are absolutely necessary. It leaves no residue and often eliminates brake squeal caused by contaminants.

Electrical cleaner removes oxidation, corrosion and carbon deposits from electrical contacts, restoring full current flow. It can also be used to clean spark plugs, carburetor jets, voltage regulators and other parts where an oil free surface is desired.

Demoisturants remove water and moisture from electrical components such as alternators, voltage regulators, electrical connectors and fuse blocks. It is non-conductive, non-corrosive and non-flammable.

Degreasers are heavy-duty solvents used to remove grease from the outside of the engine and from chassis components. They can be sprayed or brushed on, and, depending on the type, are rinsed off either with water or solvent.

Lubricants

Motor oil is the lubricant formulated for use in engines. It normally contains a wide variety of additives to prevent corrosion and reduce foaming and wear. Motor oil comes in various weights (viscosity ratings) from 5 to 80. The recommended weight of the oil depends on the season, temperature and the demands on the engine. Light oil is used in cold climates and under light load conditions. Heavy oil is used in hot climates and where high loads are encountered. Multi-viscosity oils are designed to have characteristics of both light and heavy oils and are available in a number of weights from 5W-20 to 20W-50.

Gear oil is designed to be used in differentials, manual transaxles and other areas where high-temperature lubrication is required.

Chassis and wheel bearing grease is a heavy grease used where increased loads and friction are encountered, such as for wheel bearings, balljoints, tie rod ends and universal joints.

High temperature wheel bearing grease is designed to withstand the extreme temperatures encountered by wheel bearings in disc brake equipped vehicles. It usually contains molybdenun disulfide (moly), which is a dry-type lubricant.

White grease is a heavy grease for metal to metal applications where water is a problem. White grease stays soft under both low and high temperatures (usually from -100°F to + 190°F), and will not wash off or dilute in the presence of water.

Assembly lube is a special extreme pressure lubricant, usually containing moly, used to lubricate high-load parts such as main and rod bearings and cam lobes for initial start-up of a new engine. The assembly lube lubricates the parts without being squeezed out or washed away until the engine oiling system begins to function.

Silicone lubricants are used to protect rubber, plastic, vinyl and nylon parts.

Graphite lubricants are used where oils cannot be used due to contamination problems, such as in locks. The dry graphite will lubricate metal parts while remaining uncontaminated by dirt, water, oil or acids. It is electrically conductive and will not foul electrical contacts in locks such as the ignition switch.

Moly penetrants loosen and lubricate frozen, rusted and corroded fasteners and prevent future rusting or freezing.

Heat-sink grease is a special electrically non-conductive grease that is used for mounting HEI ignition modules where it is essential that heat be transferred away from the module.

Sealants

RTV sealant is one of the most widely used gasket compounds. Made from silicone, RTV is air curing, it seals, bonds, waterproofs, fills surface irregularities, remains flexible, doesn't shrink, is relatively easy to remove, and is used as a supplementary sealer with almost all low and medium temperature gaskets.

Anaerobic sealant is much like RTV in that it can be used either to seal gaskets or to form gaskets by itself. It remains flexible, is solvent resistant and fills surface imperfections. The difference between an anaerobic sealant and an RTV-type sealant is in the curing. RTV cures when exposed to air, while an anaerobic sealant cures only in the absence of air. This means that an anaerobic sealant cures only after the assembly of parts, sealing them together.

*Thread and pipe sealant*is used for sealing hydraulic and pneumatic fittings and vacuum lines. It is usually made from a teflon compound, and comes in a spray, a paint-on liquid and as a wrap-around tape.

Chemicals

Anti-seize compound prevents seizing, galling, cold welding, rust and corrosion in fasteners. High temperature anti-seize, usually made with copper and graphite lubricants, is used for exhaust system and manifold bolts.

Anaerobic locking compounds are used to keep fasteners from vibrating or working loose, and cure only after installation, in the absence of air. Medium strength locking compound is used for small nuts, bolts and screws that you expect to be removing later. High strength locking compound is for large nuts, bolts and studs which you don't intend to be removing on a regular basis.

Oil additives range from viscosity index improvers to chemical treatments that claim to reduce internal engine friction. It should be noted that most oil manufacturers caution against using additives with their oils.

Gas additives perform several functions, depending on their chemical makeup. They usually contain solvents that help dissolve gum and varnish that build up on carburetor and intake parts. They also serve to break down carbon deposits that form on the inside surfaces of the combustion chambers. Some additives contain upper cylinder lubricants for valves and piston rings, and others chemicals to remove condensation from the gas tank.

Miscellaneous

Brake fluid is specially formulated hydraulic fluid that can withstand the heat and pressure encountered in brake systems. Care must be taken that this fluid does not come in contact with painted surfaces or plastics. An opened container should always be resealed to prevent contamination by water or dirt.

Weatherstrip adhesive is used to bond weatherstripping around doors, windows and trunk lids. It is sometimes used to attach trim pieces.

Undercoating is a petroleum-based tar-like substance that is designed to protect metal surfaces on the underside of the vehicle from corrosion. It also acts as a sound-deadening agent by insulating the bottom of the vehicle.

Waxes and polishes are used to help protect painted and plated surfaces from the weather. Different types of paint may require the use' of different types of wax and polish. Soma polishes utilize a chemical or abrasive cleaner to help remove the top layer of oxidized (dull) paint on older vehicles. In recent years many non-wax polishes that contain a wide variety of chemicals such as polymers and silicones have been introduced. These non-wax polishes are usually easier to apply and last longer than conventional waxes and polishes.

Safety first!

Regardless of how enthusiastic you may be about getting on with the job at hand, take the time to ensure that your safety is not jeopardized. A moment's lack of attention can result in an accident, as can failure to observe certain simple safety precautions. The possibility of an accident will always exist, and the following points should not be considered a comprehensive list of all dangers. Rather, they are intended to make you aware of the risks and to encourage a safety conscious approach to all work you carry out on your vehicle.

Essential DOs and DON'Ts

DON'T rely on a jack when working under the vehicle. Always use approved jackstands to support the weight of the vehicle and place them under the recommended lift or support points. DON'T attempt to loosen extremely tight fasteners (i.e. wheel lug nuts) while the vehicle is on a jack — it may fall.

DON'T start the engine without first making sure that the transmission is in Neutral (or Park where applicable) and the parking brake is set. DON'T remove the radiator cap from a hot cooling system — let it cool or cover it with a cloth and release the pressure gradually. DON'T attempt to drain the engine oil until you are sure it has cooled to the point that it will not burn you.

DON'T touch any part of the engine or exhaust system until it has cooled sufficiently to avoid burns.

DON'T siphon toxic liquids such as gasoline, antifreeze and brake fluid by mouth, or allow them to remain on your skin. DON'T inhale brake lining dust — it is potentially hazardous (see *Asbestos* below)

DON'T allow spilled oil or grease to remain on the floor — wipe it up before someone slips on it.

DON'T use loose fitting wrenches or other tools which may slip and cause injury.

DON'T push on wrenches when loosening or tightening nuts or bolts. Always try to pull the wrench toward you. If the situation calls for pushing the wrench away, push with an open hand to avoid scraped knuckles if the wrench should slip.

DON'T attempt to lift a heavy component alone — get someone to help you.

DON'T rush or take unsafe shortcuts to finish a job. DON'T allow children or animals in or around the vehicle while you are working on it.

DO wear eye protection when using power tools such as a drill, sander, bench grinder, etc. and when working under a vehicle. DO keep loose clothing and long hair well out of the way of moving parts.

DO make sure that any hoist used has a safe working load rating adequate for the job.

DO get someone to check on you periodically when working alone on a vehicle.

DO carry out work in a logical sequence and make sure that everything is correctly assembled and tightened.

DO keep chemicals and fluids tightly capped and out of the reach of children and pets.

DO remember that your vehicle's safety affects that of yourself and others. If in doubt on any point, get professional advice.

Asbestos

Certain friction, insulating, sealing, and other products — such as brake linings, brake bands, clutch linings, torque converters, gaskets, etc. — contain asbestos. *Extreme care must be taken to avoid inhalation of dust from such products since it is hazardous to health.* If in doubt, assume that they *do* contain asbestos.

Fire

Remember at all times that gasoline is highly flammable. Never smoke or have any kind of open flame around when working on a vehicle. But the risk does not end there. A spark caused by an electrical short circuit, by two metal surfaces contacting each other, or even by static electricity built up in your body under certain conditions, can ignite gasoline vapors, which in a confined space are highly explosive. Do not, under any circumstances, use gasoline for cleaning parts. Use an approved safety solvent.

Always disconnect the battery ground (-) cable *at the battery* before working on any part of the fuel system or electrical system. Never risk spilling fuel on a hot engine or exhaust component.

It is strongly recommended that a fire extinguisher suitable for use on fuel and electrical fires be kept handy in the garage or workshop at all times. Never try to extinguish a fuel or electrical fire with water.

Fumes

Certain fumes are highly toxic and can quickly cause unconsciousness and even death if inhaled to any extent. Gasoline vapor falls into this category, as do the vapors from some cleaning solvents. Any draining or pouring of such volatile fluids should be done in a well ventilated area.

When using cleaning fluids and solvents, read the instructions on the container carefully. Never use materials from unmarked containers.

Never run the engine in an enclosed space, such as a garage. Exhaust fumes contain carbon monoxide, which is extremely poisonous. If you need to run the engine, always do so in the open air, or at least have the rear of the vehicle outside the work area.

If you are fortunate enough to have the use of an inspection pit, never drain or pour gasoline and never run the engine while the vehicle is over the pit. The fumes, being heavier than air, will concentrate in the pit with possibly lethal results.

The battery

Never create a spark or allow a bare light bulb near a battery. They normally give off a certain amount of hydrogen gas, which is highly explosive.

Always disconnect the battery ground (-) cable *at the battery* before working on the fuel or electrical systems.

If possible, loosen the filler caps or cover when charging the battery from an external source (this does not apply to sealed or maintenance-free batteries). Do not charge at an excessive rate or the battery may burst.

Take care when adding water to a non maintenance-free battery and when carrying a battery. The electrolyte, even when diluted, is very corrosive and should not be allowed to contact clothing or skin.

Always wear eye protection when cleaning the battery to prevent the caustic deposits from entering your eyes.

Household current

When using an electric power tool, inspection light, etc., which operates on household current, always make sure that the tool is correctly connected to its plug and that, where necessary, it is properly grounded. Do not use such items in damp conditions and, again, do not create a spark or apply excessive heat in the vicinity of fuel or fuel vapor.

Secondary ignition system voltage

A severe electric shock can result from touching certain parts of the ignition system (such as the spark plug wires) when the engine is running or being cranked, particularly if components are damp or the insulation is defective. In the case of an electronic ignition system, the secondary system voltage is much higher and could prove fatal.

Conversion factors

Length (distance)

Inches (in)	X	25.4	= Millimetres (mm)	X 0.0394	= Inches (in)
Feet (ft)	X	0.305	= Metres (m)	X 3.281	= Feet (ft)
Miles	X	1.609	= Kilometres (km)	X 0.621	= Miles

Volume (capacity)

Cubic inches (cu in; in^3)	X	16.387	= Cubic centimetres (cc; cm^3)	X 0.061	= Cubic inches (cu in; in^3)
Imperial pints (Imp pt)	X	0.568	= Litres (l)	X 1.76	= Imperial pints (Imp pt)
Imperial quarts (Imp qt)	X	1.137	= Litres (l)	X 0.88	= Imperial quarts (Imp qt)
Imperial quarts (Imp qt) US	X	1.201	= US quarts (US qt)	X 0.833	= Imperial quarts (Imp qt)
quarts (US qt) Imperial	X	0.946	= Litres (l)	X 1.057	= US quarts (US qt)
gallons (Imp gal) Imperial	X	4.546	= Litres (l)	X 0.22	= Imperial gallons (Imp gal)
gallons (Imp gal) US gallons	X	1.201	= US gallons (US gal)	X 0.833	- Imperial gallons (Imp gal)
(US gal)	X	3.785	= Litres (l)	X 0.264	= US gallons (US gal)

Mass (weight)

Ounces (oz)	X	28.35	= Grams (g)	X 0.035	= Ounces (oz)
Pounds (lb)	0.454	= Kilograms (kg)		X 2.205	= Pounds (lb)

Force

Ounces-force (ozf; oz)	X	0.278	= Newtons (N)	X 3.6	= Ounces-force (ozf; oz)
Pounds-force (lbf; lb)	X	4.448	= Newtons (N)	X 0.225	= Pounds-force (lbf; lb)
Newtons (N)	X	0.1	= Kilograms-force (kgf; kg)	X 9.81	= Newtons (N)

Pressure

Pounds-force per square inch (psi; lbf/in^2; lb/in^2)	X	0.070	= Kilograms-force per square centimetre (kgf/cm^2; kg/cm^2)	X 14.223	= Pounds-force per square inch (psi; lbf/in^2; lb/in^2)
Pounds-force per square inch (psi; lbf/in^2; lb/in^2) Pounds-force per square inch (psi; lbf/in^2; lb/in^2) Pounds-force per square inch (psi; lbf/in^2; lb/in^2) Kilopascals (kPa)	X	0.068	= Atmospheres (atm)	X 14.696	= Pounds-force per square inch (psi; lbf/in^2; lb/in^2)
	X	0.069	= Bars	X 14.5	= Pounds-force per square inch (psi; lbf/in^2; lb/in^2)
	X	6.895	= Kilopascals (kPa)	X 0.145	= Pounds-force per square inch (psi; lbf/in^2; lb/in^2)
Millibar (mbar)	X	0.01	= Kilograms-force per square centimetre (kgf/cm^2; kg/cm^2)	X 98.1	= Kilopascals (kPa)
Millibar (mbar)	X	100	= Pascals (Pa)	X 0.01	= Millibar (mbar)
Millibar (mbar)	X	0.0145	= Pounds-force per square inch (psi; lbf/in^2; lb/in^2)	X 68.947	= Millibar (mbar)
Millibar (mbar)	X	0.75	= Millimetres of mercury (mmHg)	X 1.333	= Millibar (mbar)
Millimetres of mercury (mmHg)	X	0.401	= Inches of water (inH_20)	X 2.491	= Millibar (mbar)
Inches of water (inH_20)	X	0.535	- Inches of water (inH_20)	X 1.868	- Millimetres of mercury (mmHg)
	X	0.036	= Pounds-force per square inch (psi; lbf/in^2; lb/in^2)	X 27.68	= Inches of water (inH_20)

Torque (moment of force)

Pounds-force inches (lbf in; lb in)	X	1.152	= Kilograms-force centimetre (kgf cm; kg cm)	X 0.868	= Pounds-force inches (lbf in; lb in)
Pounds-force inches (lbf in; lb in)	X	0.113	= Newton metres (Nm)	X 8.85	= Pounds-force inches (lbf in; lb in)
Pounds-force inches (lbf in; lb in)	X	0.083	= Pounds-force feet (lbf ft; lb ft)	X 12	= Pounds-force inches (lbf in; lb in)
Pounds-force feet (lbf ft; lb ft)	X	0.138	= Kilograms-force metres (kgf m; kg m)	X 7.233	= Pounds-force feet (lbf ft; lb ft)
Pounds-force feet (lbf ft; lb ft)	x	1.356	= Newton metres (Nm)	X 0.738	= Pounds-force feet (lbf ft; lb ft)
Newton metres (Nm)	x	0.102	= Kilograms-force metres (kgf m; kg m)	X 9.804	= Newton metres (Nm)

Power

Horsepower (hp)	X	745.7	= Watts (W)	X 0.0013	= Horsepower (hp)

Velocity (speed)

Miles per hour (miles/hr; mph)	X	1.609	= Kilometres per hour (km/hr; kph)	X 0.621	= Miles per hour (miles/hr; mph)

Fuel consumption

Miles per gallon, Imperial (mpg)	X	0.354	= Kilometres per litre (km/l)	X 2.825	= Miles per gallon, Imperial (mpg)
Miles per gallon, US (mpg)	0.425	= Kilometres per litre (km/l)		X 2.352	= Miles per gallon, US (mpg)

Temperature

Degrees Fahrenheit = (°C x 1.8) + 32

Degrees Celsius (Degrees Centigrade; °C) = (°F - 32) x 0.56

** It is common practice to convert from miles per gallon (mpg) to litres/100 kilometres (1/100km), where mpg (Imperial) x l/100 km = 282 and mpg (US) x l/100 km = 235*

Troubleshooting

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This section provides an easy reference guide to the more common problems which may occur during the operation of your vehicle. These problems and their possible causes are grouped under headings denoting various components or systems, such as Engine, Cooling system, etc. They also refer you to the chapter and/or section which deals with the problem.

Remember that successful troubleshooting is not a mysterious black art practiced only by professional mechanics. It is simply the result of the right knowledge combined with an intelligent, systematic approach to the problem. Always work by a process of elimination, starting with the simplest solution and working through to the most complex — and never overlook the obvious. Anyone can run the gas tank dry or leave the lights on overnight, so don't assume that you are exempt from such oversights.

Finally, always establish a clear idea of why a problem has occurred and take steps to ensure that it doesn't happen again. If the electrical system fails because of a poor connection, check the other connections in the system to make sure that they don't fail as well. If a particular fuse continues to blow, find out why — don't just replace one fuse after another. Remember, failure of a small component can often be indicative of potential failure or incorrect functioning of a more important component or system.

Engine

1 Engine will not rotate when attempting to start

1 Battery terminal connections loose or corroded (Chapter 1).
2 Battery discharged or faulty (Chapter 1).
3 Automatic transmission not completely engaged in Park (Chapter 7) or clutch not completely depressed (Chapter 8).
4 Broken, loose or disconnected wiring in the starting circuit (Chapters 5 and 12).
5 Starter motor pinion jammed in flywheel ring gear (Chapter 5).
6 Starter solenoid faulty (Chapter 5).
7 Starter motor faulty (Chapter 5).
8 Ignition switch faulty (Chapter 1 2).
9 Starter pinion or flywheel teeth worn or broken (Chapter 5).

2 Engine rotates but will not start

1 Fuel tank empty.
2 Battery discharged (engine rotates slowly) (Chapter 5).
3 Battery terminal connections loose or corroded (Chapter 1).
4 Leaking fuel injector(s), faulty cold start valve, fuel pump, pressure regulator, etc. (Chapter 4).
5 Fuel not reaching fuel rail (Chapter 4).
6 Ignition components damp or damaged (Chapter 5).
7 Worn, faulty or incorrectly gapped spark plugs (Chapter 1).
8 Broken, loose or disconnected wiring in the starting circuit (Chap ter 5).
9 Loose distributor is changing ignition timing (Chapter 5).
10 Broken, loose or disconnected wires at the ignition coil or faulty coil (Chapter 5).

3 Engine hard to start when cold

1 Battery discharged or low (Chapter 1).
2 Malfunctioning fuel system (Chapter 4).
3 Faulty cold start injector (Chapter 4).
4 Injector(s) leaking (Chapter 4).
5 Distributor rotor carbon tracked (Chapter 5).
6 Faulty air control valve (Chapter 2a).

4 Engine hard to start when hot

1 Air filter clogged (Chapter 1).
2 Fuel not reaching the fuel injection system (Chapter 4).
3 Corroded battery connections, especially ground (Chapter 1).
4 Faulty air control valve (Chapter 2a).

5 Starter motor noisy or excessively rough in engagement

1 Pinion or flywheel gear teeth worn or broken (Chapter 5).
2 Starter motor mounting bolts loose or missing (Chapter 5).

6 Engine starts but stops immediately

1 Loose or faulty electrical connections at distributor, coil or alternator (Chapter 5).
2 Insufficient fuel reaching the fuel injector(s) (Chapters 1 and 4).
3 Vacuum leak at the gasket between the intake manifold/plenum and throttle body (Chapters 1 and 4).
4 Faulty air control valve (Chapter 2a).

7 Oil puddle under engine

1 Oil pan gasket and/or oil pan drain bolt washer leaking (Chapter 2).
2 Oil pressure sending unit leaking (Chapter 2).
3 Cylinder head covers leaking (Chapter 2).
4 Engine oil seals leaking (Chapter 2).
5 Oil pump housing leaking (Chapter 2).

8 Engine lopes while idling or idles erratically

1 Vacuum leakage (Chapters 2 and 4).
2 Leaking EGR valve (Chapter 6).
3 Air filter clogged (Chapter 1).
4 Fuel pump not delivering sufficient fuel to the fuel injection system (Chapter 4).
5 Leaking head gasket (Chapter 2).
6 Timing belt and/or pulleys worn (Chapter 2).
7 Camshaft lobes worn (Chapter 2).

9 Engine misses at idle speed

1 Spark plugs worn or not gapped properly (Chapter 1).
2 Faulty spark plug wires (Chapter 1).
3 Vacuum leaks (Chapter 1).
4 Incorrect ignition timing (Chapter 1).
5 Uneven or low compression (Chapter 2).

10 Engine misses throughout driving speed range

1 Fuel filter clogged and/or impurities in the fuel system (Chapter 1).
2 Low fuel output at the injector(s) (Chapter 4).
3 Faulty or incorrectly gapped spark plugs (Chapter 1).
4 Incorrect ignition timing (Chapter 5).
5 Cracked distributor cap, disconnected distributor wires or damaged distributor components (Chapters 1 and 5).
6 Leaking spark plug wires (Chapters 1 or 5).
7 Faulty emission system components (Chapter 6).
8 Low or uneven cylinder compression pressures (Chapter 2).
9 Weak or faulty ignition system (Chapter 5).
10 Vacuum leak in fuel injection system, intake manifold, air control valve or vacuum hoses (Chapter **4).**

11 Engine stumbles on acceleration

1 Spark plugs fouled (Chapter 1).
2 Fuel injection system needs adjustment or repair (Chapter 4).
3 Fuel filter clogged (Chapters 1 and 4).
4 Incorrect ignition timing (Chapter 5).
5 Intake manifold/air control valve air leak (Chapters 2 and 4).

12 Engine surges while holding accelerator steady

1 Intake air leak (Chapter 4).
2 Fuel pump faulty (Chapter 4).
3 Loose fuel injector wire harness connectors (Chapter 4).
4 Defective ECU (Chapter **6).**

13 Engine stalls

1 Idle speed incorrect (Chapter 1).
2 Fuel filter clogged and/or water and impurities in the fuel system (Chapters 1 and 4).
3 Distributor components damp or damaged (Chapter 5).
4 Faulty emissions system components (Chapter 6).
5 Faulty or incorrectly gapped spark plugs (Chapter 1).
6 Faulty spark plug wires (Chapter 1).
7 Vacuum leak in the fuel injection system, intake manifold or vacuum hoses (Chapters 2 and 4).
8 Valve clearances incorrectly set (Chapter 1).

14 Engine lacks power

1 Incorrect ignition timing (Chapter 5).
2 Excessive play in distributor shaft (Chapter 5).
3 Worn rotor, distributor cap or wires (Chapters 1 and 5).
4 Faulty or incorrectly gapped spark plugs (Chapter 1).
5 Fuel injection system out of adjustment or excessively worn (Chapter 4).
6 Faulty coil (Chapter 5).
7 Brakes binding (Chapter 9).
8 Automatic transaxle fluid level incorrect (Chapter 1).
9 Clutch slipping (Chapter 8(.
10 Fuel filter clogged and/or impurities in the fuel system (Chapters 1 and 4).
11 Emission control system not functioning properly (Chapter 6).
12 Low or uneven cylinder compression pressures (Chapter 2).

15 Engine backfires

1 Emission control system not functioning properly (Chapter 6).
2 Ignition timing incorrect (Chapter 5).
3 Faulty secondary ignition system (cracked spark plug insulator, faulty plug wires, distributor cap and/or rotor) (Chapters 1 and 5).
4 Fuel injection system in need of adjustment or worn excessively (Chapter 4).
5 Vacuum leak at fuel injector(s), intake manifold, air control valve or vacuum hoses (Chapters 2a and 4).
6 Valve clearances incorrectly set and/or valves sticking (Chapter 1).

16 Pinging or knocking engine sounds during acceleration or uphill

1 Incorrect grade of fuel.
2 Ignition timing incorrect (Chapter 5).
3 Fuel injection system in need of adjustment (Chapter 4).
4 Improper or damaged spark plugs or wires (Chapter 1).
5 Worn or damaged distributor components (Chapter 5).
6 Faulty emission system (Chapter 6).
7 Vacuum leak (Chapters 2a and 4).

17 Engine runs with oil pressure light on

1 Low oil level (Chapter 1).
2 Idle rpm below specification (Chapter 1).
3 Short in wiring circuit (Chapter 1 2).
4 Faulty oil pressure sender (Chapter 2).
5 Worn engine bearings and/or oil pump (Chapter 2).

18 Engine diesels (continues to run) after switching off

1 Idle speed too high (Chapter 1).
2 Excessive engine operating temperature (Chapter 3).

Engine electrical system

19 Battery will not hold a charge

1 Alternator drivebelt defective or not adjusted properly (Chapter 1).
2 Battery electrolyte level low (Chapter 1).
3 Battery terminals loose or corroded (Chapter 1).
4 Alternator not charging properly (Chapter 5).
5 Loose, broken or faulty wiring in the charging circuit (Chapter 5).
6 Short in vehicle wiring (Chapter 12).
7 Internally defective battery (Chapters 1 and 5).

20 Alternator light fails to go out

1 Faulty alternator or charging circuit (Chapter 5).
2 Alternator drivebelt defective or out of adjustment (Chapter 1).
3 Alternator voltage regulator inoperative (Chapter 5).

21 Alternator light fails to come on when key is turned on

1 Warning light bulb defective (Chapter 12).
2 Fault in the printed circuit, dash wiring or bulb holder (Chapter 12).

Fuel system

22 Excessive fuel consumption

1 Dirty or clogged air filter element (Chapter 1).
2 Incorrectly set ignition timing (Chapter 5).
3 Emissions system not functioning properly (Chapter 6).
4 Fuel injection internal parts excessively worn or damaged (Chapter 4).
5 Low tire pressure or incorrect tire size (Chapter 1).

23 Fuel leakage and/or fuel odor

1 Leaking fuel feed or return line (Chapters 1 and 4).
2 Tank overfilled.
3 Evaporative canister filter clogged (Chapters 1 and 6).
4 Fuel injector internal parts excessively worn (Chapter **4).**

Cooling system

24 Overheating

1 Insufficient coolant in system (Chapter 1).
2 Water pump drivebelt defective or out of adjustment (Chapter 1).
3 Radiator core blocked or grille restricted (Chapter 3).
4 Thermostat faulty (Chapter 3).
5 Electric coolant fan blades broken or cracked (Chapter 3).
6 Radiator cap not maintaining proper pressure (Chapter 3).
7 Ignition timing incorrect (Chapter 5).

25 Overcooling

1 Faulty thermostat (Chapter 3).
2 Inaccurate temperature gauge sending unit (Chapter 3)

26 External coolant leakage

1 Deteriorated/damaged hoses; loose clamps (Chapters 1 and 3).
2 Water pump seal defective (Chapter 3).
3 Leakage from radiator core or coolant reservoir bottle (Chapter 3).
4 Engine drain or water jacket core plugs leaking (Chapter 2).

27 Internal coolant leakage

1 Leaking cylinder head gasket (Chapter 2).
2 Cracked cylinder bore or cylinder head (Chapter **2).**

28 Coolant loss

1 Too much coolant in system (Chapter 1).
2 Coolant boiling away because of overheating (Chapter 3).
3 Internal or external leakage (Chapter 3).
4 Faulty radiator cap (Chapter 3).

29 Poor coolant circulation

1 Inoperative water pump (Chapter 3).
2 Restriction in cooling system (Chapters 1 and 3).
3 Water pump drivebelt defective/out of adjustment (Chapter 1).
4 Thermostat sticking (Chapter 3).

Clutch

30 Pedal travels to floor — no pressure or very little resistance

1 Master or slave cylinder faulty (Chapter 8).
2 Hose/pipe burst or leaking (Chapter 8).
3 Connections leaking (Chapter 8).
4 No fluid in reservoir (Chapter 8).
5 If fluid level in reservoir rises as pedal is depressed, master cylinder center valve seal is faulty (Chapter 8).
6 If there is fluid on dust seal at master cylinder, piston primary seal is leaking (Chapter 8).
7 Broken release bearing or fork (Chapter 8).

31 Fluid in area of master cylinder dust cover and on pedal

Rear seal failure in master cylinder (Chapter **8).**

32 Fluid on slave cylinder

Slave cylinder plunger seal faulty (Chapter 8).

33 Pedal feels spongy when depressed

Air in system (Chapter 8).

34 Unable to select gears

1 Faulty transaxle (Chapter 7).
2 Faulty clutch disc (Chapter 8).
3 Fork and bearing not assembled properly (Chapter 8).
4 Faulty pressure plate (Chapter 8).
5 Pressure plate-to-flywheel bolts loose (Chapter 8).

35 Clutch slips (engine speed increases with no increase in vehicle speed)

1 Clutch plate worn (Chapter 8).
2 Clutch plate is oil soaked by leaking rear main seal (Chapter 8).
3 Clutch plate not seated. It may take 30 or 40 normal starts for a new one to seat.
4 Warped pressure plate or flywheel (Chapter 8).
5 Weak diaphragm spring (Chapter 8).
6 Clutch plate overheated. Allow to cool.

36 Grabbing (chattering) as clutch is engaged

1 Oil on clutch plate lining, burned or glazed facings (Chapter 8).
2 Worn or loose engine or transaxle mounts (Chapters 2 and 7).
3 Worn splines on clutch plate hub (Chapter 8).
4 Warped pressure plate or flywheel (Chapter 8).
5 Burned or smeared resin on flywheel or pressure plate (Chapter 8).

37 Transaxle rattling (clicking)

1 Release fork loose (Chapter 8).
2 Clutch plate damper spring failure (Chapter 8).
3 Low engine idle speed (Chapter 1).

38 Noise in clutch area

1 Fork shaft improperly installed (Chapter 8).
2 Faulty bearing (Chapter 8).

39 Clutch pedal stays on floor

1 Piston binding in bore (Chapter 8).
2 Broken release bearing or fork (Chapter 8).

40 High pedal effort

1 Piston binding in bore (Chapter 8).
2 Pressure plate faulty (Chapter 8).
3 Incorrect size master or slave cylinder fitted (Chapter 8).

Manual transaxle

41 Knocking noise at low speeds

1 Worn driveaxle constant velocity (CV) joints (Chapter 8).
2 Worn side gear shaft counterbore in differential case (Chapter 7a). *

42 Noise most pronounced when turning

Differential gear noise (Chapter 7a).*

43 Clunk on acceleration or deceleration

1 Loose engine or transaxle mounts (Chapters 2 and 7a).
2 Worn differential pinion shaft in case.*
3 Worn side gear shaft counterbore in differential case (Chapter 7a).*
4 Worn or damaged driveaxle inboard CV joints (Chapter 8).

44 Clicking noise in turns

Worn or damaged outboard CV joint (Chapter 8).

45 Vibration

1 Rough wheel bearing (Chapters 1 and 10).
2 Damaged driveaxle (Chapter 8).
3 Out of round tires (Chapter 1).
4 Tire out of balance (Chapters 1 and 10).
5 Worn CV joint (Chapter 8).

46 Noisy in neutral with engine running

1 Damaged input gear bearing (Chapter 7a).*
2 Damaged clutch release bearing (Chapter **8).**

47 Noisy in one particular gear

1 Damaged or worn constant mesh gears (Chapter 7a).*
2 Damaged or worn synchronizers (Chapter 7a).*
3 Bent reverse fork (Chapter 7a).*
4 Damaged fourth speed gear or output gear (Chapter 7a).*
5 Worn or damaged reverse idler gear or idler bushing (Chapter 7a). *

48 Noisy in all gears

1 Insufficient lubricant (Chapter 7a).
2 Damaged or worn bearings (Chapter 7a).*
3 Worn or damaged input gear shaft and/or output gear shaft (Chapter 7a).*

49 Slips out of gear

1 Worn or improperly adjusted linkage (Chapter 7a).
2 Transaxle loose on engine (Chapter 7a).
3 Shift linkage does not work freely, binds (Chapter 7a).
4 Input gear bearing retainer broken or loose (Chapter 7a).*
5 Dirt between clutch cover and engine housing (Chapter 7a).
6 Worn shift fork (Chapter 7a).*

50 Leaks lubricant

1 Side gear shaft seals worn (Chapter 8).
2 Excessive amount of lubricant in transaxle (Chapters 1 and 7a).
3 Loose or broken input gear shaft bearing retainer (Chapter 7a).*
4 Input gear bearing retainer O-ring and/or lip seal damaged (Chapter 7a).*

51 Locked in second gear

Lock pin or interlock pin missing (Chapter 7a).* * *Although the corrective action necessary to remedy the symptoms described is beyond the scope of the home mechanic, the above information should be helpful in isolating the cause of the condition so that the owner can communicate clearly with a professional mechanic.*

Automatic transaxle

Note: *Due to the complexity of the automatic transaxle, it is difficult for the home mechanic to properly diagnose and service this component. For problems other than the following, the vehicle should be taken to a dealer or transmission shop.*

52 Fluid leakage

1 Automatic transmission fluid is a deep red color. Fluid leaks should not be confused with engine oil, which can easily be blown onto the transaxle by air flow.
2 To pinpoint a leak, first remove all built-up dirt and grime from the transaxle housing with degreasing agents and/or steam cleaning. Then drive the vehicle at low speeds so air flow will not blow the leak far from its source. Raise the vehicle and determine where the leak is coming from. Common areas of leakage are:

a) Pan (Chapters 1 and 7)
b) Dipstick tube (Chapters 1 and 7)
c) Transaxle oil lines (Chapter 7)
d) Speed sensor (Chapter 7)

53 Transaxle fluid brown or has a burned smell

Transaxle fluid burned (Chapter 1).

54 General shift mechanism problems

1 Chapter 7b deals with checking and adjusting the shift linkage on automatic transaxles. Common problems which may be attributed to poorly adjusted linkage are:

a) Engine starting in gears other than Park or Neutral.
b) Indicator on shifter pointing to a gear other than the one actually being used.
c) Vehicle moves when in Park.

2 Refer to Chapter 7b for the shift linkage adjustment procedure.

55 Transaxle will not downshift with accelerator pedal pressed to the floor

Throttle valve cable out of adjustment (Chapter 7b).

56 Engine will start in gears other than Park or Neutral

Neutral start switch malfunctioning (Chapter 7b).

57 Transaxle slips, shifts roughly, is noisy or has no drive in forward or reverse gears

There are many probable causes for the above problems, but the home mechanic should be concerned with only one possibility — fluid level. Before taking the vehicle to a repair shop, check the level and condition of the fluid as described in Chapter 1. Correct the fluid level as necessary or change the fluid and filter if needed. If the problem persists, have a professional diagnose the cause.

Driveaxles

58 **Clicking** noise in **turns**

Worn or damaged outboard CV joint (Chapter 8).

59 Shudder or vibration during acceleration

1 Excessive toe-in (Chapter 10).
2 Incorrect spring heights (Chapter 10).
3 Worn or damaged inboard or outboard CV joints (Chapter 8).
4 Sticking inboard CV joint assembly (Chapter 8).

60 Vibration at highway speeds

1 Out of balance front wheels and/or tires (Chapters 1 and 10).
2 Out of round front tires (Chapters 1 and 10).
3 Worn CV joint(s) (Chapter 8).

Brakes

Note: *Before assuming that a brake problem exists, make sure that:*

a) The tires are in good condition and properly inflated (Chapter 1).
b) The front end alignment is correct (Chapter 10).

c) The vehicle is not loaded with weight in an unequal manner.

61 Vehicle pulls to one side during braking

1 Incorrect tire pressures (Chapter 1).
2 Front end out of line (have the front end aligned).
3 Front, or rear, tires not matched to one another.
4 Restricted brake lines or hoses (Chapter 9).
5 Malfunctioning caliper assembly (Chapter 9).
6 Loose suspension parts (Chapter 10).
7 Loose calipers (Chapter 9).

62 Noise (high-pitched squeal when the brakes are applied)

Front and/or rear disc brake pads worn out. The noise comes from the wear sensor rubbing against the disc (does not apply to all vehicles). Replace pads with new ones immediately (Chapter 9).

63 Brake roughness or chatter (pedal pulsates)

1 Excessive lateral runout (Chapter 9).
2 Uneven pad wear (Chapter 9).
3 Defective rotor (Chapter 9).

64 Excessive brake pedal effort required to stop vehicle

1 Malfunctioning power brake booster (Chapter 9).
2 Partial system failure (Chapter 9).
3 Excessively worn pads (Chapter 9).
4 Piston in caliper stuck or sluggish (Chapter 9).
5 Brake pads contaminated with oil or grease (Chapter 9).
6 New pads installed and not yet seated. It will take a while for the new material to seat against the rotor.

65 Excessive brake pedal travel

1 Partial brake system failure (Chapter 9).
2 Insufficient fluid in master cylinder (Chapters 1 and 9).
3 Air trapped in system (Chapters **1** and 9).

66 Dragging brakes

1 Incorrect adjustment of brake light switch (Chapter 9).
2 Master cylinder pistons not returning correctly (Chapter 9).
3 Restricted brakes lines or hoses (Chapters 1 and 9).
4 Incorrect parking brake adjustment (Chapter 9).

67 Grabbing or uneven braking action

1 Malfunction of combination valve (Chapter 9).
2 Malfunction of power brake booster unit (Chapter 9).
3 Binding brake pedal mechanism (Chapter 9).

68 Brake pedal feels spongy when depressed

1 Air in hydraulic lines (Chapter 9).
2 Master cylinder mounting bolts loose (Chapter 9).
3 Master cylinder defective (Chapter 9).

69 Brake pedal travels to the floor with little resistance

1 Little or no fluid in the master cylinder reservoir caused by leaking caliper piston(s) (Chapter 9).
2 Loose, damaged or disconnected brake lines (Chapter 9).

70 Parking brake does not hold

Parking brake linkage improperly adjusted (Chapters 1 and 9).

Suspension and steering systems

Note: *Before attempting to diagnose the suspension and steering systems, perform the following preliminary checks:*

a) Tires for wrong pressure and uneven wear.
b) Steering universal joints from the column to the rack and pinion for loose connectors or wear.
cl Front and rear suspension and the rack and pinion assembly for loose or damaged parts, d) Out-of-round or out-of-balance tires, bent rims and loose and/or rough wheel bearings.

71 Vehicle pulls to one side

1 Mismatched or uneven tires (Chapter 10).
2 Broken or sagging springs (Chapter 10).
3 Wheel alignment (Chapter 10).
4 Front brake dragging (Chapter 9).

72 Abnormal or excessive tire wear

1 Wheel alignment (Chapter 10).
2 Sagging or broken springs (Chapter 10).
3 Tire out of balance (Chapter 10).
4 Worn strut damper (Chapter 10).
5 Overloaded vehicle.
6 Tires not rotated regularly.

73 Wheel makes a thumping noise

1 Blister or bump on tire (Chapter 10).
2 Improper strut damper action (Chapter **10).**

74 Shimmy, shake or vibration

1 Tire or wheel out-of-balance or out-of-round (Chapter 10).
2 Loose or worn wheel bearings (Chapters 1, 8 and 10).
3 Worn tie-rod ends (Chapter 10).
4 Worn lower balljoints (Chapter 10).
5 Excessive wheel runout (Chapter 10).
6 Blister or bump on tire (Chapter 10).

75 Hard steering

1 Lack of lubrication at balljoints, tie-rod ends and rack and pinion assembly (Chapter 10).
2 Front wheel alignment (Chapter 10).
3 Low tire pressure(s) (Chapters 1 and 10).

76 Poor returnability of steering to center

1 Lack of lubrication at balljoints and tie-rod ends (Chapter 10).
2 Binding in balljoints (Chapter 10).
3 Binding in steering column (Chapter 10).
4 Lack of lubricant in rack and pinion assembly (Chapter 10).
5 Front wheel alignment (Chapter 10).

77 Abnormal noise at the front end

1 Lack of lubrication at balljoints and tie-rod ends (Chapters 1 and 10).
2 Damaged strut mounting (Chapter 10).
3 Worn control arm bushings or tie-rod ends (Chapter 10).
4 Loose stabilizer bar (Chapter 10).
5 Loose wheel nuts (Chapters 1 and 10).
6 Loose suspension bolts (Chapter 10).

78 Wander or poor steering stability

1 Mismatched or uneven tires (Chapter 10).
2 Lack of lubrication at balljoints and tie-rod ends (Chapters 1 and 10).
3 Worn strut assemblies (Chapter 10).
4 Loose stabilizer bar (Chapter 10).
5 Broken or sagging springs (Chapter 10).
6 Wheel alignment (Chapter 10).

79 Erratic steering when braking

1 Wheel bearings worn (Chapter 10).
2 Broken or sagging springs (Chapter 10).
3 Leaking wheel cylinder or caliper (Chapter 10).
4 Warped rotors (Chapter 10).

80 Excessive pitching and/or rolling around comers or during braking

1 Loose stabilizer bar (Chapter 10).
2 Worn strut dampers or mountings (Chapter 10).
3 Broken or sagging springs (Chapter 10).
4 Overloaded vehicle.

81 Suspension bottoms

1 Overloaded vehicle.
2 Worn strut dampers (Chapter 10).
3 Incorrect, broken or sagging springs (Chapter 10).

82 Cupped tires

1 Front wheel or rear wheel alignment (Chapter 10).
2 Worn strut dampers (Chapter 10).
3 Wheel bearings worn (Chapter 10).
4 Excessive tire or wheel runout (Chapter 10).
5 Worn balljoints (Chapter 10).

83 Excessive tire wear on outside edge

1 Inflation pressures incorrect (Chapter 1).
2 Excessive speed in turns.
3 Front end alignment incorrect (excessive toe-in). Have professionally aligned.
4 Suspension arm bent or twisted (Chapter 10).

84 Excessive tire wear on inside edge

1 Inflation pressures incorrect (Chapter 1).
2 Front end alignment incorrect (toe-out). Have professionally aligned.
3 Loose or damaged steering components (Chapter 10).

85 Tire tread worn in one place

1 Tires out of balance.
2 Damaged or buckled wheel. Inspect and replace if necessary.
3 Defective tire (Chapter 1).

86 Excessive play or looseness in steering system

1 Wheel bearing(s) worn (Chapter 10).
2 Tie-rod end loose (Chapter 10).
3 Rack and pinion loose (Chapter 10).
4 Worn or loose steering intermediate shaft (Chapter 10).

87 Rattling or clicking noise in rack and pinion

1 Insufficient or improper lubricant in rack and pinion assembly (Chapter 10).
2 Rack and pinion attachment loose (Chapter 10).

Chapter 1 Tune-up and routine maintenance

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Specifications

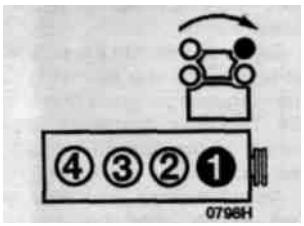
Recommended lubricants, fluids and capacities

Note: *Listed here are manufacturer recommendations at the time this manual was written. Manufacturers occasionally upgrade their fluid and lubricant specifications, so check with your local auto parts store for current recommendations.*

Engine oil type and viscosity	API grade SF or SF/CC multigrade. Use SAE 10W-30 or 10W-40 if normal temperatures are above -10°F (-23 °C). Consult your owner's manual or local dealer for other viscosity recommendations on the particular service grade and viscosity oil recommended for your area, special driving conditions and climatic parameters
Engine oil capacity (including filter)	
without air conditioning	3.3 liters (3.5 qts)
with air conditioning	3.4 liters (3.6 qts)
Windshield washer fluid	Plain water (fluid containing antifreeze is available at Toyota dealers and most parts stores for operation in cold areas. Follow manufacturer's directions for mixture ratio. Don't use engine antifreeze, which will damage your vehicle's paint)
Brake and clutch reservoir fluid type	SAE J1703 or DOT 3 brake fluid
Brake and clutch reservoir fluid levels	Within 10 mm (0.4 in) below the maximum level line

General

Clutch pedal	
height	153 to 163 mm (6.03 to 6.41 in)
freeplay	5.0 to 15.0 mm (0.197 to 0.590 in)
push rod play at pedal top	1.0 to 5.0 mm (0.039 to 0.197 in)
Accessory drivebelt tension (with Burroughs BTG-20 95506-00020 or Nippondenso BT-33-73F gauge)	
alternator	
used	115 ± 20 lb
new	175 ± 5 lb
air conditioner	
used	105 ± 10 lb
new	160 ± 20 lb
Minimum brake pad thickness	1.0 mm (0.039 in)
Mininum brake disc thickness	
front	17.0 mm (0.669 in)
rear	9.0 mm (0.354 in)
Maximum disc runout	0.15 mm (0.0059 in)



Cylinder location and distributor rotation - MR2 1587cc FI engine

The blackened terminal shown on the distributor cap indicates the Number One spark plug wire position

Recommended spark plugs	ND PQ16R or NGK BCPR5EP11
Spark plug gap	
maximum limit for used plugs	1.3 mm (0.051 in)
correct electrode gap for new plugs	1.1 mm (0.043 in)
Spark plug insulation resistance	More than 10 meg ohm
Maximum resistance between distributor cap and each spark plug wire	25,000 ohms
Valve clearance (cold)	
intake	0.15 to 0.25 mm (0.006 to 0.010 in)
exhaust	0.20 to 0.30 mm (0.008 to 0.012 in)
Idle speed	800 rpm
Recommended automatic transaxle fluid	ATF Dexron II
Automatic transaxle (1986 and 1987) capacity	2.3 liters (2.4 qts)
Recommended differential fluid (automatic transaxle)	ATF Dexron II
Differential fluid capacity	1.4 liters (1.5 qts)
Recommended manual transaxle oil	Oil grade API GL-4 or GL-5, viscosity SAE 75W-90 or 80W-90
Manual transaxle oil capacity	2.3 liters (2.4 qts)
Maximum steering wheel freeplay	30 mm (1.18 in)
Wheel lateral runout	
front	1.2 mm (0.047 in)
rear	1.0 mm (0.039 in)
Vehicle height	
front	221 mm (8.70 in)
rear	204 mm (8.03 in)
Maximum balljoint vertical play	0 mm (0 **in)**
Coolant type	Ethylene glycol antifreeze and **water**
Cooling system capacity	12.8 liters (1 3.5 qts)

Torque specifications	**Nm**	**Ft lbs**
Spark plugs	18	13
Drain cocks		
radiator pipe	17	12
engine	13	9
Front seat mounting bolts	37	27
Front suspension member-to-body bolts and nuts	118	87
Strut bar bracket-to-body bolts (left and right)	65	48
Rear wheel bearing lock nut	186	137
Wheel lug nuts	88 to 118	65 to 87
Fuel filter banjo bolts	29	22
Fuel line threaded flare nut fittings	**34**	25

1 Introduction

This chapter is designed to help the home mechanic maintain the Toyota MR2 for peak performance, economy, safety and long life.

On the following pages is a master maintenance schedule, followed by sections dealing specifically with each item on the schedule. Visual checks, adjustments, component replacement and other helpful items are included. Refer to the accompanying photos of the engine compartment and the underside of the vehicle for the location of various components.

Servicing your MR2 in accordance with the mileage/time maintenance schedule and the following Sections will provide it with a planned maintenance program that should result in a long and reliable service life. This is a comprehensive plan, so maintaining some items but not others at the specified service intervals will not produce the same results.

As you service your MR2, you will discover that many of the procedures can — and should — be grouped together because of the nature of the particular procedure you're performing or because of the close proximity of two otherwise unrelated components to one another.

For example, if the vehicle is raised for chassis lubrication, you should inspect the exhaust, suspension, steering and fuel systems while you're under the vehicle. When you're rotating the tires, it makes good sense to check the brakes and wheel bearings since the wheels are already removed.

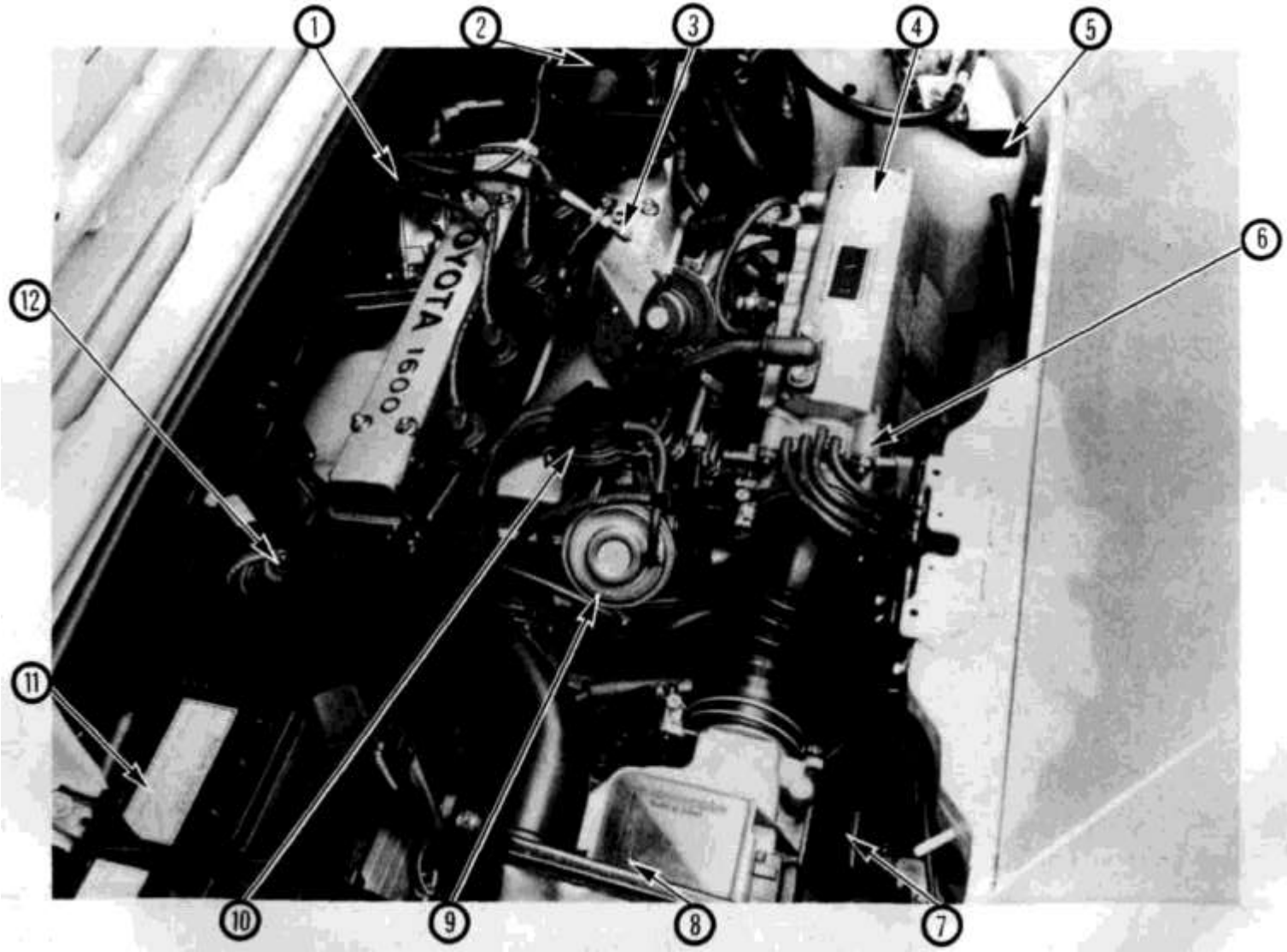
Finally, let's suppose you have to borrow or rent a torque wrench. Even if you only need to tighten the spark plugs, you might as well check the torque of as many critical fasteners as time allows.

The first step of this maintenance program is to prepare yourself before the actual work begins. Read through all sections pertinent to the procedures you're planning to do, then make a list of and gather together all the parts and tools you will need to do the job. If it looks like you might run into problems during a particular segment of some procedure, seek advice from your local parts man or dealer service department.

2 Maintenance schedule

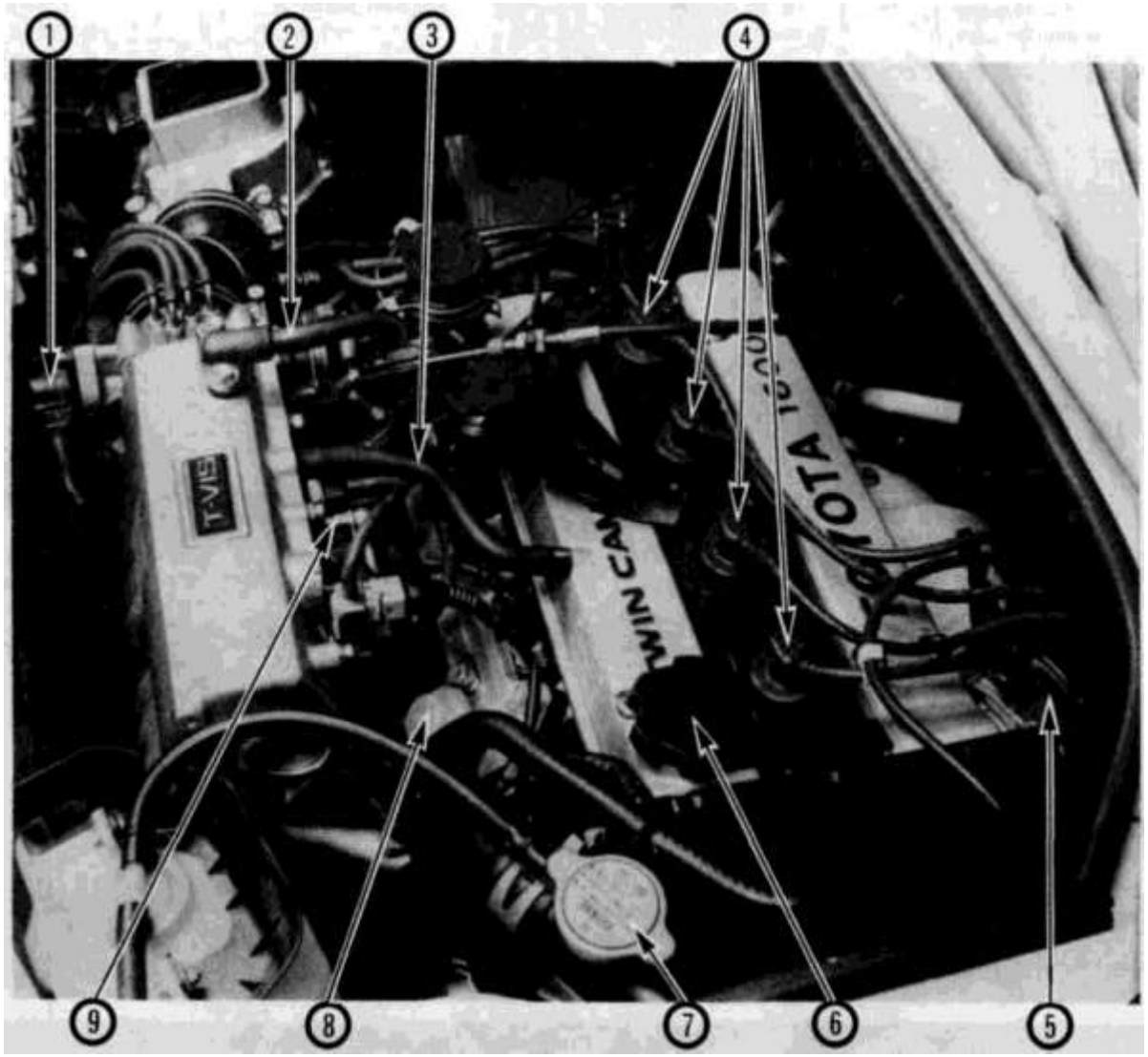
The maintenance intervals in this manual are provided with the assumption that you, not the dealer, will be doing the work. These are the minimum maintenance intervals recommended by the factory for MR2s that are driven daily. If you wish to keep your vehicle in peak condition at all times, you may wish to perform some of these procedures even more often. Because frequent maintenance enhances the efficiency, performance and resale value of your car, we encourage you to do so. If you drive in dusty areas, tow a trailer, idle or drive at low speeds for extended periods or drive for short durations (less than four miles) in below freezing temperatures, shorter intervals are also recommended.

When your vehicle is new, it should be serviced by a factory authorized dealer service department to protect the factory warranty. In many cases, the initial maintenance check is done at no cost to the owner.



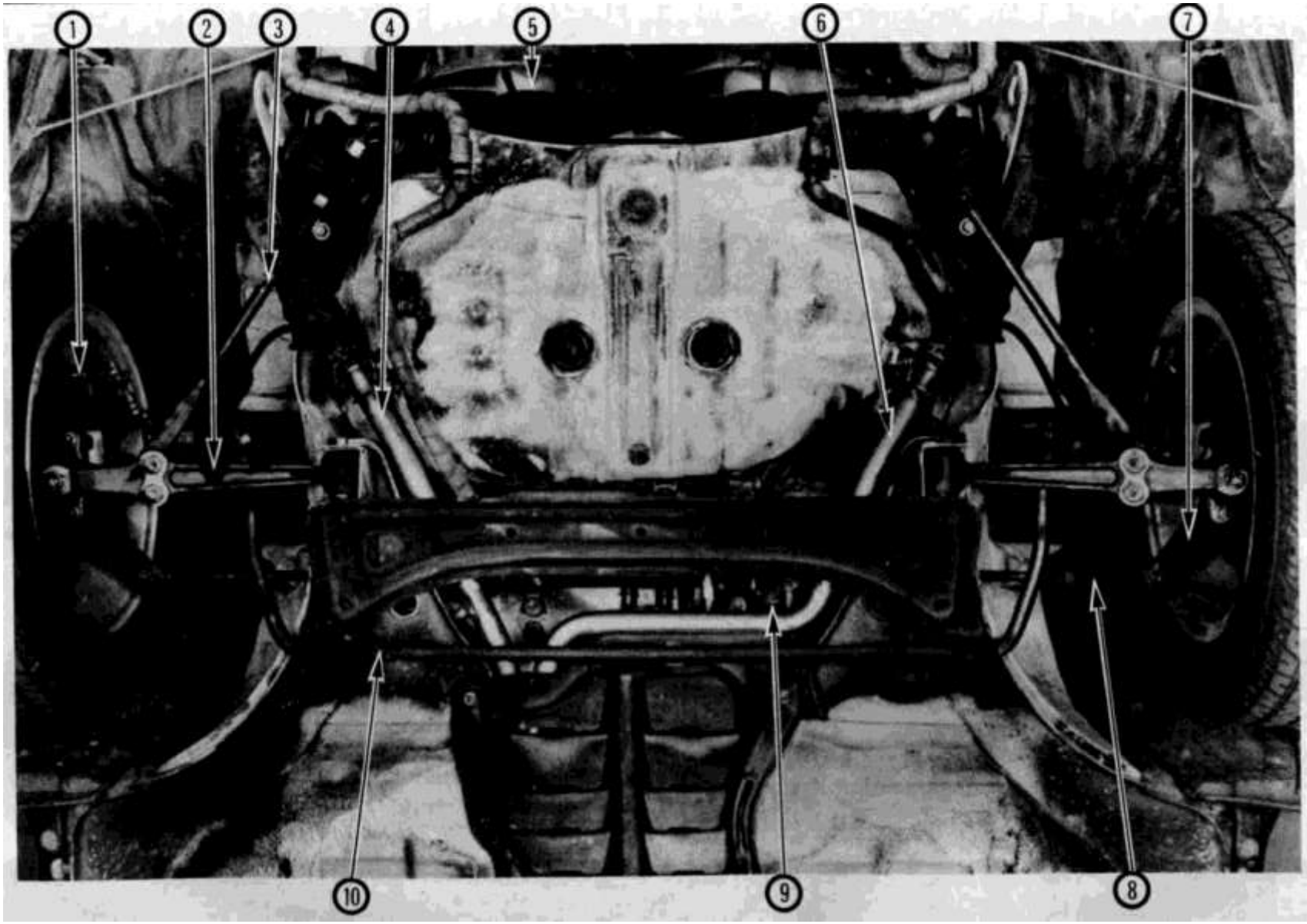
1.2a The engine compartment viewed from the left side

7 *Distributor*	*4*	*7*	*10*	*P*
2	*lenum*	*iagnostic connector*	*GR vacuum modulator*	
oil	*5*	*8*	*11*	*C*



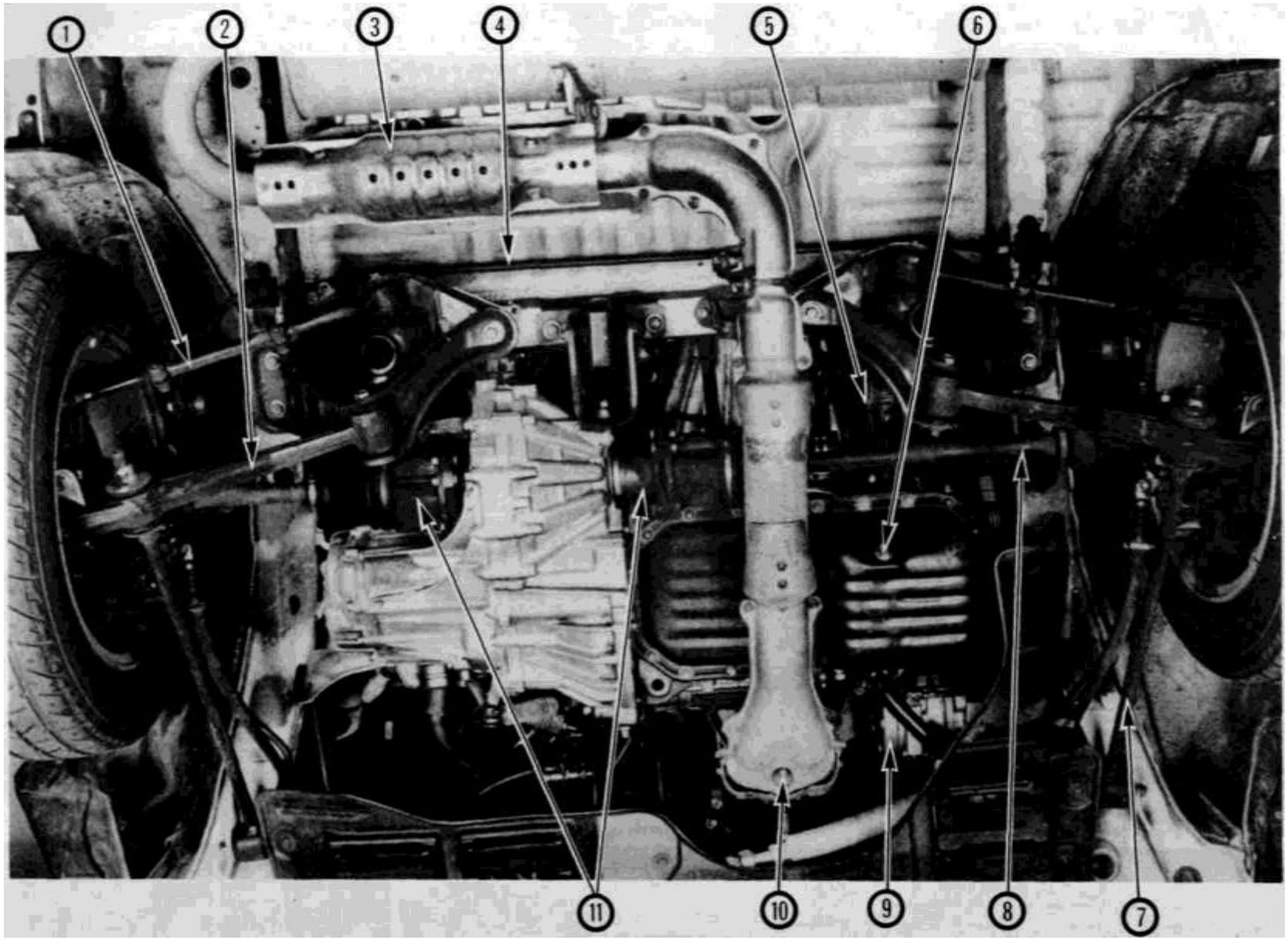
1.2b The engine compartment viewed from the right side

7 Throttle position sensor
2
GR pipe
4
park plug boots/wires
5
E
7
ngine coolant filler cap
8



1.2c The front suspension, steering and cooling system components

7 Brake caliper
2
ontrol arm
4
adiator pipe
C
6
adiator pipe
8
9
10 Stabilizer bar
R



1.2d The rear suspension and under-engine components

7 5 Suspension arm A
2 lternator liveaxle
ower arm 6 9 F
3 if conditioning compressor

General operating checks

The following maintenance and inspection items should be checked on a daily basis. None of them require special tools.

Before entering your vehicle, check and, if necessary, adjust the tire pressures. Inspect the tires for cuts, damage or excessive wear. Check the wheels for missing lug nuts. Look for loose nuts and tighten them if necessary.

If the windshield wiper blades fail to wipe clean, inspect them for wear or cracks. If necessary, replace them. Look underneath your vehicle for fuel, oil, water or other leaks. Should you detect gasoline fumes or notice any fuel leakage, find the cause and correct it immediately. Inspect the engine air scoop opening for obstructions such as leaves, paper or ice.

Check the doors and both the front and rear deck lids for proper operation. Make sure that all latches operate properly too, especially the front hood secondary latch, which secures the hood from opening when the primary latch is released.

Check the operation of the license plate light, the sidemarker lights, the headlights (including the high beams), the parking lights, the taillights, the brake lights, the turn signals, the backup lights, the instrument panel lights and the hazard warning flashers. Be alert for broken, scratched, dirty or damaged glass, mirrors, lights or reflectors that could reduce your visibility or cause personal injury. If any damage or deterioration is discovered, replace, clean or repair it promptly.

Under hood checks

Front compartment

Check the windshield washer fluid. Make sure there is enough fluid in the tank for proper operation of the washer system. Inspect the front of the radiator for leaves, dirt or bugs. Check the radiator hoses for cracks, kinks, rot or loose connections. Check the brake fluid is near the upper level line on the reservoir. Check the clutch fluid level too; it should be up to the top of the narrow neck of the clutch reservoir. **Rear (engine) compartment**

Check the coolant level. It should be between the Full and Low lines on the see-through reservoir. Check the coolant hoses for cracks, kinks, rot or loose connections. Make sure that the battery electrolyte level of all battery cells is between the upper and lower level lines on the case. If the the level is low, add distilled water only. Check the engine drivebelts for fraying, cracks, wear or oiliness. Check the level on the engine oil dipstick with the engine turned off. If your vehicle is equipped with an automatic transaxle, check the fluid level in accordance with the procedure outlined in Section 21 of this chapter. Inspect the exhaust system for cracks, holes or loose supports.

Inside vehicle

Once you're inside the vehicle, note whether all indicator and interior lights are working properly. Check the operation of all warning lights and buzzers. Make sure that the horn works. Inspect the windshield glass for scratches, pits or abrasions. Check the windshield wipers and the washer for proper operation. Make sure that the wipers do not streak. Check the defroster outlet to make sure that air comes out when the heater or air conditioner are in operation. Do this with the heater control set at Defrost and the fan set on High. Make sure the rear view mirror is securely mounted and properly aligned. Check the sun visors for free movement and secure mounting. Check the seat controls (adjuster latches, seatback recliners, etc.) for smooth operation. Make sure that the latches lock securely in all positions and that the locks hold securely in any latched position. Check the head restraints to ensure that they move up and down smoothly and that the locks hold securely in any latched position. Check the seat belt system — buckles, retractors and anchors — for proper operation. Make sure that the belt webbing is not cut, frayed, worn or damaged. Check the brake and clutch pedals for smooth operation, proper free play (see Section 8 in this chapter and Chapters 8 and 9), uneven effort or catching. Check the parking brake lever for proper travel.

While operating your MR2

If your vehicle is equipped with an automatic transaxle, make sure that the automatic shift indicator points to the gear chosen. Be sure to note any abnormal sounds, increased brake or clutch pedal travel or repeated pulling to one side when braking. If the brake system warning light comes on, something may be wrong with part of the brake system (see Chapter 9). Periodically verify that the parking brake can hold the vehicle on an incline. Be alert to any vibration of the steering wheel or seat at normal highway speeds. It could mean a wheel is out of balance. A pull to the right or left on a straight, level road may indicate that the tire pressure needs to be adjusted or the wheels aligned. Note any changes in steering action. If the steering wheel suddenly becomes harder to turn or has too much free play, or if unusual sounds are noted when turning or parking, the steering system needs to be inspected. Note any irregularity in the headlight pattern. If the beam aim doesn't look right, the headlights should be adjusted. Be alert to any changes in the sound of the exhaust system or the smell of fumes. Either of these symptoms could indicate that the system is leaking or overheating. Have it inspected and repaired at once.

Every 250 mites or weekly, whichever comes first

Check the engine oil level (Section 4)
Check the engine coolant level (Section 4)
Check the windshield washer fluid level (Section 4)
Check the brake fluid and clutch fluid levels (Section 4)
Check the tires and tire pressures (Section 5)

Every 3000 miles or 3 months, whichever comes first

All items listed above plus:
Change the engine oil and the oil filter (Section 6)

Every 6000 miles or 6 months, whichever comes first

All items listed above plus:
Inspect and, if necessary, replace the windshield wiper blades (Section 7) Check the clutch pedal for proper free play (Section 8) Check and, if necessary, service the battery (Section 9) Check and, if necessary, adjust the engine drivebelts (Section 10) Inspect and, if necessary, replace underhood hoses (Section 11) Check the cooling system (Section 12) Rotate the tires (Section 13) Inspect the brake system (Section **14)**

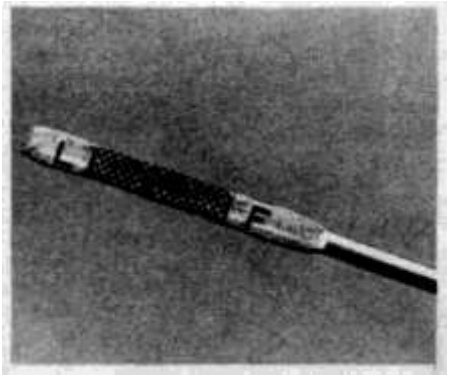
Every 12,000 miles or 12 months, whichever comes first

All items listed above plus:
Replace the air filter (Section 1 5)
Inspect the fuel system (Section 16)
Replace the fuel filter (Section 17)
Check and, if necessary, replace the spark plugs (Section 18)
Inspect the spark plug wires, distributor cap and rotor (Section 19)
Check and, if necessary, adjust the engine idle speed (Section 20)
Check the automatic transaxle fluid level (Section 21)
Check the manual transaxle fluid level (Section 22)
Inspect the suspension and steering components (Section 23)
Service the cooling system (drain, flush and refill) (Section 24)

Every 24,000 miles or 24 months, whichever comes first

All items listed above plus:
Inspect the evaporative emissions control system (Section 25)
Inspect and, if necessary, adjust the valve clearance (Section 26)
Inspect the exhaust pipes and mountings (Section 27)
Change the automatic transaxle fluid (Section 28)
Change the manual transaxle oil (Section 29)
Check and tighten critical chassis and body fasteners (Section 30)

4.2 The engine oil dipstick (arrow) is located at the right rear corner of the engine block, just in front of the coolant reservoir



4.4 The oil level on the dipstick should be at or near the F mark — if it isn't, add oil (it takes one full quart to raise the level from the L to the F mark)

4.6 The threaded oil filler cap is located at the right end of the rear cam cover — always make sure that the area around this opening is clean before unscrewing the cap to prevent dirt from contaminating the engine

3 Tune-up general information

The term *tune-up* is used in this manual to represent a combination of individual operations rather than one specific procedure.

If, from the time the vehicle is new, the routine maintenance schedule is followed closely and frequent checks are made of fluid levels and high wear items, as suggested throughout this manual, the engine will be kept in relatively good running condition and the need for additional work will be minimized.

More likely than not, however, there will be times when the engine is running poorly due to lack of regular maintenance. This is even more likely if a used vehicle, which has not received regular and frequent maintenance checks, is purchased. In such cases, an engine tune-up will be needed outside of the regular routine maintenance intervals.

The first step in any tune-up or engine diagnosis to help correct a poor running engine would be a cylinder compression check. A check of the engine compression (Chapter 2 Part A) will give valuable information regarding the overall performance of many internal components and should be used as a basis for tune-up and repair procedures. If, for instance, a compression check indicates serious internal engine wear, a conventional tune-up will not help the running condition of the engine and would be a waste of time and money. Because of its importance, compression checking should be performed by someone with the proper compression testing gauge and the knowledge to use it properly.

The following series of operations are those most often needed to bring a generally poor running engine back into a proper state of tune.

Minor tune-up Clean, inspect and test the battery Check all engine related fluids Check and adjust the drivebelts Replace the spark plugs Inspect the distributor cap and rotor Inspect the spark plug and coil wires Check and adjust the idle speed Check the PCV valve Check the air filter Check the cooling system Check all underhood hoses

Major tune-up

(the above operations and those listed below)
Check the EGR system
Check the ignition system
Check the charging system
Check the fuel system
Replace the air filter
Replace the distributor cap and rotor
Replace the spark plug wires

4 Fluid level checks

Refer to illustrations 4.2, 4.4, 4.6, 4.8, 4.9, 4.14, 4.15, 4.16,4.17a and 4.17b

1 Fluids are an essential part of the lubrication, cooling, brake, clutch and other systems. Because these fluids gradually become depleted and/or contaminated during normal operation of the vehicle, they must be periodically replenished. See *Recommended lubricants, fluids and capacities* at the beginning of this Chapter before adding fluid to any of the following components. **Note:** *The vehicle must be on level ground before fluid levels can be checked.*

Engine oil

2 The engine oil level is checked with a dipstick located at the right rear corner of the engine **(see illustration).** The dipstick extends through a metal tube from which it protrudes down into the engine oil pan.

3 The oil level should be checked before the vehicle has been driven, or about 1 5 minutes after the engine has been shut off. If the oil is checked immediately after driving the vehicle, some of the oil will remain in the upper engine components, producing an inaccurate reading on the dipstick.

4 Pull the dipstick from the tube and wipe all the oil from the end with a clean rag or paper towel. Insert the clean dipstick all the way back into its metal tube and pull it out again. Observe the oil at the end of the dipstick. At its highest point, the level should be between the L and F marks **(see illustration).**

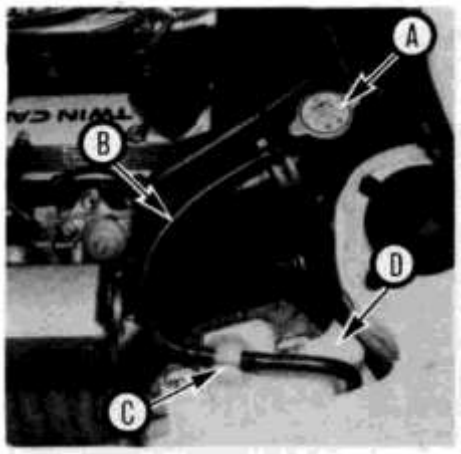
5 It takes one quart of oil to raise the level from the L mark to the F mark on the dipstick. Do not allow the level to drop below the L mark or oil starvation may cause engine damage. Conversely, overfilling the engine (adding oil above the F mark) may cause oil fouled spark plugs, oil leaks or oil seal failures.

6 Remove the threaded cap located on the rear cam cover to add oil **(see illustration).** Use an oil can spout or funnel to prevent spills. After adding the oil, install the filler cap hand tight. Start the engine and look carefully for any small leaks around the oil filter or drain plug. Stop the engine and check the oil level again after it has had sufficient time to drain from the upper block and cylinder head galleys.

7 Checking the oil level is an important preventive maintenance step. A continually dropping oil level is indicates oil leakage through damaged seals, from loose connections or past worn rings or valve guides. If the oil looks milky in color or has water droplets in it, a cylinder head gasket may be blown. The engine should be checked immediately. The condition of the oil should also be checked. Each time you check the oil level, slide your thumb and index finger up the dipstick before wiping off the oil. If you see small dirt or metal particles clinging to the dipstick, the oil should be changed (Section 6).

Engine coo/ant

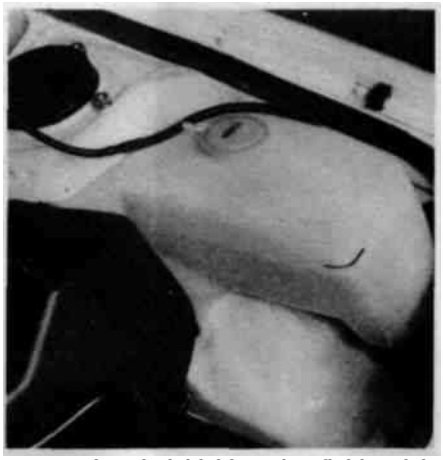
8 All vehicles covered by this manual are equipped with a pressurized coolant recovery system. A white coolant reservoir located in the right



4.8 The coolant recovery system

a) Pressure cap
b) Connecting hose
c) Reservoir filler cap
d) Reservoir

4.9 Make sure that the coolant level in the reservoir is between the Low and Full marks — if it's below the Low mark, add a sufficient quantity of the prescribed mixture of antifreeze and water



4.14 The windshield washer fluid tank is located in the left front corner of the front compartment — the washer system can use plain water or special washer fluid containing antifreeze to allow operation of the system in climates where the temperature goes below the freezing point

rear corner of the engine compartment is connected by a hose to the base of the coolant filler cap **(see illustration).** If the coolant heats up during engine operation, coolant can escape through a pressurized filler cap, then through a connecting hose into the reservoir. As the engine cools, the coolant is automatically drawn back into the cooling system to maintain the correct level.

9 The coolant level should be checked regularly. It must be between the Full and Low lines on the tank **(see illustration).** The level will vary with the temperature of the engine. When the engine is cold, the coolant level should be at or slightly above the Low mark on the tank. Once the engine has warmed up, the level should be at or near the Full mark. If it isn't, allow the fluid in the tank to cool, then remove the cap from the reservoir and add coolant to bring the level up to the Full line. Use only ethylene/glycol type coolant and water in the mixture ratio recommended by your owner's manual. Do not use supplemental inhibitors or additives. If only a small amount of coolant is required to bring the system up to the proper level, water can be used. However, repeated additions of water will dilute the recommended antifreeze and water solution. In order to maintain the proper ratio of antifreeze and water, it is advisable to top up the coolant level with the correct mixture. Refer to your owner's manual for the recommended ratio.

10 If the coolant level drops within a short time after replenishment, there may be a leak in the system. Inspect the radiator, hoses, engine coolant filler cap, drain plugs, air bleeder plugs and water pump. If no leak is evident, have the radiator cap pressure tested by your dealer. **Warning:** *Never remove the radiator cap or the coolant recovery reservoir cap when the engine is running or has just been shut down because the cooling system is hot. Escaping steam and scalding liquid could cause serious injury.*

11 If it is necessary to open the radiator cap, wait until the system has cooled completely, then wrap a thick cloth around the cap and turn it to the first stop. If any steam escapes, wait until the system has cooled further, then remove the cap.

12 When checking the coolant level, always note its condition. It should be relatively clear. If it is brown or rust colored, the system should be drained, flushed and refilled. Even if the coolant appears to be normal, the corrosion inhibitors wear out with use, so it must be replaced at the specified intervals.

13 Do not allow antifreeze to come in contact with your skin or painted surfaces of the vehicle. Flush contacted areas immediately with plenty of water.

Windshield washer fluid

14 Fluid for the windshield washer system is stored in a plastic reser voir which is located at the left front corner of the front compartment

4.15 Keep the electrolyte level of all six cells in the battery between the Lower and Upper levels — use only distilled water to replenish a cell and never overfill it or electrolyte may squirt out of the battery during periods of heavy charging

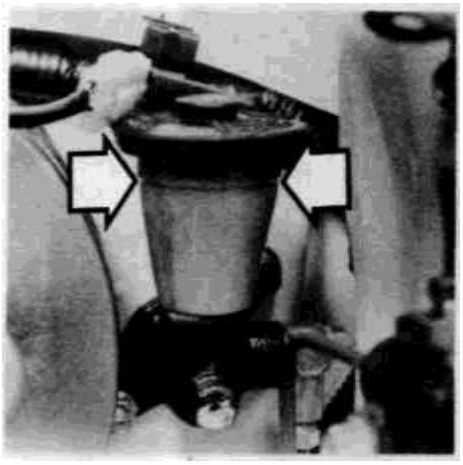
(see illustration). In milder climates, plain water can be used to top up the reservoir, but the reservoir should be kept no more than 2/3 full to allow for expansion should the water freeze. In colder climates, the use of a specially designed windshield washer fluid, available at your dealer and any auto parts store, will help lower the freezing point of the fluid. Mix the solution with water in accordance with the manufacturer's directions on the container. Do not use regular antifreeze. It will damage the vehicle's paint.

Battery electrolyte

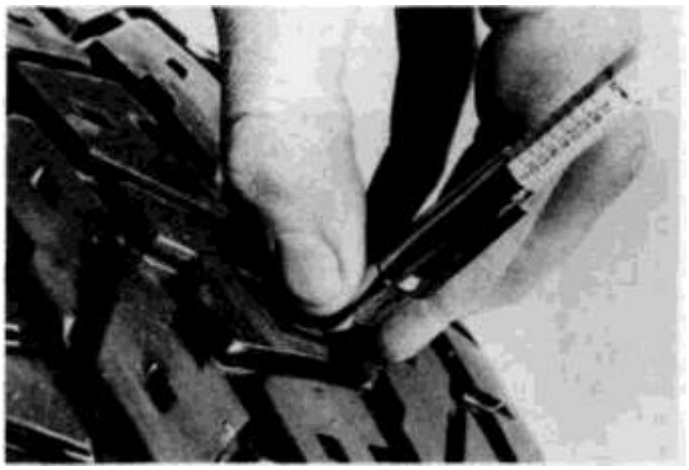
15 Check the electrolyte level of all six battery cells. It must be between the upper and lower levels **(see illustration).** If the level is low, unscrew the filler/vent cap and add distilled water. Install and securely retighten the cap. **Caution:** *Overfilling the cells may cause electrolyte to spill over during periods of heavy charging, causing corrosion or damage.*

4.16 The brake and clutch master cylinders and reservoirs are located in the left rear corner of the front compartment — the brake reservoir is the larger one closer to the center of the vehicle

4.17a The brake fluid level should be between the Min and Max lines on the reservoir body — a sight window (arrow) allows you to see the Min mark — add fluid to the *dotted* line and the reservoir will be full when you install the cap



4.17b There are no calibrated lines on the clutch reservoir body to indicate the minimum and maximum levels for fluid — just keep the fluid level even with the top (arrows) of the conical portion of the reservoir



5.2 Measuring the tire tread depth with a tread depth indicator will enable you to monitor the wear rates of your tires — to use the indicator, simply push the screwdriver-like tip into a tread groove until it bottoms and read the indicated depth on the calibrated barrel

Brake and clutch fluid

1 6 The brake master cylinder is mounted on the front of the power booster unit in the front compartment **(see illustration).** The clutch cylinder used on manual transaxles is located just behind the master cylinder.

17 To check the fluid level of the brake master cylinder reservoir, simply look at the *Max* and *Min* marks on the reservoir **(see illustration).** To check the fluid level of the clutch master cylinder reservoir, note whether the fluid level is even with the maximum level line **(see illustration).** The level should be within the specified distance from the maximum fill line for both reservoirs.

18 If the level is low for either reservoir, wipe the top of the reservoir cover with a clean rag to prevent contamination of the brake or clutch system before lifting the cover.

19 Add only the specified brake fluid to the brake or clutch reservoir (refer to *Recommended lubricants and fluids* at the front of this chapter or to your owner's manual). Mixing different types of brake fluid can damage the system. Fill the brake master cylinder reservoir only to the dotted line — this brings the fluid to the correct level when you put the cover back on. **Warning:** *Use caution when filling either reservoir — brake fluid can harm your eyes and damage painted surfaces. Do not use brake fluid that has been opened for more than one year or has been left open. Brake fluid absorbs moisture from the air. Excess moisture can cause a dangerous loss of braking.*

20 While the reservoir cap is removed, inspect the master cylinder reservoir for contamination. If deposits, dirt particles or water droplets are present,the system should be drained and refilled (see Chapter 8 for clutch reservoir or Chapter 9 for brake reservoir).

21 After filling the reservoir to the proper level, make sure the lid is properly seated to prevent fluid leakage and/or system pressure loss.

22 The brake fluid in the master cylinder will drop slightly as the brake pads at each wheel wear down during normal operation. If the master cylinder requires repeated replenishing to keep it at the proper level, this is an indication of leakage in the brake system, which should be corrected immediately. Check all brake lines and connections, along with the wheel cylinders and booster (see Section 14 for more information).

23 If, upon checking the master cylinder fluid level, you discover one or both reservoirs empty or nearly empty, the brake system should be bled (Chapter 9).

5 Tire and tire pressure checks

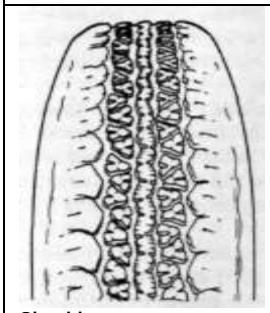
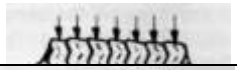
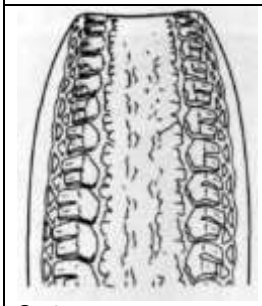
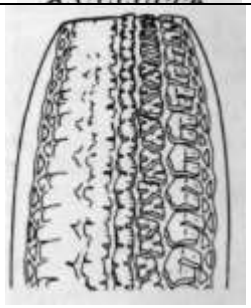
Refer to illustrations 5.2, 5.3, 5.4a, 5.4b and 5.8

1 Periodic inspection of the tires may spare you from the inconvenience of being stranded with a flat tire. It can also provide you with vital information regarding possible problems in the steering and suspension systems before major damage occurs.

2 Normal tread wear can be monitored with a simple, inexpensive device known as a tread depth indicator **(see illustration).** When the tread depth reaches the specified minimum, replace the tire(s).

3 Note any abnormal tread wear **(see illustration).** Tread pattern irregularities such as cupping, flat spots and more wear on one side than the other are indications of front end alignment and/or balance problems. If any of these conditions are noted, take the vehicle to a tire shop or service station to correct the problem.

4 Look closely for cuts, punctures and embedded nails or tacks. Sometimes a tire will hold its air pressure for a short time or leak down very slowly even after a nail has embedded itself into the tread. If a slow leak persists, check the valve stem core to make sure it is tight **(see illustration).** Examine the tread for an object that may have embedded itself into the tire or for a "plug" that may have begun to leak (radial tire punctures are repaired with a plug that is installed in a puncture). If a puncture is suspected, it can be easily verified by spraying a solution of soapy water onto the puncture area **(see illustration).** The soapy solution will bubble if there is a leak. Unless the puncture is inordinately large, a tire shop or gas station can usually repair the

Condition	Probable cause	Corrective action	Condition	Probable cause	Corrective action
 Shoulder wear	• Underinflation (both sides wear) • Incorrect wheel camber (one side wear) • Hard cornering • Lack of rotation	• Measure and adjust pressure. • Repair or replace axle and suspen sion parts. • Reduce speed. • Rotate tires.	Feathered edge 	• Incorrect toe	• Adjust toe-in.
 Center wear	• Overinflation • Lack of rotation	• Measure and adjust pressure. • Rotate tires.	 Uneven wear	• Incorrect camber or caster • Malfunctioning suspension • Unbalanced wheel • Out-of-round brake drum • Lack of rotation	• Repair or replace axle and suspen sion parts • Repair or replace suspension parts. • Balance or replace. • Turn or replace. • Rotate tires.

5.3 If a tire begins to show evidence of any of these conditions, take immediate remedial action or the tire will be ruined

5.4a If a tire keeps losing pressure every time you add air, check the valve stem cores with a core removal tool to make sure that they're tight before looking for a leak in the tread

5.4b To look for a leak, spray the suspicious area with a solution of soapy water — if there is a leak in the vicinity, bubbles will appear

5.8 Get a good, accurate tire gauge like this and keep it in your glovebox — the gauges fitted to air hoses at service stations are often inaccurate

punctured tire.

5 Carefully inspect the inboard sidewall of each tire for evidence of brake fluid leakage. If you see any, inspect the brakes immediately.

6 Correct tire air pressure adds miles to the lifespan of the tires, improves mileage and enhances overall ride quality. Tire pressure cannot be accurately estimated by looking at a tire, particularly if it is a radial. A tire pressure gauge is therefore essential. Keep an accurate gauge in the glovebox. The pressure gauges fitted to the the nozzles of air hoses at gas stations are often inaccurate.

7 Always check tire pressure when the tires are cold. "Cold," in this case, means the vehicle has not been driven over a mile in the three hours preceding a tire pressure check. A pressure rise of four to eight pounds is not uncommon once the tires are warm.

8 Unscrew the valve cap protruding from the wheel or hubcap and push the gauge firmly onto the valve **(see illustration).** Note the reading on the gauge and compare this figure to the recommended tire pressure shown on the tire placard on the left door. Be sure to reinstall the valve cap to keep dirt and moisture out of the valve stem mechanism. Check all four tires and, if necessary, add enough air to bring them up to the recommended pressure levels.

9 Don't forget to keep the spare tire inflated to the specified pressure (consult your owner's manual). Note that the air pressure specified for the compact spare is significantly higher than the pressure of the regular tires.

6 Engine oil and oil filter change

Refer to illustrations 6.2, 6.7 and 6.12

1 Frequent oil changes are the best preventive maintenance the home mechanic can give the engine because aging oil becomes diluted and contaminated, which leads to premature engine wear.

2 Make sure that you have all the necessary tools before you begin this procedure **(see illustration).** You should also have plenty of rags or newspapers handy for mopping up any spills.

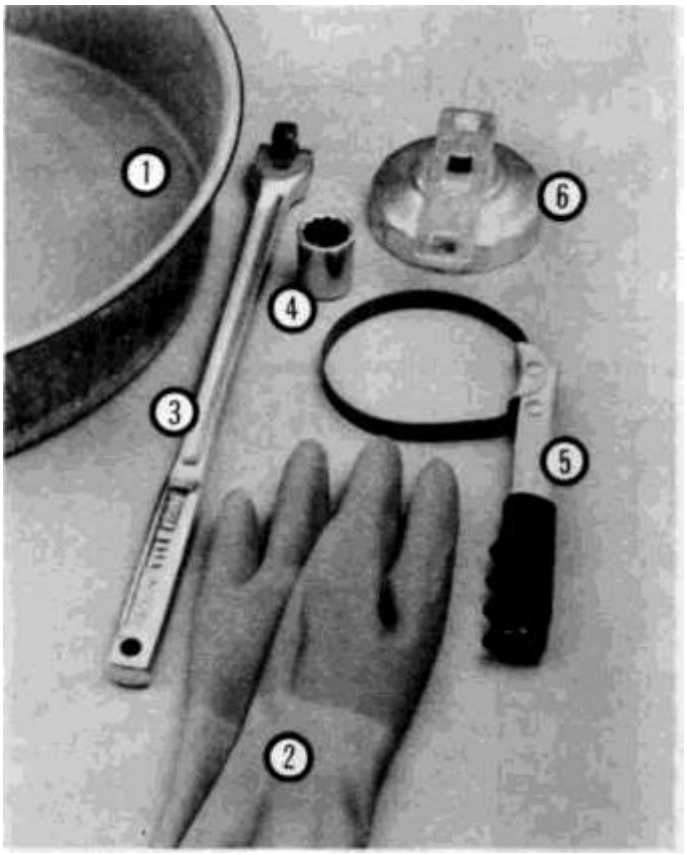
3 Access to the underside of the vehicle is greatly improved if the vehicle can be lifted on a hoist, driven onto ramps or supported by jackstands. **Warning:** *Do not work under a vehicle which is supported only by a bumper, hydraulic or scissors-type jack.*

4 If this is your first oil change, get under the vehicle and familiarize yourself with the locations of the oil drain plug and the oil filter. The engine and exhaust components will be warm during the actual work, so try to anticipate any potential problems before the engine and accessories are hot.

5 Park the vehicle on a level spot. Start the engine and allow it to reach its normal operating temperature (the needle on the temperature gauge should be at least above the bottom mark). Warm oil and sludge will flow out more easily. Turn off the engine when it's warmed up. Remove the filler cap in the rear cam cover.

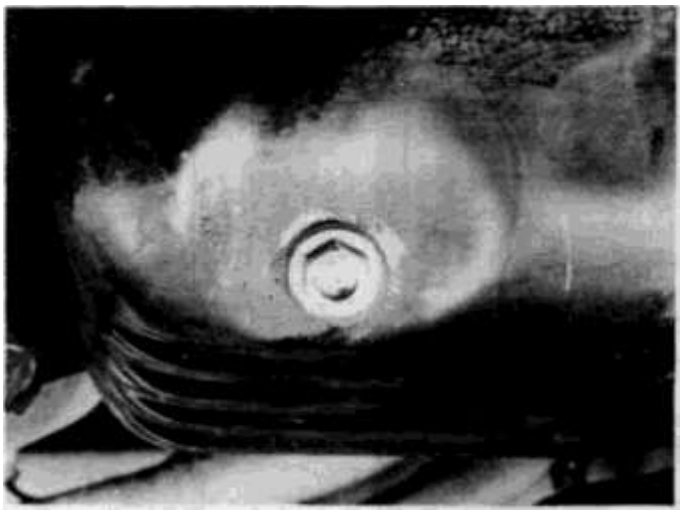
6 Raise the vehicle and support it on jackstands. **Warning:** *To avoid personal injury, never get beneath the vehicle when it is supported by only by a jack. The jack provided with your vehicle is designed solely for raising the vehicle to remove and replace the wheels. Always use jackstands to support the vehicle when it becomes necessary to place your body underneath the vehicle.*

7 Being careful not to touch the hot exhaust components, place the drain pan under the drain plug **(see illustration)** in the bottom of the pan and remove the plug. You may want to wear gloves while unscrewing the plug the final few turns if the engine is really hot.

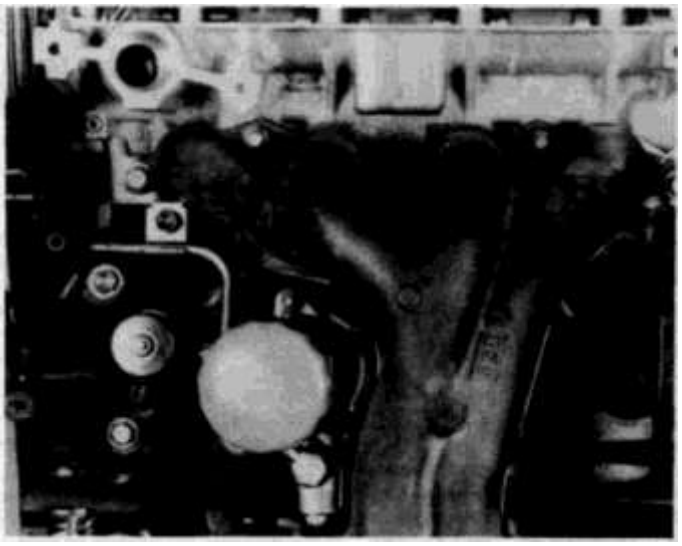


6.2 These tools are required when changing the engine oil and filter

1 ***Drain pan*** *— It should be fairly shallow in depth, but wide in order to prevent spills*
2 ***Rubber gloves*** *— When removing the drain plug and filter it is inevitable that you will get oil on your hands (the gloves will prevent burns)*
3 ***Breaker bar*** *— Sometimes the oil drain plug is pretty tight and a long breaker bar is needed to loosen it*
4 ***Socket*** *— To be used with the breaker bar or a ratchet (must be the correct size to fit the drain plug)*
5 ***Filter wrench*** *— This is a metal band-type wrench, which requires clearance around the filter to be effective*
6 ***Filter wrench*** *— This type fits on the bottom of the filter and can be turned with a ratchet or breaker bar (different size wrenches are available for different types of filters)*



6.7 The oil pan drain plug is located in the lower rear side of the pan — there is also a gasket between the plug and the pan which, if damaged, should be replaced



6.12 The oil filter is located in the front left side of the engine block — it's in an awkward location so you may wish to wear goggles as well as gloves when removing it to protect your eyes from dripping oil

8 Allow the old oil to drain into the pan. It may be necessary to move the pan farther under the engine as the oil flow slows to a trickle. Inspect the old oil for the presence of metal shavings and chips.

9 After all the oil has drained, wipe off the drain plug with a clean rag. Even minute metal particles clinging to the plug would immediately contaminate the new oil.

10 Clean the area around the drain plug opening, reinstall the plug and tighten it securely, but do not strip the threads.

11 Move the drain pan into position under the oil filter.

12 Loosen the oil filter **(see illustration)** by turning it counterclockwise with the filter wrench. Any standard filter wrench will work. Sometimes the oil filter is screwed on so tightly that it cannot be loosened. If this situation occurs, punch a metal bar or long screwdriver directly through the side of the canister and use it as a T-bar to turn the filter. Be prepared for oil to spurt out of the canister as it is punctured. Once the filter is loose, use your hands to unscrew it from the block. Just as the filter is detached from the block, immediately tilt the open end up to prevent the oil inside the filter from spilling out. **Warning:** *The engine exhaust manifold may still be hot, so be careful.*

1 3 With a clean rag, wipe off the mounting surface on the block. If a residue of old oil is allowed to remain, it will smoke when the block is heated up. It will also prevent the new filter from seating properly. Also make sure that the none of the old gasket remains stuck to the mounting surface. It can be removed with a scraper if necessary. 14 Compare the old filter with the new one to make sure they are the same type. Smear some engine oil on the rubber gasket of the new filter and screw it into place. Because overtightening the filter will damage the gasket, do not use a filter wrench to tighten the filter. Tighten it *by hand* until the gasket contacts the seating surface. Then seat the filter by giving it an additional 3/4-tum. 1 5 Remove all tools, rags, etc. from under the vehicle, being careful not to spill the oil in the drain pan, then lower the vehicle. 16 Add new oil to the engine through the oil filler cap in the rear cam cover. Use a spout or funnel to prevent oil from spilling onto the top of the engine. Pour three quarts of fresh oil into the engine. Wait a few minutes to allow the oil to drain into the pan, then check the level on the oil dipstick (see Section 4 if necessary). If the oil level is at or near the F mark, install the filler cap hand tight, start the engine and allow the new oil to circulate.

1 7 Allow the engine to run for about a minute. While the engine is running, look under the vehicle and check for leaks at the oil pan drain plug and around the oil filter. If either is leaking, stop the engine and tighten the plug or filter slightly.

18 Wait a few minutes to allow the oil to trickle down into the pan, then recheck the level on the dipstick and, if necessary, add enough oil to bring the level to the F mark. 1 9 During the first few trips after an oil change, make it a point to check frequently for leaks and proper oil level. 20 The old oil drained from the engine cannot be reused in its present state and should be discarded. Oil reclamation centers, auto repair shops and gas stations will normally accept the oil, which can be refined and used again. After the oil has cooled, it can be drained into a suitable container (capped plastic jugs, topped bottles, milk cartons, etc.) for transport to one of these disposal sites.

7 Windshield wiper blade inspection and replacement

Refer to illustrations 7.5 and 7.7

1 The windshield wiper and blade assembly should be inspected periodically for damage, loose components and cracked or worn blade elements.

2 Road film can build up on the wiper blades and affect their efficiency, so they should be washed regularly with a mild detergent solution.

3 The action of the wiping mechanism can loosen bolts, nuts and fasteners, so they should be checked and tightened, as necessary, at the same time the wiper blades are checked.

4 If the wiper blade elements are cracked, worn or warped, or no longer clean adequately, they should be replaced with new ones.

5 Lift the arm assembly away from the glass for clearance and pull the top end of the rubber blade element inward **(see illustration)** until the rubber blade is free of the end slot and you can see the replacement hole.

6 Remove the rubber blade from the frame and discard it.

7 To install a new rubber wiper element, insert the end with the small protrusions **(see illustration)** into the replacement hole and work the rubber along the slot in the blade frame.

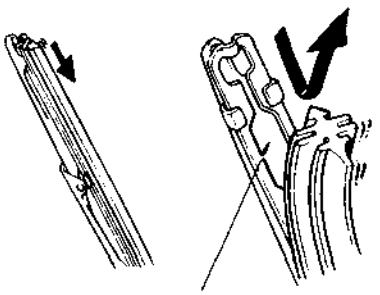
8 Once all the rubber is in the frame slot, allow it to expand and fill in the end.

8 Clutch pedal free play check and adjustment

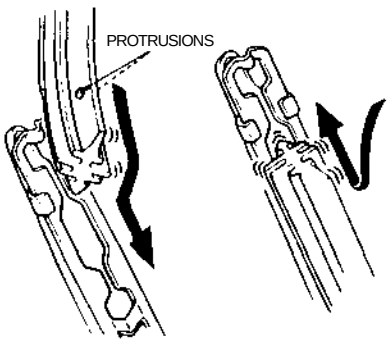
Refer to illustrations 8.1 and 8.3

1 Press down lightly on the clutch pedal and, with a small steel ruler, measure the distance that it moves freely before the clutch resistance is felt **(see illustration).** The free play should be within the specified limits. If it isn't, it must be adjusted.

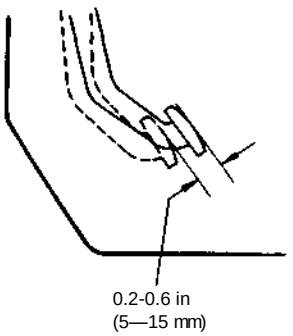
2 Remove the instrument finish lower panel and air duct (see Chapter 11).



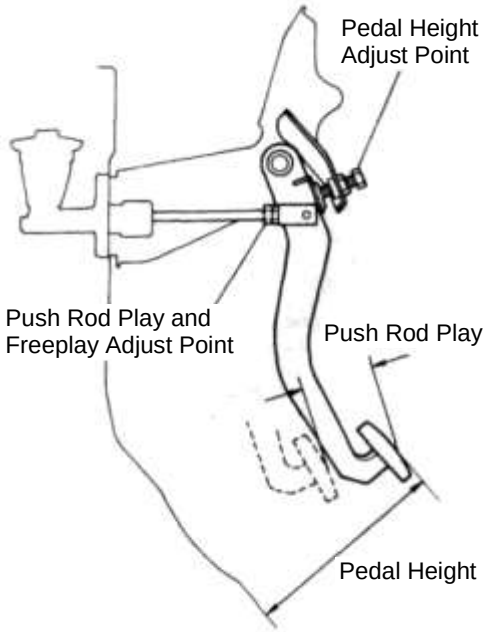
7.5 To remove the old wiper blade element, pull the top end of the blade downward until the blade is free of the end slot and you can see the replacement hole, then pull the rubber blade out of the frame — to facilitate reassembly, be sure to note the relationship of the blade to the frame before completely removing the blade



7.7 To install a new blade, insert the end of the blade with small protrusions into the replacement hole and work the rubber along the slot in the blade frame — once all the rubber is in the frame slot, allow it to expand and fill in the end



8.1 To check clutch pedal free play, measure the distance between the natural resting place of the pedal and the point at which you encounter resistance



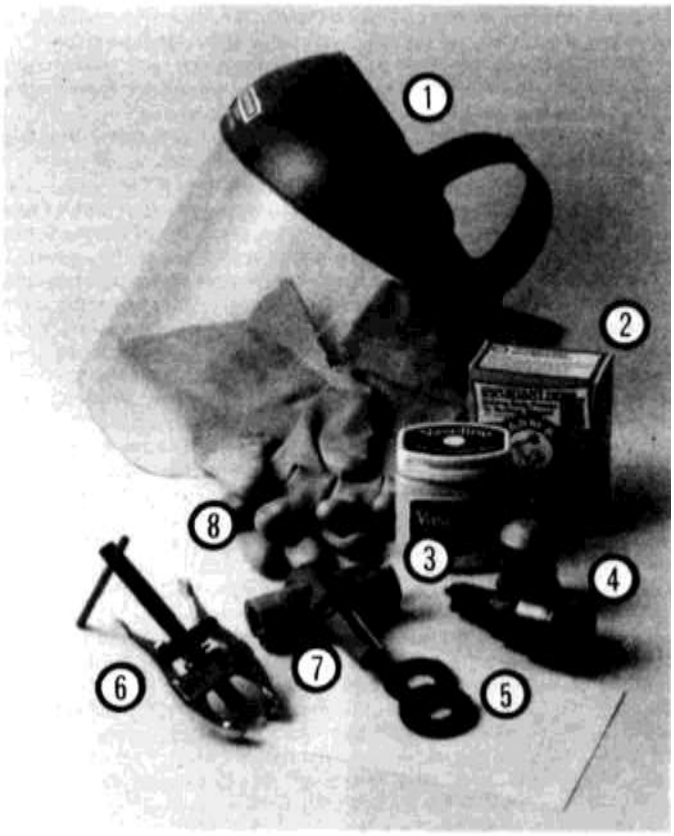
8.3 The clutch pedal must be adjusted for push rod play and pedal height — each of these adjustments is accomplished by loosening a locknut and turning a threaded adjuster

3 Loosen the locknut on the pedal end of the clutch push rod **(see illustration).**
4 Turn the push rod until pedal free play and push rod free play are correct.
5 Tighten the lock nut.
6 After adjusting the pedal free play, check the pedal height.
7 If pedal height is incorrect, loosen the lock nut and turn the stopper bolt until the height is correct. Tighten the lock nut.
8 Install the air duct and instrument finish lower panel.

9 Battery check and maintenance

Refer to illustrations 9.1, 9.6a, 9.6b, 9.7a and 9.7b

1 A routine preventive maintenance program for the battery in your vehicle is the only way to ensure quick and reliable starts. But before performing any battery maintenance, make sure that you have the proper equipment necessary to work safely around the battery **(see illustration).**
2 There are also several precautions that should be taken whenever battery maintenance is performed. Before servicing the battery, always turn the engine and all accessories off and disconnect the cable from the negative terminal of the battery.
3 The battery produces hydrogen gas, which is both flammable and explosive. Never create a spark, smoke or light a match around the battery. Always charge the battery in a ventilated area.
4 Electrolyte contains poisonous and corrosive sulfuric acid. Do not allow it to get in your eyes, on your skin on on your clothes. Never ingest it. Wear protective safety glasses when working near the battery. Keep children away from the battery.
5 Note the external condition of the battery. If the positive terminal and cable clamp on your vehicle's battery is equipped with a rubber protector, make sure that it's not torn or damaged. It should completely cover the terminal. Look for any corroded or loose connections, cracks in the case or cover or loose hold down clamps. Also check the entire length of each cable for cracks and frayed conductors.
6 If corrosion, which looks like white, fluffy deposits **(see illustration)** is evident, particularly around the terminals, the battery should be removed for cleaning. Loosen the cable clamp bolts with a wrench, being careful to remove the ground cable first, and slide them off the terminals **(see illustration).** Then disconnect the hold down clamp bolt and nut, remove the clamp and lift the battery from the engine compartment.
7 Clean the cable clamps thoroughly with a battery brush or a terminal cleaner and a solution of warm water and baking soda **(see illustration).** Wash the terminals and the top of the battery case with the same solution but make sure that the solution doesn't get into the battery. When cleaning the cables, terminals and battery top, wear safety goggles and rubber gloves to prevent any solution from coming in contact with your eyes or hands. Wear old clothes too — even diluted, sulfuric acid splashed onto clothes will burn holes in them. If the terminals have been extensively corroded, clean them up with a terminal cleaner **(see illustration).** Thoroughly wash all cleaned areas with plain water.



9.1 Tools and materials required for battery maintenance

1. ***Face shield/safety goggles*** *— When removing corrosion with a brush, the acidic particles can easily fly up into your eyes*
2. ***Baking soda*** *— A solution of baking soda and water can be used to neutralize corrosion*
3. ***Petroleum jelly*** *— A layer of this on the battery posts will help prevent corrosion*
4. ***Battery post/cable cleaner*** *— This wire brush cleaning tool will remove all traces of corrosion from the battery posts and cable clamps*
5. ***Treated felt washers*** *— Placing one of these on each post, directly under the cable clamps, will help prevent corrosion*
6. ***Puller*** *— Sometimes the cable clamps are very difficult to pull off the posts, even after the nut/bolt has been completely loosened. This tool pulls the clamp straight up and off the post without damage*
7. ***Battery post/cable cleaner*** *— Here is another cleaning tool which is a slightly different version of number 4 above, but it does the same thing*
8. ***Rubber gloves*** *— Another safety item to consider when servicing the battery; remember that's acid inside the battery/*

9.6a This is what a badly corroded terminal looks like — the boot, the post, the cable clamp and the top of the battery case must be thoroughly cleaned to restore the performance of a battery in this condition

9.6b When loosening a cable clamp bolt, be absolutely sure that you don't create a short circuit between the terminal and ground by removing the ground cable first

9.7a After washing the cable clamp with a solution of warm water and baking soda, clean it out with a battery brush like this or ream it with a blade type cleaner — remove only enough metal from the inside of the clamp to rid it of any residual corrosion that didn't wash off

9.7b To ensure good electrical contact, clean each terminal post with a terminal cleaner — again, take off only enough metal to remove any residual corrosion that may have escaped the baking soda bath

8 Before reinstalling the battery into the engine compartment, inspect the plastic battery carrier. If it's dirty or covered with corrosion, remove it and clean it in the same solution of warm water and baking soda. Inspect the metal brackets which support the carrier to make sure that they are not covered with corrosion. If they are, wash them off. If corrosion is extensive, sand the brackets down to bare metal and spray them with a zinc-based primer (available in spray cans at auto paint and body supply stores).

9 Reinstall the battery carrier and the battery back into the engine compartment. Make sure that no parts or wires are laying on the carrier during installation of the battery.

10 Install a pair of specially treated felt washers around the terminals (available at auto parts stores), then coat the terminals and the cable clamps with petroleum jelly or grease to prevent further corrosion. In-, stall the cable clamps and tighten the bolts, being careful to install the negative cable last.

11 Install the hold down clamp and bolts. Tighten the bolts only enough to hold the battery firmly in place. Overtightening these bolts can crack the battery case.

12 Further information on the battery, charging and jump starting can be found in Chapter 5 and at the front of this manual.

10 Drivebelt check, adjustment and replacement

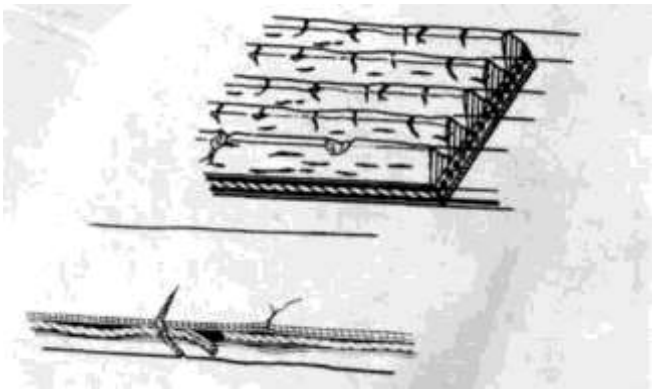
Refer to illustrations 10.3, 10.4, 10.5 and 10.10

Check

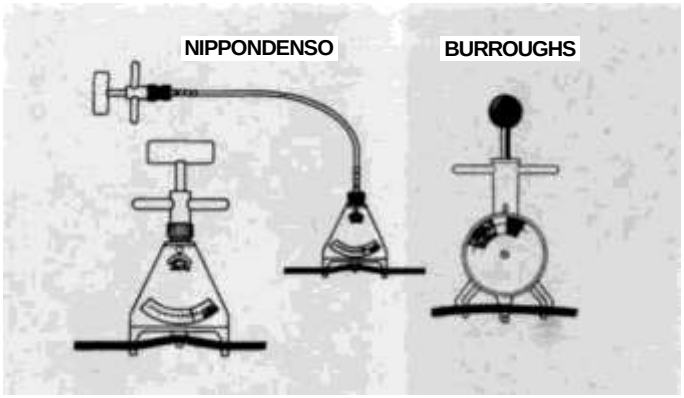
1 The alternator and air conditioning compressor drivebelts, also referred to as V-ribbed belts or simply "fan" belts, are located at the right end of the engine. The good condition and proper adjustment of the alternator belt is critical to the operation of the engine. Because of their composition and the high stresses to which they are subjected, drivebelts stretch and deteriorate as they get older. They must therefore be periodically inspected.

2 The number of belts used on a particular vehicle depends on the accessories installed. One belt transmits power from the crankshaft to the alternator and water pump. If your vehicle is equipped with air conditioning, the A/C compressor is driven by another belt.

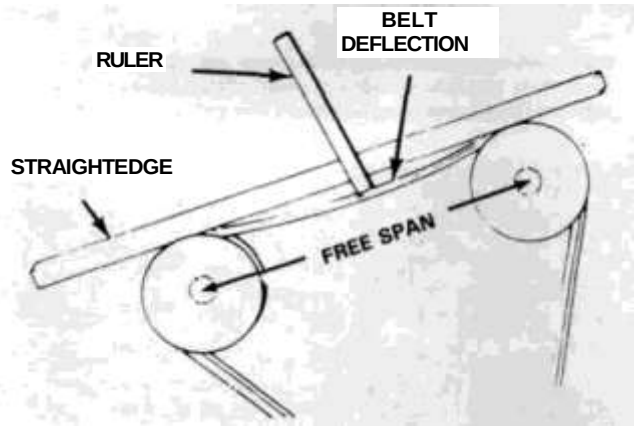
3 With the engine off, open the hood and locate the drivebelts at the right end of the engine. With a flashlight, check each belt for separation of the adhesive rubber on both sides of the core, core separation from the belt side, a severed core, separation of the ribs from the adhesive rubber, cracking or separation of the ribs, torn or worn ribs



10.3 Check the V-ribbed belt for signs of wear like these — if it looks worn, replace it

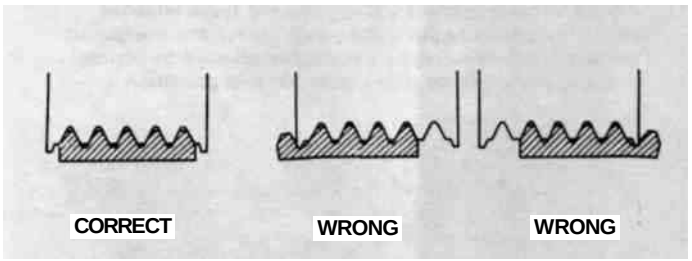


10.4 If you are able to borrow either a Nippondenso or Burroughs belt tension gauge, this is how it's installed onto the belt — compare the reading on the scale with the specified drive belt tension



MAKE SURE RULER IS PERPENDICULAR TO STRAIGHTEDGE

10.5 Drivebelt tension can also be checked with a straightedge and a ruler — place the straightedge along the circumference of two pulleys, deflect the belt with your thumb, measure the amount of deflection and compare it to the rule of thumb specifications provided in the text for this procedure



10.10 When installing a V-ribbed belt, make sure that it is centered on the pulley — it must not overlap either edge of the pulley

or cracks in the inner ridges of the ribs **(see illustration).** Also check for fraying and glazing, which gives the belt a shiny appearance. Both sides of the belt should be inspected, which means you will have to twist the belt to check the underside. Use your fingers to feel the belt where you can't see it. If any of the above conditions are evident, replace the belt (go to Step 8).

4 To check the tension of each belt in accordance with factory specifications, install either a Nippondenso or Burroughs belt tension gauge on the belt (see **illustration).** Measure the tension in accordance with the manufacturer's instructions and compare your measurement to the specified drive belt tension for either a used or new belt. **Note:** *A "used" belt is defined as any belt which has been operated more than five minutes on the engine; a "new" belt is one that has been used for less than five minutes.*

5 If you don't have either of the above tools, and cannot borrow one, the following rule of thumb method is recommended: Push firmly on the belt with your thumb at a distance halfway between the pulleys and note how far the belt can be pushed (deflected). Measure this deflection with a ruler **(see illustration).** The belt should deflect 1/4-inch if the distance from pulley center to pulley center is between 7 and 11 inches; the belt should deflect 1 /2-inch if the distance from pulley center to pulley center is between 12 and 16 inches.

Adjustment

6 If the alternator belt must be adjusted, loosen the adjustment bolt that secures the alternator to its slotted bracket and pivot the alter nator (away from the engine block to tighten the belt, toward the block to loosen the belt). It's helpful to lever the alternator with a large pry bar when adjusting the belt because the pry bar enables you to precisely position the alternator until the adjuster bolt is tightened. Be very careful not to damage the aluminum housing of the alternator. Recheck the belt tension using one of the above methods. Repeat this Step until the alternator drivebelt tension is correct.

7 If the air conditioner compressor drivebelt must be adjusted, locate the idler pulley on the front right corner of the block, just above the compressor. Turn the idler pulley adjuster bolt (clockwise to tighten the belt and counterclockwise to loosen it). Measure the belt tension in accordance with one of the above methods. Repeat this step until the air conditioning compressor drivebelt is adjusted.

Replacement

8 To replace a belt, follow the above procedures for drivebelt adjustment but slip the belt off the crankshaft pulley and remove it. If you are replacing the alternator belt, you will have to remove the air conditioning compressor belt first because of the way they are arranged on the crankshaft pulley. Because of this and because belts tend to wear out more or less together, it is a good idea to replace both belts at the same time. Mark each belt and its appropriate pulley groove so the replacement belts can be installed in their proper positions.

9 Take the old belts to the parts store in order to make a direct comparison for length, width and design.

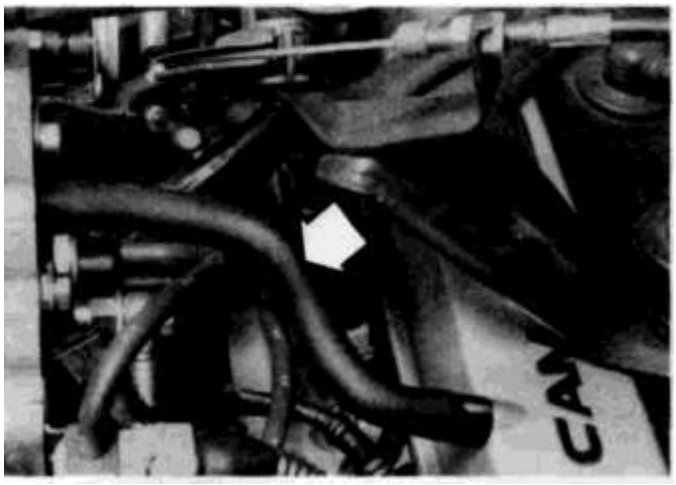
10 After replacing the drivebelt, make sure that it fits properly in the ribbed grooves in the pulleys **(see illustration).** It is essential that the belt be properly centered.

11 Adjust the belt(s) in accordance with the procedure outlined above.

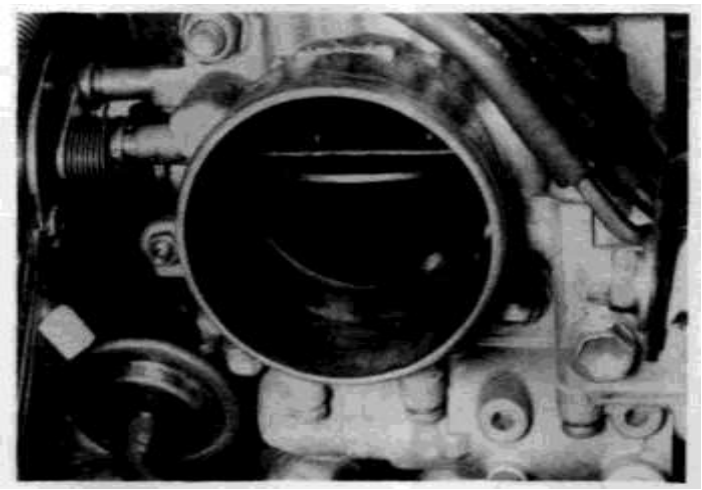
11 Underhood hose check and replacement

Refer to illustrations 11.1 and 11.3

Warning: *Replacement of air conditioning hoses must be left to a dealer or air conditioning specialist who has the proper equipment to depressurize the system safely. Never remove air conditioning components or hoses until the system has been depressurized.*



11.1 The PCV system hose (arrow) vents crankcase blow-by gases from the crankcase by routing them back into the intake manifold where they are mixed with incoming air and then burned in the combustion chamber — but the hose can't do it's job if it leaks, is cracked or is clogged



11.3 Once in a while, it's a good idea to inspect the throttle bore area immediately behind the throttle plate — this area can become clogged with a buildup of residue from the PCV hose

PCV system hose

1 In order to reduce hydrocarbon emissions, crankcase blow-by gas is routed from the rear camshaft cover through a rubber hose to the intake manifold **(see illustration)** where it mixes with and is vaporized by incoming air before being burned in the combustion chamber.

2 Check this hose for cracks, leaks or damage. Disconnect it from the cam cover and the intake manifold and inspect the inside for blockage. If it's clogged, clean it out with solvent.

3 The PCV system hose can cause a buildup of residue in the throttle bore area immediately behind the throttle plate, hindering free movement of the plate on its shaft. Therefore, it's a good idea to periodically remove the intake ducting from the throttle body, rotate the throttle plate on its shaft until it's wide open and inspect the throttle bore for residue **(see illustration).** Carefully remove the residue with your fingers and then wipe out the bore with a clean rag dipped in solvent.

Vacuum hoses

4 High temperatures under the hood can cause the deterioration of the rubber and plastic hoses used for engine, accessory and emission systems operation. Periodic inspection should be made for cracks, loose clamps, material hardening and leaks.

5 A periodic inspection should be conducted for pinches, cuts, cracks, loose clamps, disconnects, leaks and hardened hose material.

6 Some, but not all, vacuum hoses use clamps to secure the hoses to fittings. Check all hose clamps for tension to prevent leakage. Make sure that hoses which don't use clamps have not expanded or hardened, allowing them to leak or slip off.

7 Various fuel and emission systems require hoses with different wall thicknesses, collapse resistance and temperature resistance. It is therefore critical to replace old hoses with new ones of identical specification.

8 Often the only effective way to inspect a hose is to remove it completely from the vehicle. It it's necessary to remove more than one hose, be sure to label the hoses and their respective connections to insure proper reattachment.

9 When checking vacuum hoses, don't forget to inspect plastic T-fittings. Check the fittings for cracks and tight hose fit.

10 A small piece of vacuum hose (1/4-inch inside diameter) can be used as a stethoscope to detect vacuum leaks. Hold one end of the hose to your ear and probe around vacuum hoses and fittings, listening for the "hissing" sound characteristic of a vacuum leak. **Warning:** *When probing with the vacuum hose stethoscope, be careful not to allow your body or the hose to come into contact with moving engine components like drivebelts.*

Rubber fuel hoses

Warning: *Certain precautions must be taken before inspecting or servicing fuel system components. Work in a well ventilated area and do not allow open flames (cigarettes, appliance pilot lights, etc.) or bare light bulbs near the work area. Mop up any spills immediately and do not store fuel-soaked rags where they could ignite. Finally, should it become necessary to replace an y part of the fuel line, the fuel system pressure must be relieved first (Chapter 4).*

11 Check the rubber hose sections of the fuel lines for deterioration and chafing. Watch for cracks. Check all threaded connectors for a tight fit.

12 Deteriorated rubber fuel hose must be replaced with hose of the same specification. It's a good idea to take the section being replaced with you to the dealer to ensure the proper replacement is obtained.

Metal fuel lines

13 Unlike the rubber sections, the metal sections of fuel line are not likely to deteriorate but they can develop vibration induced cracks. Inspect them carefully for kinks and crimps.

14 Make sure that all the threaded connectors on both ends of the metal lines are tight.

15 If a section of metal fuel line is cracked, replace it. Do not substitute metal tubing of "similar" length and diameter. Replace it with an identical section of the correct specification. Tubing of the wrong material, wall thickness, etc. may not be designed to withstand the pressure and vibration to which it will be subjected.

Metal brake and clutch lines

16 In the front compartment, check the metal brake lines connected to the brake master cylinder, proportioning valve and clutch master cylinder for cracks in the lines or loose fittings. Any sign of brake fluid leakage calls for an immediate and thorough inspection of the brake system.

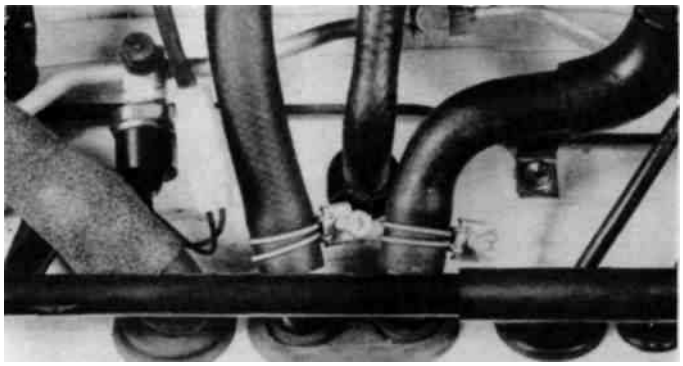
12 Cooling system check

Refer to illustrations 12.4a, 12.4b, 12.4c and 12.4d

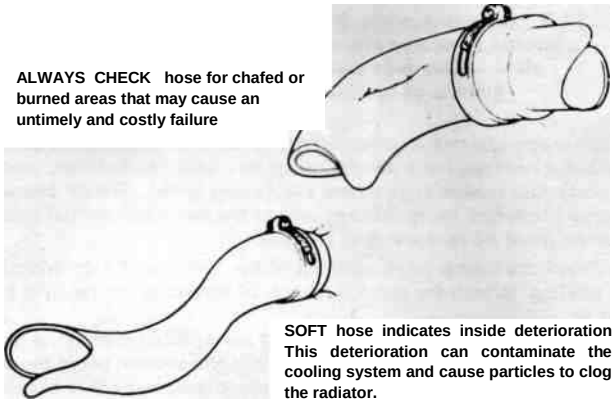
1 Many major engine failures can be attributed to a faulty cooling system. If your vehicle is equipped with an automatic transaxle, the cooling system also plays an important role in prolonging transmission life because it cools the transaxle fluid.

2 The engine should be cold for a cooling system check, so perform the following procedure before the vehicle is driven for the day or after it has been shut of for at least three hours.

3 Remove the engine coolant filler cap and clean it thoroughly, inside and out, with clean water. Also clean the engine coolant filler cap neck. There should not be any excessive deposit of rust or scale in the neck. Remove all traces of corrosion. Dip your finger into the filler neck and examine the condition of the coolant. It should be oil free and relatively clean. If it is excessively dirty, replace it (Section 24).



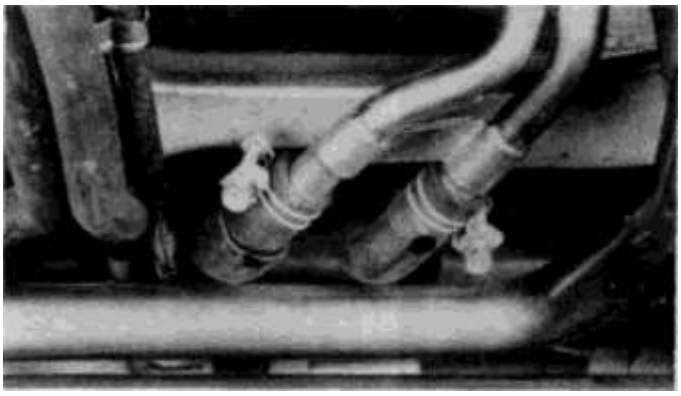
12.4a The heater hoses are hidden behind the luggage compartment trim panel



12.4c A few simple checks like these can detect cooling hose problems before they become cooling system problems

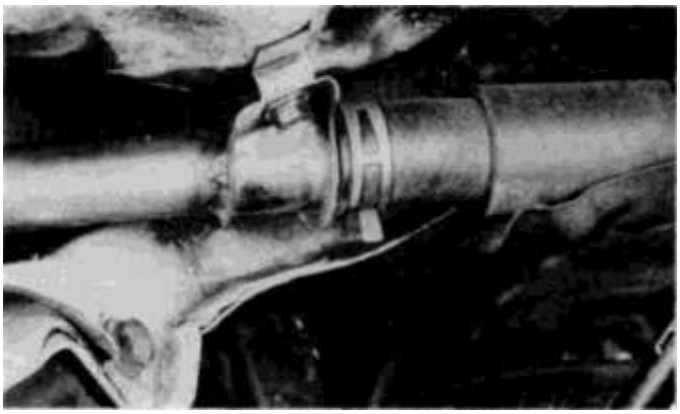
4 Carefully check the radiator hoses **(see illustrations).** Inspect each coolant hose along its entire length, replacing any hose which is cracked, swollen or otherwise deteriorated. Cracks are more apparent if the hose is squeezed **(see illustration).** Because of the front mounted radiator and mid-engine design, the radiator hoses are connected to the engine cooling hoses by metal tubes. Pay close attention to the hose clamps that secure the rubber hoses to the metal tubes **(see illustration).** Because these clamps tightly pinch and occasionally puncture old rubber hose material, leaks often develop in this area. Inspect all metal tubing for dents, kinks and deterioration that might block the flow of coolant.

5 Make sure that all hose connections are tight. A leak in the cooling system will usually show up as white or rust colored deposits on the area adjoining the leak.



12.4b The lower ends of the heater hoses are visible from underneath the vehicle once the forward fuel tank protector is removed

6 Clean the front of the radiator core and the air conditioning con-



12.4d Coolant usually starts leaking in the vicinity of a clamped connection between hose and tubing because the pinching pressure of the clamp weakens the hose material

denser with compressed air, if available, or a soft brush. Remove all bugs, leaves, road grit or gravel that may have imbedded itself into the cooling fins of the radiator. Be extremely careful not to damage the delicate cooling fins or cut your fingers on the sharp edges.

7 Pressure test the radiator cap and the cooling system with a pressure tester, if available, or have them tested by a repair shop or gas station.

8 Check the coolant for proper level and condition. It should be clear and free of impurities. If the coolant looks murky or rust colored, the system should be drained, flushed and refilled.

13 Tire rotation

Refer to illustration 13.2

1 The tires should be rotated at the specified intervals and whenever uneven wear is noticed. Since the vehicle will be raised and the tires removed anyway, check the brakes (Section 14) at this time.

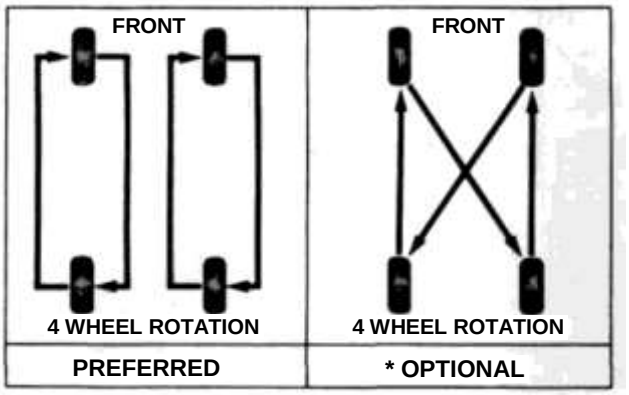
2 Radial tires must be rotated in a specific pattern **(see illustration).**

3 Refer to the information in *Jacking and towing* at the front of this manual for the proper procedures to follow when raising the vehicle and changing a tire. If the brakes are to be checked, do not apply the parking brake as stated. Make sure the tires are blocked to prevent the vehicle from rolling.

4 Preferably, the entire vehicle should be raised at the same time. This can be done on a hoist or by jacking up each corner and then lowering the vehicle onto jackstands placed under the frame rails. Always use four jackstands and make sure the vehicle is firmly supported.

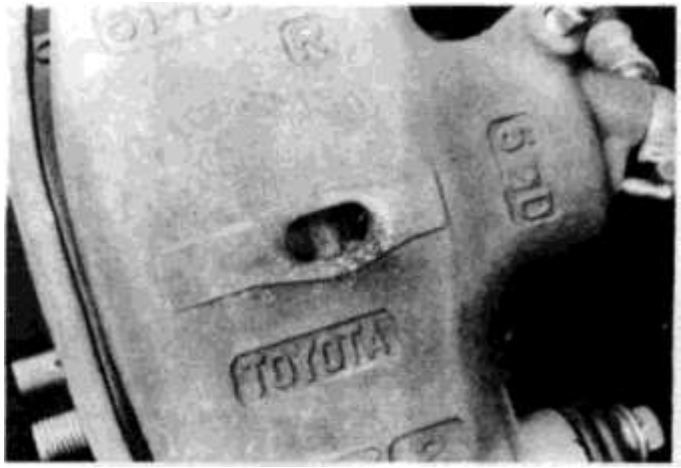
5 After rotation, check and adjust the tire pressures as necessary and be sure to check the lug nut tightness.

6 For further information on the wheels and tires, refer to Chapter 10.

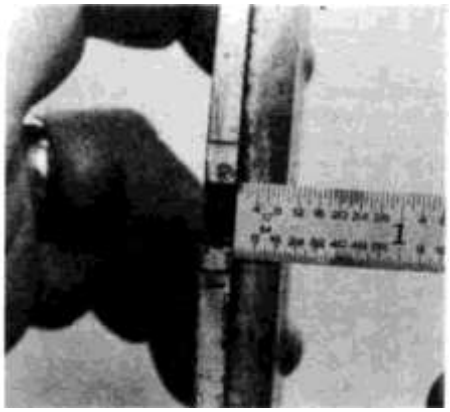


*** THE OPTIONAL 'X' ROTATION PATTERN FOR RADIALS IS ACCEPTABLE WHEN REQUIRED FOR MORE UNIFORM TIRE WEAR.**

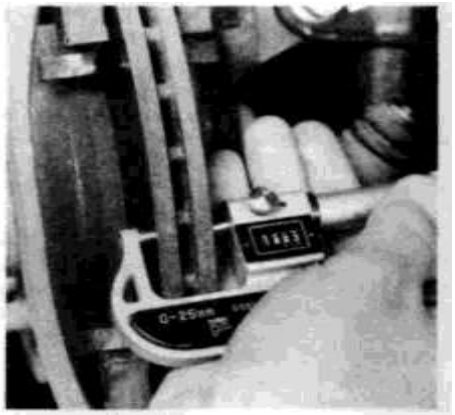
13.2 These are the only tire rotation patterns possible for your radial equipped vehicle



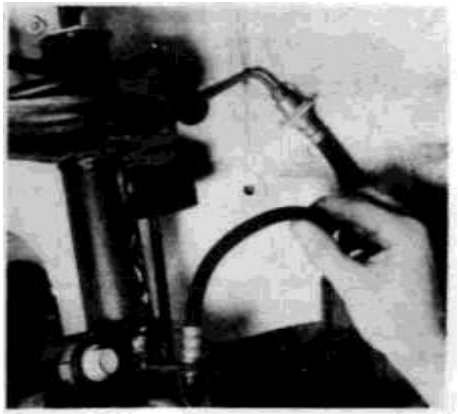
14.6 You will find an inspection hole like this in each caliper — placing a steel ruler across the hole should enable you to determine the thickness of remaining pad material for both inner and outer pads



14.9 If a more precise measurement of pad thickness is necessary, the pads must be removed from the caliper and measured like this — spraying the pads with brake cleaner will help you determine where the pad material ends and the steel backing material begins



14.10 Measure rotor thickness with a micrometer or a vernier caliper — even if the rotor has some service life remaining, closely scrutinize it for signs of wear such as gouging, scoring and burned spots



14.11 Always inspect the brake hoses at each caliper before installing the wheels — look for cracks, leaks and damage of any kind that would indicate potential hydraulic problems

14 Brake check

Refer to illustrations 14.6, 14.9, 14.10, 14.11 and 14.21

Note: *For detailed photographs of the brake system, refer to Chapter 9.*

1 In addition to the specified intervals, the brakes should be inspected every time the wheels are removed or whenever a defect is suspected. Any of the following symptoms could indicate a potential brake system defect: The vehicle pulls to one side when the brake pedal is depressed; the brakes make squealing or dragging noises when applied; brake travel is excessive; the pedal pulsates; brake fluid leaks, usually onto the inside of the tire or wheel.

2 The disc brake pads have built-in wear indicators which should make a high pitched squealing or scraping noise when they are worn to the replacement point. When you hear this noise, replace the pads immediately or expensive damage to the rotors can result.

3 Loosen the wheel lug nuts.

4 Raise the vehicle and place it securely on jackstands.

5 Remove the wheels (see *Jacking and towing* at the front of this book, or your owner's manual, if necessary).

6 There are two pads — an outer and an inner — in each caliper. The pads are visible through small inspection holes in each caliper **(see illustration)** .

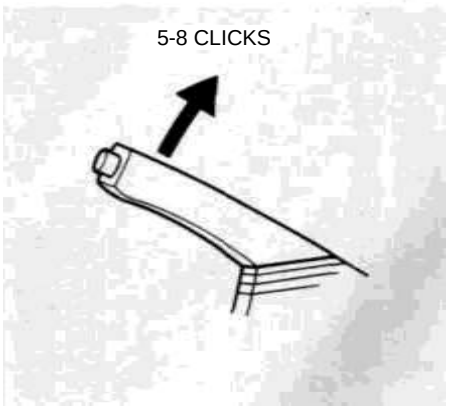
7 Check the pad thickness by looking at each end of the caliper and through the inspection hole in the caliper body. If the lining material is less than the specified thickness, replace the pads. **Note:** *Keep in mind that the lining material is riveted or bonded to a metal backing plate and the metal portion is not included in this measurement.*

8 If it is difficult to determine the exact thickness of the remaining pad material by the above method, or if you are at ail concerned about the condition of the pads, remove the caliper(s), then remove the pads from the calipers for further inspection (refer to Chapter 9).

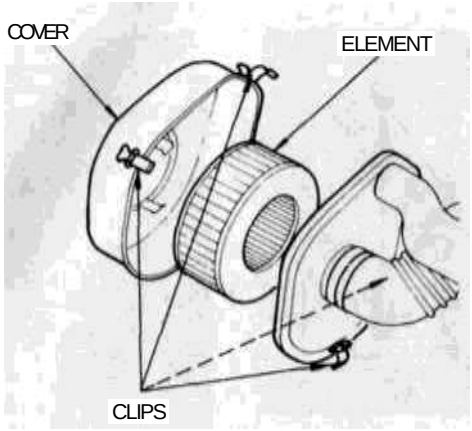
9 Once the pads are removed from the calipers, clean them with brake cleaner and remeasure them with a small steel pocket ruler **(see illustration)** or a vernier caliper.

10 Measure the disc rotor thickness with a micrometer **(see illustration)** to make sure that it still has service life remaining. If any disc is thinner than the specified minimum thickness, replace it (refer to Chapter 9). Even if the rotor has service life remaining, check its condition. Look for scoring, gouging and burned spots. If these conditions exist, remove the rotor and have it resurfaced (refer to Chapter 9).

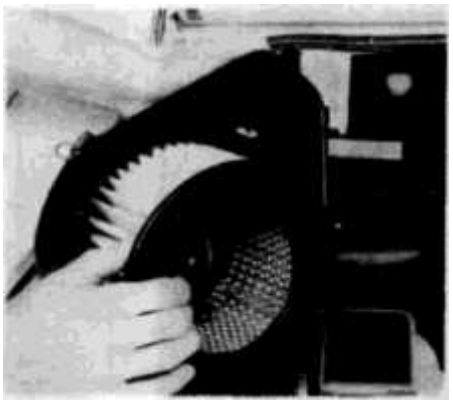
11 Before installing the wheels, check all brake lines and hoses for damage, wear, deformation, cracks, corrosion, leakage, bends and twists, particularly in the vicinity of the rubber hoses at the calipers **(see illustration).** Check the clamps for tightness and the connections for leakage. Make sure that all hoses and lines are clear of sharp edges, moving parts and the exhaust system. If any of the above conditions are noted, repair, reroute or replace the lines and/or fittings as necessary (refer to Chapter 9).



14.21 Slowly pull up on the parking brake and count the number of clicks you hear — if the handle reaches its maximum travel in more or less than 5 to 8 clicks, adjust the parking brake cable



15.1 Two clips on the top and two on the bottom keep the two halves of the air cleaner housing together — they can be pried loose with a medium size screwdriver



15.2 Once the two halves of the air cleaner housing are separated, the filter element can be removed — it's held in place by the friction of two long tabs pushing against its inner wall

12 Install the wheels and snug the wheel lug nuts finger tight.
13 Remove the jackstands and lower the vehicle.
14 Tighten the wheel lug nuts to the specified torque.

Brake booster check

15 Sit in the driver's seat and perform the following sequence of tests.
16 With the brake fully depressed, start the engine - the pedal should move down a little when the engine starts.
17 With the engine running, depress the brake pedal several times - the travel distance should not change.
18 Depress the brake, stop the engine and hold the pedal in for about 30 seconds - the pedal should neither sink nor rise.
19 Restart the engine, run it for about a minute and turn it off. Then firmly depress the brake several times - the pedal travel should decrease with each application.
20 If your brakes do not operate as described above when the preceding tests are performed, the brake booster is either in need of repair or has failed. Refer to Chapter 9 for the removal procedure.

Parking brake

21 Slowly pull up on the parking brake and count the number of clicks you hear until the handle is up as far as it will go **(see illustration).** The adjustment is correct if you hear between 5 and 8 clicks. If you hear more or less clicks, it's time to adjust the parking brake (refer to Chapter 9).
22 An alternative method of checking the parking brake is to park the vehicle on a steep hill with the parking brake set and the transmission in Neutral. If the parking brake cannot prevent the vehicle from rolling, it is in need of adjustment (see Chapter 9).

15 Air filter replacement

Refer to illustrations 15.1, 15.2 and 15.3

1 The air filter is located inside the air cleaner housing at the left rear corner of the engine compartment. To remove the air filter, release the four spring clips — two on the top and two on the bottom — that keep the two halves of the air cleaner housing together **(see illustration).**
2 Lift the left half of the air cleaner housing out of the engine compartment and remove the air filter **(see illustration).**
3 Inspect the outer surface of the air filter. If it is dirty, replace it. If it is only moderately dusty, it can be reused by blowing it clean from the *inside* with compressed air **(see illustration).** Because it is a pleated paper type filter, the air filter cannot be washed or oiled. If it cannot be cleaned satisfactorily with compressed air, discard and replace it. **Caution:** *Never drive the vehicle with the air cleaner removed. Excessive engine wear could result and backfiring could even cause a fire under the hood.*
4 Installation is the reverse of removal.

16 Fuel system check

Refer to illustration 16.2

Warning: *Certain precautions should be observed when inspecting or servicing the fuel system components. Work in a well ventilated area and do not allow open flames (cigarettes, appliance pilot lights, etc.) near the work area. Mop up spills immediately and do not store fuel soaked rags where they could ignite. It is a good idea to keep a dry chemical (Class B) fire extinguisher near the work area any time the fuel system is being serviced.*

1 If you smell gasoline while driving or after the vehicle has been sitting in the sun, inspect the fuel system immediately.
2 Remove the gas filler cap and inspect if for damage and corrosion. The gasket should have an unbroken sealing imprint. If the gasket is damaged or corroded, remove it **(see illustration)** and install a new one.
3 Inspect the fuel feed and return lines for cracks. Make sure that the threaded flare nut type connectors which secure the metal fuel lines to the fuel injection system and the banjo bolts which secure the banjo fittings to the in-line fuel filter are tight. **Warning:** *It is necessary to relieve the fuel system pressure before servicing fuel system components. The correct procedures for fuel system pressure relief are outlined in Chapter 4.*
4 Since some components of the fuel system — the fuel tank and part of the fuel feed and return lines, for example — are underneath the vehicle, they can be inspected more easily with the vehicle raised on a hoist. If that's not possible, raise the vehicle and secure it on jackstands.
5 With the vehicle raised and safely supported, inspect the gas tank and filler neck for punctures, cracks and other damage. The connection between the filler neck and the tank is particularly critical. Sometimes a rubber filler neck will leak because of loose clamps or deteriorated rubber. These are problems a home mechanic can usually rectify. **Warning:** *Do not, under any circumstances, try to repair a fuel tank (except rubber components). A welding torch or any open flame can easily cause fuel vapors inside the tank to explode.*
6 Carefully check all rubber hoses and metal lines leading away from the fuel tank. Check for loose connections, deteriorated hoses, crimped lines and other damage. Carefully inspect the lines from the tank to the fuel injection system. Repair or replace damaged sections as necessary.

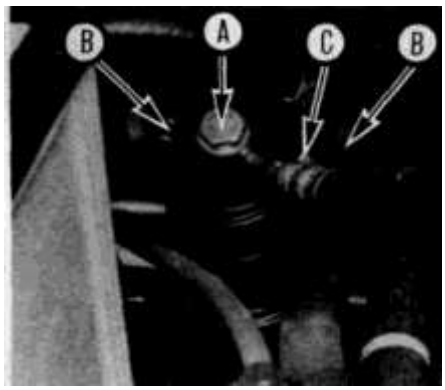
17 Fuel filter replacement

Refer to illustrations 17.1 and 17.3

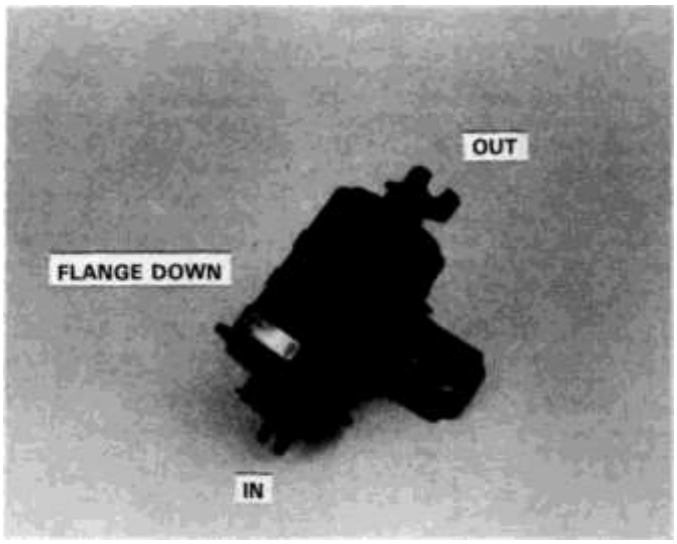
Warning: *Before removing the fuel filter, the fuel system pressure must be relieved by pulling the 15A EFI fuse from the fuse panel located in the left end of the engine compartment. Refer to Chapter 4 for more complete information on fuel pressure relief.*

15.3 If the filter is excessively dirty or mildewed, discard it — but if it looks only slightly dusty, try blowing it out from the inside with compressed air

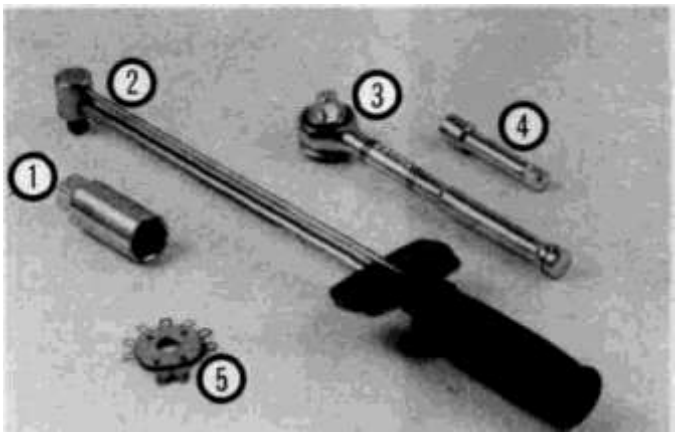
16.2 If the gas filler cap rubber gasket is damaged or worn, remove it with a small screwdriver and install a new one



17.1 After relieving the fuel pressure, disconnect both banjo fittings (a) from the fuel filter (only the top fitting is visible in this photo — the other one is at the lower end of the filter) and the bracket support bolts (b) from the firewall, then remove the filter/bracket assembly from the engine compartment and remove the filter clamp bolt (c)



17.3 Don't install the fuel filter backwards — make sure that the flanged end is facing downward



18.1 Tools required for changing spark plugs

1 Loosen the threaded banjo fittings on both ends of the fuel filter **(see illustration)** with a flare nut wrench. Disconnect both ends.
2 Remove both bracket bolts from the firewall and remove the old filter and the filter support bracket.
3 Remove the filter clamp bolt and separate the old filter from the bracket. Note that the inlet and outlet pipes are clearly labelled on their respective ends of the filter and that the flanged end of the filter faces downward **(see illustration).**
4 Install the new filter and bracket assembly and tighten the bracket bolts securely. Make sure that the new filter is installed so that it's facing the proper direction js-noted above. When correctly installed, the filter should be installed so that the outlet pipe pipe faces up and the inlet pipe faces downward.
5 Using the new crush washers — two per banjo fitting — provided by the filter manufacturer, install the inlet and outlet banjo fittings and tighten to the specified torque.
6 The remainder of installation is the reverse of the removal procedure.

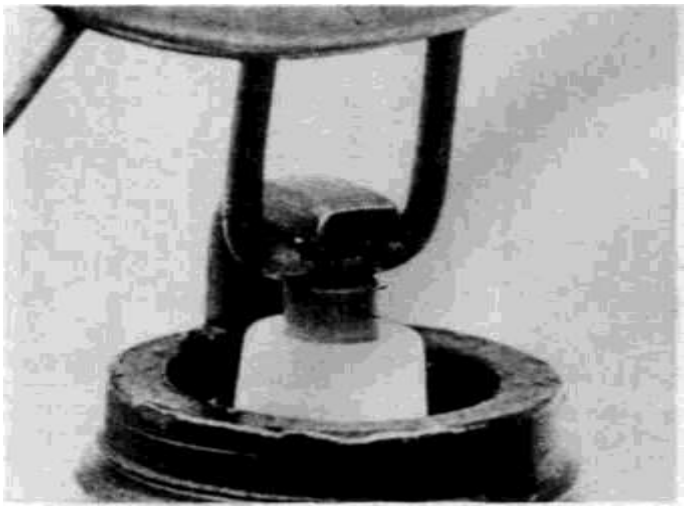
18 Spark plug check and replacement

Refer to illustrations 18.1, 18.4a. 18.4b. 18.6 and 18.10 and the illustrations on page 49

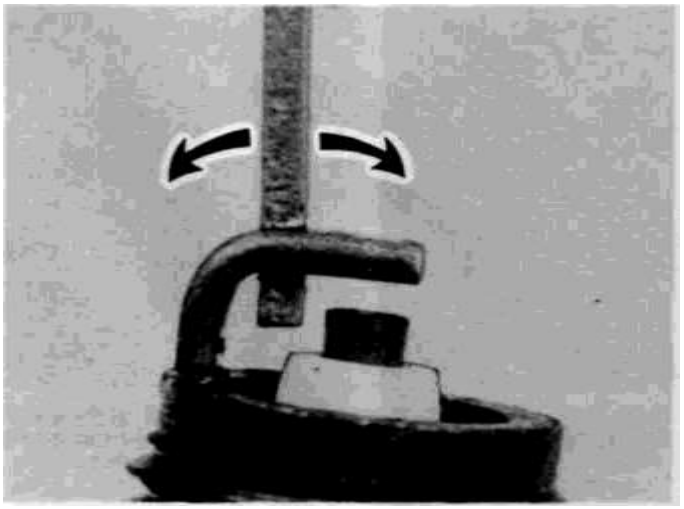
1 ***Spark plug socket*** *— This will have special padding inside to protect the spark plug porcelain insulator*
2 ***Torque wrench*** *— Although not mandatory, use of this tool is the best way to ensure that the plugs are tightened properly*
3 ***Ratchet*** *— Standard hand tool to fit the plug socket*
4 ***Extension*** *— Depending on model and accessories, you may need special extensions and universal joints to reach one or more of the plugs*
5 ***Spark plug gap gauge*** *— This gauge for checking the gap comes in a variety of styles. Make sure the gap for your engine is included*

Note: *The manufacturer recommends that the spark plugs be changed every 60,000 miles. We feel that this interval is too long. That's why we recommend that the plugs be changed once a year. However, if you wish to extend the service life of the spark plugs beyond our recommendations, perform the following procedure once a year to check the condition of the plugs.*

1 Spark plug replacement requires a spark plug socket which fits onto a ratchet wrench. This socket is lined with a rubber grommet to protect the porcelain insulator of the spark plug and to hold the plug while you insert it into the spark plug hole. You will also need a wire-type feeler gauge to check and adjust the spark plug gap and a torque wrench to tighten the new plugs to the specified torque **(see illustration).**

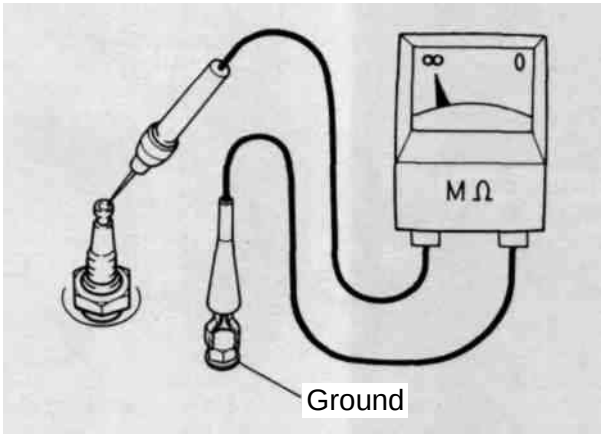


18.4a Spark plug manufacturers recommend using a wire-type gauge when checking the gap — if the wire does not slide between the electrodes with a slight drag, adjustment is required



18.4b To change the gap, bend the *side* electrode only, as indicated by the arrows, and be very careful not to crack or chip the porcelain insulator surrounding the center electrode

18.6 To disconnect a spark plug wire from the plug, grasp the boot like this and, with a twisting motion, pull it straight up



18.10 To measure the insulation resistance of each plug with an insulation resistance meter, attach the clip to ground and touch the probe to the top of each plug — the indicated value should exceed the specified resistance value; if it doesn't, replace the plugs

New plug checks

2 If you are replacing the plugs, purchase the new plugs, adjust them to the proper gap and then replace each plug one at a time. **Note:** *When buying new spark plugs, it's essential that you obtain the correct plugs for your specific vehicle. This information can be found on the Vehicle Emissions Control Information (VECI) label located on the underside of the engine compartment lid or in the owner's manual. If these two sources specify different plugs, purchase the spark plug type specified on the VECI label because that information is provided specifically for your engine.*

3 Inspect each of the new plugs for defects. If there are any signs of cracks in the porcelain insulator of a plug, don't use it.

4 Check the electrode gaps of the new plugs. Check the gap by inserting the wire gauge of the proper thickness between the electrodes at the tip of the plug **(see illustration).** The gap between the electrodes should be identical to that specified at the beginning of this chapter or on the VECI label. If the gap is incorrect, use the notched adjuster on the feeler gauge body to bend the curved side electrode slightly **(see illustration).**

5 If the side electrode is not exactly over the center electrode, use the notched adjuster to align them. **Caution:** *If the gap of a new plug must be adjusted, bend only the base of the ground electrode — do not touch the tip.*

Removal

Note: *If you wish to reuse the old plugs, perform one of the electrode checks outlined in Steps 10 and 11 before removing the plugs.*

6 To prevent the possibility of mixing up spark plug wires, work on one spark plug at a time. Remove the wire and boot from one spark plug. Grasp the boot — not the cable — as shown, give it a half twisting motion and pull straight up **(see illustration).**

7 If compressed air is available, blow any dirt or foreign material away from the spark plug area before proceeding (a common bicycle pump will also work).

8 Remove the spark plug.

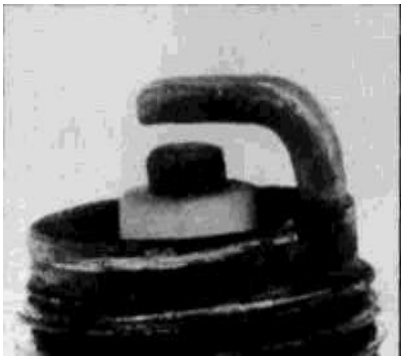
9 Whether you are replacing the plugs at this time or intend to reuse the old plugs, compare each old spark plug with those shown in the accompanying photos to determine the overall running condition of the engine.

Checking the old plugs

10 To inspect the electrodes of used plugs, use an insulation resistance meter to measure the resistance of the insulation of each spark plug **(see illustration).** If the indicated resistance of even one electrode is less than the specified value, replace all four plugs.

11 If you don't have access to such a meter, quickly race the engine

Common spark plug conditions



NORMAL

Symptoms: Brown to grayish-tan color and slight electrode wear. Correct heat range for engine and operating conditions.
Recommendation: When new spark plugs are installed, replace with plugs of the same heat range.

WORN

Symptoms: Rounded electrodes with a small amount of deposits on the firing end. Normal color. Causes hard starting in damp or cold weather and poor fuel economy.
Recommendation: Plugs have been left in the engine too long. Replace with new plugs of the same heat range. Follow the recommended maintenance schedule.

CARBON DEPOSITS

Symptoms: Dry sooty deposits indicate a rich mixture or weak ignition. Causes misfiring, hard starting and hesitation.
Recommendation: Make sure the plug has the correct heat range. Check for a clogged air filter or problem in the fuel system or engine management system. Also check for ignition system problems.

ASH DEPOSITS

Symptoms: Light brown deposits encrusted on the side or center electrodes or both. Derived from oil and/or fuel additives. Excessive amounts may mask the spark, causing misfiring and hesitation during acceleration.
Recommendation: If excessive deposits accumulate over a short time or low mileage, install new valve guide seals to prevent seepage of oil into the combustion

line brands.

OIL DEPOSITS

Symptoms: Oily coating caused by poor oil control. Oil is leaking past worn valve guides or piston rings into the combustion chamber. Causes hard starting, misfiring and hesitation.
Recommendation: Correct the mechanical condition with necessary repairs and install new plugs.

GAP BRIDGING

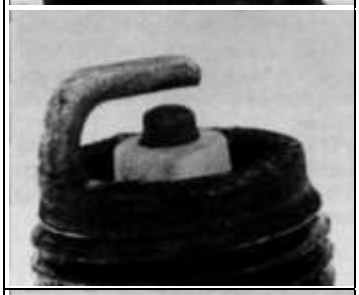
Symptoms: Combustion deposits lodge between the electrodes. Heavy deposits accumulate and bridge the electrode gap. The plug ceases to fire, resulting in a dead cylinder.
Recommendation: Locate the faulty plug and remove the deposits from between the electrodes.

TOO HOT

Symptoms: Blistered, white insulator, eroded electrode and absence of deposits. Results in shortened plug life.
Recommendation: Check for the correct plug heat range, over-advanced ignition timing, lean fuel mixture, intake manifold vacuum leaks, sticking valves and insufficient engine cooling.

PREIGNITION

Symptoms: Melted electrodes. Insulators are white, but may be dirty due to misfiring or flying debris in the combustion chamber. Can lead to engine damage. ***Recommendation:*** Check for the correct plug heat range, over-advanced ignition timing, lean fuel mixture, insufficient engine cooling and lack of lubrication.



HIGH SPEED GLAZING

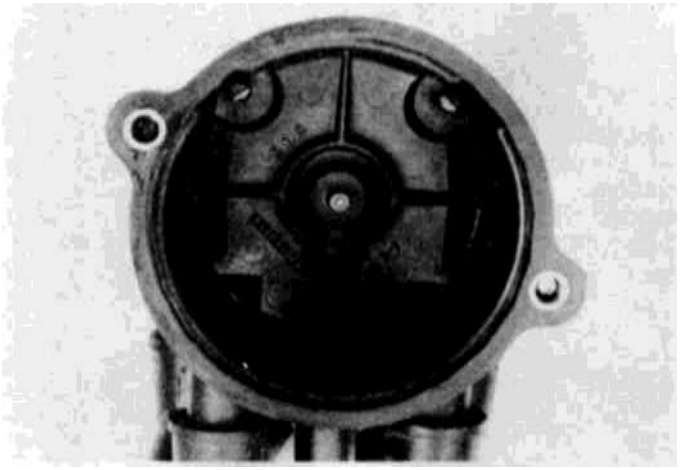
Symptoms: Insulator has yellowish, glazed appearance. Indicates that combustion chamber temperatures have risen suddenly during hard acceleration. Normal deposits melt to form a conductive coating. Causes misfiring at high speeds.
Recommendation: Install new plugs. Consider using a colder plug if driving habits warrant.

DETONATION

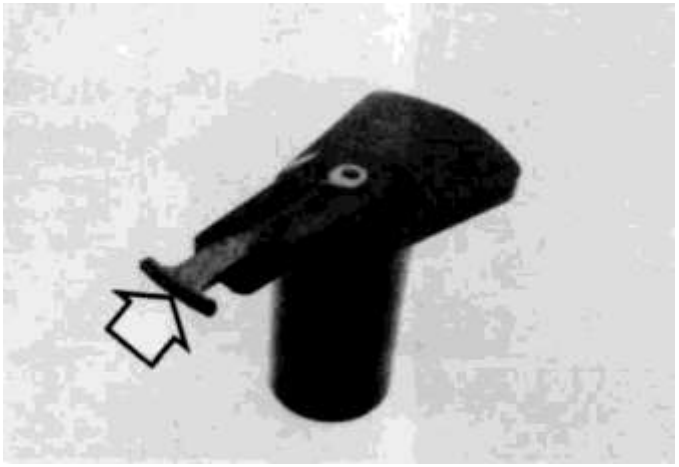
Symptoms: Insulators may be cracked or chipped. Improper gap setting techniques can also result in a fractured insulator tip. Can lead to piston damage. ***Recommendation:*** Make sure the fuel anti-knock values meet engine requirements. Use care when setting the gaps on new plugs. Avoid lugging the engine.

MECHANICAL DAMAGE

Symptoms: May be caused by a foreign object in the combustion chamber or the piston striking an incorrect reach (too long) plug. Causes a dead cylinder and could result in piston damage.
Recommendation: Repair the mechanical damage. Remove the foreign object from the engine and/or install the correct reach plug.



19.11 Inspect the inside of the distributor cap for cracks, carbon tracks and worn, burned or loose contacts



19.12 Check the rotor contact (arrow) for carbon tracks and excessive pitting or corrosion

to 4,000 rpm five times. Then remove the plugs and visually inspect them. If the electrodes are dry, the plugs probably have service life remaining. But if the electrode of even one plug is wet (indicating thread or insulator damage), replace all four plugs.

1 2 Inspect the electrode gap of the old plugs. If the gap of even one plug exceeds the maximum allowable specified gap, replace all four plugs. **Caution:** *The gap cannot adjusted on used platinum tipped spark plugs.*

1 3 If any electrode shows traces of wet carbon, allow it to dry then clean it with a spark plug cleaner, if available. If you do not have access to spark plug cleaner, replace all four plugs. **Caution:** *Platinum tipped spark plugs cannot be cleaned with a wire brush.*

Installation

14 It's often difficult to insert spark plugs into their holes without cross-threading them. To avoid this possibility, fit a short piece of 3/16-inch rubber tubing over the end of the spark plug. The flexible tubing acts as a universal joint to help align the plug with the plug hole. Should the plug begin to cross-thread, the hose will slip on the spark plug, preventing thread damage. Use a torque wrench, if available, to tighten the plug to the specified torque.

1 5 Attach the plug wire to the new spark plug, again using a twisting motion on the boot until it is firmly seated on the end of the spark plug.

16 Follow the above procedure for the remaining spark plugs, replacing them one at a time to prevent mixing up the spark plug wires.

19 Spark plug wire, distributor cap and rotor check and replacement

Refer to illustrations 19.11. 19.12 and 19.13

1 The spark plug wires should be checked whenever new spark plugs are installed.

2 Begin this procedure by making a visual check of the spark plug wires while the engine is running. In a darkened garage (make sure there is ventilation) start the engine and observe each plug wire. Be careful not to come into contact with any moving engine parts. If there is a break in the wire, you will see arcing or a small spark at the damaged area. If arcing is noticed, make a note to obtain new wires, then allow the engine to cool and check the distributor cap and rotor.

3 The spark plug wires should be inspected one at a time to prevent mixing up the order, which is essential for proper engine operation. Each original plug wire should be numbered to help identify its location. If the number is illegible, a piece of tape can be marked with the correct number and wrapped around the plug wire.

4 Disconnect the plug wire from the spark plug. A removal tool can be used for this purpose or you can grasp the rubber boot, twist the boot half a turn and pull the boot free. Do not pull on the wire itself.

5 Check inside the boot for corrosion, which will look like a white crusty powder.

6 Push the wire and boot back onto the end of the spark plug. It

19.13 Measure the resistance value of the distributor cap and the spark plug wires — if it exceeds the specified maximum value, replace either the cap, or the wires, or both

should fit tightly onto the end of the plug. If it doesn't, remove the wire and use pliers to carefully crimp the metal connector inside the wire boot until the fit is snug.

7 Using a clean rag, wipe the entire length of the wire to remove built-up dirt and grease. Once the wire is clean, check for burns, cracks and other damage. Do not bend the wire sharply, because the conductor might break.

8 Disconnect the wire from the distributor. Again, pull only on the rubber boot. Check for corrosion and a tight fit. Replace the wire in the distributor.

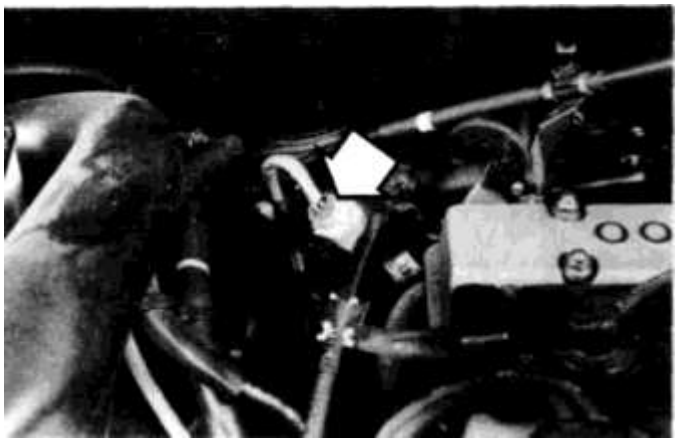
9 Inspect the remaining spark plug wires, making sure that each one is securely fastened at the distributor and spark plug when the check is complete.

10 If new spark plug wires are required, purchase a set for your specific engine model. Pre-cut wire sets with the boots already installed are available. Remove and replace the wires one at a time to avoid mix-ups in the firing order.

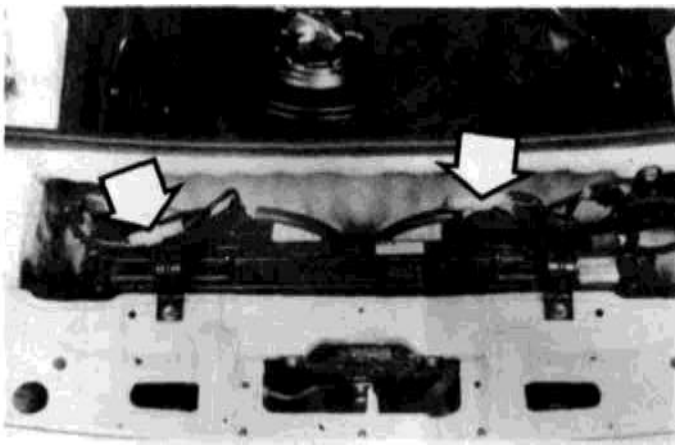
11 Disconnect the distributor cap by removing the two cap retaining bolts. Remove the cap and look inside it for cracks, carbon tracks and worn, burned or loose contacts **(see illustration).**

12 Pull the rotor off the distributor shaft and examine it for cracks and carbon tracks **(see illustration).** Replace the cap and rotor if any damage or defects are noted.

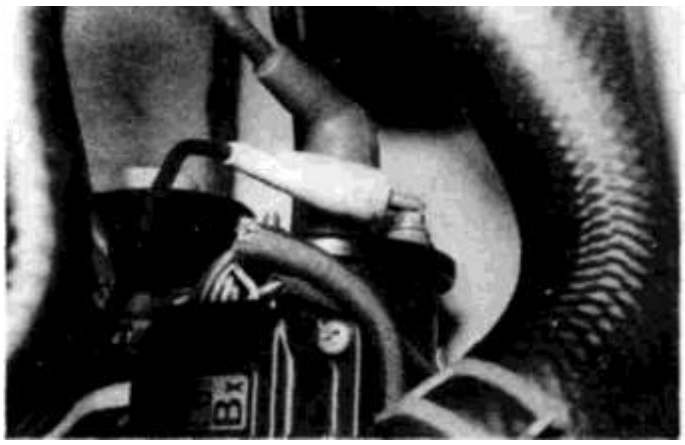
13 It is common practice to install a new cap and rotor whenever new spark plug wires are installed, but if you wish to continue using the old cap, check the resistance between the spark plug wires and the cap first **(see illustration).** If the indicated resistance is more than the specified maximum value, replace the cap and/or wires.



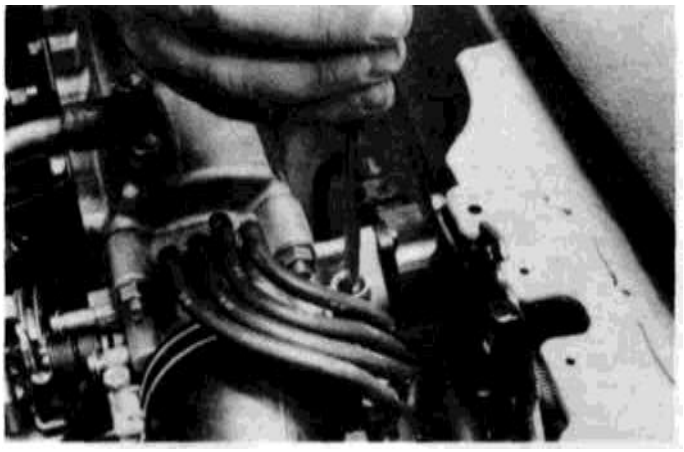
20.2a Disconnect the engine compartment cooling fan motor wire harness from the temperature sensor connector (arrow) to prevent the fan from switching on during the idle speed adjustment procedure



20.2b Disconnect both radiator cooling fan motor wire harness connectors (arrows) to prevent either fan from switching on during the idle speed adjustment procedure



20.3 Make sure that the tachometer positive terminal is hooked up to the coil negative terminal



20.5 The idle speed adjusting screw is on the rear side of the throttle body — note that the idle speed is quite sensitive to even the slightest turn of this screw

14 When installing a new cap, remove the wires from the old cap one at a time and attach them to the new cap in the exact same location — do not simultaneously remove all the wires from the old cap or firing order mix-ups may occur.

20 Engine idle speed check and adjustment

Refer to illustrations 20.2a, 20.2b, 20.3 and 20.5

1 Engine idle speed is the speed at which the engine operates when no accelerator pedal pressure is applied, as when stopped at a traffic light. This speed is critical to the performance of the engine itself, as well as many engine subsystems.

2 Set the parking brake firmly set and block the wheels to prevent the car from rolling. Make sure that all accessories are switched off. Disconnect the engine compartment electric cooling fan motor wire harness connector from the air temperature sensor **(see illustration)** and disconnect both cooling fan motor wire harness connectors above the two radiator fans **(see illustration).** If any of the three fans should switch on during the idle adjustment procedure, it will affect engine idle. Put the transaxle in neutral.

3 Hook up a hand held tachometer to the negative terminal of the coil **(see illustration). Note:** *Some tachometers may not be compatible with this ignition system. It is recommended that you consult with the manufacturer.* **Caution:** *Do not allow the tachometer to touch ground or it could result in damage to the igniter and/or the ignition coil.*

4 Start the engine and race it at 2,500 rpm for about two minutes to warm it up.

5 Allow the engine to idle. Note the indicated idle rpm on the tachometer and if the idle speed is too low or too high, adjust it by removing the plastic plug from the adjusting screw bore and turning the idle speed adjusting screw **(see illustration).**

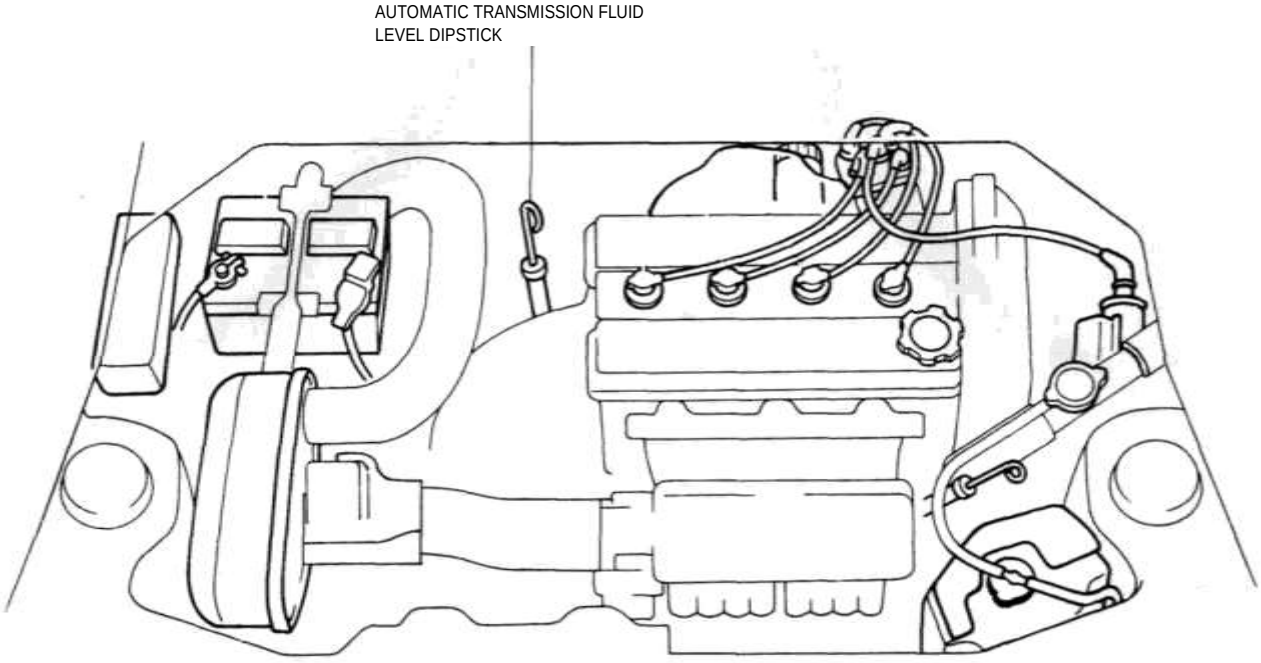
6 Turn off the engine, disconnect the tachometer and reconnect the electric cooling fan motor wire harness.

21 Automatic transaxle fluid level check

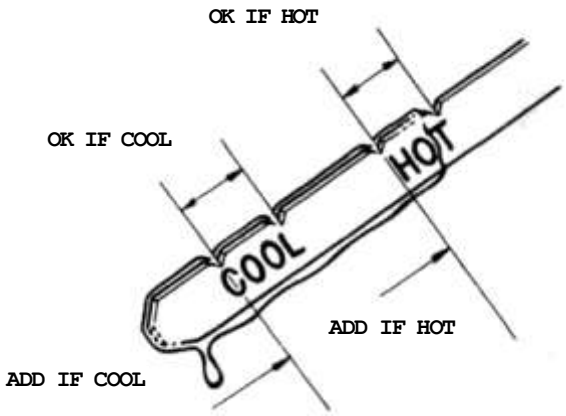
Refer to illustrations 21.4a and 21.4b

1 The level of the automatic transaxle fluid should be carefully maintained. Low fluid level can lead to slipping or loss of drive, while overfilling can cause foaming, loss of fluid and transaxle damage.

2 The transaxle fluid level should only be checked when the transaxle is hot (at its normal operating temperature). If the vehicle has just been driven over 10 miles (15 miles in a frigid climate), and the fluid temperature is 160-175°F, the transaxle is hot. **Caution:** *If the vehicle has just been driven for a long time at high speed or in city traffic in hot weather, or if it has been pulling a trailer, an accurate fluid level reading cannot be obtained. Allow the fluid to cool down for about 30 minutes.*



21.4a The automatic transaxle dipstick (arrow) is located at the front of the transaxle



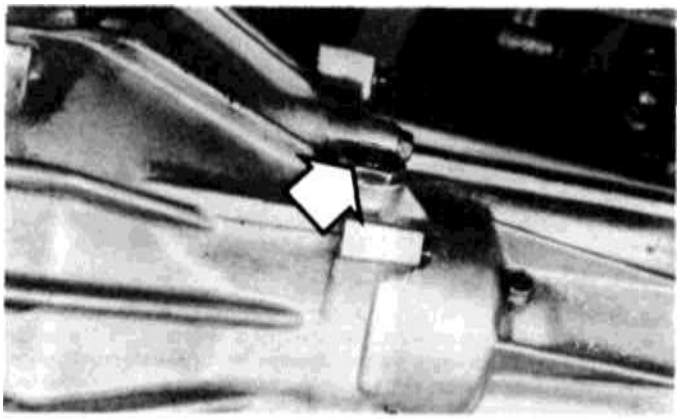
21.4b When it's cool or hot, the fluid level should fall within one of these two areas, respectively

3 If the vehicle has not just been driven, park the vehicle on level ground, set the parking brake and start the engine. While the engine is idling, depress the brake pedal and move the selector lever through all the gear ranges, beginning and ending in Park.

4 With the engine still idling, remove the dipstick from its tube **(see illustration).** Check the level of the fluid on the dipstick **(see illustration)** and note its condition.

5 Wipe the fluid from the dipstick with a clean rag and reinsert it back into the filler tube until the cap seats.

6 Pull the dipstick out again and note the fluid level. If the transaxle is cold, the level should be in the Cool range on the dipstick. It it is hot, the fluid level should be in the Hot range. If the level is at the low side of either range, add the specified automatic transmission fluid through the dipstick tube with a funnel.



22.1 The larger bolt (arrow) must be removed from the manual transaxle to check the oil level — do not remove the smaller bolt next to the inspection bolt (it's the locater bolt for the reverse idler gear shaft)

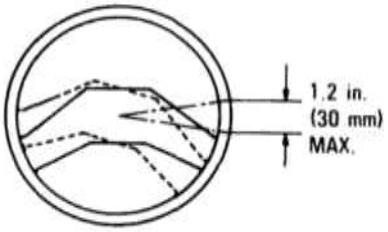
7 Add just enough of the recommended fluid to fill the transaxle to the proper level. It takes about one pint to raise the level from the low mark to the high mark when the fluid is hot, so add the fluid a little at a time and keep checking the level until it is correct.

8 The condition of the fluid should also be checked along with the level. If the fluid at the end of the dipstick is black or a dark reddish-brown color, or if it emits a burned smell, the fluid should be changed (Section 28). If you are in doubt about the condition of the fluid, purchase some new fluid and compare the two for color and smell.

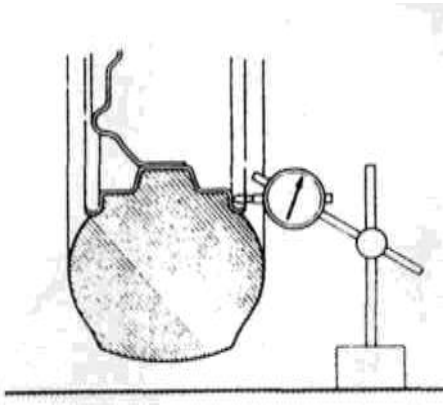
22 Manual transaxle oil level check

*Refer to illustration **22.1***

1 The manual transaxle does not have a dipstick. To check the fluid level, place the vehicle on level ground and slide under the left rear



23.1 Steering wheel free play is the amount of travel between an initial steering input and the point at which the front wheels begin to turn (indicated by a slight resistance)



23.6 If you have a dial gauge, you can easily pinpoint lateral wheel runout — set it up like this with the pointer against the bead flange of the wheel, then slowly spin the wheel

23.8 To check a balljoint for wear, jack up the vehicle, place it on safety stands, place a block of wood with a height of 7.09 to 7.87 inches under the tire, block the wheel with chocks and lower the jack until there is about half a load on the coil spring — then move the lower arm up and down with a prybar to make sure that there is no play in the balljoint (if there is, replace it)

quarter panel just in front of the left rear wheel. On the lower front side of the transaxle housing, you will see a plug **(see illustration).** Remove it. If the oil level is correct, it should be up to the lower edge of the hole.

2 If the transaxle needs more oil (if the oil level is not up to the hole), use a syringe to squeeze the appropriate lubricant into the opening. Stop filling the transaxle when the oil begins to run out the hole.

3 Install the plug and tighten it securely. Drive the vehicle a short distance, then check for leaks.

23 Steering and suspension check

Refer to illustrations 23.1, 23.6 and 23.8

Note: *For detailed illustrations of the steering and suspension components, refer to Chapter 10*

With the wheels on the ground

1 With the vehicle stopped and the front wheels pointed straight ahead, rock the steering wheel gently back and forth. If free play **(see illustration)** is excessive , a front wheel bearing, main shaft yoke, intermediate shaft yoke, lower arm balljoint or steering system joint is worn or the steering gear is out of adjustment or broken. Refer to Chapter 10 for the appropriate repair procedure.

2 Other symptoms such as excessive vehicle body movement over rough roads, swaying (leaning) around coiners and binding as the steering wheel is turned may indicate faulty steering and/or suspension components.

3 Check the shock absorbers by pushing down and releasing the vehicle several times at each corner. If the vehicle does not come back to a level position within one or two bounces, the shocks/struts are worn and must be replaced. When bouncing the vehicle up and down, listen for squeaks and noises from the suspension components. Additional information on suspension components can be found in Chapter 10.

4 Measure the front and rear chassis clearance (the height of the vehicle above the ground) by measuring the distance from the ground to the center of the control arm bolts. Also note whether the vehicle looks canted to one side or corner. If the clearance of the vehicle is not as specified or if it is canted to one side or corner, try to level it by rocking it down. If this doesn't work, look for bad springs or worn or loose suspension parts.

Under the vehicle

5 Raise the vehicle with a floor jack and support it securely on jackstands. See *Jacking and towing* at the front of this book for the proper jacking points.

6 Check the tires for irregular wear patterns (see Section 5) and proper inflation. If you have a dial gauge and base, check the lateral runout of the wheels **(see illustration).** If lateral runout is not within specification, the tires are worn or improperly inflated, the wheels are out of balance or the wheel bearings are worn. See Section 5 in this chapter for information regarding tire wear and Chapter 10 for the wheel bearing replacement procedures.

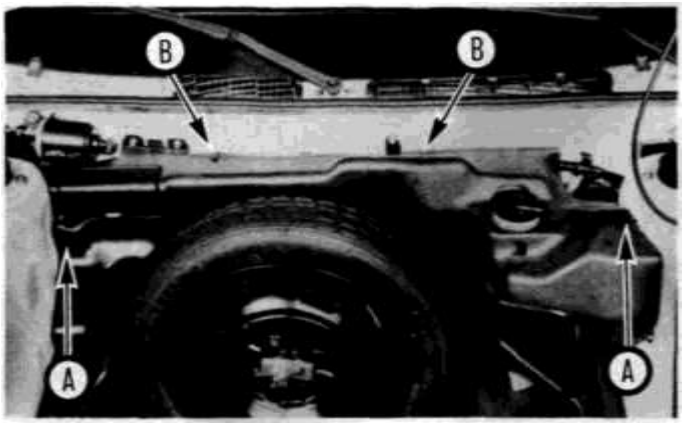
7 Inspect the universal joint between the steering shaft and the steering gear housing. Check the steering gear housing for grease leakage or oozing. Make sure that the dust seals and boots are not damaged and that the boot clamps are not loose. Check the steering linkage for looseness or damage. Check the tie rod ends for excessive play. Look for loose bolts, broken or disconnected parts and deteriorated rubber bushings on all suspension and steering components. While an assistant turns the steering wheel from side-to-side, check the steering components for free movement, chafing and binding. If the steering components do not seem to be reacting with the movement of the steering wheel, try to determine where the slack is located

8 Check the balljoints for wear by placing a wooden block with a height of 7.09 to 7.87 inches under each tire. Lower the jack until there is about half a load on the coil spring. Make sure that the front wheels are in a straight forward position and block the wheel with chocks. Move each lower arm up and down with a pry bar **(see illustration)** to ensure that its balljoint has no play. If any balljoint does have play, replace it. Refer to Chapter 10 for the front balljoint replacement procedure.

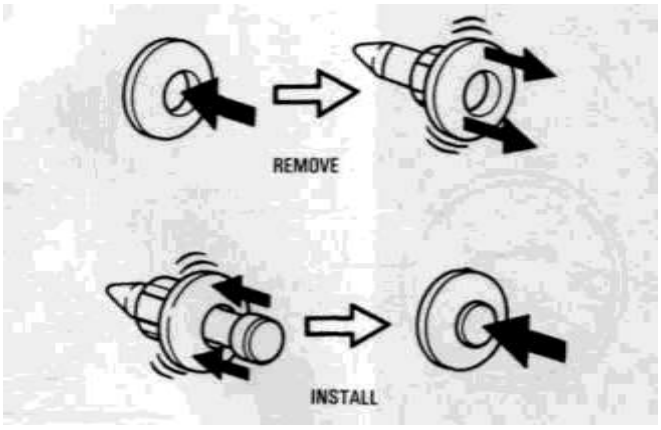
24 Cooling system service (drain, flush and refill)

Refer to illustrations 24.3a, 24.3b, 24.4, 24.9, 24.11, 24.12, 24.20a, 24.20b, 24.20c, 24.21, 24.24a, 24.24b and 24.26 **Warning:** *Antifreeze is a corrosive and poisonous solution, so be careful not to spill any of the coolant mixture on the vehicle's paint or your skin. If this happens, rinse immediately with plenty of clean water. Consult your local authorities regarding proper waste disposal procedures of antifreeze before draining the cooling system. In many areas, reclamation centers have been established to collect used automotive engine oil and coolant mixtures so that they won't be introduced into the public sewage system.*

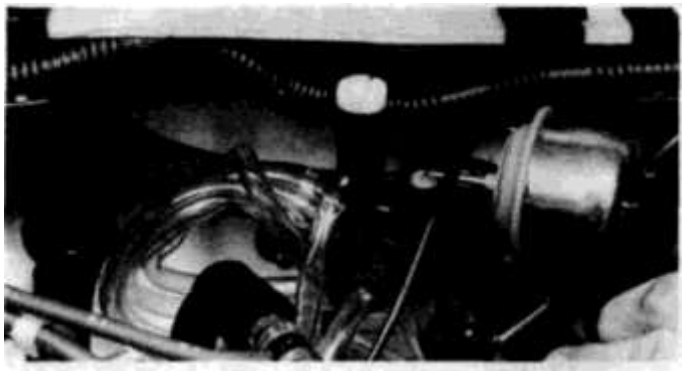
1 Periodically, the cooling system should be drained, flushed and refilled to replenish the antifreeze mixture and prevent formation of rust and corrosion, which can impair the performance of the cooling system and cause engine damage.



24.3a To remove the luggage compartment trim panel, pry the two plastic pop fasteners (a) loose, then disconnect the panel from the two spring clips (b)



24.3b To disconnect the plastic pop fasteners, depress the center portion (top), then pull the fastener out of the body and trim panel - to install, align the trim panel hole with the body hole, depress the fastener ring (bottom), push the fastener through the panel and into the body, then push in on the center portion



24.4 If you purchased a new vehicle, there should be two clear plastic service hoses coiled and stored just to the right of the heater air drain valve — if your vehicle is used, these hoses may be missing, but you can purchase about five feet of 1/4-inch plastic tubing at any auto parts store

24.9 The radiator drain cock is located at the lower right rear corner of the radiator

Draining

2 Remove the spare tire from the luggage (front) compartment.

3 Remove the luggage compartment trim panel **(see illustration).** The panel is retained to the body with a combination of two pop fasteners and two clips. The panel can be easily pulled loose from the clips but the plastic pop fasteners are difficult to remove and may be destroyed if not removed properly **(see illustration).**

4 Remove the two clear plastic service hoses coiled up next to the heater air drain valve **(see illustration).** These hoses are provided by the manufacturer to make draining the coolant a little neater and are also used as coolant level visual aids during the refilling procedure. **Note:** *If you purchased a used vehicle, these hoses may be missing. Buy about five feet of 1/4-inch ID plastic hose at an auto parts store and cut it into two equal sections.*

5 Jack up the vehicle and place it on jackstands.

6 Remove the forward fuel tank protector retaining screws and remove the protector.

7 Set the heater temperature control lever to the hottest position.

8 Remove the water filler (radiator) pressure cap. **Warning:** *Make sure that the engine is cold or has cooled off for at least 30 minutes before removing the water filler cap. Removal of this cap while the engine coolant is hot could cause serious injury.*

9 Find the radiator drain cock **(see illustration)** and place a large container (at least 13.5 quart capacity) underneath it.

10 Open the spigot and drain the coolant from the radiator. If the drain cock is excessively corroded and cannot be opened, disconnect the lower radiator hose instead. **Warning:** *Do not splash the coolant solution on your skin or into your eyes.*

11 While the radiator is draining, locate the engine drain cock, which is on the front right side of the engine block, between the oil filter and the oil pressure sender gauge **(see illustration).** Mount one of the service hoses to the spigot. When the radiator has drained, turn off the spigot, move the container underneath the engine and drain the engine coolant.

12 While the coolant is draining from the engine, find the two radiator pipe drain plugs **(see illustration).** When the engine has drained, turn off the drain cock and tighten it to the specified torque. Place the container under the radiator pipe drain plugs.

13 When the remainder of the coolant has drained from the radiator pipe drain plugs, reinstall and tighten them to the specified torque.

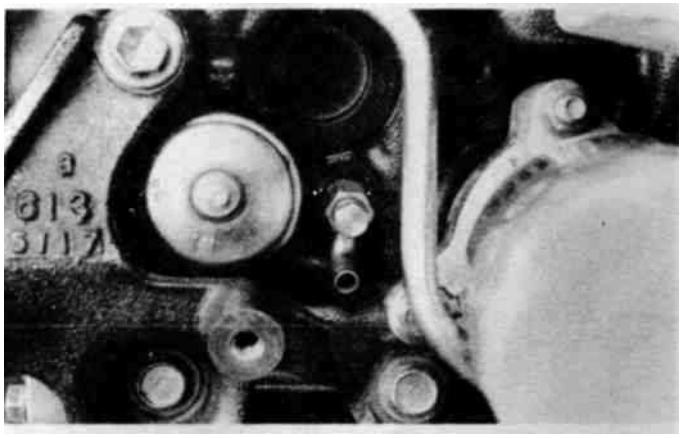
14 Disconnect the hose from the coolant reservoir and remove the reservoir. Flush it out with clean water. Reinstall the reservoir.

15 When servicing the cooling system, it's a good practice to inspect and, if necessary, replace the water filler (radiator) pressure cap and any worn hoses (Section 12).

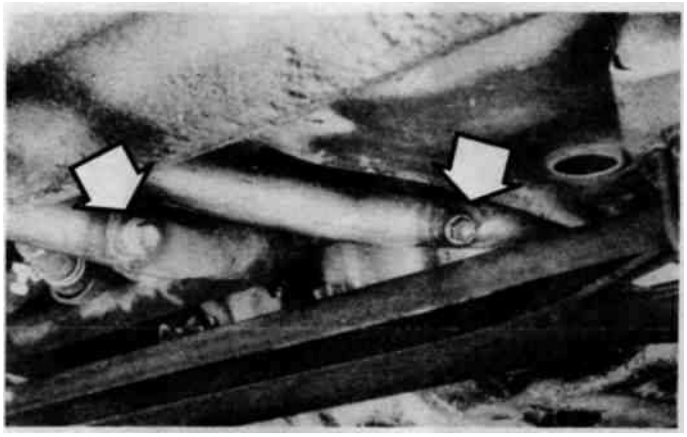
Flushing

16 On a conventional vehicle, the flushing procedure simply involves opening the radiator drain cock, placing a garden hose in the radiator filler neck and flushing the system until the water runs clear at all drain points. This procedure will work on the MR2, but since there are four drain points instead of only one, it will be messy.

17 The alternative method is to close all four drain points, fill the system with plain water and run the engine until the thermostat opens

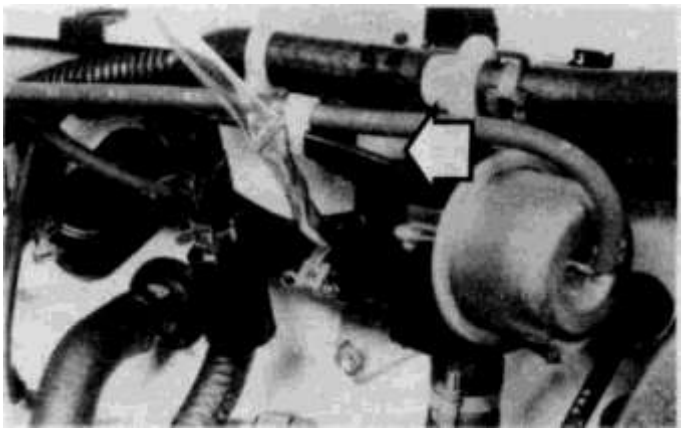


24.11 The engine coolant drain plug is located at the lower right front side of the engine block, between the oil filter and the oil pressure sender gauge (the A/C compressor has been removed for clarity) — attach one of the clear plastic service hoses to the spigot underneath the drain cock to prevent the old coolant from dribbling down the front of the block



24.12 The radiator pipe drain plugs (arrows) are easily identified once the forward fuel tank protector is removed

24.20a The radiator air drain valve (arrow) should be opened three turns before adding coolant



24.20b The heater air drain valve (arrow) also must be opened three turns before adding coolant

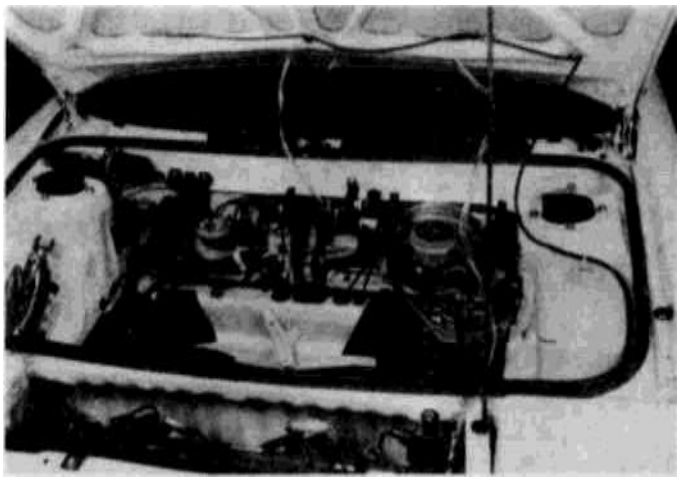
and the water circulates throughout the cooling system. After the water has circulated for a few minutes, shut off the engine and drain the water at each drain point. Repeat this procedure as often as necessary until the water is clear at all drain points.

18 When the coolant is regularly drained and the system refilled with the correct antifreeze/water mixture, there should be no need to use chemical cleaners or descalers. However, if the cooling system is very dirty, you may wish to add a flush kit to the water. Flush kits, which are available at any auto parts store, are chemicals specially designed to clean dirty cooling systems. Flush kits are mixed with water and circulated through the cooling system to help break down rust, scale and corrosion inside engine block cooling jackets and coolant pipes. Follow the manufacturer's directions on the package.

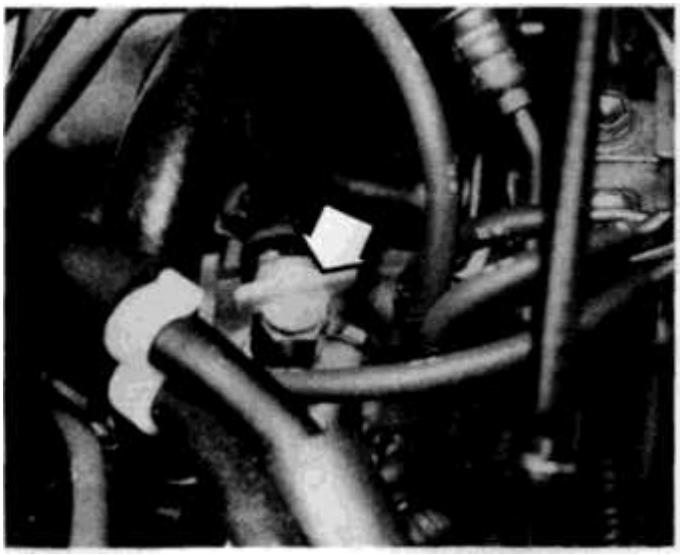
19 If the radiator is severely contaminated or clogged, remove it (see Chapter 3) and reverse flush it. Insert the hose in the bottom radiator outlet to allow the water to run in the opposite direction of its normal flow. When the water draining through the inlet pipe is clear, reinstall the radiator. Consult a radiator repair shop if further cleaning or repair is necessary.

Refilling

20 Connect the service hoses to the radiator and heater air drain valves **(see illustrations).** Suspend the opposite end of the hose connected to the radiator to the hood stay; suspend the opposite end of the hose connected to the heater air drain valve to the windshield washer tube. **Caution:** *Do not close or pinch either tube.*



24.20c Connect the two service hoses to the heater air drain valve and the radiator air drain valve like this — suspend the upper end of the hose connected to the radiator valve to the hood stay and the upper end of the hose connected to the heater air drain valve to the windshield washer tube



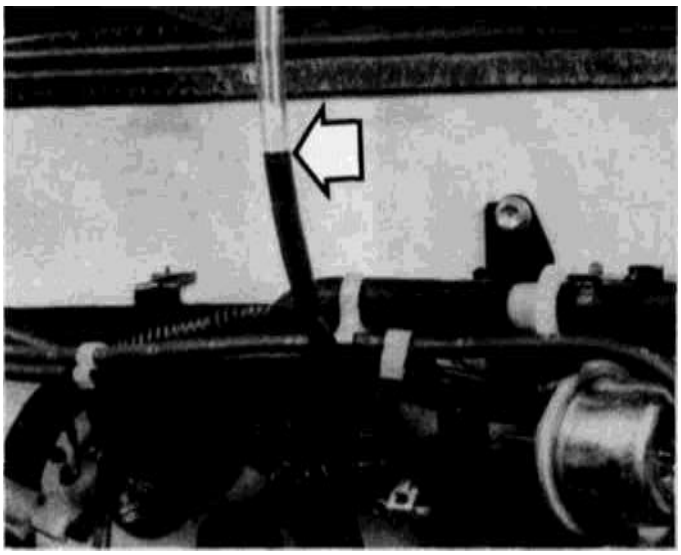
24.21 The engine air drain valve (arrow) should be opened three turns before adding coolant to the system — because it is the lowest of the three air drain valves, it will be the first to bleed out the air trapped inside the engine block when coolant is added

21 Open the engine **(see illustration),** radiator and heater air drain valves about three turns.
22 Add ethylene/glycol based coolant — mixed in accordance with the manufacturer's directions — through the water filler neck. When the coolant begins to back up in the clear plastic tube between the engine air drain valve and the coolant reservoir, stop pouring and close the engine air drain valve.
23 Continue pouring coolant into the water filler neck until the coolant level is even with the base of the filler neck.
24 Check the coolant levels in the suspended service hoses attached to the heater and radiator air drain valves. They should be level with the water filler neck **(see illustrations).** If the coolant level in either tube does not come up to the level of the filler neck, check the tube for folds or obstructions. Continue filling until the levels in both tubes are even with the filler neck.
25 Close the heater and radiator air drain valves and disconnect the service hoses. **Caution:** *When removing the service hoses, place a rag underneath each valve to catch the coolant that will drip from each tube when it is disconnected from the air drain valve.*
26 Install the water filler cap and tighten it to the first stop point **(see illustration).** Do not tighten it to the second stop point at this time.
27 Start the engine and run it at fast idle for about three minutes, then turn it off.
28 Remove the water filler cap and check the level of coolant in the filler neck. If the level has fallen below the bottom of the filler neck, add coolant until the level is again at the bottom of the filler neck.
29 Repeat Steps 27 and 28 above.
30 Install and completely tighten the water filler cap.
31 Fill the coolant reservoir to the Full mark.
32 Install the forward fuel tank protector.
33 Thoroughly flush out the two service hoses with plain water, coil them and store them next to the heater air drain valve.
34 Start the engine and check for leaks at all four drain points, at all three air valves and at all hose clamps.
35 Stop the engine and lower the vehicle.
36 Install the front luggage compartment trim panel and spare tire.

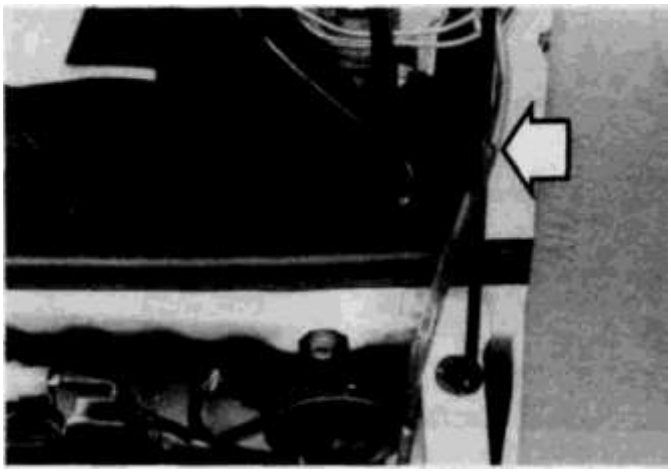
25 Evaporative emissions control system check

Refer to illustration 25.2, 25.3 and 25.5

1 The function of the Fuel Evaporative Emission Control (EVAP) System is to store fuel vapors from the fuel tank in a charcoal canister until they can be routed to the intake manifold where they mix with incoming air before being burned in the cylinder combustion chambers.



24.24a The coolant level (arrow) inside the service hose attached to the heater air drain valve should be even with the bottom of the filler neck

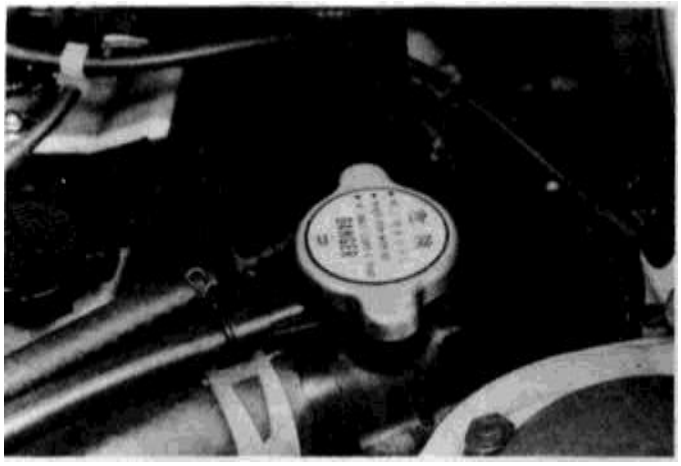


24.24b The coolant level (arrow) in the service hose attached to the radiator air drain valve should also be even with the bottom of the filler neck

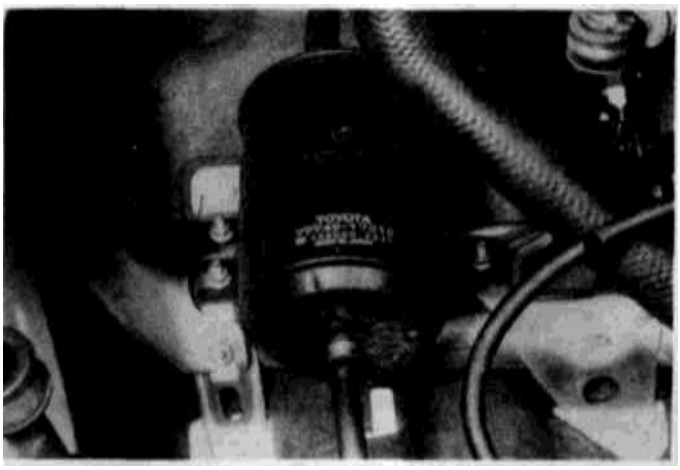
2 The most common symptom of a faulty evaporative emissions system is a strong fuel odor in the engine compartment. If a fuel odor is detected, inspect the charcoal canister, located on the lower left side of the engine compartment forward firewall **(see illustration)** and the EVAP system hoses.
3 To perform a simple check of system operation, remove the canister. Inspect the canister for cracks or damage before beginning the following tests. Check for a clogged filter and/or stuck check valve by using low pressure compressed air and blowing into the tank pipe to see if air flows without resistance from the other pipes **(see illustration).** If it does, replace the canister.
4 Blow into the purge pipe and check that the air does not flow from the other pipes. If this condition is noted, replace the canister.
5 The charcoal canister filter can be cleaned by blowing out the tank pipe with no more than 43 psi (294 kPa) of compressed air while plugging the other upper canister pipe with a finger **(see illustration).**
6 The evaporative emissions control system is explained in more detail in Chapter 6.

26 Valve clearance check and adjustment

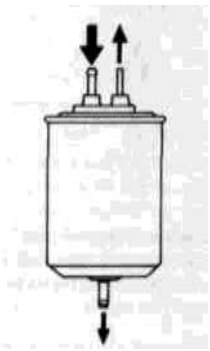
Refer to illustrations 26.6a, 26.6b, 26.7, 26.9a, 26.9b and 26.10 **Note:** *The following procedure requires the use of a special valve lifter*



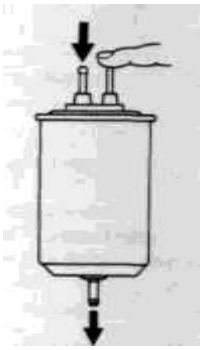
24.26 Once the coolant level has reached the base of the filler neck (and has risen in the service accessory hoses until it is even with the filler neck), tighten the heater and radiator air drain valves and tighten the water filler cap to the first stop point, then run the engine long enough for the thermostat to open and circulate the coolant through the system



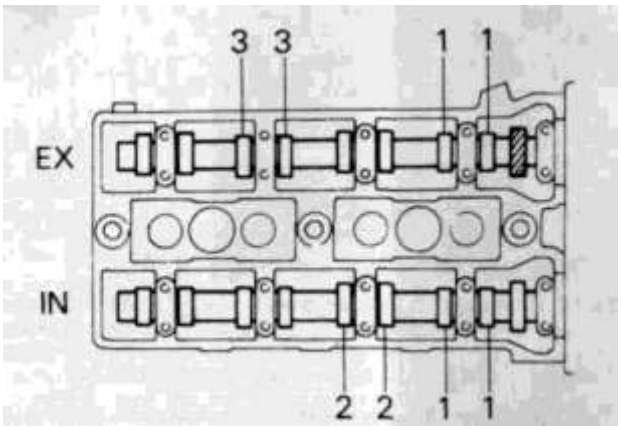
25.2 The charcoal canister for the EVAP system is located on the lower left corner of the engine compartment forward firewall



25.3 Using low pressure compressed air, blow into the tank pipe and check that air flows without resistance from the other pipes



25.5 Clean the charcoal canister filter by blowing no more than 43 psi of compressed air into the tank pipe while holding the other upper canister pipe closed



26.6a When the No. 1 piston is at TDC on its compression stroke, the valve clearance for the No.1 and No. 3 exhaust valves and the No. 1 and No. 2 intake valves can be measured

tool (SST 09248-70011-01) manufactured by the Owatonna Tool Company of Owatonna, Minnesota. It is impossible to perform this task without it.

1 Disconnect the cable from the negative terminal of the battery.

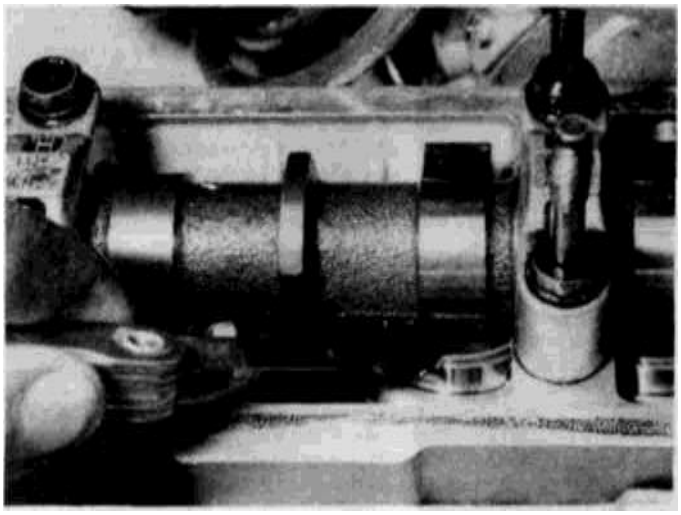
2 If your vehicle is equipped with cruise control, disconnect the cruise control cable.

3 Remove the cylinder head covers (refer to Section 8 in Chapter 2 Part A).

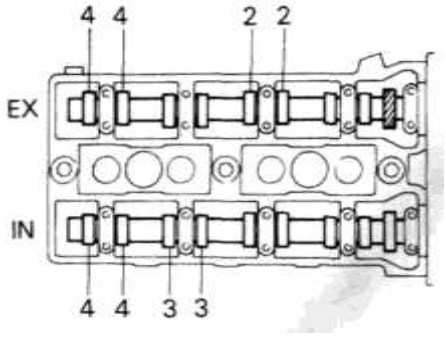
4 Blow out the recessed area between the camshafts with compressed air, if available, to remove any debris that might fall into the cylinders, then remove the spark plugs (Section 18).

5 Set the No. 1 cylinder at Top Dead Center (TDC) on the compression stroke by turning the crankshaft pulley in a clockwise direction until the groove in the pulley is aligned with the stationary pointer (refer to Section 3 in Chapter 2 Part A). Note that there are actually three timing marks on the pulley. The first two are advance marks for ignition timing. The third mark is the TDC mark. To verify that the No. 1 piston is on the compression stroke, make sure that the valve lifters on the No. 1 cylinder are loose and that the valve lifters on the No. 4 cylinder are tight. If they aren't, turn the crankshaft pulley one more complete revolution.

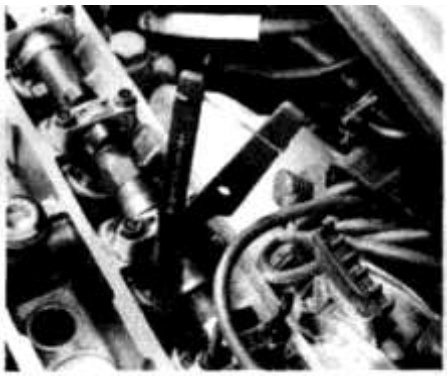
6 Measure the clearances of the indicated valves with a feeler gauge of the specified thickness **(see illustrations).** Record the measurements which are out of specification. They will be used later to determine the required replacement shims.



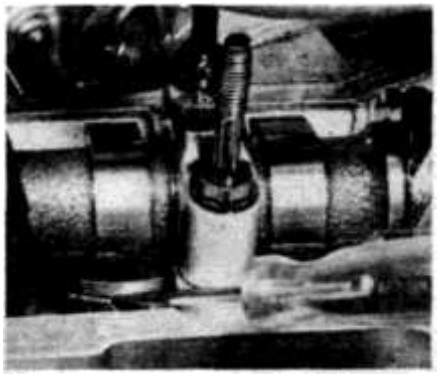
26.6b Measure the clearance for each valve with a feeler gauge of the specified thickness — if the clearance is correct, you should feel a slight drag on the gauge as you pull it out



26.7 When the No. 4 piston is at TDC on its compression stroke, the valve clearance for the No. 2 and No. 4 exhaust valves and the No. 3 and No. 4 intake valves can be **measured**

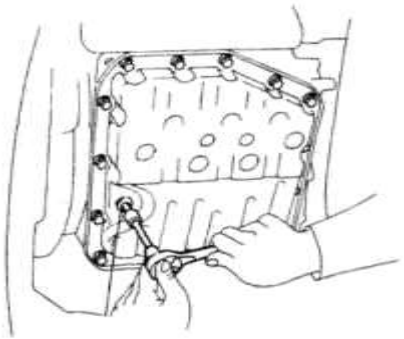


26.9a Install the valve lifter tool as shown and squeeze the handles together to lower the valve lifter so that the shim can be removed

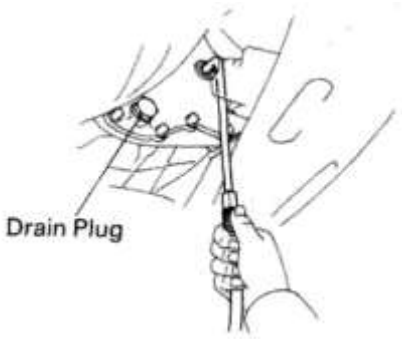


26.9b Remove the shim with a small screwdriver, a pair of tweezers or a magnet

26.10 Measure the shim thickness with a micrometer



28.7 The automatic transaxle drain plug is located in the lowest part of the transaxle pan



28.8 The automatic transaxle differential drain plug and filler plug are in the differential carrier cover

7 Turn the crankshaft pulley one more complete revolution and align the timing marks as described in Step 9 above. Measure the remaining valves **(see illustration).**

8 After all the valve clearances have been measured, turn the crankshaft pulley until the camshaft lobe above the first valve which you intend to adjust is pointing upward, away from the shim.

9 Position the notch in the valve lifter toward the spark plug. Then press down the valve lifter with the special valve lifter tool **(see illustration).** Place the special valve lifter tool in position as shown, with the longer jaw of the tool gripping the lower edge of the cast lifter boss and the upper, shorter jaw gripping the upper edge of the lifter itself. Press down the valve lifter by squeezing the handles of the valve lifter tool together and remove the adjusting shim with a small screwdriver or a pair of tweezers **(see** illustration). Note that the wire hook on the end of one valve lifter tool handle can be used to clamp both handles together to keep the lifter depressed while the shim is removed.

10 Measure the thickness of the shim with a micrometer **(see illustration).** To calculate the correct thickness of a replacement shim that will place the valve clearance within the specified value, use the following formula:

Intake side: N = T + (A-0.20 mm) Exhaust side: N = T + (A-0.25 mm)

T = thickness of the shim used
A = valve clearance measured
N = thickness of the new shim

11 Select a shim with a thickness as close as possible to the valve clearance calculated. Shims, which are available in 17 sizes, in incre ments of 0.050 mm (0.0020 in), range in size from 2.500 mm (0.0984 in) to 3.300 mm (0.1 299 in). **Note:** *Through luck and careful analysis of the shim sizes needed to bring all the out of specification valve clearances within specification, it is often possible to simply move a shim that has to come out anyway to another valve lifter requiring a shim of that particular size, thereby reducing the number of new shims that must be purchased.*

12 Place the special valve lifter tool in position as shown, with the longer jaw of the tool gripping the lower edge of the cast lifter boss and the upper, shorter jaw gripping the upper edge of the lifter itself, press down the valve lifter by squeezing the handles of the valve lifter tool together and install the new adjusting shim (note that the wire hook on the end of one valve lifter tool hand can be used to clamp the handles together to keep the lifter depressed while the shim is removed). Measure the clearance with a feeler gauge to make sure that your calculations are correct.

13 Repeat this procedure until all the valves which are out of clearance have been corrected.

14 Installation of the spark plugs, cylinder head covers, center cover, spark plug wires and boots, accelerator cable bracket, etc. is the reverse of removal.

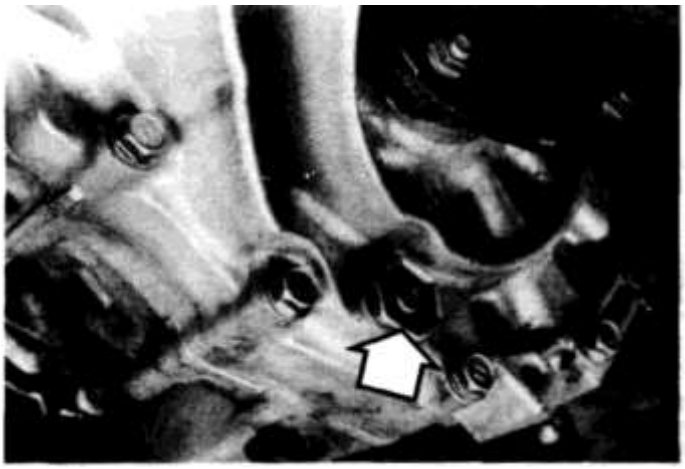
27 Exhaust system check

1 With the engine cold (at least three hours after the vehicle has been driven), check the complete exhaust system from its starting point at the engine to the end of the tailpipe. This should be done on a hoist where unrestricted access is available.

2 Check the pipes and connections for evidence of leaks, severe corrosion or damage. Make sure that all brackets and hangers are in good condition and tight.

3 At the same time, inspect the underside of the body for holes, corrosion, open seams, etc. which may allow exhaust gases to enter the passenger compartment. Seal all body openings with silicone or body putty.

4 Rattles and other noises can often be traced to the exhaust system, especially the mounts and hangers. Try to move the pipes, muffler and catalytic converter. If the components can come in contact with the body or suspension parts, secure the exhaust system with new mounts.



29.1 The manual transaxle drain plug (arrow) is located on the lower part of the transmission case cover

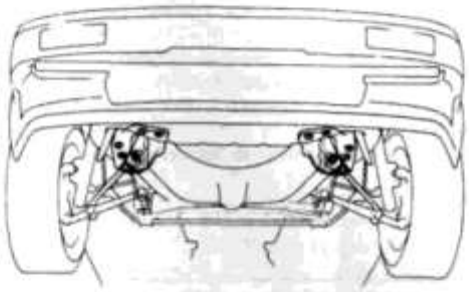
5 Check the running condition of the engine by inspecting inside the end of the tailpipe. The exhaust deposits here are an indication of engine state-of-tune. If the pipe is black and sooty or coated with white deposits, the engine is in need of a tune-up, including a thorough fuel system inspection and adjustment.

28 Automatic transaxle and differential fluid change

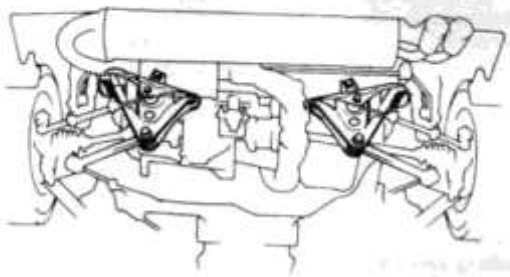
Refer to illustrations 28.7 and 28.8

1 At the specified time intervals, the automatic transaxle fluid should be drained and replaced.
2 Before beginning work, purchase the specified transmission fluid (see *Recommended fluids and lubricants* at the front of this chapter).
3 Other tools necessary for this job include jackstands to support the vehicle in a raised position, a 10 mm hex driver and a ratchet, a drain pan capable of holding at least eight pints, newspapers and clean rags.
4 The fluid should be drained immediately after the vehicle has been driven. Hot fluid is more effective than cold fluid at removing built up sediment. **Caution:** *Fluid temperature can exceed 350° in a hot transaxle. Wear protective gloves.*
5 After the vehicle has been driven to warm up the fluid, raise it and place it on jackstands for access to the transaxle and differential drain plugs.
6 Move the necessary equipment under the vehicle, being careful not to touch any of the hot exhaust components.
7 Place the drain pan under the drain plug in the transaxle pan **(see illustration)** and remove the drain plug with the 10 mm hex driver. Be sure the drain pan is in position, as fluid will come out with some force. Once the fluid is drained, reinstall the drain plug securely.
8 Find the differential drain plug **(see illustration).** Place the drain pan underneath the plug, remove it with the 10 mm hex driver and drain the fluid. When the differential fluid has drained, reinstall the plug securely.
9 Add new fluid to the differential until it begins to run out of the filler hole (see *Recommended fluids and lubricants* at the beginning of this chapter for the specified fluid type and capacity).
10 Lower the vehicle.
11 With the engine off, add new fluid to the transaxle through the dipstick tube (see *Recommended fluids and lubricants* for the recommended fluid type and capacity). Use a funnel to prevent spills. It is best to add a little fluid at a time, continually checking the level with the dipstick (Section 21). Allow the fluid time to drain into the pan.
12 Start the engine and shift the selector into all positions from P through L, then shift into P and apply the parking brake.
13 With the engine idling, check the fluid level. Add fluid up to the Cool level on the dipstick. **Caution:** *Do not overfill. The automatic trans-axle and the differential are separate units.*

SEAT



FRONT SUSPENSION



REAR SUSPENSION

30.1 The mounting bolts for the front seats, the bolts and nuts that attach the front suspension members to the body and the bolts that attach the strut bar brackets to the body are critical fasteners that must be periodically checked and properly tightened

29 Manual transaxle oil change

Refer to illustration 29.1

1 Remove the drain plug **(see illustration)** and drain the oil.
2 Reinstall the drain plug securely.
3 Add new oil until it begins to run out of the filler hole (see Section 22). See *Recommended fluids and lubricants* for the specified oil type and capacity.

30 Chassis and body fastener check

Refer to illustration 30.1

Tighten the following parts to the specified torque: front seat mounting bolts, front suspension member-to-body mounting bolts and nuts and strut bar bracket-to-body mounting bolts (left and right sides) **(see illustration).**

Chapter 2 Part A Four-cylinder engine

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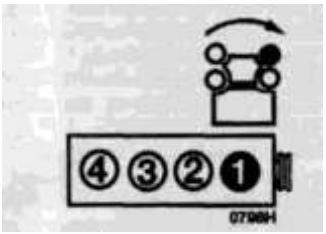
Specifications

General

Compression pressure	1,236 kPa (179 psi)
Minimum compression pressure	883 kPa (128 psi)
Difference between each cylinder	98 kPa (14 psi) maximum
Timing belt deflection	4 mm at 2 kg
Camshaft thrust clearance	
standard	0.08 to 0.19mm (0.0031 to 0.0075 in)
maximum	0.25 mm (0.0098 in)

Torque specifications

	Nm	Ft-lbs
Cylinder head bolts	60	44
Camshaft bearing cap bolts	13	9
Camshaft timing belt pulley bolts	47	34
Crankshaft timing belt pulley bolt	118	87
Timing belt idler pulley set bolt	37	27
Spark plugs	18	13
Transaxle-to-engine bolts		
10 mm bolt	39 to 46	29 to 34
12 mm bolt	64	47
Left hand mounting insulator bracket bolts	52	38
Rear mounting insulator		
insulator-to-body bolts	52	38
insulator-to-mounting bracket through-bolt	78	58
Front mounting insulator		
insulator-to-body bolts	52	38
insulator-to-mounting bracket through-bolt	78	58
Intake manifold/air control valve bolts	22	16
Fuel injector delivery pipe bolts	17	13
Exhaust manifold	25	18
Pressure regulator bolts	9.3	82 in-lbs
Fuel pipe-to-pressure regulator fitting	29	22
Pulsation damper	29	22
Cold start injector pipe bolts	18	13
Oil strainer bolts	9.3	82 in-lbs
Oil pan bolts and nuts	4.9	43 in-lbs
Oil pump bolts	18 to 25	13 to 18
Starter motor bolts	39	29
Exhaust pipe-to-exhaust manifold nuts	62	46
Rear oil seal retainer	9.3	82 in-lbs
Clutch slave cylinder/shift cable bracket bolts	18	13
Shift cable bracket bolts		
bracket-to-transaxle	64	47
bracket stay-to-front mounting insulator	19	**14**



Cylinder location and distributor rotation - MR2 1587cc FI engine

The blackened terminal shown on the distributor cap indicates the Number One spark plug wire position

1 General information

This part of Chapter 2 is devoted to repair procedures which can be performed on the engine while it is in the vehicle. Information regarding cylinder head and engine block overhaul procedures is in Part B of this chapter.

The following repair procedures are based on the assumption that the engine is still installed in the vehicle. So if the engine is already out of the vehicle and mounted on a stand, many of the steps outlined in this part of Chapter 2 will not apply.

The specifications included in this part of Chapter 2 apply only to the procedures contained in this part. Part B of Chapter 2 contains the specifications necessary for cylinder head and engine block rebuilding.

2 Repair operations possible with engine in vehicle

Many major repair operations can be accomplished without removing the engine from the vehicle.

It is a good idea to clean the engine compartment and the exterior of the engine with some type of pressure washer before beginning any work. A clean engine will make the job easier and will prevent the possibility of getting dirt into internal areas of the engine.

Remove the engine compartment lid (Chapter 11) and cover the fenders to provide as much working room as possible and to prevent damage to the painted surfaces.

If oil or coolant leaks develop, indicating a need for gasket or seal replacement, the repairs can generally be made with the engine in the vehicle. The oil pan gasket, the cylinder head gasket, the intake manifold, air control valve and exhaust manifold gaskets, timing belt cover gaskets and the front and rear crankshaft oil seals can be replaced without removing the engine.

Exterior engine components such as the water pump, the starter motor, the alternator, the distributor, the fuel injection system, the intake manifold, the air control valve and the exhaust manifold can be removed for repair or replacement with the engine in place."

Since the cylinder head can be removed without pulling the engine, valve component removal can also be accomplished with the engine in the vehicle (for information regarding valve servicing, see Part B of this Chapter).

Inspection and replacement of the timing belt, the camshaft timing pulleys, the crankshaft pulley and the oil pump are all possible with the engine in place.

In extreme cases caused by a lack of necessary equipment, repair or replacement of piston rings, pistons, connecting rods and rod bearings and reconditioning of the cylinder bores is possible with the engine in the vehicle. However, this practice is not recommended because of the cleaning and preparation work that must be done to the components involved.

Detailed removal, inspection, repair and installation procedures for the above mentioned components can be found in the appropriate part of Chapter 2 or the other chapters in this manual.

3 Locating top dead center (TDC)

*Refer to illustrations 3.3a, 3.3b and **3.4***

Note: *You will need a helper to perform this procedure properly.*

1 Disconnect the cable from the negative terminal of the battery.

2 Remove all four spark plugs (refer to Chapter 1).

3 From underneath the right side of the vehicle, just inboard of the right rear wheel well, locate the crankshaft pulley. Turn the crankshaft pulley in a clockwise direction with a 19 mm socket and ratchet **(see illustration),** or breaker bar, until the third groove on the crank pulley is aligned with the stationary pointer which protrudes through the timing belt cover **(see illustration).** Note that there are actually three timing marks on the pulley. The first two are advance marks for ignition timing. The third mark (as the crankshaft pulley is rotated clockwise) indicates that the No. 1 piston is at TDC. If you do not have an assistant to watch the TDC mark and stationary pointer for you, it is possible to turn the crankshaft pulley from above. But because there is little room for moving a wrench or ratchet, it is difficult to obtain much leverage.

4 To verify that the engine is at TDC, remove the oil filler cap. Note that only half of the filler neck is actually open to the cylinder head. The rear half is covered by a cast-in floor. The straight edge of this floor is the stationary alignment mark for a small dimple in the intake camshaft. If the No. 1 piston is at TDC on the compression stroke, the dimple should be bisected by the straight edge of the filler neck floor **(see illustration).**

5 If the dimple isn't there, the No. 1 piston is not on the compression stroke. Rotate the crankshaft pulley one more complete revolution. Recheck the dimple on the crankshaft. It should be aligned with the straight edge in the filler neck.

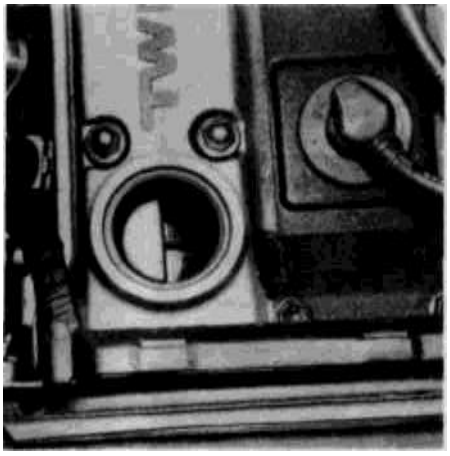
4 Cylinder compression — check

Refer to illustrations 4.4 and 4.7

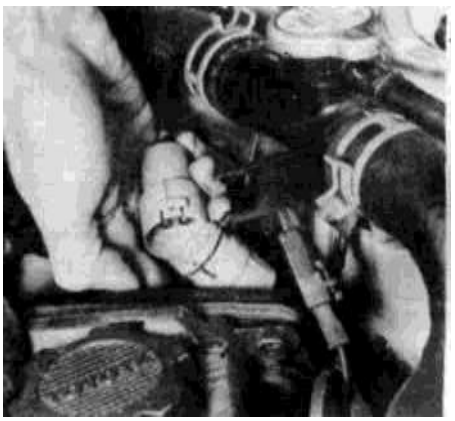
1 If the engine lacks power, has excessive oil consumption or poor fuel mileage after a tune-up, measure the cylinder compression pressure. A compression check will tell you the mechanical condition

3.3a Although it's possible to get a wrench or socket on the crankshaft pulley bolt from above, it's easier to turn it from below, just forward of and inboard of the right rear wheel

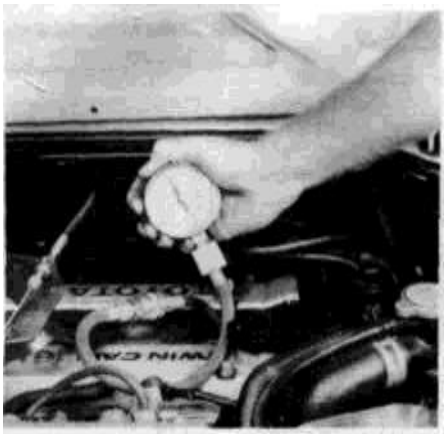
3.3b This is what you should see when the No. 1 piston is at TDC. The third mark on the crankshaft pulley (arrow) is aligned with the stationary marker on the idler pulley bolt



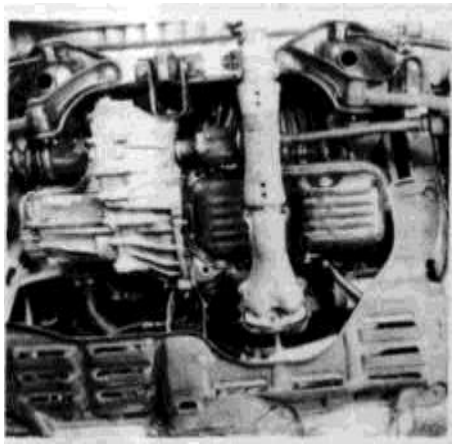
3.4 To verify that the No. 1 piston is at TDC on the compression stroke, remove the oil filler cap and look for a little dimple in the camshaft — the dimple should be aligned with the straight edge of the filler neck floor



4.4 Although disconnecting the coil high tension wire will prevent the coil from sending spark to the distributor, it won't prevent the coil from being destroyed trying to overcome the resistance between the coil terminal and the nearest ground — the better practice in this case is to **unplug the electrical connector between the main engine wire harness and the igniter/coil assembly**



4.7 While an assistant depresses the accelerator pedal all the way to the floor and cranks the engine over five or six times, watch the needle on the compression gauge and record its highest reading



5.2 The louvered plastic engine undercover is located directly underneath the gap between the front underside of the engine and the rear edge of the vehicle pan — to remove it, take out all ten bolts

of the engine. It can tell you if the compression is down due to leakage caused by worn piston rings, defective valves and seats or a leaking head gasket.

2 Warm the engine to normal operating temperature.

3 Remove all four spark plug boots. Before removing the plugs, carefully inspect the cavity between the cylinder head covers with a small flashlight. If it is dirty, remove the center cover (Section 8) and blow it out with compressed air to prevent dirt from falling into the spark plug holes and contaminating the cylinders. Remove the spark plugs (refer to Chapter 1).

4 Disconnect the high tension lead from the ignition coil or disconnect the electrical connector between the engine wire harness and the igniter/coil assembly **(see illustration).**

5 Disconnect the cold start injector connector and the four fuel injector connectors (refer to Chapter 4).

6 Thread a compression gauge hose into the spark plug hole for the No. 1 piston. Be careful not to cross thread the fitting for the compression gauge hose when screwing it into the spark plug hole. Attach the hose to the compression gauge. **Note:** *Although the type of compression gauge which uses a rubber tip instead of a threaded fitting for the spark plug hole can also be used, it is not recommended for measuring the compression of this cylinder head because its high compression will make it difficult to hold the gauge against the cylinder pressure.*

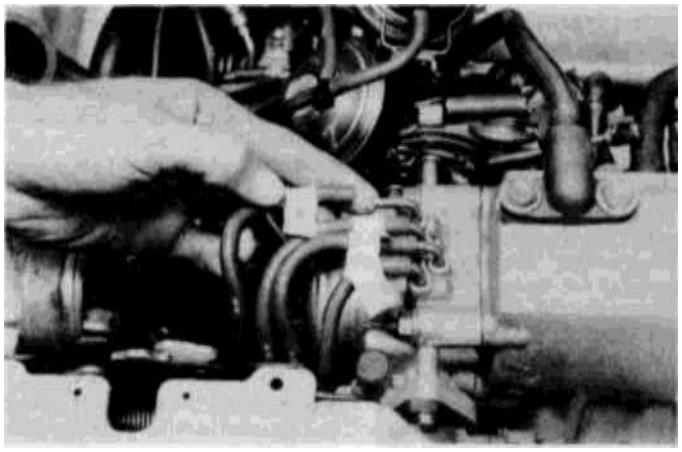
7 While an assistant depresses the accelerator pedal all the way to the floor, turns the ignition key to the Start position and cranks the engine over several times, watch the needle on the gauge **(see illustration).** It should jump to a higher pressure reading each time the piston in the No. 1 cylinder passes TDC on its compression stroke. Jot down the highest reading. **Caution:** *To avoid damage to the starter, never crank the engine more than five or six times in succession.* **Note:** *Always use a fully charged battery to assure that at least 250 rpm can be attained.*

8 Repeat Steps 6 and 7 for each cylinder. Compare your readings to the specified compression pressure.

9 If the compression pressure of any cylinder is low, squirt a small amount of engine oil (about three squirts from a plunger-type oil can) into that cylinder through the spark plug hole and repeat Steps 6 and 7 **for** that cylinder.

10 If the addition of oil raises the compression for a cylinder, the piston rings and/or cylinder bore are worn or damaged.

11 If the compression pressure remains low or doesn't increase significantly, the leakage is occurring at the valves or the cylinder head gasket. If a valve is leaking, it may be sticking because it is bent, cracked or warped or it may be improperly seated because of a burned valve face and/or seat.



5.6 Label and disconnect the four vacuum hoses from the top of the throttle body

12 If two adjacent cylinders have equally low compression, there is a strong possibility that the head gasket between them is blown. The appearance of coolant in the combustion chambers or the crankcase would verify this condition. The head will have to be removed for further investigation (refer to Section 11).

13 If the compression is unusually high, the combustion chambers are probably coated with carbon deposits. If that is the case, the cylinder heads should be removed and decarbonized.

14 If compression is way down or varies greatly between cylinders, it would be a good idea to have a leak-down test performed by an automotive repair shop. This test will pinpoint exactly where the leakage is occurring and how severe it is.

5 Intake manifold — removal and installation

Refer to illustrations 5.2, 5.6, 5.7, 5.9, 5.11, 5.12, ***5.15, 5.16*** *and 5.19*

1 Disconnect the cable from the negative terminal of the battery.

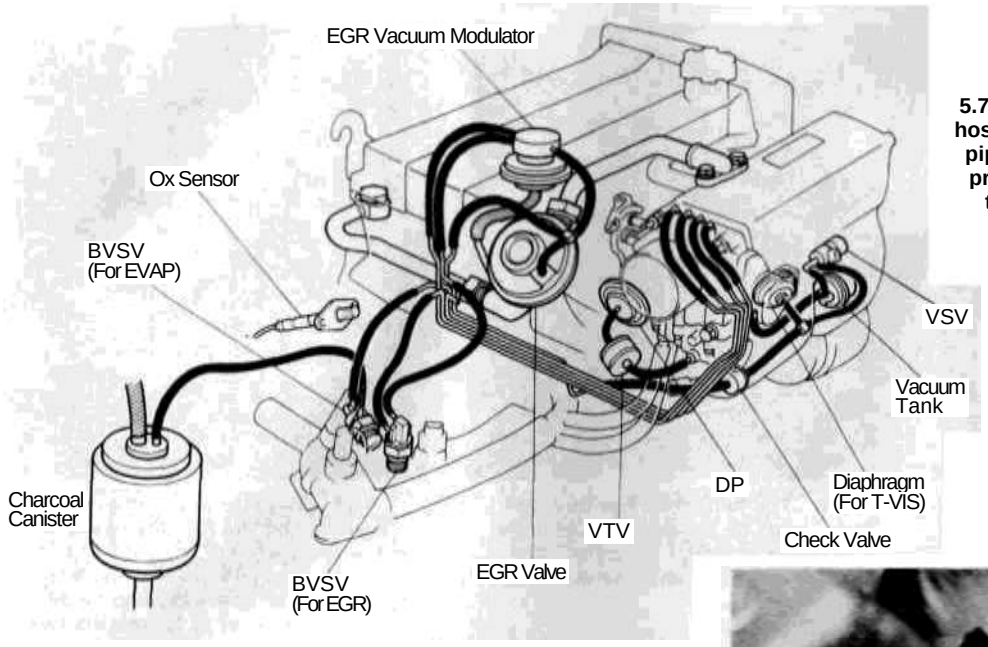
2 Raise the vehicle and place it on jackstands. Remove the engine under cover bolts and the under cover **(see illustration).**

3 Drain the engine coolant (refer to Chapter 1).

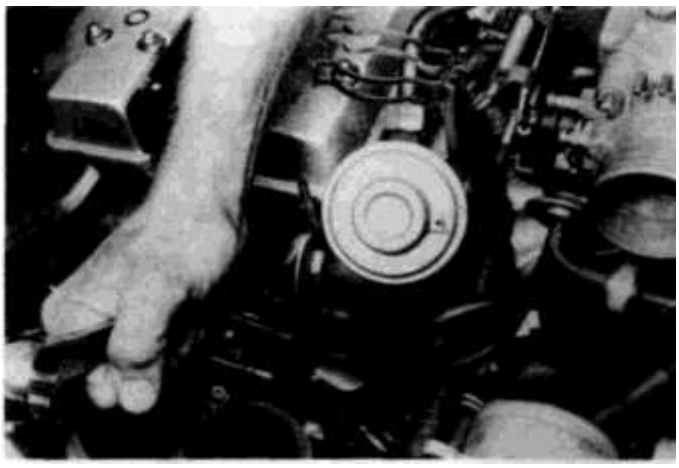
4 Remove the duct between the air flow meter and the throttle body.

5 Disconnect the link rod from the throttle cable assembly and remove the accelerator cable bracket (refer to Section 8).

6 Label and disconnect the four vacuum hoses from the top of the throttle body **(see illustration).**



5.7 Label and disconnect the vacuum hoses between the vacuum transmitting pipe and the thermostat housing — to prevent any confusion at reassembly time, it's a good idea to label both the hose and the metal pipe from which it is disconnected



5.9 Disconnect the threaded fitting between the EGR pipe and the EGR valve — should it prove difficult to break loose, use **a thread penetrant to loosen It**

7 Label and disconnect the upper and lower BVSV (Bimetal Vacuum Switching Valve) vacuum hoses, the upper and lower EVAP BVSV hoses, the hose between the EGR valve and the EGR vacuum modulator and the hose between the vacuum transmitting pipe assembly and the air control valve actuator **(see illustration).** This vehicle has a lot of vacuum hoses. To prevent confusion during reinstallation, it's a good idea to label each vacuum line and the metal pipe from which it is disconnected.

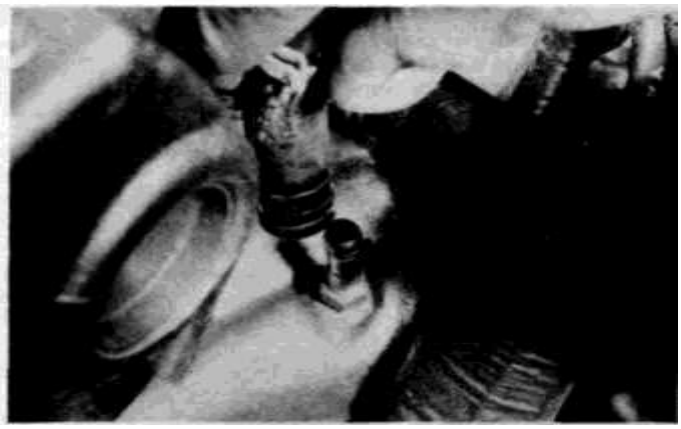
8 Remove the vacuum transmitting pipe assembly mounting bolts from the throttle body, the intake manifold and the cylinder head and remove the vacuum transmitting pipe assembly.

9 Disconnect the threaded EGR pipe fitting **(see illustration).** Remove the two EGR valve and pipe assembly mounting bolts from the head and the two bolts from the plenum and remove the EGR valve and pipe assembly.

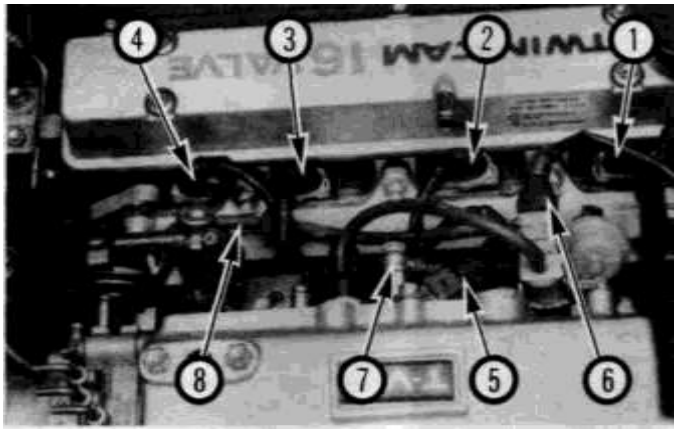
10 Remove the PCV hose from between the rear cylinder cover and the plenum.

11 Disconnect the brake booster hose from the intake manifold **(see illustration)** and, if your vehicle is equipped with cruise control, disconnect the cruise control vacuum hose from the intake manifold. Disconnect the auxiliary air valve hose from underneath the throttle body.

12 Disconnect the electrical connectors from the four fuel injectors, the cold start valve and the vacuum switching valve for the pressure



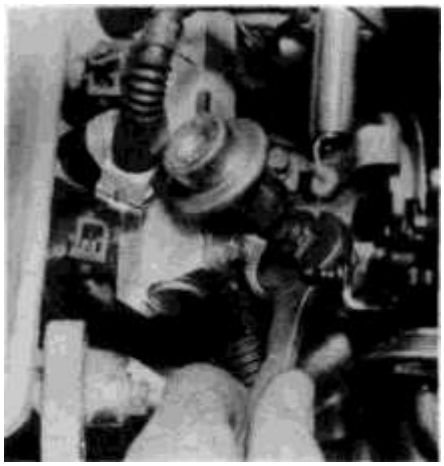
5.11 Disconect the brake booster hose from the right end of the intake manifold



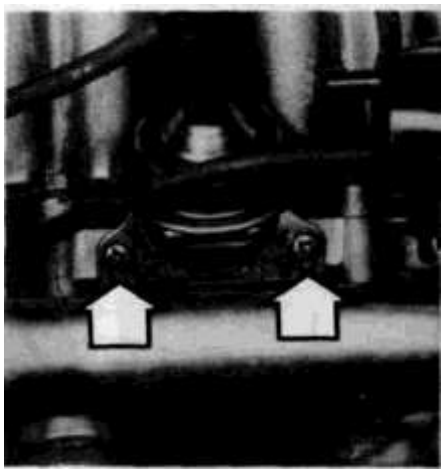
5.12 Several components must be disconnected and set aside before the delivery pipe can be removed:

7 No. 1 cylinder fuel injector electrical connector
2 No. 2 cylinder fuel injector
3 No. 3 cylinder fuel injector
4 No. 4 cylinder fuel injector connector
5 Electrical connector for the cold start valve
6 Electrical connector for the pressure regulator vacuum switching valve electrical connector
7 Fuel line banjo fitting for the cold start valve electrical connector
8 Vacuum hose from the vacuum switching valve to electrical the pressure regulator

5.15 To disconnect the fuel feed line from the delivery pipe, remove the pulsation damper (arrow) — when the banjo fitting for the fuel feed line is removed, note that there are two crush washers and that the upper one is a special design



5.16 The fuel return line threaded fitting must be disconnected from the pressure regulator line before the delivery pipe can be removed



5.19 The clearance between the plenum and the rear firewall of the engine compartment is tight so removing the air control valve and the intake manifold as an assembly can be difficult — it's much easier to loosen the two air control valve actuator bracket screws (arrows) to allow the top of the actuator to clear the underside of the intake manifold, then remove the intake manifold and the air control valve separately

regulator **(see** illustration).
13 Disconnect the cold start valve banjo fitting from the cold start valve.
14 Disconnect the vacuum control hose from the pressure regulator. 1
5 Disconnect the pulsation damper **(see illustration)** and remove the fuel feed line banjo fitting. Note that the upper crush washer is different than the lower one. Screw the pulsation damper back into the delivery pipe.
16 Disconnect the threaded fuel return line fitting from the pressure regulator **(see illustration).**
1 7 Remove the three delivery pipe bolts and remove the delivery pipe assembly. If the fuel injectors should come loose from the cylinder head and remain attached to the delivery pipe, make sure that they don't fall from the pipe once it is detached from the cylinder head (a tight fit between each injector and its respective bore in the delivery pipe, and an O-ring, is all that secures it to the pipe).
18 Remove the wire harness retaining strap bolt, fuel feed line retaining bracket bolt and wire harness ground bolt from the top of the intake manifold.
19 Remove the five bolts from the top side and the four bolts from the underside of the intake manifold. Remove the intake manifold and air control valve assemblies from the cylinder head. **Note:** *Because of the tight clearance between the end of the two outer cylinder head-to-intake manifold studs, it's difficult to remove the intake manifold and air control valve at the same time. It's easier to remove the assemblies one at a time. To remove them separately, remove the air control valve actuator bracket screws from the underside of the air control valve* **(see illustration)** *so that the actuator can be dropped down far enough to allow removal of the in take manifold by itself. The air control valve can then be removed.*
20 If you are planning to re-use the same intake manifold and air control valve, carefully scrape away all old gasket material with a razor blade.
21 Before reinstalling either manifold, it's a good idea to measure both for flatness. For these inspection procedures, refer to Section 8 in Chapter 2, Part B.
22 Installation is the reverse of removal. Be sure to tighten the air control valve/intake manifold bolts to the specified torque.

6 Toyota Variable Induction System (T-VIS) — check

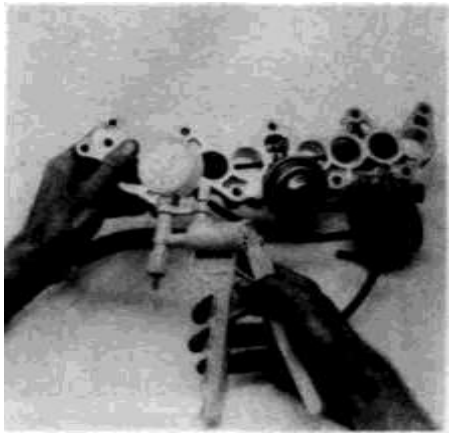
Refer to illustrations 6.1, 6.2, 6.3, 6.4 and 6.5

1 Check air control valve operation by applying 30 cm Hg (11.81 in Hg) of vacuum to the actuator **(see illustration).** The control valve should move smoothly to the fully closed position. If it doesn't, adjust it by turning the adjusting screw.
2 Check the vacuum tank by blowing air into each pipe. Air should flow from pipe A to pipe B. Air should not flow from pipe B to pipe A **(see illustration).**
3 Apply 50 cm Hg (19.69 in Hg) of vacuum to pipe A and check that there is no change in the vacuum after one minute **(see illustration).** If there is a change, replace the vacuum tank.
4 Check vacuum circuit continuity in the vacuum switching valve (VSV) by connecting the VSV terminals to the battery terminals **(see illustration)** and blowing air into pipe E. Air should come out of pipe F. If it doesn't, replace the VSV.
5 Disconnect the battery and blow air into pipe E. Air should come out of the air filter **(see illustration).** If it doesn't, replace the VSV.

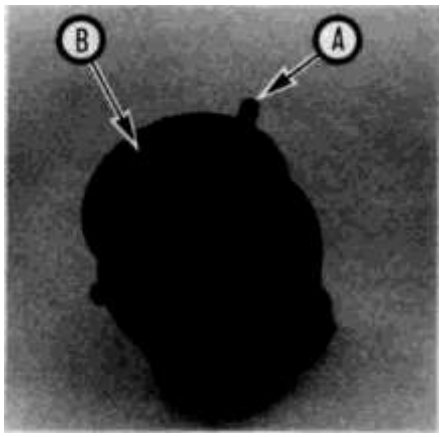
7 Exhaust manifold — removal and installation

Refer to illustrations 7.3, 7.4, 7.6, 7.9 and 7.11

1 Disconnect the cable from the negative terminal of the battery.
2 Raise the vehicle and support it securely on jackstands.
3 Remove the three exhaust manifold-to-exhaust pipe nuts **(see illustration).**
4 Remove the two bolts from the center hanger exhaust pipe brace **(see illustration).**
5 Slide the entire exhaust pipe assembly to the left to disconnect the two rear braces from the rear hangers and remove it from the vehicle.
6 From underneath the engine compartment, remove the three lower exhaust manifold insulator retaining bolts **(see illustration).**
7 Lower the vehicle and disconnect the oxygen sensor electrical | connector.
8 Remove the distributor cap, rotor and shield (refer to Chapter 1).
9 Remove the bolt that retains the throttle cable bracket and the i engine compartment temperature sensor bracket **(see illustration)** and set both brackets and their respective components aside.
10 Remove the remaining three retaining bolts from the insulator (refer to illustration 7.6) and remove the insulator from the exhaust manifold.

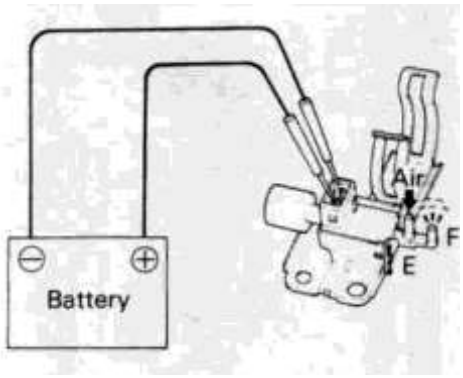


6.1 Apply 30 cm Hg (11.81 in) of vacuum to the air control valve actuator and note whether the control valve moves smoothly to the fully closed position

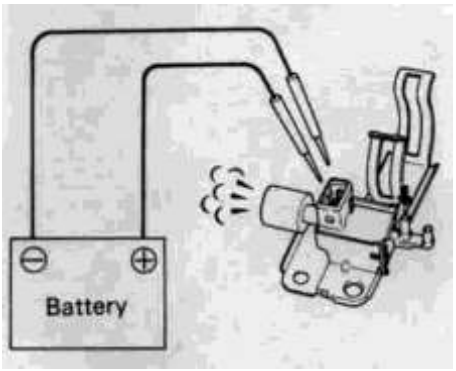


6.2 Test the vacuum tank by blowing air into each pipe — air should flow from pipe A to pipe B but should not flow from pipe B to pipe A

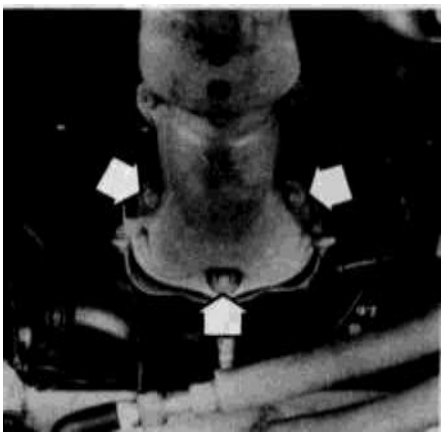
6.3 Apply 50 cm Hg (19.69 in) of vacuum to pipe A (the one with the elbow) and make sure that there is no change in the vacuum reading for one minute



6.4 Connect the vacuum switching valve (VSV) terminals to the battery terminals as shown and blow into pipe E — air should come out of pipe F

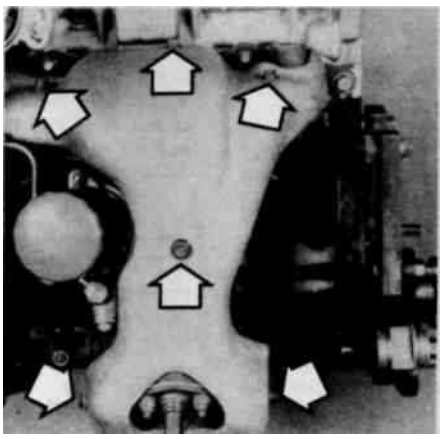


6.5 Disconnect the battery and blow into pipe E — air should come out of the air filter

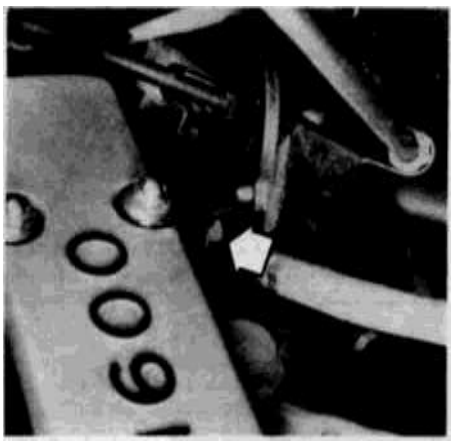


7.3 Remove the three exhaust manifold-to-exhaust pipe stud nuts (arrows)

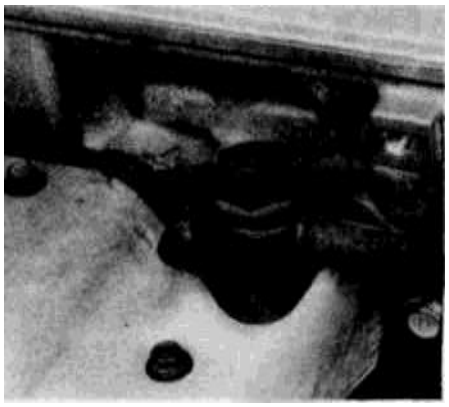
7.4 Remove the two center hanger-to-exhaust pipe bolts (arrows)



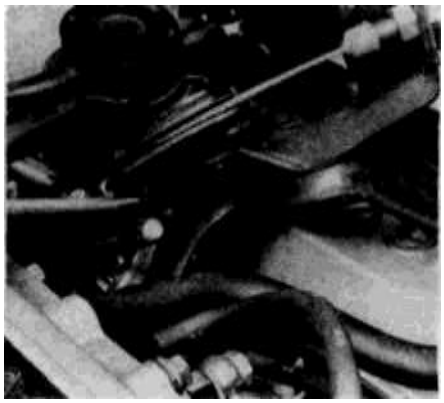
7.6 Remove the exhaust manifold outer insulator bolts (arrows)



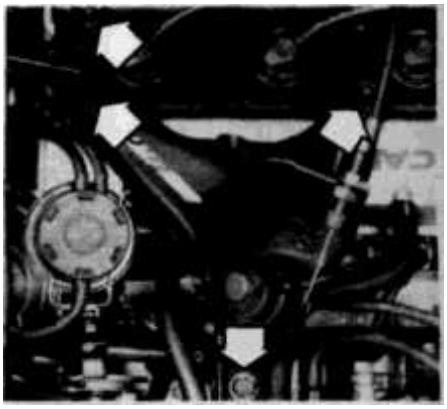
7.9 Remove the bolt (arrow) that retains the speedometer cable bracket and the engine compartment ambient air temperature bracket and set the brackets aside



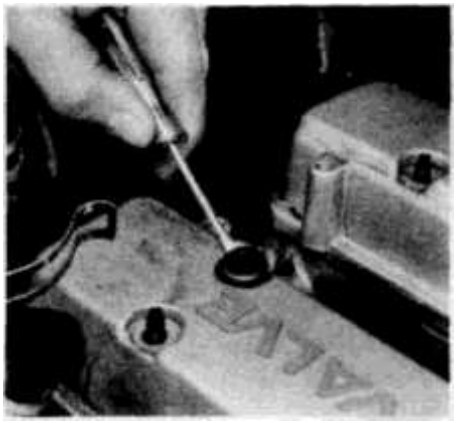
7.11 Remove the EGR pipe bolt from the exhaust manifold



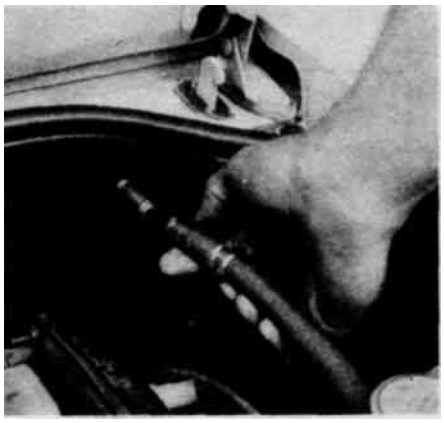
8.2 Disconnect the accelerator cable link rod from the accelerator cable assembly by placing the tip of a screwdriver blade between the clip on the end of the rod and the cable assembly — twist the screwdriver and the rod will pop loose from the small spherical bearing on the cable assembly bellcrank



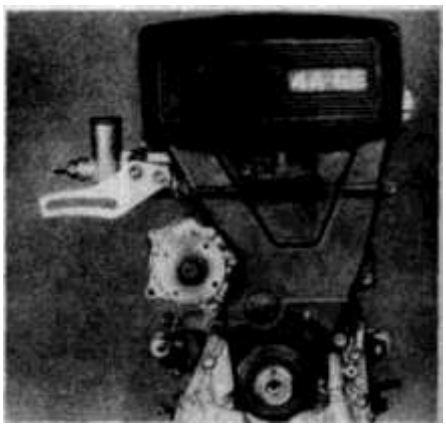
8.3 Remove the three acceleretor cable bracket bolts and the remaining speedometer cable bracket bolt (arrows) and set the cable assemblies and brackets aside



8.7 Pry the washer/seals off the cylinder head cover retaining studs with a small screwdriver



9.4 Disconnect the brake booster hose from the metal vacuum transmitting pipe in the right front corner of the engine compartment



9.6 Two upper and three lower bolts on the upper timing belt cover must be removed before the cover comes off

11 Remove the EGR pipe bolt **(see illustration)** and remove the EGR pipe assembly.
12 Remove the three bolts and two nuts from the exhaust manifold and remove the manifold from the cylinder head.
13 Scrape all old gasket material from the mating surfaces of the exhaust manifold (if you intend to re-install the same manifold) and the cylinder head.
14 It's a good idea to measure these two mating surfaces for flatness (Section 8 in Chapter 2, Part B) before reinstalling the manifold.
15 Installation is the reverse of removal. Be sure to tighten the exhaust manifold bolts to the specified torque.

8 Cylinder head covers — removal and installation

Refer to illustrations 8.2, 8.3 and 8.7

1 Disconnect the cable from the negative terminal of the battery.
2 Disconnect the accelerator cable link rod by popping it loose from the cable assembly **(see illustration).**
3 Remove all three accelerator cable bracket bolts and the single remaining bolt from the speedometer cable bracket **(see illustration).** Set both cable and bracket assemblies aside.
4 Remove the PCV system hose between the rear cylinder head cover and the plenum.
5 Disconnect the spark plug wires and boots (refer to Section 19 in Chapter 1) and set them aside.
6 Remove the center cover bolts, the cover and the cover gasket.
7 Remove the cylinder head cover cap nuts and pry off the cap nut washer/seals with a small screwdriver **(see illustration).**
8 Remove the cylinder head covers. If they are stuck to the cylinder head, carefully tap them with a rubber mallet.
9 Inspect the cylinder head cover gaskets. If they are still in good shape, they can be reused. Coat them with a light coat of silicone sealant before installing.
10 Installation is the reverse of removal.

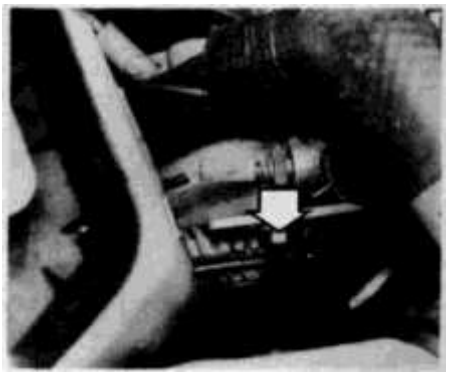
9 Timing belt and pulleys — removal and installation

Refer to illustrations 9.4, 9.6, 9.7, 9.8, 9.9, 9.17, 9.19, 9.20a, 9.20b, 9.21, 9.22a, 9.22b, 9.28, 9.29, 9.30, 9.31 and 9.32

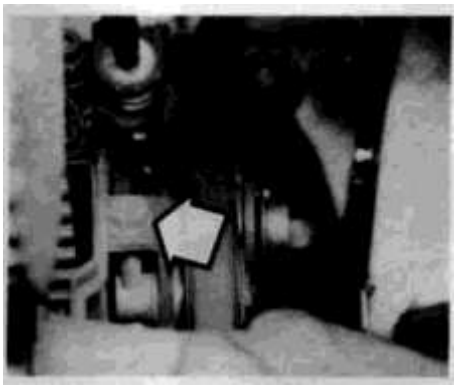
Removal

1 Disconnect the cable from the negative terminal of the battery.
2 Disconnect the spark plug boots from the spark plugs and set the wires and boots aside (refer to Chapter 1).
3 Remove the spark plugs (refer to Chapter 1).
4 Disconnect the power brake booster hose from the metal vacuum transmitting pipe in the front right corner of the engine compartment **(see illustration).**

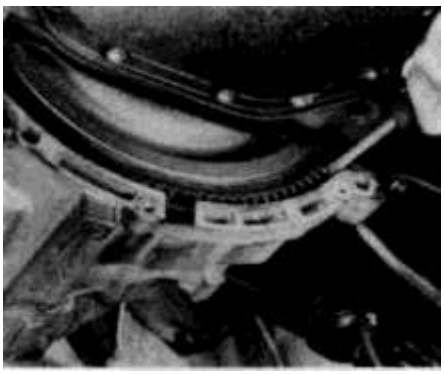
9.7 Remove all four water pump pulley bolts (arrows — you can only see three from this angle), slide the pulley off the pump shaft and remove it — the pulley nust be removed from above because of the tight clearance between the end of the shaft and the vehicle



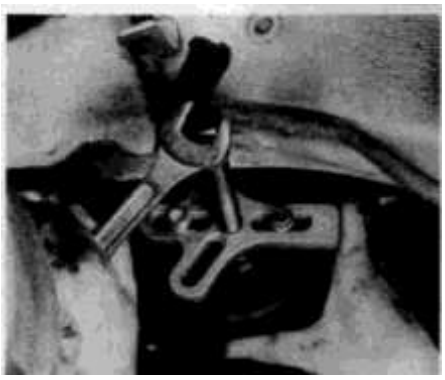
9.8 Loosen the alternator adjusting bolt (arrow)



9.9 Take the tension off the A/C compressor drivebelt by loosening this bolt (arrow) on the drivebelt tensioner pulley



9.17 To get at the flywheel ring gear, remove the flywheel inspection cover bolts and the cover itself, then jam a large screwdriver or pry bar between the ring gear teeth and the transaxle housing to immobilize the crankshaft



9.19 Install a puller on the crankshaft drivebelt pulley and remove the pulley

9.20a To remove the lower timing belt cover, remove all four bolts

5 Locate the wire harness that is routed between the right end of the cylinder head covers and the upper timing belt cover. These wires connect the distributor, engine compartment fan, oxygen sensor, A/C compressor and oil pressure switch to the engine main wire harness. Label both ends of each connector and disconnect all of them. Then free the harness assembly from the two upper timing belt cover studs and set it aside.

6 Remove the two upper and three lower bolts from the upper timing belt cover **(see illustration).**

7 Loosen but do not remove the water pump pulley bolts **(see illustration).**

8 Loosen the alternator adjustment bolt **(see illustration).**

9 Loosen the A/C compressor drivebelt idler pulley bolt **(see illustration).**

10 Remove the A/C compressor drivebelt.

11 Loosen but do not remove the wheel lug nuts on the right rear wheel.

12 Raise the vehicle and place it securely on jackstands. Remove the wheel.

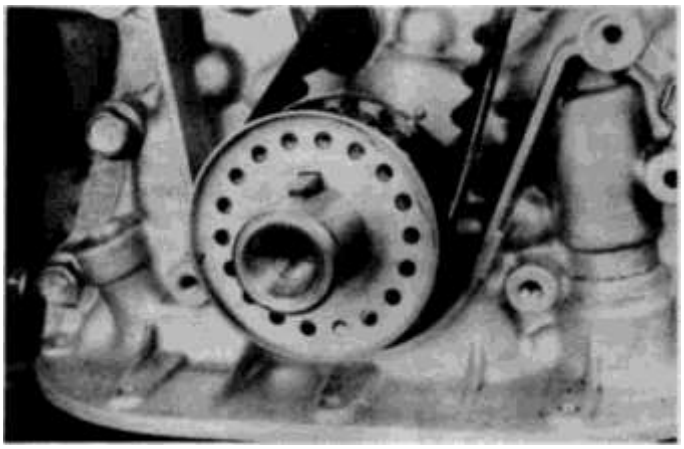
13 Loosen the alternator pivot bolt, rotate the alternator toward the block and remove the alternator drivebelt.

14 Remove the water pump pulley bolts and the pulley. **Note:** *Because of the tight clearance between the water pump shaft and the frame, the pulley can only be removed from above — it cannot be pulled out from underneath.*

15 Set the piston in the No. 1 cylinder at TDC (see Section 3).

16 Remove the flywheel inspection cover bolts and the inspection cover.

17 Place a large screwdriver between the flywheel ring gear teeth and the flywheel housing **(see illustration)** to prevent the crankshaft from turning and break the crankshaft pulley bolt loose with a 19 mm socket and breaker bar.



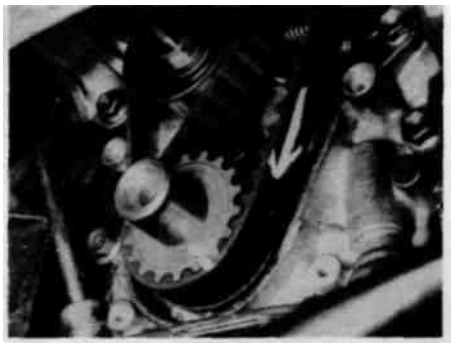
9.20b Note that the timing belt guide is installed with the cupped side facing outward — make sure that it is reinstalled the same way

18 Recheck the timing marks to make sure that the piston in the No. 1 cylinder is still at TDC.

19 Install a puller on the crankshaft pulley **(see illustration)** and remove the pulley.

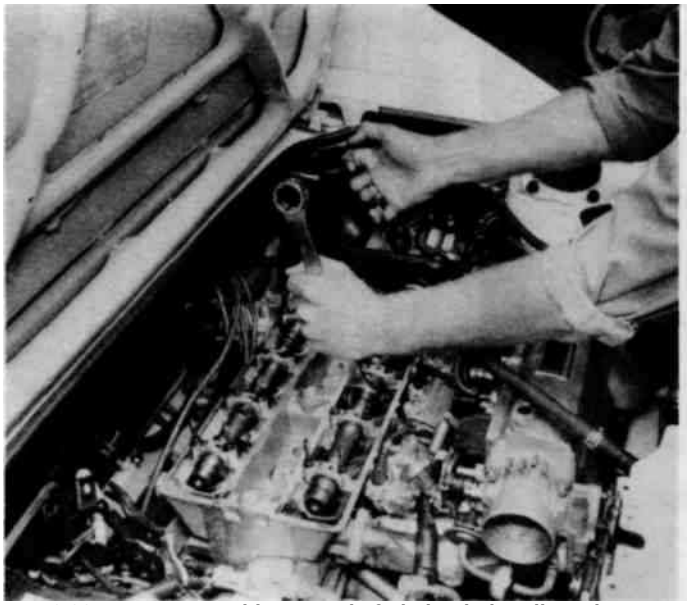
20 Remove the four lower timing belt cover bolts and the cover **(see illustration).** Remove the timing belt guide **(see illustration).** Note that the cupped side of the timing belt guide faces outward.

9.21 The middle timing belt cover shares retaining bolts with the lower and upper covers, so once they're off, it's only held by one additional bolt (arrow), which is hidden behind the A/C drivebelt tensioner pulley

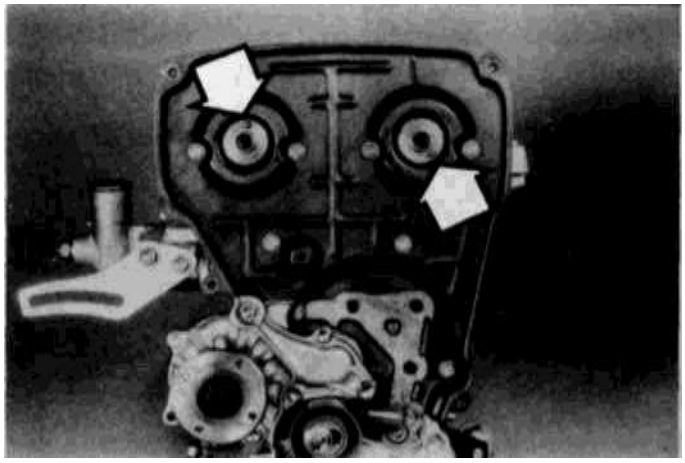


9.22a Before removing the timing belt, be sure to mark the belt's direction of rotation, then index the timing belt to the crankshaft timing pulley

9.22b Also index the belt to the camshaft pulleys



9.28 To remove either camshaft timing belt pulley, place a wrench on the large cast-in hex nut between the lobes for cylinders No. 2 and 3 to immobilize the camshaft, then break the pulley bolt loose with another wrench — do not turn the camshaft during pulley bolt removal or you will bend the valves



9.29 The knock pins (arrows) on the camshafts should be positioned as shown, with the pin on the intake camshaft at 12 o'clock and the pin on the exhaust cam at five o'clock

21 Remove the single remaining middle timing belt cover bolt **(see illustration)** and remove the cover.

22 If you intend to reuse the timing belt, mark its direction of rotation and index it to the crankshaft pulley **(see illustration)** and the camshaft pulleys **(see illustration).**

23 Loosen the timing belt idler pulley bolt, push the pulley as far as it will go to the left (toward the rear of the vehicle) and temporarily retighten it.

24 Support the engine with a floor jack. Place a block of wood between the floor jack pad and the engine oil pan sump to prevent damage to the pan.

25 Raise the engine slightly and disconnect the right mounting insulator from the engine block by removing the bolt and two nuts. To break the engine loose from the insulator, lower the floor jack pad slightly. Loosen the insulator through-bolt and pivot the insulator up and out of the way.

26 Remove the timing belt. If you are simply replacing the timing belt, skip the following steps relating to camshaft and/or crankshaft timing belt pulley removal and installation, and proceed to timing belt installation, which begins with Step 33.

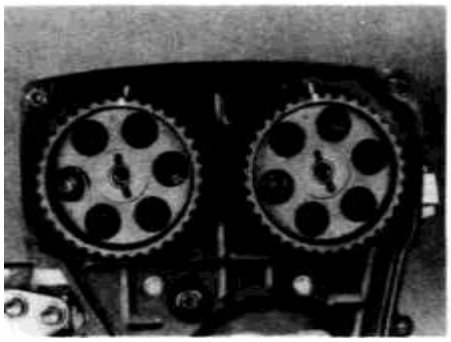
27 Remove the speedometer cable bracket and the cylinder head covers (see Section 8).

28 Immobilize the camshaft by placing a wrench on the large hexagonal "nut" cast into the camshaft between the No. 2 and No. 3 cam lobes **(see illustration),** break the camshaft timing pulley bolt loose, remove the bolt and remove the pulley. **Caution:** *Do not rotate the camshaft itself when loosening the pulley bolt or pulling the pulley off the camshaft. Once the timing belt has been removed, rotating the camshaft can bend the valves.*

29 Installation of the camshaft pulleys is the reverse of removal. Before installing the camshaft timing belt pulleys, make sure that the knock pins on the ends of the camshafts are positioned properly **(see illustration),** with the knock pin on the intake camshaft pulley at approximately 12 o'clock and the pin on the exhaust camshaft pulley at about 5 o'clock.

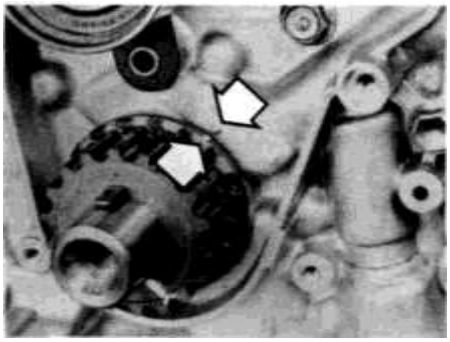
30 Slide the camshaft timing belt pulleys onto the ends of the camshafts. Make sure that the index marks on the camshaft timing pulleys are aligned with the stamped match marks on the timing belt cover **(see illustration).** Tighten the camshaft timing belt pulley bolts to the specified torque.

31 Pry the crankshaft timing pulley loose from the crankshaft nose with a small pry bar **(see illustration).** If the pulley cannot be removed with a pry bar, use a puller to remove it. **Caution:** *Do not turn the crankshaft during crankshaft timing belt pulley removal. Turning the*

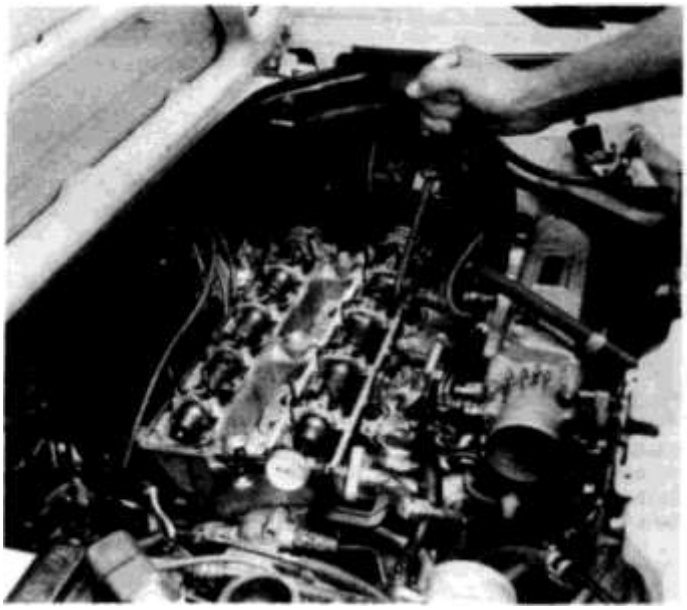


9.30 Make sure that the camshaft timing belt pulley index marks are aligned with the stationary match marks on the timing belt cover when installing the pulleys

9.31 The crankshaft timing belt pulley can usually be pried loose from the nose of the crank with a small pry bar — if the pulley proves difficult to pry off, take it off with a puller



9.32 Align the TDC mark on the crankshaft timing belt pulley with the stationary marker on the oil pump housing



10.4 To measure camshaft thrust clearance, install a dial gauge as shown on the end of the cylinder head and lever the camshaft back and forth with a large screwdriver or pry bar — if the clearance exceeds the specified maximum, either the camshaft, the head or both will have to be replaced

10.5 To pull the inner timing belt cover off the cylinder head, remove all seven bolts. The seventh bolt, which isn't visible in this photo, is just below and to the right of the right hand engine mounting bracket. If the cover must be removed (for cylinder head and/or engine removal), the right side engine mounting bracket must be disconnected

crankshaft after the timing belt has been removed can bend the valves.

32 Installation of the crankshaft pulley is the reverse of removal. Be sure to align the TDC marks on the oil pump body and the crankshaft timing pulley **(see illustration).**

Installation

33 Slide the belt onto the camshaft timing belt pulleys, then onto the crankshaft pulley, then push the tensioner to the left and slide the timing belt into place against the tensioner pulley. Make sure that none of the pulleys move out of alignment when installing the timing belt.

34 Tighten the tensioner pulley bolt temporarily.

35 Rotate the engine two times and make sure that the index marks on the three pulleys are still aligned with the stationary TDC marks on the inner timing belt cover and the oil pump housing.

36 If the marks are still aligned, tighten the tensioner pulley bolt to the specified torque.

37 Install the timing belt guide.

38 Install the lower timing belt cover and tighten all of the bolts securely except the upper left bolt (which is common with the iower and middle covers).

39 Install the middle timing belt cover and tighten all of the bolts securely.

40 Install the upper timing belt cover and tighten all of the bolts securely.

41 The remainder of the installation is the reverse of removal.

10 Camshaft — removal and installation

Refer to illustrations 10.4, 10.5, 10.6, 10.7 ***and*** *10.9*

1 Remove the cylinder head cover(s) (refer to Section 8).

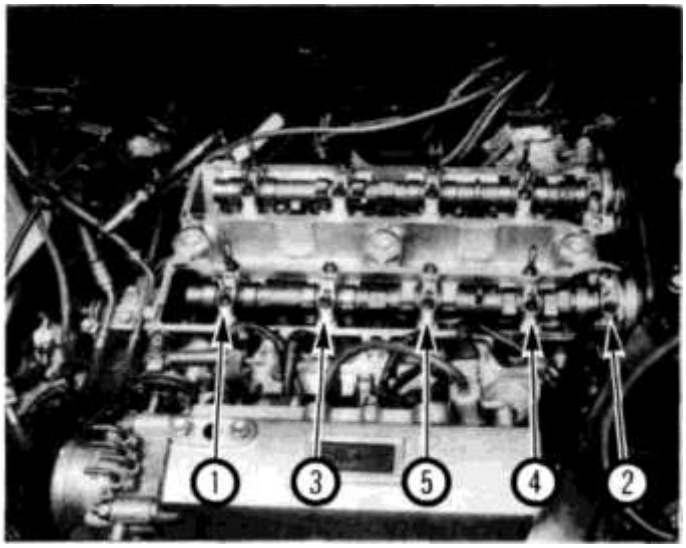
2 Remove the timing belt (refer to Section 9).

3 Remove the camshaft timing pulley(s) (refer to Section 9).

4 Measure the camshaft thrust clearance **(see illustration)** with a dial gauge. If the clearance is greater than the specified maximum, replace the camshaft and/or the cylinder head.

5 Remove the inner timing belt cover bolts **(see illustration)** and slide the cover off the end of the cylinder head (it can't be removed unless the right engine mounting insulator bracket is disconnected from the engine and rotated out of the way, but complete removal of the cover is only necessary if you are removing the cylinder head and/or engine).

6 Loosen each camshaft bearing cap a little at a time in the proper sequence **(see illustration).** Remove the caps, the oil seal and the camshaft.
7 Apply engine assembly lube to the bearing saddles and install the camshafts with the intake camshaft knock pin at 12 o'clock and the exhaust camshaft knock pin at 5 o'clock **(see illustration).**
8 Install the camshaft bearing caps and gradually tighten the cap bolts to the specified torque in the opposite sequence to that shown in illustration 10.6.
9 Drive the new camshaft seals into place with a socket or a short section of pipe slightly smaller in diameter than the outside diameter of the camshaft seals **(see illustration).**
10 The rest of installation is the reverse of removal.

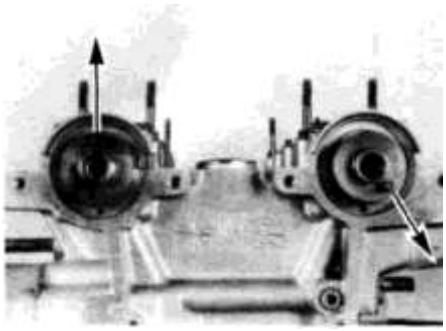


10.6 To remove either camshaft, loosen the camshaft bearing caps a little at a time in the order shown

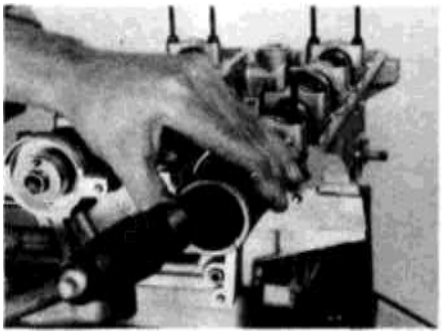
11 Cylinder head — removal and installation

*Refer to illustrations 11.**10,** 11.11, 11.12, 11.13, 11.14 and 11.16*

1 Disconnect the cable from the negative terminal of the battery.
2 Drain the engine coolant (refer to Chapter 1.
3 Remove the intake manifold (refer to Section 5).
4 Remove the exhaust manifold (refer to Section 7).
5 Remove the cylinder head covers (refer to Section 8).
6 Remove the timing belt and the camshaft timing pulleys (refer to Section 9).

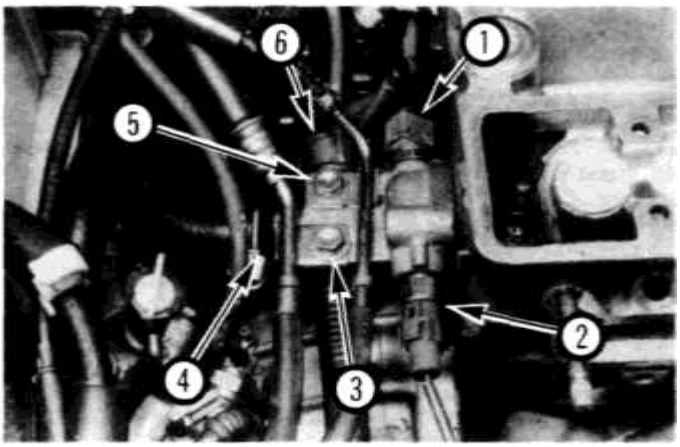


10.7 When installing the camshafts, make sure that the intake cam knock pin is at 12 o'clock and that the exhaust cam knock pin is at five o'clock



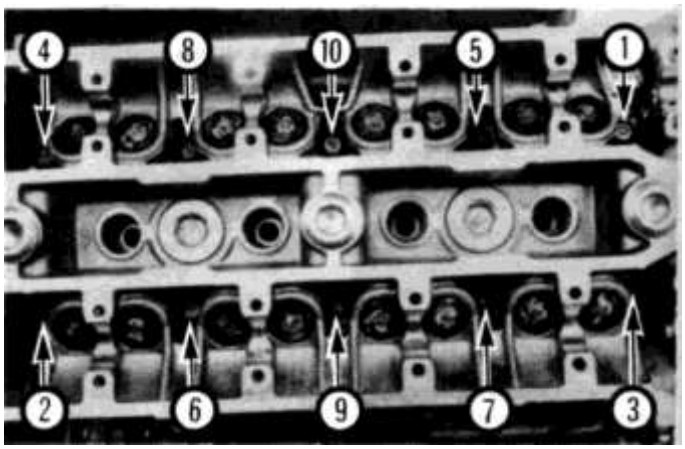
10.9 Drive the new seals into place with a large socket or a short section of pipe slightly smaller in diameter than the outside diameter of the seal

11.10 Disconnect the bypass pipe bolts (arrows) from the water outlet and the block before removing the head (or, the water outlet can be disconnected from the head, but it's easier to do that after the head is removed from the engine compartment

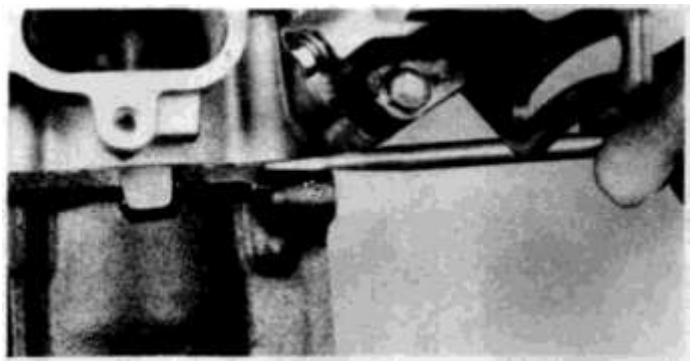


11.11 The rear cover serves as a mounting point for the following components, all of which must be disconnected before the head can be removed:

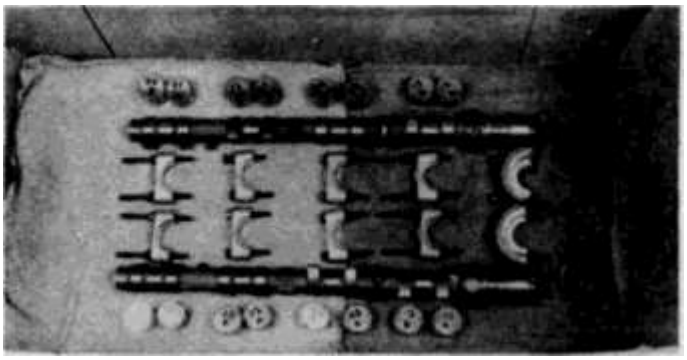
1 *Coolant temperature sensor electrical connector*
2 Coolant temperature sensor electrical connector
3 Fuel line bracket bolt
4 Heater hose clamp
5 Fuel line bracket bolt
6 Wire harness clip



11.12 Gradually loosen the cylinder head bolts in this order

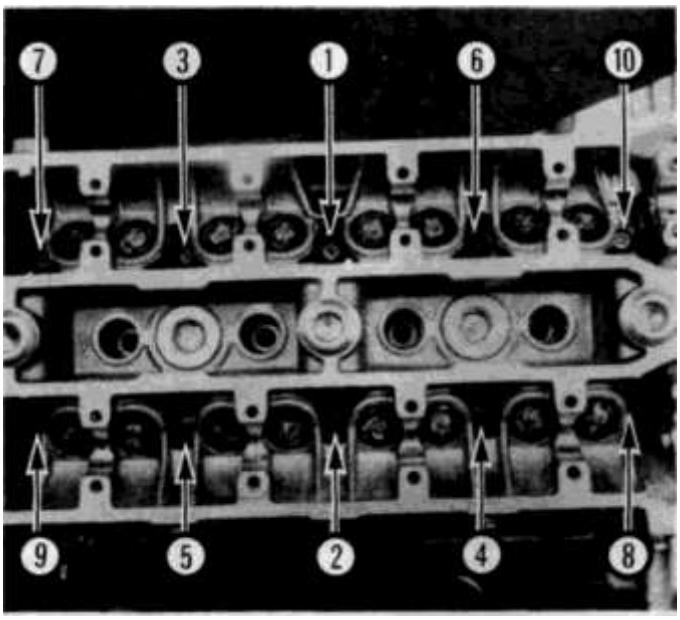


11.13 If the head won't release from the block, pry it loose with a large screwdriver or pry bar, but only at this point



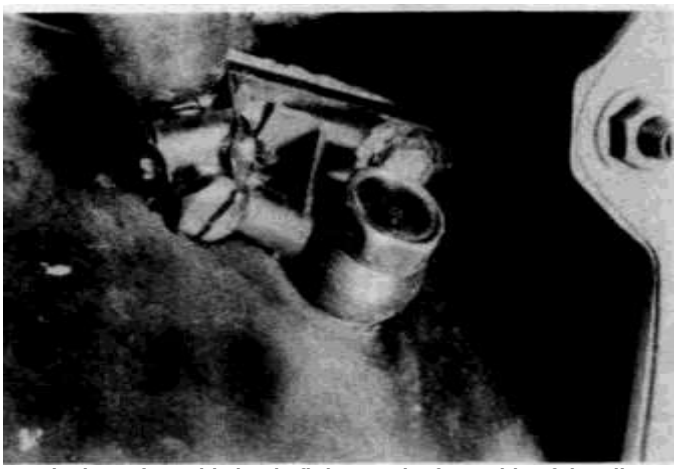
11.14 Any time the valve lifters and shims are out of the cylinder head, they should be carefully to make sure that they are reinstalled in the same bores from which they were removed

7 Remove the camshafts (refer to Section 10).
8 Remove the distributor (refer to Chapter 5).
9 Remove the alternator adjustment bolt.
10 Remove the coolant hose between the filler cap and the water outlet. Disconnect the bypass pipe from the water outlet and from the block **(see illustration),** then set it aside .
11 Disconnect the heater hose, the fuel line brackets, both temperature sensors and the wire harness from the rear cover **(see illustration).**
12 Remove the cylinder head bolts gradually in three passes and in the order shown **(see illustration).**
13 Carefully lift the cylinder head straight up from the cylinder block dowel pins and remove it from the vehicle. If the head is difficult to remove from the block, pry it loose with a large screwdriver or pry bar placed between the head and the projection on the block **(see illustration).** Place the head on wooden blocks on a clean work surface. **Caution:** *Do not under any circumstances tilt the head on its side or turn it upside down while the valve lifters and shims are still installed in their bores. They will fall out and get mixed up.*
14 If you are simply replacing a damaged head gasket, mark the lifters and shims, then remove them from their bores and set them aside in order **(see illustration).** Carefully scrape off all old gasket material from the head and block mating surfaces. Use a sharp, clean scraper and avoid putting nicks or gouges in either mating surface. Stuff the cylinders with clean shop rags to protect them from gasket material or dirt.
15 If you are planning to send the head out for a valve job, new guides or a complete overhaul, refer to Chapter 2, Part B for the disassembly, inspection and reassembly procedures.
16 Lay the new gasket in place on the block. Place the cylinder head in position and install the short head bolts on the intake side and the long bolts on the exhaust side. It's a good practice to apply a light coating of engine oil on the bolt threads and under the bolt head before installing the bolts. Then gradually tighten the the head bolts in the proper sequence **(see illustration).** Tighten the bolts to the specified torque on the final pass.
17 The remainder of installation is the reverse of removal.



11.16 Gradually tighten the cylinder head bolts, in this order, to the specified torque

12.4 Loosen the oil cooler line hose clamp and disconnect

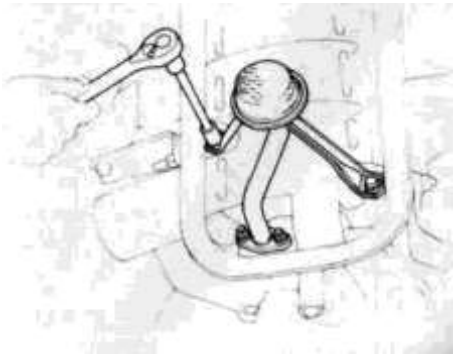


the hose from this banjo fitting on the front side of the oil pan — if you should remove this banjo fitting for any reason, be sure to use new crush washers when reinstalling it

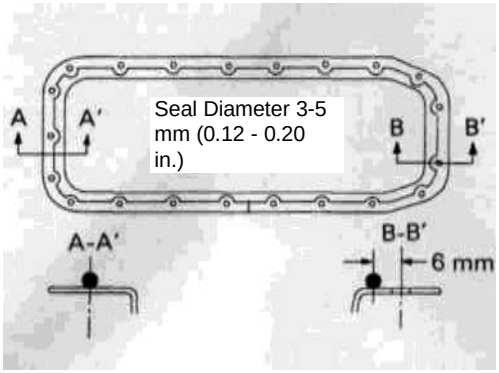
12 Oil pan and strainer — removal and installation

Refer to illustration 12.4, 12.7, 12.12a and 12.12b

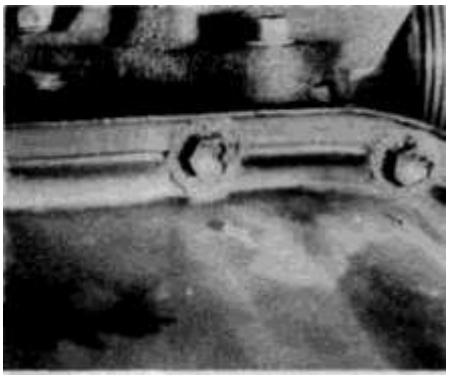
1 Warm the engine and drain the engine oil (see Chapter 1).
2 Raise the vehicle and place it securely on jackstands.
3 Remove the exhaust pipe (refer to Chapter 4).
4 Disconnect the oil cooler hose from the short metal pipe protruding from the banjo fitting on the front side of the pan **(see illustration).** Tie the hose out of the way with the open end higher than the oil cooler and facing upward to prevent oil from dripping out.
5 Remove all 19 bolts and both nuts from the oil pan.
6 Carefully pry the pan loose from the bottom edge of the engine block and the oil pump housing with a screwdriver or a scraper. Be especially careful when prying the flange loose from the aluminum oil pump housing. **Caution:** *Do not bend the oil pan flange or it will leak when the pan is reinstalled.*



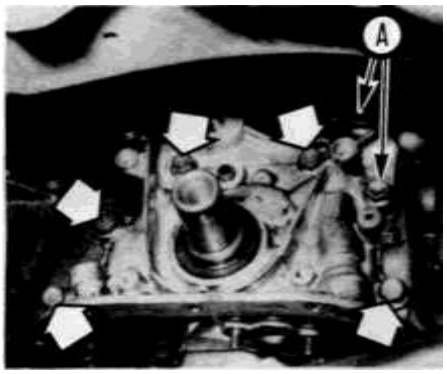
12.7 The oil strainer is attached to the block with two bracket bolts and to the oil pump housing with two pickup tube bolts



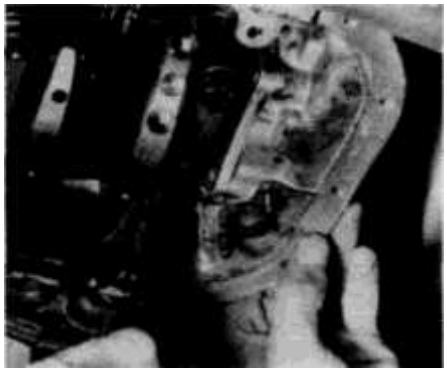
12.12a When installing the oil pan, apply a 3 to 5 mm bead of RTV sealant to the flange as shown — note that the bead should be offset approximately 6 mm at the end of the pan that bolts to the underside of the rear main oil seal retainer



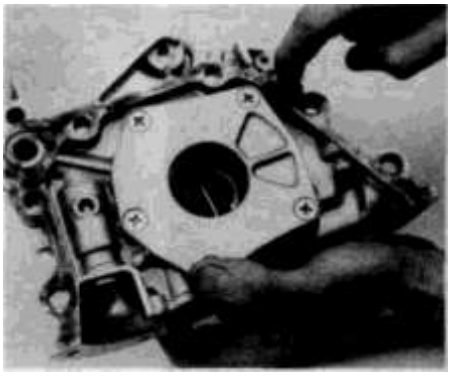
12.12b Place a thin bead of RTV sealant around each oil pan flange bolt hole before installing the bolts



13.7 There are seven oil pump housing bolts (arrows) — note that the two upper right bolts (A) are longer than the other five



13.8 To break loose the gasket sealer between the mating surfaces of the oil pump housing and the block, insert a pry bar or a large screwdriver between the No. 1 main bearing cap and the pump cover — do not attempt to pry between the actual mating surfaces or you may damage them



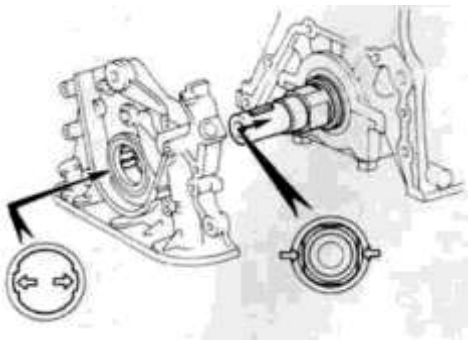
13.11 Although it's not absolutely necessary, it's a good idea to apply gasket sealer to the mating surfaces of the oil pump housing and the block itself

7 Remove the oil strainer mounting nuts and bolts and remove the strainer **(see illustration).**
8 Carefully pry the baffle plate loose from the block with a small screwdriver or scraper. Do not warp the plate.
9 Using a razor blade and scraper, remove all old RTV sealant material from the mating surface of the block, both sides of the baffle plate and the oil pan flange. Thoroughly wash the baffle plate, strainer and oil pan in clean non-residue solvent and blow dry. **Caution:** *Do not use a solvent which will affect the painted surfaces.*
10 Apply a 3 to 5 mm wide bead of RTV sealant to the mating surface of the block.
11 Place the baffle plate and the oil strainer in position. Use a new gasket between the pickup tube flange and the oil pump housing. Tighten the strainer mounting bolts and nuts to the specified torque.
12 Apply a 3 to 5 mm wide bead of RTV sealant to the oil pan flange **(see illustration).** Do not apply too much sealant and be particularly careful around oil passages. Note that the bead is slightly offset (6 mm) at the end of the block where the rear main oil seal retainer is located. Place the pan in position. Before installing the bolts, apply a thin bead of sealant around each mounting bolt hole **(see illustration).** Install all 19 bolts and two nuts and tighten them to the specified torque.
13 Attach the oil cooler hose to the banjo fitting on the front side of the pan.
14 Install the exhaust system (refer to Chapter 4 if necessary).
15 Add the specified oil to the engine, start the engine and check the pan flange and oil cooler hose fitting for leaks.

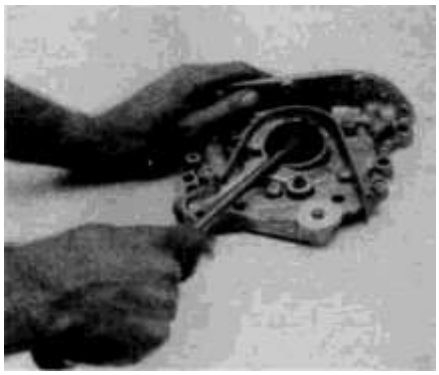
13 Oil pump — removal and installation

Refer to illustrations 13.7, 13.8, 13.11 and 13.13

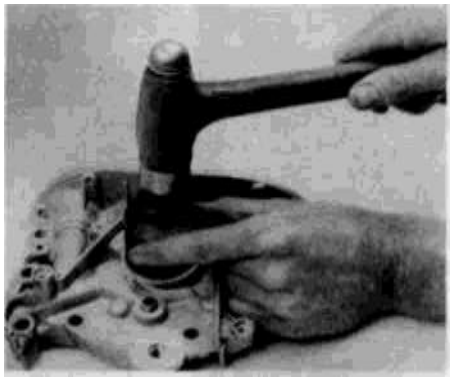
1 Warm the engine and drain the engine oil.
2 Remove the timing belt (refer to Section 9).
3 Remove the crankshaft timing pulley (refer to Section 9).
4 Remove the timing belt tensioner/idler pulley bolt and the pulley.
5 Remove the dipstick tube retaining strap bolt from the water pump. Remove the tube from the oil pump housing.
6 Remove the oil pan and strainer (refer to Section 12).
7 Remove all seven oil pump bolts **(see illustration).** Note that the two upper right bolts are longer than the other five.
8 Gently pry between the No. 1 main bearing cap and the oil pump cover to break the gasket sealer free **(see illustration). Caution:** *Do not pry on the gasket mating surface.*
9 Remove the oil pump housing. If you are replacing the pump, proceed to the next Step. If you are replacing the oil seal in the old pump, refer to Section 14.
10 Clean the gasket mating surfaces of the oil pump and the front of the block.
11 Apply RTV sealant to the gasket mating surfaces of the oil pump **(see illustration)** and the block and install the new gasket on the block.
12 Make sure that the seal lip is generously coated with multipurpose grease (see Section 14).
13 Carefully slide the oil pump housing onto the front of the block.



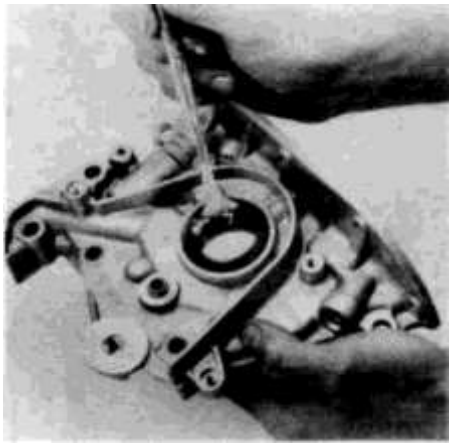
13.13 When installing the oil pump housing on the block, make sure that the splined teeth of the drive gear are engaged with the large teeth of the crankshaft



14.4 To remove the old seal from the oil pump housing, lay the housing on a clean work surface and carefully pry the seal from its bore with a screwdriver — if the seal proves difficult to remove, lay a large socket or ratchet extension between the screwdriver and the pump housing to act as a fulcrum and protect the housing from damage

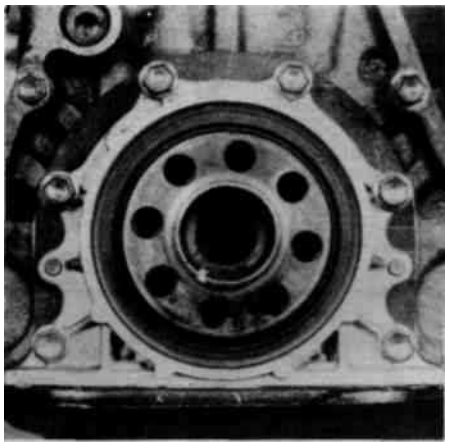


14.5 To install the new seal, place it into position and drive it into the bore with a hammer and a socket slightly smaller in diameter than the outside diameter of the new seal — make sure that the seal does not become cocked in the bore or it will leak



14.6 Coat the lip of the new seal with multipurpose grease so that it won't be damaged by the nose of the crankshaft when the oil pump housing is reinstalled onto the block

15.3 The rear end plate has to come off before the rear oil seal retainer can be removed — remove both bolts to remove it



15.5 The rear oil seal retainer is secured to the block by six bolts

Make sure that the seal lip is not damaged by the Woodruff key in the nose of the crankshaft. Install the oil pump on the block with the spline teeth of the drive gear engaged with the large teeth of the crankshaft **(see illustration).**

14 Install all seven oil pump bolts and tighten them to the specified torque. Remember that the two longer bolts go in the upper right holes.

15 Install a new O-ring on the lower end of the dipstick tube and coat the O-ring with a small amount of engine oil. Install the tube into the oil pump housing. Tighten the tube bracket-to-water pump mounting bolt securely. Insert the dipstick into the tube.

16 The remainder of installation is the reverse of removal.

14 Front oil seal — replacement

Refer to illustrations 14.4, 14.5 and 14.6

1 Remove the timing belt covers, the timing belt and the crankshaft timing belt pulley (refer to Section 9).

2 Remove the oil pan and strainer (refer to Section 12).

3 Remove the oil pump housing (refer to Section 13).

4 Place the oil pump housing on a clean work surface and, using a screwdriver, pry the old seal from its bore **(see illustration).** Do not scratch or gouge the seal bore.

5 Using a mallet and a large socket slightly smaller in diameter than the outside diameter of the seal, install the new seal **(see illustration).** Make sure that the seal is not cocked in the bore.

6 Lightly coat the seal lips with multipurpose grease **(see illustration).**

7 Installation is the reverse of removal.

15 Rear oil seal — replacement

Refer to illustration 15.3, 15.5, 15.6 and 15.8.

1 Remove the transaxle (refer to Chapter 7).

2 Remove the clutch pressure plate, the clutch disc and the flywheel (refer to Chapter 8) if equipped with a manual transaxle, or the torque converter and driveplate if equipped with an automatic transaxle (refer to Chapter 7).

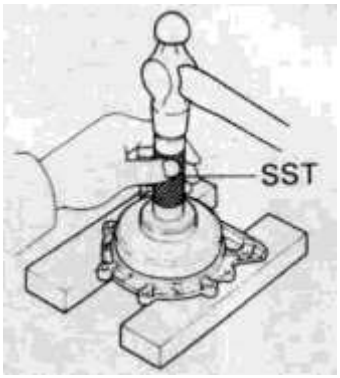
3 Remove the remaining two rear end plate bolts and the rear end plate **(see illustration).**

4 Remove the two bolts that attach the oil pan flange and the rear oil seal retainer.

5 Remove the six rear oil seal retainer bolts and the retainer **(see illustration).** Discard the old retainer gasket.

6 Place the rear oil seal retainer on a couple of blocks of wood above a clean, flat surface and drive out the old seal with a punch or screwdriver **(see illustration).** Do not scratch the seal bore.
7 Wash the retainer with clean solvent and inspect the seal bore for nicks. Minor damage to the bore can be removed with emery paper.
8 To install the new rear oil seal, place the housing on a clean, flat surface and drive it into place with a large socket or cylindrical object slightly smaller than the outside diameter of the seal **(see illustration).**
9 Coat the new gasket with a light coat of gasket sealer and place it in position on the block. Install the rear oil seal retainer and tighten the six bolts to the specified torque.
10 The remainder of installation is the reverse of removal.

15.6 To remove the old rear oil seal from the retainer, place it on a pair of wood blocks and knock it out with a drift punch and a hammer



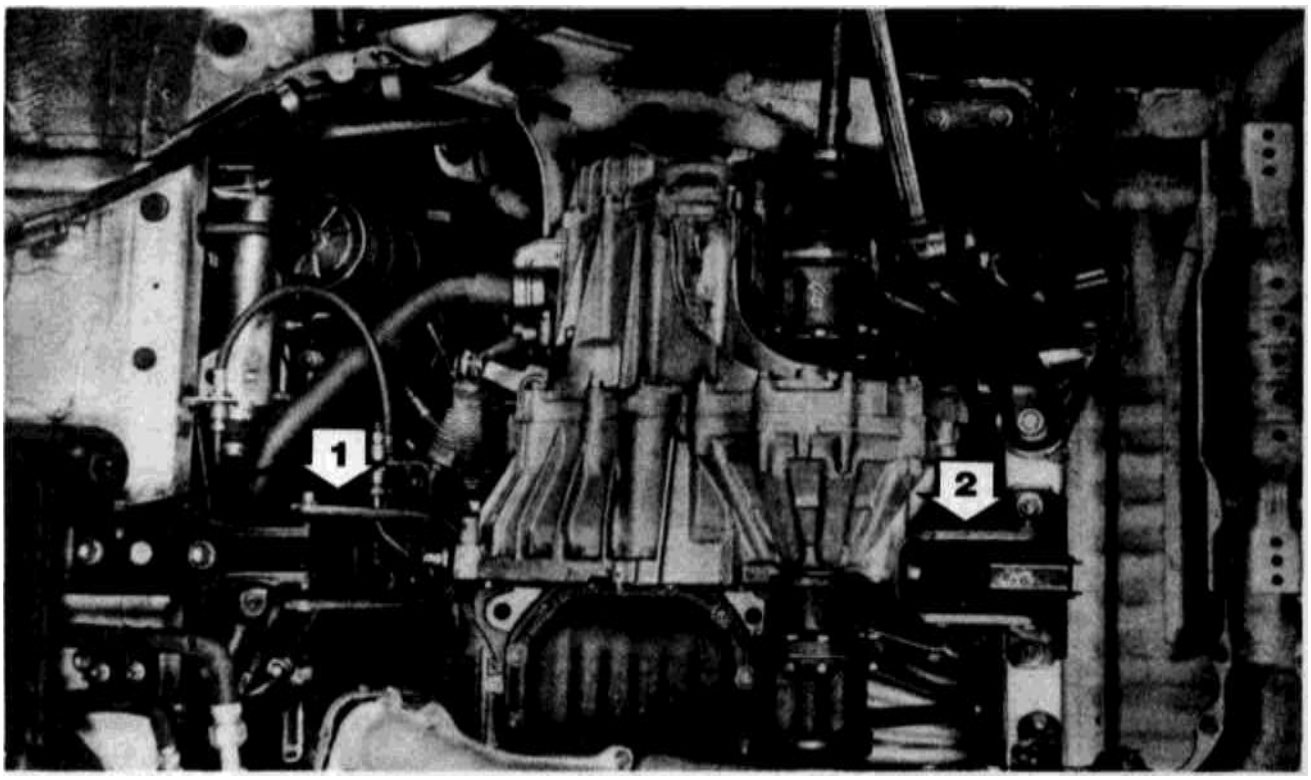
15.8 To install the new rear oil seal into the retainer, place the retainer on a pair of wood blocks, place the seal squarely over the seal bore and carefully drive it into place with a large socket (or some other suitable cylindrical object) and hammer — do not allow the seal to become cocked in the bore

16 Engine and transaxle mounts — check and replacement with engine in vehicle

Refer to illustrations 16.2a, 16.2b, 16.2c, 16.3, 16.4a, 16.4b and 16.10

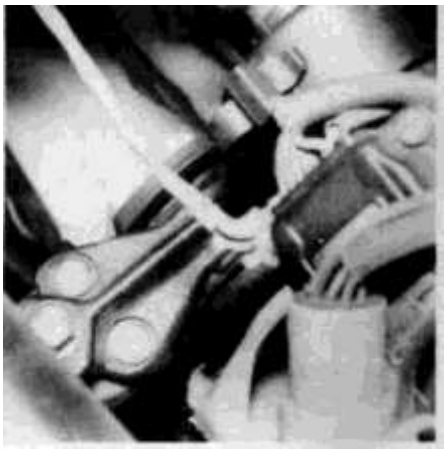
Check

1 To check the engine/transaxle mounts, raise the vehicle and place it securely on jackstands.
2 There are four mounts, all virtually identical in design. Three of them — the left, front and rear mounting insulators — are attached to the transaxle housing **(see illustrations).** A fourth — the right mounting insulator — is attached to the engine **(see illustration).** Each mounting insulator assembly consists of two brackets, one of which is bolted to the frame and one to the transaxle or engine. Each two brackets are connected by a rubber insulator and through-bolt. With age, the rubber insulators dry out and crack.
3 Carefully inspect each mounting insulator for obvious cracks **(see illustration).** Dried out and cracked insulators must be replaced.
4 Even if an insulator doesn't look dried out or cracked, it may still be worn out. To check it, place a pry bar between the two brackets and apply leverage **(see illustrations).** If the mounting insulator requires very little effort to deflect, replace it.



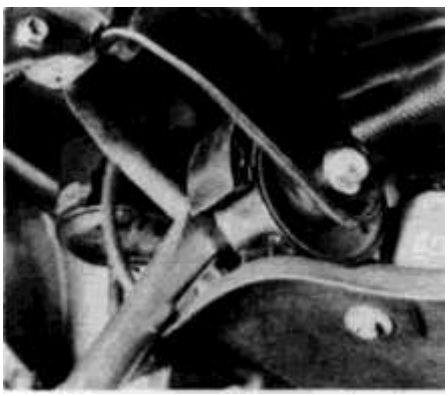
16.2a The front (1) and rear (2) mounting insulators are clearly visible from underneath the vehicle

16.2b The left mounting insulator is difficult to spot from above because it's hidden by the battery carrier — from below, you can locate it between the left upper end of the transaxle and the body



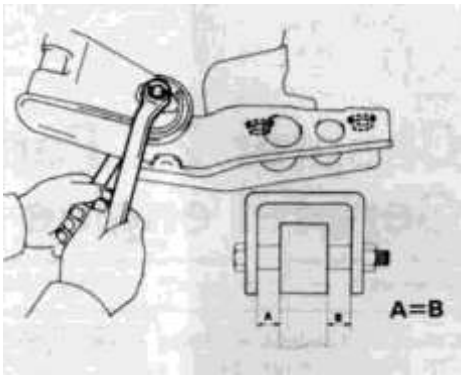
16.2c The right mounting insulator is located at the right end of the engine, between the timing belt cover and the right frame rail

16.3 This hairline crack (arrow) is a typical symptom of an aging mounting insulator that will soon have to be replaced



16.4a To check the condition of the front mounting insulator, place a pry bar or large screwdriver between the insulator and the inside surface of the bracket and then lever it to see how much it deflects — if deflection is excessive, replace the insulator

16.4b The procedure for checking the rear mounting insulator is similar to that described for the front insulator



16.10 Before tightening the through-bolt of the front mounting insulator to the specified torque, be sure to give the engine a few good bounces so that the insulator will settle to the middle of the bracket — distance A between the insualtor and the bracket must be the same on both sides

Replacement

5 To replace a mounting insulator, place a floor jack under the oil pan, put a block of wood between the floor jack head and the pan, then raise the engine just enough to take the weight off the mounting insulators.

6 Remove the through-bolt from the worn out insulator.

7 Remove the bracket bolts and the bracket half containing the worn out insulator and discard it (the new insulator comes with its own bracket).

8 Install the new mounting insulator bracket and tighten the bracket-to-body bolts to the specified torque.

9 Install the through-bolt to connect the mounting insulator bracket to the engine/transaxle bracket. Adjust the floor jack up or down slightly if necessary to align the holes in the bracket with the bolt hole in the insulator. Tighten the through-bolt to the specified torque.

10 When replacing the front mounting insulator, bounce the engine to confirm that the mounting insulator is centered on the bracket before tightening the through-bolt to the specified torque **(see illustration).**

11 Lower and remove the floor jack.

1 2 Remove the jackstands and lower the vehicle.

Chapter 2 Part B
General engine overhaul procedures

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Specifications

General

Bore and stroke	81.0 x 77.0 mm (3.19 x 3.03 in)
Oil pressure	
at idle speed, more than	29 kPa (4.3 psi)
at 3000 rpm	245 to 490 kPa (36 to 71 psi)
Timing belt deflection	**4** mm at 2 kg **(0.16** in at **4.4 lb)**

Cylinder head

Surface warpage limit	0.05 mm (0.0020 in)
Manifold surface warpage limit	
intake (air control valve) side	0.05 mm (0.0020 in)
exhaust side	0.10 mm (0.0039 in)
Valve seat	
refacing angle	30°, 45° and 60°
contacting angle	45°
contacting width	1.0 to 1.4 mm (0.039 to 0.055 in)

Valve guide bushing	
inside diameter	6.01 to 6.03 mm (0.2366 to 0.2374 in)
outside diameter	
standard	11.033 to 11.044 mm (0.4344 to 0.4348 in)
oversize type 0.05	11.083 to 11.094 mm (0.4363 to 0.4368 in)
Valve overall length	
standard	
intake	99.6 mm (3.921 in)
exhaust	99.75 mm (3.9272 in)
limit	
intake	99.1 mm (3.902 in)
exhaust	99.25 mm (3.9075 in)
Valve face angle	44.5°
Stem diameter	
intake	5.970 to 5.985 mm (0.2350 to 0.2356 in)
exhaust	5.965 to 5.980 mm (0.2348 to 0.2354 in)
Stem oil clearance	
standard	
intake	0.025 to 0.060 mm (0.0010 to 0.0024 in)
exhaust	0.030 to 0.065 mm (0.0012 to 0.0026 in)
limit	
intake	0.08 mm (0.0031 in)
exhaust	0.10 mm (0.0039 in)
Margin width	
intake	0.5 mm (0.020 in)
exhaust	0.5 mm (0.020 in)
Valve spring	
free length	41.78 mm (1.6449 in)
installed height	34.7 mm (1.366 in)
installed load	16.3 kg (35.9 lb)
squareness limit	2.5 mm (0.098 in)

Camshaft

End play	
standard	0.08 to 0.19 mm (0.0031 to 0.0075 in)
maximum	0.25 mm (0.0098 in)
Lobe height	
standard	35.555 to 35.565 mm (1.3998 to 1.4002 in)
minimum	35.155 mm (1.3841 in)
Journal diameter	26.95 to 26.97 mm (1.0610 to 1.0616 in)
Valve lifter outer diameter (standard)	27.975 to 27.985 mm (1.1014 to 1.1018 in)
Lifter-to-cylinder head oil clearance	
standard	0.015 to 0.046 mm (0.0006 to 0.0018 in)
limit	0.10 mm (0.0039 in)

Intake, exhaust manifold and air control valve

Warpage	
intake limit	0.05 mm (0.0020 in)
exhaust limit	0.3 mm (0.012 in)
air control valve limit	0.05 mm (0.0020 in)

Engine block

Warpage limit	0.05 mm (0.0020 in)
Cylinder bore	
wear limit	0.2 mm (0.008 in)
diameter	81.00 to 81.03 mm (3.1890 to 3.1902 in)
taper limit	0.02 mm (0.0008 in)
out-of-round limit	0.02 mm (0.0008 in)

Pistons and rings

Piston diameter	80.89 to 80.92 mm (3.1846 to 3.1858 in)
Piston-to-cylinder bore clearance	0.10 to 0.12 mm (0.0039 to 0.0047 in)
Piston ring end gap No.	
1	
standard	0.25 to 0.47 mm (0.0098 to 0.0047 in)
limit	1.07 mm (0.0421 in)
No. 2	
standard	0.15 to 0.42 mm (0.0059 to 0.0165 in)
limit	1.02 mm (0.0402 in)
Oil	
standard	0.3 to 1.02 mm (0.01 2 to 0.0402 in)
limit	1.62 mm (0.0638 in)

Ring to ring groove clearance limit	
No. 1	0.03 to 0.07 mm (0.001 2 to 0.0028 in)
No. 2	0.02 to 0.06 mm (0.0008 to 0.0024 in)

Connecting rods and bearings

End play	
standard	0.1 5 to 0.25 mm (0.0059 to 0.0098 in)
limit	0.30 mm (0.01 2 in)
Bearing oil clearance	
standard	0.020 to 0.051 mm (0.0008 to 0.0020 in)
limit	0.08 mm (0.0031 in)

Crankshaft

End play	
standard	0.02 to 0.22 mm (0.0008 to 0.0087 in)
limit	0.30 mm (0.012 in)
Main journal oil clearance	
standard	0.012 to 0.039 mm (0.0005 to 0.001 5 in)
limit	0.10 mm (0.0039 in)
Main journal diameter	47.985 to 48.000 mm (1.8892 to 1.8898 in)
Connecting rod journal diameter	39.985 to 40.000 mm (1.5742 to 1.5748 in)
Main journal taper and out-of-round limits	0.02 mm (0.0008 in)
Crank pin journal taper and out-of-round limit	0.02 mm (0.0008 in)

Torque specifications	Nm	Ft-lbs
Pressure regulator-to-fuel rail	9.3	82 in-lbs
Pulsation damper-to-fuel rail	29	22
Cold start injector pipe-to-fuel rail	18	13
Cold start injector pipe-to-cold start injector	18	13
Fuel return pipe-to-pressure regulator	29	22
Cylinder head bolts	60	44
Camshaft bearing cap-to-cylinder head	13	9
Spark plugs	18	13
Intake manifold/air control valve-to-cylinder head	22	16
Exhaust manifold-to-cylinder head	25	18
Fuel rail-to-cylinder head	17	13
Oil pump-to-cylinder block	18 to 25	13 to 18
Crankshaft bearing cap-to-cylinder block	60	44
Oil pan-to-cylinder block	4.9	43 in-lbs
Timing belt idler pulley-to-oil pump housing	37	27
Camshaft timing pulley-to-camshaft	47	34
Crankshaft pulley-to-crankshaft	118	87
Flywheel-to-crankshaft	74	54
Connecting rod cap-to-connecting rod	49	36
Oil strainer-to-oil pump	9.3	82 in-lbs
Water pump-to-block	15	11
Clutch pressure plate-to-flywheel	19	14
Transaxle-to-engine block		
10 mm bolt	39	29
12 mm bolt	64	47
Rear mounting insulator		
bracket-to-body bolts	52	38
through-bolt	78	58
Front mounting insulator		
bracket-to-body bolts	52	38
through-bolt	78	58

1 General information

Near the beginning of this chapter, you will find a complete description of the engine removal and installation procedures. The remainder of the chapter is devoted to general overhaul procedures for the cylinder head, the block and internal engine components. The information ranges from advice concerning preparation for an overhaul and the purchase of replacement parts to detailed, step-by-step procedures covering removal, inspection and installation of internal engine components.

The general engine overhaul sections assume that the engine has been removed from the vehicle and completely disassembled. For information regarding in-vehicle engine repairs, refer to Part A of this chapter. For information concerning the external components which must be removed from the engine prior to overhaul, refer to Section 6 in this chapter. The installation of those same parts after the engine is overhauled is outlined in Section 20.

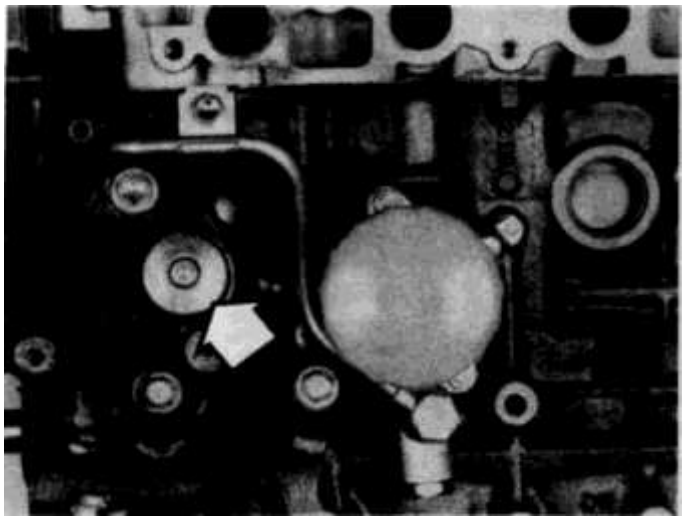
The specifications with this part are only those which are necessary for the inspection and overhaul procedures which follow. Refer to Chapter 2 Part A for additional specifications.

2 Engine overhaul — general information

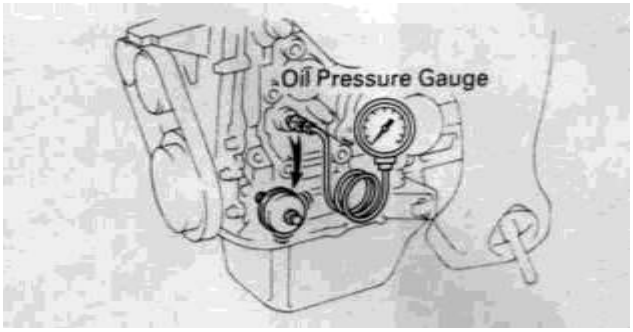
Refer to illustrations 2.4a and 2.4b

It is not always easy to determine when, or if, an engine should be completely overhauled. A number of factors must be considered.

High mileage is not necessarily an indication that an overhaul is i needed, while low mileage does not preclude the need for an overhaul.



2.4a The oil pressure sending unit is located on the front of the block, just to the right of the oil filter and pressure regulator — remove it with the special tool available at any Toyota dealer, or a pair of channel lock pliers, and screw an oil pressure gauge into the block



2.4b Start the engine and warm it to normal operating temperature, then note the oil pressure at idle and at 3000 rpm. Stop the engine and compare your readings with the specified pressure — when you're through, wrap the threads of the oil pressure sending unit with teflon tape, install it, start the engine and check for leaks

The frequency with which service intervals are performed is probably the most important consideration. An engine which has had regular required maintenance, frequent oil and filter changes in particular, will most likely give many thousands of miles of reliable service. Conversely, a neglected engine may require an overhaul very early in its service life.

Excessive oil consumption is an indication that piston rings and/or valve guides are in need of attention. Make sure that oil leaks are not responsible before deciding that the rings and/or guides are bad. Perform a cylinder compression test (see Chapter 2 Part A), or have a leakdown test performed by an experienced tune-up mechanic, to determine the extent of the work required.

If the engine is making obvious knocking or rumbling noises, the connecting rod and/or main bearings are probably at fault. Check the oil pressure with a gauge installed in place of the oil pressure sending unit (see **illustrations)** and compare it to the specified oil pressure. If it is extremely low, the bearings and/or oil pump are probably worn out.

Loss of power, rough running, excessive valve train noise and high fuel consumption may also point to the need for an overhaul, especially if they are all present at the same time. If a complete tune-up does not remedy the situation, major mechanical work is the only solution.

An engine overhaul involves restoring the internal parts to the specifications of a new engine. During an overhaul, the piston rings are replaced and the cylinder walls are reconditioned. Toyota does not have an approved procedure for reboring the block or oversize replacement pistons available at the time of writing of this manual. Instead, if the piston to cylinder clearance is beyond the specified maximum, they recommend replacing the block. If your engine has worn to the point where the piston to cylinder clearance is beyond the specified maximum, we suggest you contact both your Toyota dealer and independent engine rebuilders regarding boring/resleeving and oversize piston and ring availability. The main bearings, connecting rod bearings and camshaft bearings are generally replaced with new ones and, if necessary, the crankshaft may be reground to restore the journals. Generally, the valves are serviced as well, since they are usually in less-than-perfect condition at this point. While the engine is being overhauled, components such as the distributor, starter and alternator should be rebuilt as well. The end result should be a like new engine that will give many trouble free miles.

Before beginning the engine overhaul, read through the entire procedure to familiarize yourself with the scope and requirements of the job. Overhauling an engine is not difficult, but it is time consuming. Plan on the vehicle being tied up for a minimum of two weeks, especially if parts must be taken to an automotive machine shop for repair or reconditioning. Check on availability of parts and make sure that any necessary special tools and equipment are obtained in advance. Most work can be done with typical hand tools, although a number of precision measuring tools are required for inspecting parts to determine if they must be replaced. Often an automotive machine shop will handle the inspection of parts and offer advice concerning reconditioning and replacement. **Note:** *Always wait until the engine has been completely disassembled and all components, especially the engine block, have been inspected before deciding what service and repair operations must be performed by an automotive machine shop. Since the condition of the block will be the major factor to consider when determining whether to overhaul the original engine or buy a rebuilt one, never purchase parts or have machine work done on other components until the block has been thoroughly inspected. As a general rule, time is the primary cost of an overhaul, so it does not pay to install worn or substandard parts.*

As a final note, to ensure maximum life and minimum trouble from a rebuilt engine, everything must be assembled with care in a spotlessly clean environment.

3 Engine rebuilding alternatives

The do-it-yourselfer is faced with a number of options when performing an engine overhaul. The decision to replace the engine block, piston/connecting rod assemblies and crankshaft depends on a number of factors, of which the condition of the block is the most important. Other things to consider are cost, access to machine shop facilities, parts availability, time required to complete the project and the extent of prior mechanical experience on the part of the do-it-yourselfer.

Some of the rebuilding alternatives include:

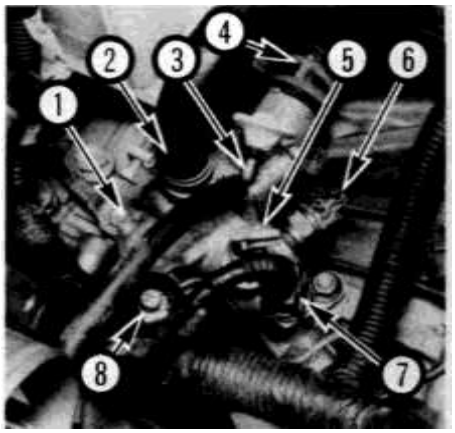
Individual parts — if the inspection procedures reveal that the engine block and most engine components are in reusable condition, purchasing individual parts may be the most economical alternative. The block, crankshaft and piston/connecting rod assemblies should all be inspected carefully. Even if the block shows little wear, the cylinder bores should be surface honed.

Crankshaft kit — this rebuild package consists of a reground crankshaft and a matched set of pistons and connecting rods. The pistons will already be installed on the connecting rods. Piston rings and the necessary bearings will be included in the kit.

Short block — a short block consists of an engine block with a crankshaft and piston/connecting rod assemblies already installed. All new bearings are incorporated and all clearances will be correct. The existing camshaft, valve train components, cylinder heads and external parts can be bolted to the short block with little or no machine shop work necessary.

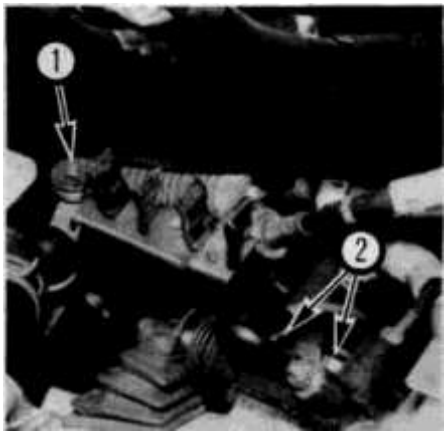
Long block — a long block consists of a short block plus an oil pump, oil pan, cylinder head, camshaft covers, camshaft and valve train components, timing sprockets and chain and timing cover. All components are installed with new bearings, seals and gaskets incorporated throughout. The installation of manifolds and external parts is all that is necessary.

Give careful thought to which alternative is best for you and discuss the situation with local automotive machine shops, auto parts dealers or parts store countermen before ordering or purchasing replacement parts.



5.11 A number of coolant hoses, vacuum lines and electrical connectors must be disconnected from the thermostat housing

7 Ground strap
2 Heater hose
3 Air bleed valve-to-reservoir hose
4 No. 1 radiator hose
5 EGR BVSV vacuum lines
6 EVAP BVSV vacuum lines
7 Start injector time switch electrical connector
8 Heater hose



5.13 Disconnect the upper shift cable from the shift lever by removing the retaining clip and washer (1), then remove both of the slave cylinder/shift cable bracket bolts (2)

5.16 Loosen the hose clamp on the oil cooler hose (arrow) and disconnect it from the pressure regulator pipe

4 Engine removal — methods and precautions

If you decide that the engine must be removed for overhaul or major repair work, the following preliminary steps will simplify the job.

Locate a suitable work area. Adequate work space for your vehicle, as well as a suitable storage place during the overhaul, is essential. A shop or garage, of course, is the ideal place to work. If one isn't available, at least try to secure the use of a flat, level, clean work space made of concrete or asphalt.

Cleaning the engine compartment and engine prior to removal will help keep tools clean and organized.

Plan the entire operation ahead of time. Obtain all of the tools and equipment you will need prior to beginning the job. An engine hoist or A-frame is a necessity. So is a heavy duty floor jack and a set of four tall jackstands. The floor jack must be able to raise the vehicle to a height sufficient to clear the detached and lowered engine/transaxle assembly. The jackstands must be able to support the vehicle at that height so that the engine can be dragged or rolled from underneath the vehicle.

Make sure that lifting equipment is rated in excess of the job for which it will be used. Because of the potential hazards involved in raising the vehicle, supporting it and removing the engine, safety should be your primary consideration when choosing a hoist, floor jack and jackstands. If you are planning to rent these items, make sure that you arrange for them in advance. And you can save money and time by performing all of the preliminary disassembly operations before you pick up the lifting equipment. Besides an engine hoist, heavy duty floor jack and tall jackstands, you will need a number of tools to perform a safe, relatively easy engine removal and installation job. A basic list would include an extra floor jack, complete sets of wrenches and sockets (described in the front of this manual), wooden blocks and plenty of rags and cleaning solvent for mopping up spills.

Plan for the vehicle to be out of use for a considerable amount of time. A machine shop will have to perform some of the work which the do-it-yourselfer cannot accomplish at home. Machine shops often have a busy schedule, so it's wise to consult a shop before removing the engine in order to accurately estimate the amount of time required to rebuild or repair components that may need work.

If you are a novice at engine removal, have a helper standing by when you remove the motor. Advice and assistance from someone with more experience is also helpful. One person cannot perform the multitude of tasks necessary to remove the engine from this vehicle.

Always use extreme caution when removing and installing the engine. Careless actions can cause serious injury. Take your time and plan ahead. Rehearse the next step before doing it. Although it's a major undertaking, a job of this nature can be successfully accomplished.

5 Engine — removal and installation

Refer to illustrations 5.11, 5.13, 5.16, 5.20a, 5.20b, 5.21a, 5.21b, 5.27a and 5.27b

Note: *The following procedure presumes that the home mechanic will not have access to a hydraulic vehicle hoist. Because engine removal requires that the vehicle be elevated high enough to clear the engine, removal of the cylinder head prior to engine removal is recommended. Although it isn't that difficult to remove the engine with the cylinder head still installed (assuming the vehicle is high enough to clear the assembly), be sure to remove the plenum/intake manifold. It will lower the overall height of the engine package, give you more room to maneuver the engine during removal and will ensure that the throttle position sensor, which is very close to the engine compartment rear firewall, isn't damaged during engine removal. You will need a floor jack, an engine hoist and four sturdy jackstands. Make sure that the jackstands you use for this job are at least 17 inches high (the height of the engine without the cylinder head). If you have access to a professional vehicle hoist, you can skip Steps 4 through 10 (except for exhaust pipe removal) and remove the engine intact.*

Removal

1 Disconnect the cable from the negative terminal of the battery.
2 Drain the engine coolant (refer to Chapter 1).
3 Drain the engine oil (refer to Chapter 1).
4 Remove the fuel rail and injectors, throttle body/intake manifold and air control valve (refer to Chapter 2 Part A).
5 Remove the exhaust pipe (refer to Chapter 4) and the exhaust manifold (refer to Chapter 2 Part A).
6 Remove the accelerator and speedometer cable brackets and the cylinder head covers (refer to Chapter 2 Part A). Unscrew the speedometer cable fitting and disconnect it from the transaxle. Set the cable and bracket assemblies aside and secure them out of the way with wire or cable ties.
7 Remove the timing belt covers, the timing belt and the camshaft timing pulleys (refer to Chapter 2 Part A).
8 Remove the camshafts (refer to Chapter 2 Part A).
9 Remove the distributor (refer to Chapter 5).
10 Remove the cylinder head (refer to Chapter 2 Part A). **Caution:** *Do not lay the head on its side or turn it upside down while the lifters and shims are in place. They will fall out of their bores and become*

mixed up.

11 Locate the thermostat housing on top of the transaxle housing. Detach the smaller diameter heater hoses, the radiator hose, the air bleed valve hose, the thermal time switch electrical connector and the ground strap from the thermostat housing **(see illustration).**

12 Disconnect the backup light switch electrical connector (located between the thermostat housing and the transaxle).

13 Locate the clutch slave cylinder and the bracket that supports the shift cables, just above and at the front of the transaxle. Remove the shift cable/shift lever retaining clip and disconnect the shift cable from the shift lever. Remove the upper shift cable bracket/slave cylinder bolts (see **illustration).**

14 Remove the intake manifold support bracket from the block.

1 5 Disconnect the two electrical connectors from the alternator, remove the alternator support bracket bolts and remove the alternator and support bracket assembly.

16 Disconnect the oil cooler hose from the metal pipe on the front right corner of the block, just above the compressor **(see illustration).**

17 Loosen but do not remove the rear wheel lug nuts.

18 Raise the vehicle and place it on jackstands. **Note:** *Remember — the block/transaxle assembly is 17 inches high so the vehicle must be at least a couple of feet off the ground to clear it.*

19 Remove the wheels.

20 Remove the remaining shift cable/shift lever retaining clip and disconnect the shift cable from the shift lever. Remove the lower shift cable bracket bolts from the transaxle housing and the front engine/ transaxle mounting insulator bracket **(see illustrations).**

21 Remove the four air conditioning compressor-to-block bolts **(see illustration),** pull the compressor away from the block and wire it out of the way **(see illustration). Warning:** *Do not disconnect the A/C line fittings unless the air conditioning system has been previously discharged by a professional.*

22 Remove the CV joints and driveaxles (refer to Chapter 8).

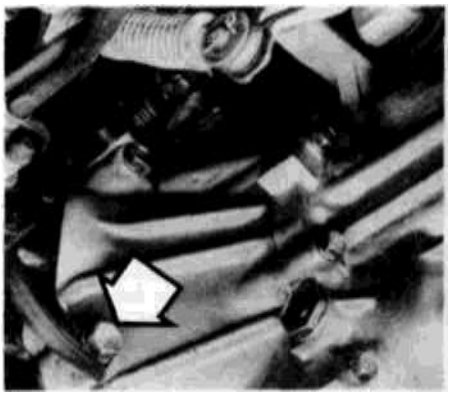
23 Disconnect both starter motor electrical connectors.

24 Place a floor jack under the engine oil pan. Use a block of wood between the floor jack head and the pan.

25 If you are removing the engine/transaxle assembly without the cylinder head, it will be necessary to remove the right engine mounting insulator to provide a mounting location for the right end of the engine hoist chain (refer to Section 16 if necessary). If you are removing the engine/transaxle assembly with the head still attached, a lifting hook is already located at the right rear corner of the cylinder head.

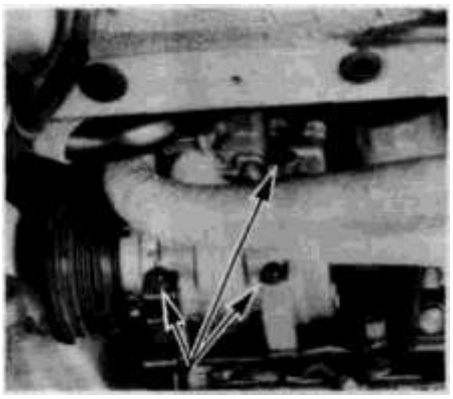
26 Remove one of the two upper transaxle-to-engine bolts and install the engine hoist chain. For best balance, if you are removing the entire engine/transaxle assembly with the cylinder head still installed, remove the forward upper transaxle-to-block bolt and install the chain there. If you are removing the block and transaxle assembly with the cylinder head already off, use the rear upper transaxle-to-block bolt.

27 If you are removing the engine/transaxle assembly with the head still attached, connect the other end of the engine hoist chain to the lifting hook at the right rear corner of the cylinder head **(see illustration).** If you have elected to remove the cylinder head already, attach the chain to a bolt screwed into one the bracket-to-block bolt holes for the right engine mounting insulator **(see illustration).**

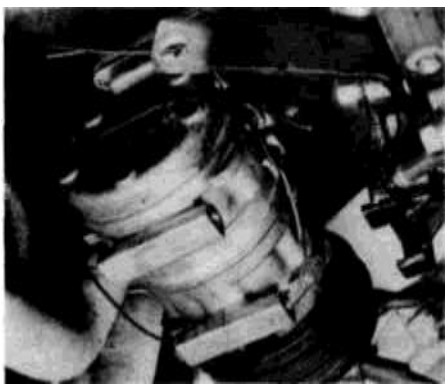


5.20a Remove the shift cable-shift lever retaining clip and washer and disconnect the cable from the lever, then remove the shift cable bracket bolt (arrow) from the transaxle

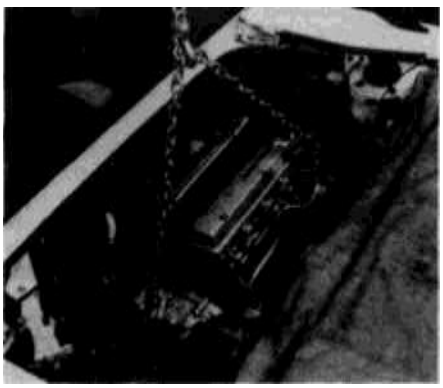
5.20b Remove the stay bolt (arrow) from the front mounting insulator bracket



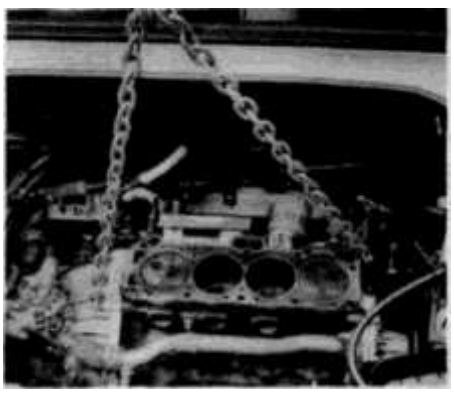
5.21a Remove the four compressor bolts (arrows — the fourth bolt is not visible because it's obscured by the oil cooler hoses)



5.21b Wire the compressor up out of the way to protect the A/C lines from damage and to protect the compressor so that it won't be damaged during engine removal



5.27a If you are removing the engine/transaxle assembly with the head intact, hook up the engine hoist chain to the front upper transaxle-to-block mounting hole and the right rear cylinder head lifting hook



5.27b If you're removing the engine/transaxle assembly with the cylinder head already off, hook up the engine hoist chain to the rear upper transaxle-to-block mounting hole and one of the right mounting insulator bolt holes

28 Lift the engine with the engine hoist until there is no slack in the chain to take the weight of the engine off the mounting insulator through-bolts.
29 Remove the left and, if you have not already done so, the right, mounting insulator through-bolts.
30 Remove the front mounting insulator through-bolt.
31 Remove the rear mounting insulator through-bolt.
32 Carefully lower the engine/transaxle assembly to the floor. **Note:** *It's a good idea to place the engine/transaxle assembly on a small, low four-wheeled dolly, if available. If you do not have access to a dolly, place a piece of thick cardboard underneath the engine to protect the oil pan and the transaxle case.*
33 When the engine/transaxle assembly is on the ground, disconnect the engine hoist chain, roll or drag the engine/transaxle assembly out from underneath the vehicle, reattach the engine hoist chain, raise the engine and roll it to the overhaul area (refer to Section 6 for the disassembly sequence of the remaining components attached to the block).

Installation

34 Like the engine removal procedure, the installation procedure presumes that you do not have access to a commercial vehicle hoist and must therefore rely on jackstands to elevate the vehicle high enough to clear the engine. Like installation, removal of the engine is simpler with the cylinder head and its attendant hardware removed. If you elect to install the engine this way, installation is the reverse of removal. However, the installation of the timing belt is much more difficult once the engine is installed in the vehicle.
35 If you have a floor jack that will elevate the vehicle high enough and sufficiently tall jackstands on which to secure the vehicle, it's preferable to install the cylinder head, camshafts, distributor, cylinder head covers, camshaft timing pulleys, timing belt, timing belt covers, water outlet housing, water pump and exhaust manifold while the engine is still on the engine stand (refer to the appropriate chapters for the procedures pertaining to these components). Do not, however, install the air control valve, the intake manifold and the fuel and emissions plumbing until the engine has been installed in the vehicle. The intake plenum protrudes higher than the top of the cylinder head covers and allows very little clearance between the throttle position sensor and the engine compartment rear firewall. The throttle position sensor will likely be damaged if the engine is installed with the intake manifold and throttle body already bolted on.
36 Place the engine/transaxle assembly in position under the vehicle and connect the engine hoist as described in the removal portion of this section.
37 With an assistant manning the engine hoist, slowly raise the engine into position in the engine compartment. Make sure that no components connected to the vehicle are in the way.
38 Align the left and right mounting insulators and install but do not tighten the through-bolts. **Note:** *If you haven't already installed the cylinder head, camshafts, timing belt, etc., you should not install the right mounting insulator until you have done so because installation of the timing belt requires removal of the right mounting insulator.*
39 Align the front and rear mounting insulators and install but do not tighten the through-bolts. Bounce the engine to verify that the mounting insulator is in the middle of the insulator mounting bracket (refer to Chapter 2 Part A if necessary). Tighten the through-bolts of all four mounting insulators to the specified torque.
40 If you have not already done so, install the water pump outlet housing and pipes (refer to Chapter 3 if necessary).
41 Install the alternator/bracket assembly and tighten the three bracket bolts securely. Attach both electrical connectors to the alternator. Install the alternator drivebelt and the alternator adjustment bolt. Adjust the belt and tighten the adjustment bolt.
42 Install the air control valve and the intake manifold (refer to Chapter 2 Part A). Use new gaskets between the air control valve and the cylinder head and between the air control valve and the intake manifold. Be sure that the main wire harness is on top of the intake manifold runners. Tighten the intake manifold/air control valve mounting bolts and nuts to the specified torque. **Note:** *The bottom bolts are easier to reach from underneath the vehicle.*
43 Install the fuel rail/injector assembly (Chapter 4) and tighten the three fuel rail bolts to the specified torque.
44 Attach the wire harness retaining strap bolt and ground bolt to the top of the intake manifold.
45 Attach the vacuum hose between the vacuum switching valve and the pressure regulator (refer to Chapter 4 if necessary).
46 Connect the electrical connectors to the four fuel injectors, the cold start valve and the vacuum switching valve for the pressure regulator (refer to Chapter 4 if necessary).
47 Attach the fuel line banjo fitting to the cold start valve and tighten the bolt to the specified torque (Chapter 4). Use new crush washers with the banjo fitting to prevent a fuel leak.
48 Install the water hose between the filler cap and the water outlet housing (just above the water pump on the right rear corner of the block).
49 Connect the electrical connector to the water outlet and the other electrical connectors — coil, ground, etc. — at the right rear corner of the cylinder head.
50 At the right front corner of the cylinder head, connect the oxygen sensor, the distributor, the oil pressure sending unit, the A/C compressor and the engine compartment fan connectors. **Note:** *The A/C compressor and oil pressure sending unit connectors are easier to connect from underneath the vehicle.*
51 Connect the brake booster vacuum hose between the intake manifold and the metal pipe at the right front corner of the engine compartment.
52 If you have not already done so, install the spark plugs and tighten them to the specified torque (refer to Chapter 1 if necessary).
53 Install the distributor cap and spark plug wires. Attach the wires to the spark plugs and to the coil (refer to Chapter 1 if necessary).
54 Install the EGR pipe to the plenum and the cylinder head. Use a new gasket between the EGR pipe mounting flange and the plenum. Tighten the bolts securely (see Chapter 2 Part A and Chapter 6).
55 Install the rear cover to the cylinder head. Use a new gasket and coat it with silicone sealant to prevent coolant leaks. **Note:** *Do not install the rear bolt until the vacuum transmitting pipe is installed — the rear cover shares this bolt with the vacuum transmitting pipe.*
56 Install the vacuum transmitting pipe to the rear cover, intake manifold and throttle body. Tighten the bolts securely.
57 Attach the water hoses to the auxiliary air valve on the underside of the throttle body.
58 Install the exhaust manifold-to-EGR valve pipe. Use anti-seize compound on the exhaust manifold bolt threads and on the threaded fitting at the EGR valve.
59 Route the wire harness underneath the rear cover. Route the starter motor wire harness toward the starter motor. Attach both temperature sensor connectors to the rear cover. Clip the wire harness to the rear cover bracket. Remove the engine removal hook bolt at the front left corner of the cylinder head and install the engine compartment temperature sensor, bracket and engine removal hook.
60 Attach the throttle position sensor electrical connector.
61 Install the clear plastic hose between the engine air bleeder valve atop the thermostat housing and the coolant recovery bottle. Attach the heater and radiator hoses to the thermostat housing.
62 Connect the electrical connector to the thermal time switch on the thermostat housing. Attach the vehicle body ground strap to the transaxle housing (bolt located at the left rear corner of the thermostat housing).
63 Attach the back-up light switch pigtail electrical connector to the main wire harness.
64 Install the clutch slave cylinder/shift cable bracket bolts and tighten them to the specified torque.
65 Attach the shift control cable bracket stay bolt to the front mounting insulator bracket.
66 Attach the (upper) select control cable to the selecting bellcrank and install the washer and retaining clip. Attach the (lower) shift control cable to the shift lever and install the washer and retaining clip.
67 Connect the electrical connector to the oil pressure sending unit and attach the upper oil cooler hose to the metal pipe just above the sending unit.
68 Install the air conditioning compressor to its bracket and tighten the bolts securely. Attach the electrical connector to the compressor.
69 Attach the lower oil cooler hose to the banjo fitting pipe on the front side of the oil pan.
70 Attach both starter motor wires to the starter motor.
71 Install the flywheel inspection cover and tighten all three bolts securely.
72 Install the intake manifold stay and tighten the bolts securely.
73 Install both driveaxles (refer to Chapter 8).
74 Install the wheels and tighten the lug nuts.
75 Install the exhaust pipe (refer to Chapter 4). Use anti-seize com-

pound on the three exhaust manifold-to-exhaust pipe bolts.
76 Attach the fuel feed line to the pulsation damper. Use new crush washers with the banjo fitting between the pulsation damper and the delivery pipe. Tighten the pulsation damper to the specified torque. Install the fuel feed line retaining strap bolt to the top of the intake manifold.
77 Attach the fuel return line threaded fitting to the pressure regulator and tighten it to the specified torque.
78 Attach the retaining strap bolts of the fuel feed and return lines to the rear cover.
79 Attach the vacuum hoses to the EGR BVSV and to the EVAP BVSV.
80 Attach the heater hoses to the rear cover and to the thermostat housing.
81 Attach the auxiliary air valve hose to the throttle body.
82 Install the duct between the air flow meter and the throttle body.
83 Attach the vacuum hose between the switching valve on the lower front of the air flow meter and the vacuum transmitting pipe.
84 Insert the speedometer cable into the transaxle and tighten the fitting securely. Install the throttle cable and the speedometer cable brackets to the cylinder head covers and tighten the bolts securely.
85 Install the battery carrier and the battery.
86 Add oil (refer to Chapter 1 if necessary).
87 Add the specified ratio of water and coolant (see Chapter 1).
88 Disconnect the green electrical connector to the coil and crank the starter for five or six seconds to pump oil to the cylinder head. Reconnect the green connector.
89 Hook up a timing light in accordance with the manufacturer's instructions and adjust the idle speed (refer to Chapter 1).
90 Take the vehicle for a brief test drive and check for leaks.

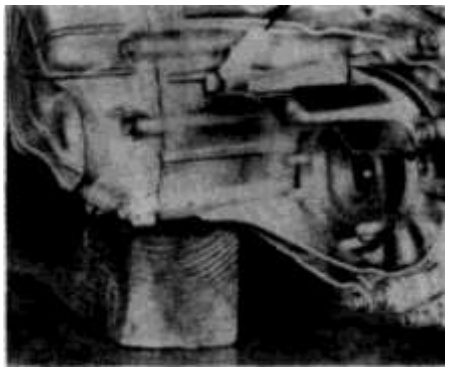
6 Engine overhaul — disassembly sequence

Refer to illustrations 6.2a, 6.2b, 6.2c, 6.4, 6.5 and 6.6

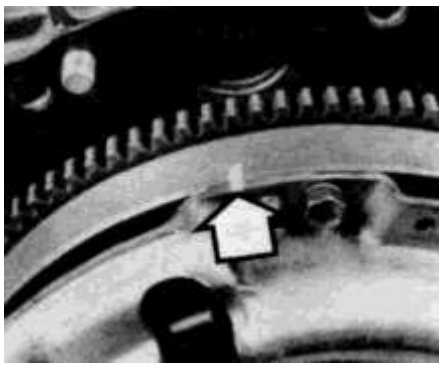
1 It is possible to disassemble the engine without an engine stand, but a stand makes engine work much easier. A stand can usually be rented inexpensively from an equipment rental yard. If you elect to disassemble the engine without a stand, block it up on a sturdy workbench or on the floor. Make sure you do not tip or drop the engine when working without a stand.
2 Before the engine can be mounted on an engine stand, the clutch and fly wheel, or driveplate, must be removed from the engine. But the engine will not remain upright by itself until the transaxle and oil pan have been removed. To prevent the engine from rocking from side to side, attach the engine hoist to the two bolt holes nearest the transaxle along the bottom edge of the block. To prevent the block and transaxle from tipping when they are separated, raise the engine slightly and place large blocks of wood under the oil pan and the transaxle **(see illustrations).**
3 Remove the remaining transaxle-to-engine block bolts and the rear end plate-to-transaxle bolts. Carefully pry the engine and transaxle apart. **Warning:** *Because the transaxle is heavy and may, unless supported, tumble when disconnected from the block, it is a good idea to have an assistant help with this task.*
4 Index the pressure plate to the flywheel **(see illustration),** remove the pressure plate bolts and remove the pressure plate and clutch disc.
5 Index the flywheel to the crankshaft **(see illustration),** remove the eight flywheel bolts and remove the flywheel.
6 Remove the two remaining rear end plate bolts and remove the

6.2a Before removing the transaxle from the engine block, hang the block from the engine hoist at this mouning point on the front side of the block . . .

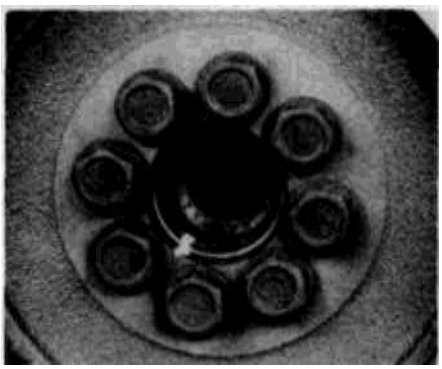
6.2b . . . and at this point on the rear side of the block, then place a block (or blocks) of wood underneath the oil pan to help balance the engine



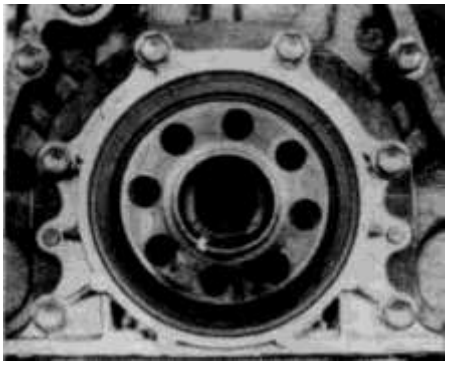
6.2c Put another large block of wood underneath the transaxle to help balance it, then lower the engine hoist until the engine/transaxle assembly is resting on the blocks of wood (but the chain should still be taut)



6.4 Index the pressure plate to the flywheel (arrow) to ensure that their balance is not upset when reinstalled



6.5 Index the flywheel to the crankshaft, then remove the flywheel bolts and the flywheel



6.6 After removing the flywheel/driveplate, remove the two end plate bolts and the end plate (the plate has already been removed in this photo for the sake of clarity) — then remove the six rear oil seal retainer bolts and the retainer and gasket

rear end plate. Remove the rear oil seal retainer bolts **(see illustration)** and the retainer (refer to Chapter 2 Part A, if necessary).

7 If you intend to swap your worn out engine for a rebuilt engine (short or long block), most and sometimes all the external components must be removed and transferred to the replacement engine.

8 Even if you intend to rebuild your existing engine, it will have to be stripped of all external components before you can begin.

9 A general list of the items that must be removed includes the following parts:

Air conditioning compressor bracket
Air conditioning compressor drivebelt tensioner pulley
Alternator and mounting and adjusting brackets
Pressure plate, clutch disc and flywheel/driveplate
Cylinder head (requires removal of camshafts, timing pulleys and distributor) Cylinder head covers
Distributor, spark plug wires and spark plugs Engine mounting insulator brackets Exhaust manifold/EGR pipe Intake manifold/throttle body/air control valve/vacuum transmitting pipe Oil filter/pressure regulator/oil cooler pipe Oil pan, baffle plate and strainer Oil pressure sending unit Rear cover Timing belt covers, timing belt, crankshaft and camshaft timing belt pulleys
Transaxle
Water outlet housing and outlet pipe Water pump and coolant delivery pipe

10 When removing the external components from the engine, pay close attention to details that may be helpful or important during installation. Note the installed position of gaskets, seals, spacers, pins, washers, bolts and other small items.

11 Remember that the cylinder head, oil pan and oil pump will have to be removed if you are obtaining a short block, which consists of the assembled engine block, crankshaft, pistons and connecting rods. Refer to *Engine rebuilding alternatives* for additional information regarding the different possibilities to be considered.

12 If you are planning a complete overhaul, the engine should be disassembled in the following order:

Camshaft timing belt pulleys
Camshafts
Distributor
Cylinder head
Valve lifters
Valve springs
Valves
Oil pan
Oil pan baffle plate
Oil pan strainer
Crankshaft timing belt pulley
Oil pump
Rear oil seal retainer
Piston/connecting rod assemblies
Crankshaft and main bearings

13 Before beginning the disassembly and overhaul procedures, make sure the following items are available:

Common hand tools
Small cardboard boxes or plastic bags for storing parts
Gasket scraper
Ridge reamer
Vibration damper puller
Micrometers
Telescoping gauges
Dial indicator set
Valve spring compressor
Cylinder surfacing hone
Piston ring groove cleaning tool
Electric drill motor
Tap and die set
Wire brushes
Oil gallery brushes
Cleaning solvent

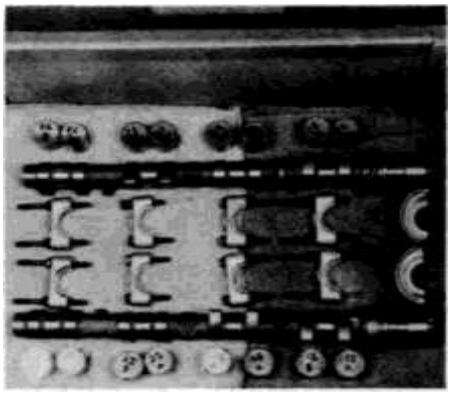
7 Cylinder head — disassembly

Refer to illustrations 7.1, 7.2a, 7.2b, 7.3a and 7.3b **Note:** *New and rebuilt cylinder heads are commonly available for most engines at dealerships and auto parts stores. Because some specialized tools are necessary for the disassembly and inspection procedures, and replacement parts may not be readily available, it may be more practical and economical for the home mechanic to purchase a replacement head rather than taking the time to disassemble, inspect and recondition the original.*

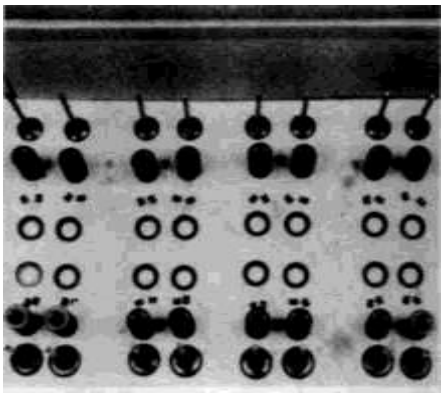
1 Place the head on a pair of wood blocks. Do not tip it on its side or turn it upside down — the valve lifters and shims will fall out of their bores. Carefully label, then remove, the valve lifters and shims. Place them in an orderly array in a clean and protected box where they will not be disturbed **(see illustration).**

2 Before removing the valves, prepare a box or label a set of plastic bags in which they can be stored, along with their related components, until they are reinstalled in the same valve guides from which they were removed **(see illustrations). Note:** *The advantage of the plastic bag system is that there is no possibility of the valves becoming mixed up — arranging the valves in a box is a good system only as long as the box is undisturbed. Should it be kicked or knocked over, the valve train components will become mixed up.*

3 Compress the spring on the first valve with a spring compressor and remove the keepers **(see illustrations).** Carefully release the valve spring compressor and remove the spring retainer, the spring and the

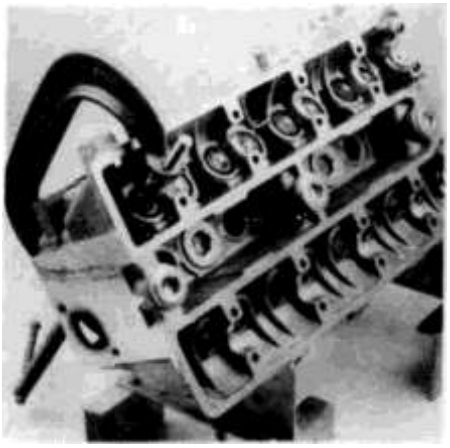


7.1 This is an acceptable way to store the shims until they are reinstalled in the head (note that each shim has been labelled with a felt tip pen to prevent mixups) — but the foolproof solution is to label each shim and store it in a taped plastic bag



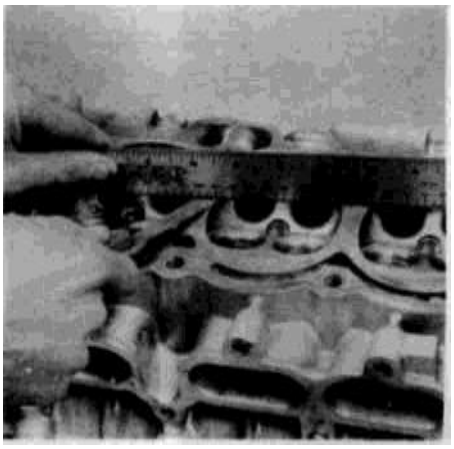
7.2a Keep the valve train components in order to make sure everything goes back in the proper place

7.2b The preferred method for valve component storage is in a labelled and taped plastic bag



7.3a Place the valve spring compressor over the first valve and retainer and press down on the retainer

7.3b Carefully extract the keepers with a pair of needle nose pincers or a small magnet



8.12a Check the cylinder head gasket surface for warpage by trying to slip a feeler gauge under the straightedge (see the Specifications for the maximum warpage allowed and use a feeler gauge of that thickness)

seat. Pull the old oil seal from the top of the guide, then pull the valve from the head. If the valve binds in the guide (won't pull through), push it back into the head and deburr the area around the keeper groove with a fine file or whetstone.

4 Repeat the procedure above for each valve. Remember to keep all the parts for each valve together so they can be reinstalled in the same locations.

5 Once the valves and related components have been removed and stored in an organized manner, the head should be thoroughly cleaned and inspected. If a complete engine overhaul is being done, finish the engine disassembly procedures before beginning the cylinder head cleaning and inspection process.

8 Cylinder head — cleaning and inspection

Refer to illustrations 8.12a, 8.12b, 8.16, 8.17 and 8.18

1 Thorough cleaning of the cylinder head and related valve train components, followed by a detailed inspection, will enable you to decide how much valve service work must be done during the engine overhaul.

Cleaning

2 Clean the combustion chambers with a wire brush. Remove all carbon residue.

3 Scrape away all traces of old gasket material and sealing compound from the mating surfaces of the head, air control valve, intake manifold and exhaust manifold. Be very careful not to gouge the cylinder head. Special gasket removal solvents, which soften gaskets and make removal much easier, are available at auto parts stores.

4 Remove any scale build-up from the coolant passages.

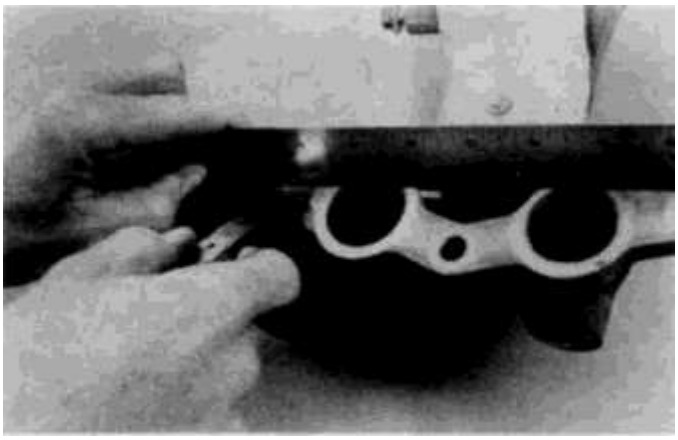
5 Run a stiff wire brush through the oil holes to remove any deposits that may have formed in them.

6 Run an appropriate size tap into each of the threaded holes to remove any corrosion and thread sealant that may be present. If compressed air is available, use it to clear the holes of debris produced by this operation.

7 Clean the threads of the exhaust and intake manifold studs with an appropriate size die.

8 Clean the cylinder head with a soft brush and solvent and dry it thoroughly. Compressed air will speed the drying process and ensure that all holes and recessed areas are clean. Commercially available decarbonizing chemicals may prove useful when cleaning cylinder heads and valve train components. They are very caustic and should be used with caution. Follow the instructions on the container. **Caution:** *Do not clean the head in a hot tank — it will seriously damage it.*

9 Clean all the valve springs, shields, keepers and retainers with solvent and dry them thoroughly. Clean only one valve set at a time to avoid mixing up the parts.



8.12b The exhaust manifold mating surface must be checked for warpage to prevent exhaust leaks

10 Scrape off any heavy deposits that may have formed on the valves, then use a motorized wire brush to remove deposits from the valve heads and stems. Again, make sure the valves do not get mixed up.

Inspection

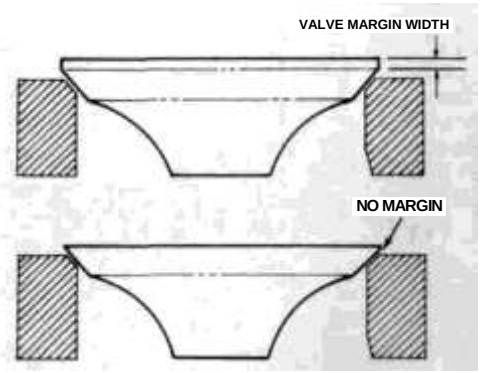
Cylinder head

11 Inspect the head surface, the intake and exhaust ports and the combustion chamber very carefully for cracks. If cracks are found, the cylinder head must be replaced. Also look for evidence of coolant leakage and other damage.

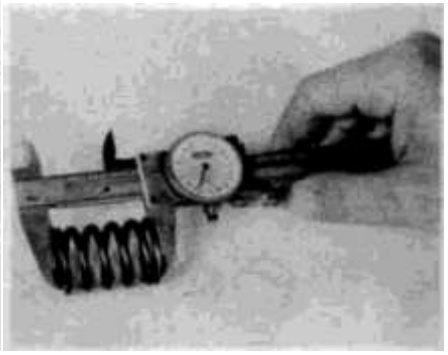
12 Using a straightedge and feeler gauge, check the cylinder head and manifold mating surfaces for warpage **(see illustrations).** Also check the three manifolds (air control valve, intake and exhaust) at this time. Make longitudinal and diagonal checks. If warpage of any surface exceeds the specified limit, take the warped component to an automotive machine shop for resurfacing.

13 Examine the valve seats in each of the combustion chambers. If they are pitted, cracked or burned, the head will require valve reconditioning, a service that is beyond the scope of the home mechanic.

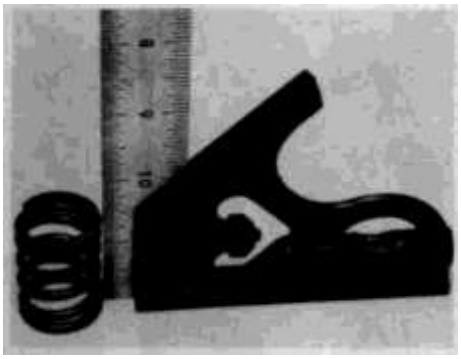
14 Because of the way the valve stems are recessed in the head casting, it is impossible to check valve guide clearance with a dial indicator. A small hole gauge and micrometer are required, and it is recommended that the head be taken to an automotive machine shop to have the valve stem to valve guide clearance checked. If the valve stem-to-guide clearance is greater than the specified clearance, the valve and/or guide will have to be replaced by the machine shop.



8.16 The margin width on each valve must be as specified (if no margin exists, the valve cannnot be reused)

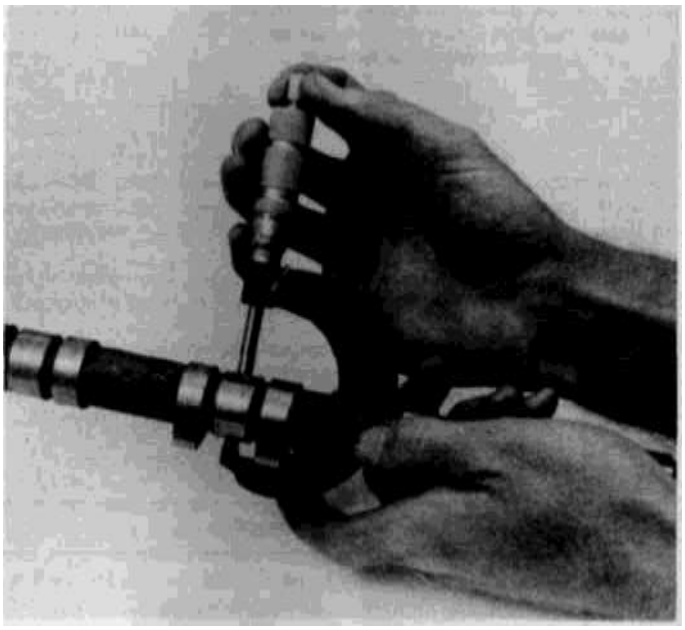


8.17 Measure the free length of each valve spring with a dial or vernier caliper



8.18 Check each valve spring for squareness

10.1 Measure the lobe height of each lobe on each camshaft — if any lobe height on either cam is less than the specified allowable minimum, replace that cam



10.2 Measure the diameter of the center journal — if it is less than the specified standard diameter, replace the cam

Valves

1 5 Carefully inspect each valve face for uneven wear, deformation, cracks, pits and burned spots. Check the valve stem for scuffing and galling. Look for cracks in the neck. Rotate the valve and check for any obvious indication that it is bent. Look for pits and excessive wear on the stem tip (end). The presence of any of these conditions indicates the need for valve service by an automotive machine shop.

16 Measure the margin width on each valve **(see illustration).** Replace any valve with a narrower than specified margin.

Valve components

17 Inspect both ends of each valve spring for wear and pitting. Measure the free length and compare it to the Specifications **(see illustration).** Any springs that are shorter than specified have sagged and should not be reused. The tension of all springs at their specified installed height should be checked by an automotive machine shop before they are installed in a rebuilt engine.

18 Stand each spring on a flat surface and check it for squareness **(see illustration).** If any of the springs are distorted or sagged, replace the entire set.

19 Any damaged or excessively worn parts must be replaced with new ones.

20 If the inspection process indicates that the valve components are in generally poor condition and worn beyond the specified limits (which is usually the case in an engine that is being overhauled) reassemble the valves in the cylinder head and refer to Section 9 for valve servicing recommendations.

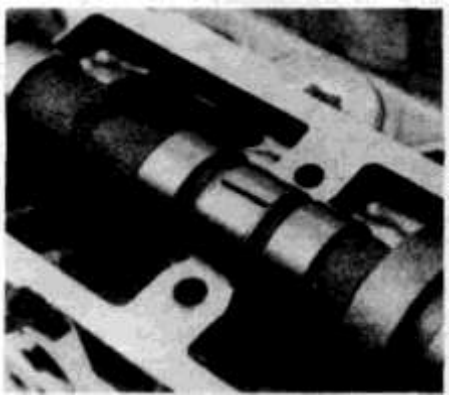
21 If the inspection turns up no excessively worn parts, and if the valve faces and seats are in good condition, the valve train components can be reinstalled in the cylinder head without major servicing. Refer to Section 11 for the cylinder head reassembly procedure.

9 Valves — servicing

1 Because of the complex nature of the job and the special tools and equipment needed, servicing of the valves, the valve seats and the valve guides, commonly known as a valve job, is best left to a professional.

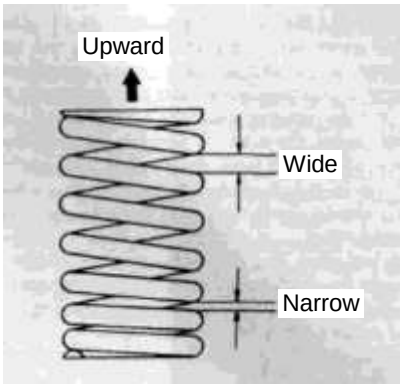
2 The home mechanic can remove and disassemble the head, do the initial cleaning and inspection, then reassemble and deliver the head to a dealer service department or an automotive machine shop for the actual valve servicing.

3 The dealer service department, or automotive machine shop, will remove the valves and springs, recondition or replace the valves and valve seats, recondition the valve guides, check and replace the valve springs, spring retainers and keepers (as necessary), replace the valve guide seals, reassemble the valve components and make sure the installed spring height is correct. The cylinder head gasket surface will also be resurfaced if it is warped.

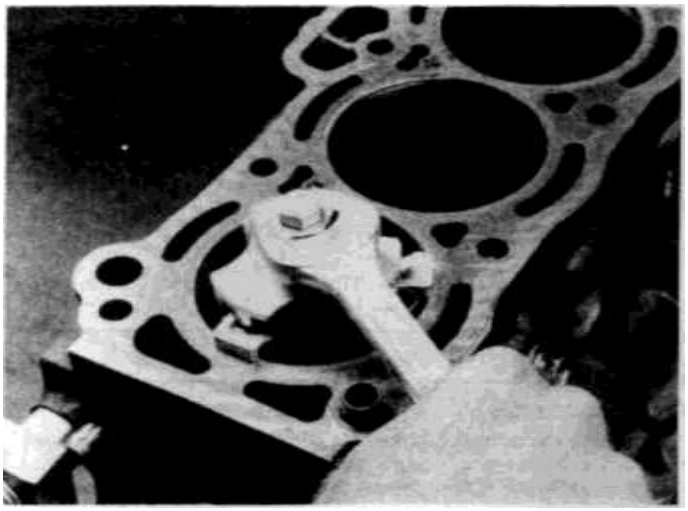


10.4a After cleaning the bearing caps and camshaft journals, lay a strip of Plastigage across each camshaft journal, install the bearing caps and tighten them to the specified torque, then remove the caps

10.4b Measure each strip of flattened Plastigage — if the measured clearance between any journal and bearing cap exceeds the specified maximum, replace the camshaft



11.5 When installing the valve springs, make sure that the widely spaced coils of each valve spring are at the top and the narrrowly spaced coils are at the bottom



12.1 A ridge reamer is required to remove the ridge from the top of the cylinder — do this before removing the pistons

4 After the valve job has been performed by a professional, the head will be in like new condition. When the head is returned, be sure to clean it again just before installation to remove any metal particles and abrasive grit that may still be present from the valve service or head resurfacing operations. Use compressed air, if available, to blow out all the oil holes and passages.

10 Camshaft, bearings and lifters — inspection

Refer to illustrations 10.1, 10.2, 10.4a and 10.4b

1 Using a micrometer, measure the camshaft lobe height of each lobe **(see illustration).** If the lobe height is less than the specified allowable minimum, replace the camshaft.
2 Using a micrometer, measure the diameter of the center journal **(see illustration).**
3 Inspect the bearings for flaking or scoring. If any of the bearings are damaged, replace the cylinder head and the camshaft that was supported by the damaged bearing.
4 Measure each camshaft oil journal oil clearance. Clean the bearing caps and the camshaft journals. Lay a strip of Plastigage across each journal **(see illustration).** Install the bearing caps on each journal with the arrows pointing toward the front. Tighten each bolt to the specified torque. Remove the caps. Measure the Plastigage **(see illustration).**

If the clearance is greater than the specified maximum, replace the head.
Caution: *Do not turn the camshaft while the Plastigage is in place.*

11 Cylinder head — reassembly

Refer to illustration 11.5

1 Regardless of whether or not the cylinder head was sent to an automotive repair shop for valve servicing, make sure it is clean before beginning reassembly.
2 If the head was sent out for a valve job, the valves and related components will already be installed. Begin the reassembly procedure with Step 8.
3 Install new seals on each of the valve guides. Using a hammer and a deep socket, gently tap each seal into place until it is completely seated on the guide. Do not twist or cock the seals during installation or they will not seal properly on the valve stems.
4 Beginning at one end of the head, lubricate and install the first valve. Apply moly-base grease or clean engine oil to the valve stem.
5 Drop the spring seat into place. Place the valve spring, shield and retainer in place. Make sure that the valve spring is installed with the more widely spaced coils at the top **(see illustration).**
6 Compress the springs with a valve spring compressor (refer to Section 7, if necessary). Position the keepers on the keeper groove in the stem, then slowly release the compressor and make sure that the keepers seat properly. If necessary, apply a small dab of grease to each keeper to hold it in place until it is seated by the retainer.
7 Repeat the above procedure for each valve. Be sure to return the components to their original locations — do not mix them up!
8 Lubricate the retainers and the valve lifters with moly-base grease, engine assembly lube or clean engine oil. Install each lifter into its corresponding bore.

12 Piston/connecting rod assembly — removal

Refer to illustrations 12.1, 12.3a, 12.3b, 12.4 and 12.5 **Note:** *Before the piston/connecting rod assemblies can be removed, the cylinder head, oil pan, oil strainer, oil pump and rear oil seal retainer must be removed from the block (refer to the appropriate sections in Chapter 2).*

1 Completely remove the ridge at the top of each cylinder with a ridge reaming tool **(see illustration).** Follow the manufacturer's instructions provided with the tool. **Caution:** *Failure to remove the ridges before attempting to remove the piston/connecting rod assemblies will result in piston breakage.*
2 After the cylinder ridges have been removed, turr) the engine upside-down so the crankshaft is facing up.

3 Before removing the connecting rods, measure the end play of each rod. Use a dial gauge if available **(see illustration).** Set up the dial gauge as shown, with its probe touching the side of the rod cap. Zero the gauge, push on the rod cap and note the amount of side movement. Record your measurement and compare it to the specified clearance. If you do not have access to a dial gauge, use a feeler gauge. Slide it between the first connecting rod and the crankshaft throw until the play is removed **(see illustration).** The end play is equal to the thickness of the feeler gauge(s). If, using either means of measuring end play, you should determine that the end play exceeds the service limit, new connecting rods will be required. If new rods (or a new crankshaft) are installed, the end play may fall under the specified minimum. If it does, the rods will have to be machined to restore it — consult an automotive machine shop for advice if necessary. Repeat this procedure for each of the connecting rods.

4 Check the connecting rods and caps for identification marks **(see illustration).** If they are not plainly marked, use a small center punch to make the appropriate number of indentations on each rod and cap (1 through 4, depending on the cylinder with which they are associated).

5 Loosen each of the connecting rod cap nuts 1 /2-turn at a time until they can be removed by hand. If necessary, lightly tap the rod bolts with a small plastic-faced hammer. Remove the number one connecting rod cap and bearing insert and set them aside. Do not drop the bearing insert out of the cap. Slip a short length of plastic or rubber hose over both connecting rod cap bolts to protect the crankshaft journal and cylinder wall from damage by the rod bolts when the piston is removed **(see illustration).** Push the connecting rod/piston assembly out through the top of the engine. Use a wooden hammer handle to push on the upper bearing insert in the connecting rod. If resistance is felt, stop. Look at the top of the cylinder and verify that all of the ridge has been removed from the cylinder.

6 Repeat this procedure for each of the cylinders. After each piston is removed, reinstall the bearing inserts and attach the rod cap and connecting rod. Install the cap nuts finger tight. Leaving the old bearing inserts in place until reassembly will help prevent the connecting rod bearing surfaces from being accidentally nicked or gouged.

13 Crankshaft — removal

Refer to illustrations 13.1 and 13.4

1 Before the crankshaft is removed, check the end play. Mount a dial indicator with the stem in line with the crankshaft and just touching one of the crank throws **(see illustration).**

2 Push the crankshaft all the way to the rear and zero the dial indicator. Pry the crankshaft to the front as far as possible and check the reading on the dial indicator. The distance that it moves is the end play. If the end play is greater than specified, replace the thrust washers as a set.

3 If a dial indicator is not available, pry the crankshaft all the way to the front of the engine and slip feeler gauges between either thrust washer, located on both the front and rear sides of the No. 3 (center) main bearing, and the adjacent crankshaft counterweight. If the thickness of the gauge(s) that can be inserted between the thrust washer and the crank counterweight exceeds the specified maximum allowable end play, replace the thrust washers as a set.

4 Look for location and direction markings on the main bearing caps **(see illustration).** They should be numbered consecutively from the front of the engine to the rear and should have a cast-in arrow pointing toward the front of the engine. If either the location number or directional arrow are missing, mark them with number stamping dies or a center punch. Loosen each of the main bearing cap bolts 1/4-turn at a time until they can be removed by hand.

5 Gently tap the caps with a soft-face plastic hammer, then separate them from the engine block. If necessary, use the bolts as levers to remove the caps. Make sure that you don't drop the bearing inserts when removing the caps. Carefully set all five caps aside nearby so that they can be bolted back onto the block as soon as the crankshaft is removed. Be particularly careful with the No. 3 (center) main bearing cap — the thrust washer lower halves located in the recesses on either side of it will probably fall off when the cap is removed.

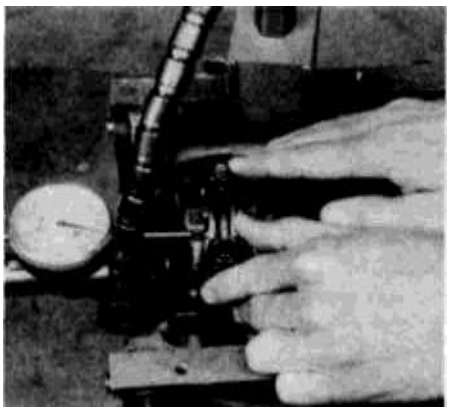
6 Carefully lift the crankshaft out of the engine. Do not remove the bearing inserts from the block or the main bearing caps. Leave them in place to protect the block and cap bearing bores until the engine is reassembled. Return the caps to their respective locations on the engine block and tighten the bolts finger tight. Make sure that you don't lose the upper thrust washer halves, which will fall from their recesses on either side of the No. 3 main bearing saddle in the block when the crankshaft is removed.

14 Engine block — cleaning

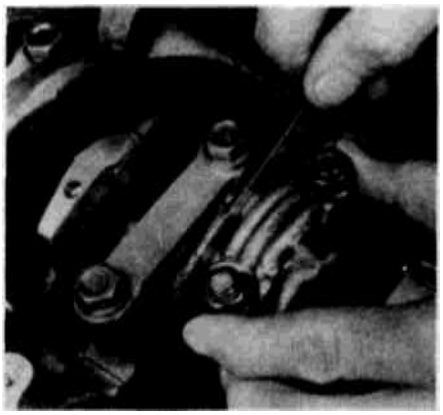
*Refer to illustrations 14.1a, **14.1b,** 14.8, 14.10a and 14.10b*

1 Remove the soft plugs from the engine block. To do this, knock the plugs into the block, using a hammer and punch, then grasp them with large pliers and pull them back through the holes **(see illustrations).**

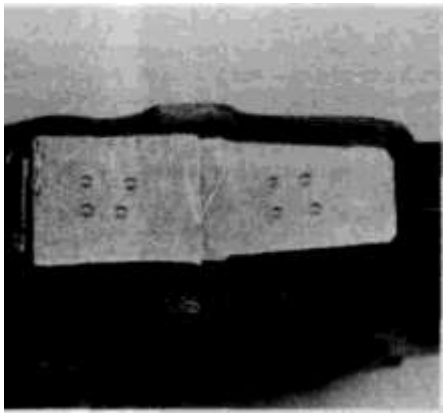
2 Using a gasket scraper, remove all traces of gasket material from



12.3a To check the connecting rod end play with a dial gauge, place the probe against the side of the rod cap, zero the gauge and push the rod cap toward the probe as far as it will go — the reading on the gauge is the amount of end play



12.3b If a dial gauge is not handy, slip a feeler gauge or gauges, of a thickness equal to the specified end play, between the rod cap and the crankshaft



12.4 Look for markings like these on side of each rod cap — four dots indicates that this is the rod for the No. 4 piston and because the number of dots on the rod and the cap are the same, we know that this rod and cap are a matched set — if there are no rod markings, make your own as you remove the rods

the engine block. Be very careful not to nick or gouge the gasket sealing surfaces.

3 Remove the main bearing caps and separate the bearing inserts from the caps and the engine block. Tag the bearings, indicating which cylinder they were removed from and whether they were in the cap or the block, then set them aside.

4 Using an Allen wrench of the appropriate size, remove all of the threaded oil gallery plugs from the block.

5 If the engine is extremely dirty it should be taken to an automotive machine shop to be steam cleaned or hot tanked.

6 After the block is returned, clean all oil holes and oil galleries one more time. Brushes specifically designed for this purpose are available at most auto parts stores. Flush the passages with warm water until the water runs clear, dry the block thoroughly and wipe all machined surfaces with a light, rust preventive oil. If you have access to compressed air, use it to speed the drying process and to blow out all the oil holes and galleries.

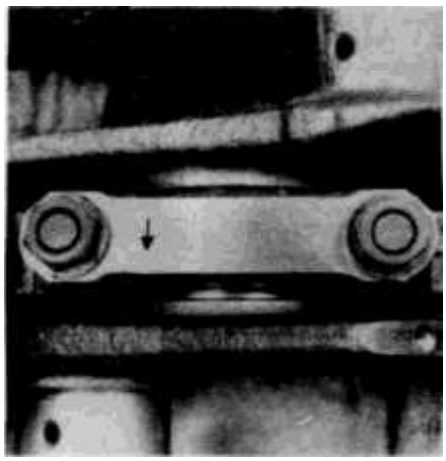
7 If the block is not extremely dirty or sludged up, you can do an adequate cleaning job with warm soapy water and a stiff brush. Take plenty of time and do a thorough job. Regardless of the cleaning method used, be sure to clean all oil holes and galleries very thoroughly, dry the block completely and coat all machined surfaces with light oil.

8 The threaded holes in the block must be clean to ensure accurate torque readings during reassembly. Run the proper size tap into each of the holes **(see illustration)** to remove any rust, corrosion, thread sealant or sludge and to restore any damaged threads. If possible, use compressed air to clear the holes of debris produced by this operation. Now is a good time to clean the threads on the head bolts and the main bearing cap bolts as well.

9 Reinstall the main bearing caps and tighten the bolts finger tight.

12.5 To prevent damage to the crankshaft journals and cylinder walls, slip sections of hose over the rod bolts before removing the pistons

13.1 Check crankshaft end play with a dial indicator — attach the gauge to the front of the block, pry the crankshaft all the way to the rear, zero the dial and pry the crank all the way forward — if the end play exceeds the specified allowable maximum, replace the thrust washers



13.4 Each main bearing cap should be stamped with a number indicating its position (the caps are numbered one to five, from front to rear) and a directional arrow which indicates which way the cap should be installed — if either the location number or the directional arrow are missing, stamp your own markings onto each cap

14.1a A hammer and large punch can be used to drive the soft plugs into the block

14.1b Use pliers to lever each soft plug through the hole in the block

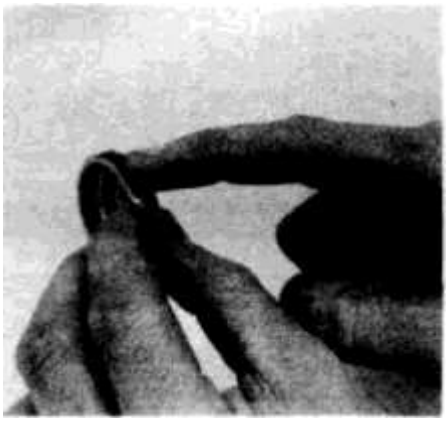
14.8 All bolt holes in the block, particularly the main bearing cap and head bolt holes, should be cleaned and restored with a tap — be sure to remove the debris from the holes after tapping them

10 After coating the sealing surfaces of the new soft plugs with gasket sealer **(see illustration),** install them in the engine block. Make sure they are driven in straight and seated properly or leakage could result. Special tools are available for this purpose, but equally good results can be obtained using a large socket, with an outside diameter that will just slip into the soft plug, and a hammer **(see illustration).**
11 If the engine is not going to be reassembled right away, cover it with a large plastic trash bag to keep it clean.

15 Engine block — inspection

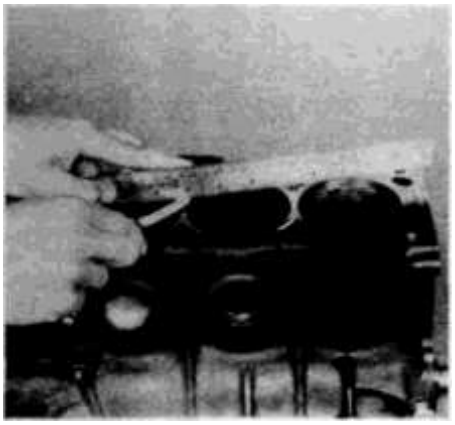
Refer to illustrations 15.3, 15.5a, 15.5b and 15.5c

1 Before the block is inspected, it should be cleaned as described in Section 14. Double-check to make sure that the ridge at the top of each cylinder has been completely removed.
2 Visually check the block for cracks, rust and corrosion. Look for stripped threads in the threaded holes. It is also a good idea to have the block checked for hidden cracks by an automotive machine shop with the special equipment to do this type of work. If defects are discovered, have the block repaired, if possible. If it can't be repaired, replace it.
3 Using a straightedge and feeler gauge, check the surface of the block that mates to the cylinder head for warpage **(see illustration).** Check the surface diagonally and along all four sides. If warpage is greater than the specified allowable maximum, take the block to an automotive machine shop to see if it can be resurfaced. If it can't, replace it.
4 Before measuring the cylinder bores, check them for scuffing, scoring and deep scratches. Toyota does not have an approved procedure for reboring the block or oversize replacement pistons available at the time of writing of this manual. Instead, if the piston to cylinder clearance is beyond the specified maximum, they recommend replacing the block. If your engine has worn to the point where the piston to cylinder clearance is beyond the specified maximum, we suggest you contact both your Toyota dealer and independent engine rebuilders regarding boring/resleeving and oversize piston and ring availability.
5 Using a telescoping bore gauge, measure the diameter of each cylinder at the top (just under the ridge area), center and bottom of the cylinder bore, parallel to the crankshaft axis **(see illustrations).** Next, measure each cylinder's diameter at the same three locations across the crankshaft axis. Record your readings and compare the results to the specified cylinder diameter.

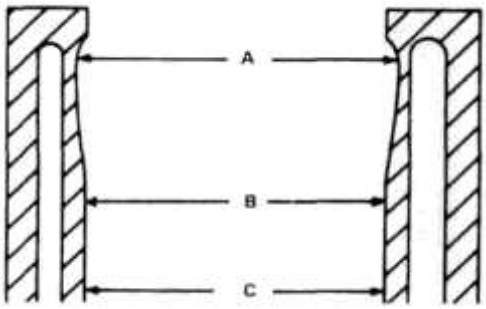


14.10a Coat the sealing surfaces of the new soft plugs with RTV sealant before installing them

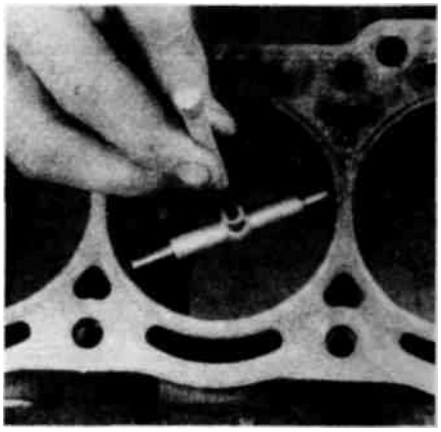
14.10b A large socket on an extension can be used to drive the new soft plugs into the bores



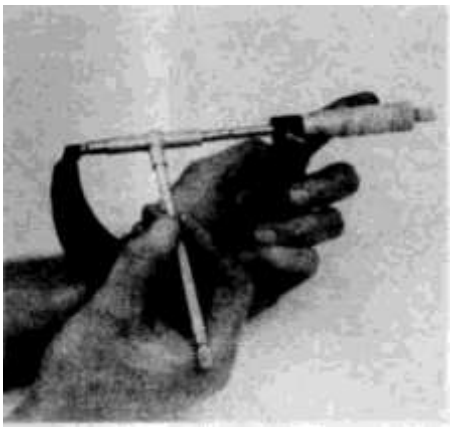
15.3 Check the surface of the block that contacts the cylinder head gasket for warpage by laying a straightedge along each of the four sides and diagonally both ways — if warpage exceeds the specified allowable maximum, the block must either be resurfaced by an automotive machine shop or, if repair is impossible, replaced



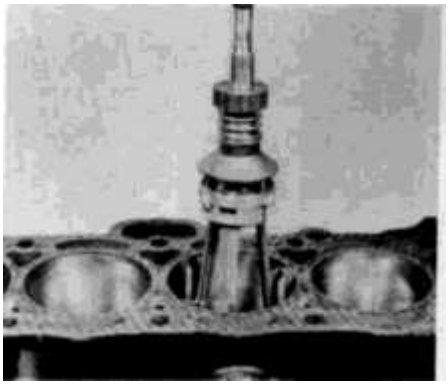
15.5a Measure the diameter of each cylinder just under the wear ridge (A), at the center (B) and at the bottom (C)



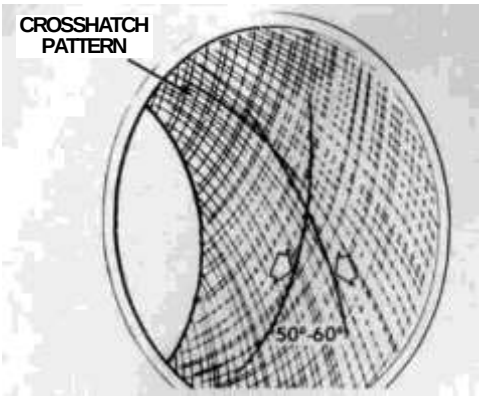
15.5b The ability to feel when the telescoping gauge is at the correct point will be developed over time, so work slowly and repeat the check until you are satisfied that the bore measurement is accurate



15.5c The gauge is then measured with a micrometer to determine the bore size

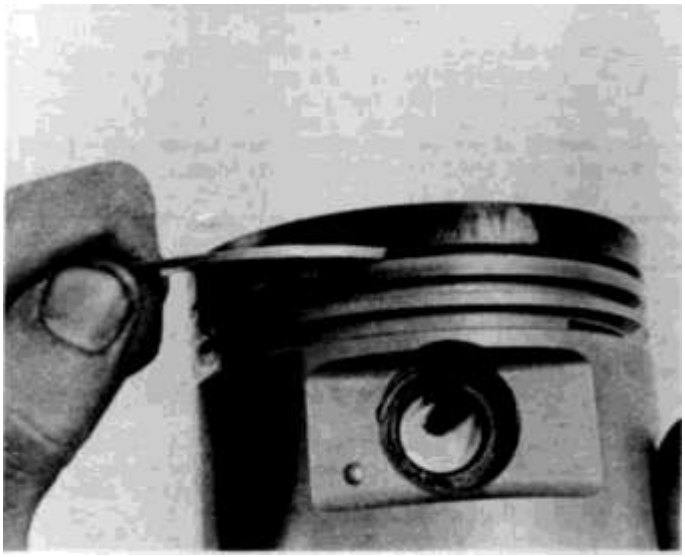


16.3a Lubricate the cylinder with plenty of oil and move the hone up and down in the cylinder at a pace which will produce a fine Crosshatch pattern



16.3b The Crosshatch lines should intersect at approximately a 60° angle

17.4a The piston rings can be cleaned with a special ring groove cleaning tool



17.4b If the tool isn't available, a section of a broken ring can be used — when cleaning the ring grooves with a piece of old ring, be careful or you will remove part of the piston itself along with the carbon deposits embedded in the groove

16 Cylinder honing

Refer to illustrations 16.3a and 16.3b

1 Prior to engine reassembly, the cylinder bores must be honed so the new piston rings will seat correctly. **Note:** *If you do not have the tools or do not want to tackle the honing operation, most automotive machine shops will do it for a reasonable fee.*

2 Before honing the cylinders, install the main bearing caps and tighten the bolts to the specified torque.

3 Two types of cylinder hones are commonly available — the flex hone or "bottle brush" type and the more traditional surfacing hone with spring-loaded stones. Both will do the job, but for the less experienced mechanic the "bottle brush" hone will probably be easier to use. You will also need plenty of light oil or honing oil, some rags and an electric drill motor. Proceed as follows:

a) Mount the hone in the drill motor, compress the stones and slip it into the first cylinder **(see illustration).**

b) Lubricate the cylinder with plenty of oil, turn on the drill and move the hone up-and-down in the cylinder at a pace which will produce a fine Crosshatch pattern on the cylinder walls. Ideally, the Crosshatch lines should intersect at approximately a 60° angle **(see illustration).** Be sure to use plenty of lubricant and do not take off any more material than is absolutely necessary to produce the desired finish.

c) Do not withdraw the hone from the cylinder while it is running. Instead, shut off the drill and continue moving the hone up-and-down in the cylinder until it comes to a complete stop, then compress the stones and withdraw the hone.

d) Wipe the oil out of the cylinder and repeat the procedure for the remaining cylinders.

4 After the honing job is complete, chamfer the top edges of the cylinder bores with a small file so the rings will not catch when the pistons are installed. Be very careful not to nick the cylinder walls with the end of the file.

5 The entire engine block must be washed again very thoroughly with warm, soapy water to remove all traces of the abrasive grit produced during the honing operation. Be sure to run a brush through all oil holes and galleries and flush them with running water.

6 After rinsing, dry the block and apply a coat of light rust preventative oil to all machined surfaces. Wrap the block in a plastic trash bag to keep it clean and set it aside until reassembly.

17 Piston/connecting rod assembly — inspection

Refer to illustrations 17.4a, 17.4b, 17.10 and 17.11

1 Before the inspection process can be carried out, the piston/connecting rod assemblies must be cleaned and the original piston rings removed from the pistons. **Note:** *Always use new piston rings when the engine is reassembled.*

2 Using a piston ring installation tool, carefully remove the rings from the pistons. Be careful not to nick or gouge the pistons in the process.

3 Scrape all traces of carbon from the crown (top) of the piston. A hand-held wire brush or a piece of fine emery cloth can be used once the majority of the deposits have been scraped away. Do not, under any circumstances, use a wire brush mounted in a drill motor to remove deposits from the pistons. The piston material is soft and will be eroded away by the wire brush.

4 Use a piston ring groove cleaning tool in accordance with the manufacturer's instructions to remove carbon deposits from the ring grooves. If a tool is not available, a piece broken off an old ring will do the job. Be very careful to remove only the carbon deposits — don't remove any metal and do not nick or scratch the sides of the ring grooves **(see illustrations).**

5 Once the deposits have been removed, clean the piston/rod assemblies with solvent and dry them with compressed air, if available. Make sure that the oil return holes in the back sides of the ring grooves are clear.

6 If the pistons are not damaged or worn excessively new pistons will not be necessary. Normal piston wear appears as even vertical wear on the piston thrust surfaces and slight looseness of the top ring **in** its groove. New piston rings should always be used when an engine is rebuilt.

7 Carefully inspect each piston for cracks around the skirt, at the pin bosses and at the ring lands.

17.10 Check the piston ring side clearance of each ring by slipping a portion of the correct ring into the groove and measuring the clearance at three or four locations around the circumference of the piston with a feeler gauge

17.11 Measure the piston diameter at a 90° angle to the piston pin and in line with it

18.2 Measure the diameter of each crankshaft main journal and connecting rod journal at several points to detect taper and out-of-round conditions

8 Look for scoring and scuffing on the thrust faces of the skirt, holes in the piston crown and burned areas at the edge of the crown. If the skirt is scored or scuffed, the engine may have been suffering from overheating and/or abnormal combustion which caused excessively high operating temperatures. The cooling and lubrication systems should be thoroughly inspected. A hole in the piston crown is an indication that abnormal combustion (preignition) was occurring. Burned areas at the edge of the piston crown are usually evidence of spark knock (detonation). If any of the above problems exist, the causes must be corrected or the damage will occur again.

9 Corrosion of the piston, in the form of small pits, indicates that coolant is leaking into the combustion chamber and/or the crankcase. Again, the cause must be corrected or the problem may persist in the rebuilt engine.

10 Measure the piston ring side clearance by laying a new piston ring in each ring groove and slipping a feeler gauge between the ring and the edge of the ring groove **(see illustration).** Check the clearance at three or four locations around each groove. Be sure to use the correct ring for each groove — they are different. If the side clearance is greater than specified, new pistons will have to be used.

11 Check the piston-to-bore clearance by measuring the bore (see Section 15) and the piston diameter. Make sure that the pistons and bores are correctly matched. Measure the piston across the skirt, at a 90° angle to and in line with the piston pin **(see illustration).** Subtract the piston diameter from the bore diameter to obtain the clearance. Compare your measurements to the specified piston dimensions. Toyota does not have an approved procedure for reboring the block or oversize replacement pistons available at the time of writing of this manual. Instead, if the piston to cylinder clearance is beyond the specified maximum, they recommend replacing the block. If your engine has worn to the point where the piston to cylinder clearance is beyond the specified maximum, we suggest you contact both your Toyota dealer and independent engine rebuilders regarding boring/resleeving and over-size piston and ring availability.

12 Check the piston-to-rod clearance by twisting the piston and rod in opposite directions. Any noticeable play indicates that there is excessive wear, which must be corrected. The piston/connecting rod assemblies should be taken to an automotive machine shop to have the pistons and rods rebored and new pins installed.

13 If the pistons must be removed from the connecting rods for any reason, they should be taken to an automotive machine shop. While they are there, have the connecting rods checked for bend and twist, since automotive machine shops have special equipment for this purpose. **Note:** *Unless new pistons and/or connecting rods must be installed, do not disassemble the pistons and connecting rods.*

14 Check the connecting rods for cracks and other damage. Temporarily remove the rod caps, lift out the old bearing inserts, wipe the rod and cap bearing surfaces clean and inspect them for nicks, gouges and scratches. After checking the rods, replace the old bearings, slip the caps into place and tighten the nuts finger tight.

18 Crankshaft — inspection

Refer to illustration 18.2

1 Clean the crankshaft with solvent and dry it with compressed air, if available. Be sure to clean the oil holes with a stiff brush and flush them with solvent. Check the main and connecting rod bearing journals for uneven wear, scoring, pits and cracks. Check the rest of the crankshaft for cracks and other damage.

2 Using a micrometer, measure the diameter of the main and connecting rod journals **(see illustration)** and compare your measurements to the specified main journal and connecting rod journal diameters. Measure the diameter at several points around each journal's circumference to determine whether or not the journal is out-of-round. Measure both ends of the journal, near the crank throws, to determine if the journal is tapered.

4 If the crankshaft journals are damaged, tapered, out-of-round or worn beyond the limits given in the Specifications, have the crankshaft reground by an automotive machine shop. Be sure to use the correct size bearing inserts if the crankshaft is reconditioned.

5 Refer to Section 19 for detailed information pertinent to the main and rod bearing inserts.

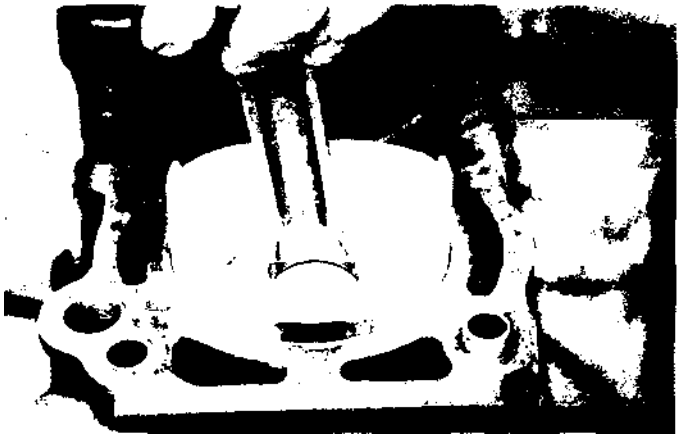
19 Main and connecting rod bearings — inspection

1 Even though the main and connecting rod bearings should be replaced with new ones during the engine overhaul, the old bearings should be retained for close examination, as they may reveal valuable information about the condition of the engine.

2 Bearing failure occurs because of lack of lubrication, the presence of dirt or other foreign particles, overloading the engine and corrosion. Regardless of the cause of bearing failure, it must be diagnosed and corrected before the engine is reassembled to prevent it from reoccurring.

3 When examining the bearings, remove them from the engine block, the main bearing caps, the connecting rods and the rod caps and lay them out on a clean surface in the same general position as their location in the engine. This will enable you to match any bearing problems with the corresponding crankshaft journal.

4 Dirt and other foreign particles get into the engine in a variety of ways. It can be left in the engine during assembly, or it can pass through filters or the PCV system. It can get into the oil, and from there into the bearings. Metal chips from machining operations and normal engine



21.3 Before checking piston ring end gap, make sure that the ring is square in the cylinder bore — the best way to do this is to push the ring into the cylinder bore with the top of a piston

21.4 With the ring square in the cylinder, measure the end gap with a feeler gauge

wear are often present. Abrasives are sometimes left in engine components after reconditioning, especially when parts are not thoroughly cleaned using the proper cleaning methods. Whatever the source, these foreign objects often end up embedded in the soft bearing material and are easily recognized. Large particles will not embed in the bearing and will score or gouge the bearing and journal. The best prevention for this cause of bearing failure is to clean all parts thoroughly and keep everything spotlessly clean during engine assembly. Frequent and regular engine oil and filter changes are also recommended.

5 Lack of lubrication (or lubrication breakdown) has a number of interrelated causes. Excessive heat (which thins the oil), overloading (which squeezes the oil from the bearing face) and oil leakage or throw off (from excessive bearing clearances, worn oil pump or high engine speeds) all contribute to lubrication breakdown. Blocked oil passages, which usually are the result of misaligned oil holes in a bearing shell, will also oil starve a bearing and destroy it. When lack of lubrication is the cause of bearing failure, the bearing material is wiped or extruded from the steel backing of the bearing. Temperatures may increase to the point where the steel backing turns blue from overheating.

6 Driving habits can have a definite effect on bearing life. Lugging the engine puts very high loads on bearings, which tends to squeeze out the oil film. These loads cause the bearings to flex, which produces fine cracks in the bearing face (fatigue failure). Eventually the bearing material will loosen in pieces and tear away from the steel backing. Short trip driving leads to corrosion of bearings because insufficient engine heat is produced to drive off the condensed water and corrosive gases. These products collect in the engine oil, forming acid and sludge. As the oil is carried to the engine bearings, the acid attacks and corrodes the bearing material.

7 Incorrect bearing installation during engine assembly will lead to bearing failure as well. Tight fitting bearings leave insufficient bearing oil clearance and will result in oil starvation. Dirt or foreign particles trapped behind a bearing insert result in high spots on the bearing which lead to failure.

20 Engine overhaul — reassembly sequence

1 Before beginning engine reassembly, make sure you have all the necessary new parts, gaskets and seals as well as the following items on hand:

Common hand tools
A 1/2-inch drive torque wrench
Piston ring installation tool
Piston ring compressor
Short lengths of rubber or plastic hose to fit over connecting rod bolts
Plastigage
Feeler gauges
A fine-tooth file
New engine oil
Engine assembly lube or moly-base grease
RTV-type gasket sealant
Anaerobic-type gasket sealant
Thread locking compound 2

In order to save time and avoid problems, engine reassembly should be done in the following general order:

Piston rings
Crankshaft and main bearings
Piston/connecting rod assemblies
Oil pump, strainer and pan
Cylinder head
Lifters and camshafts
Water pump
Timing pulleys, belt and covers
Cylinder head covers
Oil filter, pressure regulator and oil cooler pipe
Oil pressure sending unit
A/C compressor bracket (if equipped with A/C)
Exhaust manifold
Flywheel/clutch disc/pressure plate or driveplate
Transaxle
Air control valve and intake manifold (do not install until engine/transaxle assembly is reinstalled into vehicle)

21 Piston rings — installation

Refer to illustrations 21.3, 21.4 and 21.10

1 Before installing the new piston rings, the ring end gaps must be checked. It is assumed that the piston ring side clearance has been checked and verified correct (Section 17).

2 Lay out the piston/connecting rod assemblies and the new ring sets so the ring sets will be matched with the same piston and cylinder during the end gap measurement and engine assembly.

3 Insert the top ring into the first cylinder and square it up with the cylinder walls by pushing it in with the top of the piston **(see illustration).** The ring should be near the bottom of the cylinder, at the lower limit of ring travel.

4 To measure the ring end gap, slip feeler gauges between the ends of the ring until a gauge equal to the gap width is found **(see illustration).** The feeler gauge should slide between the ring ends with a slight amount of drag. Compare your measurement to the specified ring end gap. If the gap is larger or smaller than specified, double-check to make sure that you have the correct rings before proceeding. If the gap is not within specification, replace the ring. Do not file the ring end.

5 Repeat the above procedure for all three rings on each piston. Remember to keep rings, pistons and cylinders matched **up.**

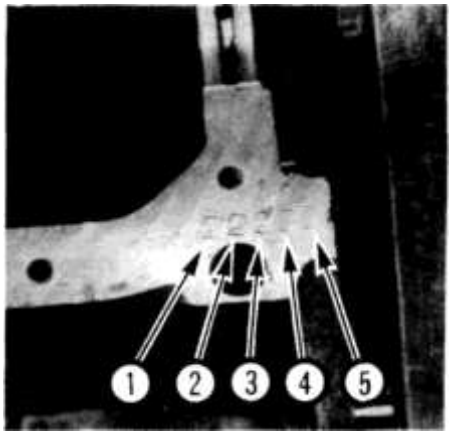
6 Once the ring end gaps have been checked/corrected, the rings can be installed on the pistons.

7 The oil control ring (lowest one on the piston) is installed first. It is composed of three separate components. First, slip the spacer/ex-

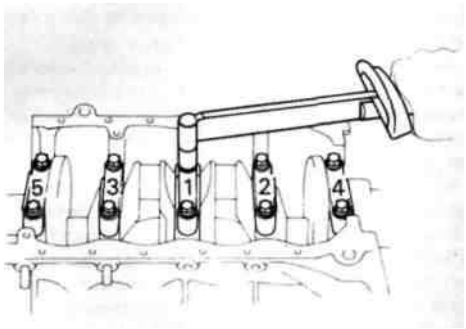
21.10 When installing the compression rings with a ring expander, make sure that the identification mark on the ring faces up

22.10 Lay a Plastigage strip on each main bearing journal — parallel to the crankshaft centerline — then install the lower main bearing halves into the caps, wipe them clean and tighten the caps to the specified torque

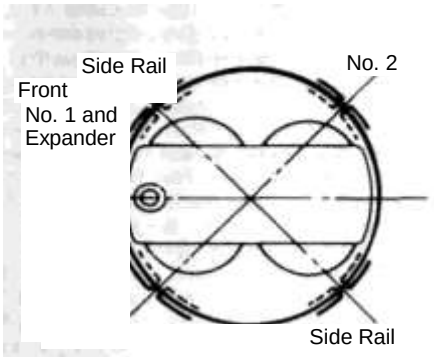
22.14 Remove the main bearing caps and compare the width of the crushed Plastigage to the scale on the container to determine the main bearing oil clearance



22.16 On the underside of the lower right corner of the block, you will find five numbers stamped into the mating surface for the oil pan flange — these numbers (1,2 or 3) indicate the standard size bearing that is installed at each main bearing journal and that must be used when replacing the original bearings



22.20 Gradually tighten the main bearing cap bolts, in three passes, to the specified torque in this order



23.5 The end gaps of the piston rings must be arranged at 90° degree intervals

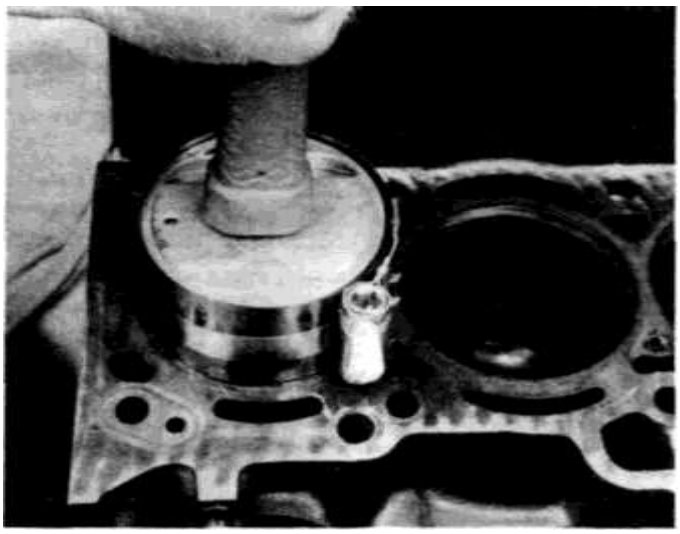
pander into the groove. Next, install the lower side rail. Do not use a piston ring installation tool on the oil ring side rails, as they may be damaged. Instead, place one end of the side rail into the groove he-tween the spacer/expander and the ring land, hold it firmly in place and slide a finger around the piston while pushing the rail into the groove. Finally, install the upper side rail in the same manner.

8 After the three oil ring components have been installed, check to make sure that both the upper and lower side rails can be turned smoothly in the ring groove.

9 The No. 2 (middle) compression ring is installed next. It is stamped with a mark which must face up, toward the top of the piston. **Note:** *Always follow the instructions printed on the ring package or box — different manufacturers may require different approaches. Do not mix up the top and middle rings, as they have different cross sections.*

10 Use a piston ring installation tool and make sure that the identification mark is facing the top of the piston, then slip the ring into the middle groove on the piston **(see illustration).** Do not expand the ring any more than is necessary to slide it over the piston.

11 Install the No. 1 (top) compression ring in the same manner. Make sure the mark is facing up. Be careful not to confuse the No. 1 and No. 2 rings.



23.9 The piston can be gently tapped into the cylinder bore with the end of a wood or plastic hammer handle

12 Repeat the above procedure for the remaining pistons and rings.

22 Crankshaft — installation and main bearing oil clearance check

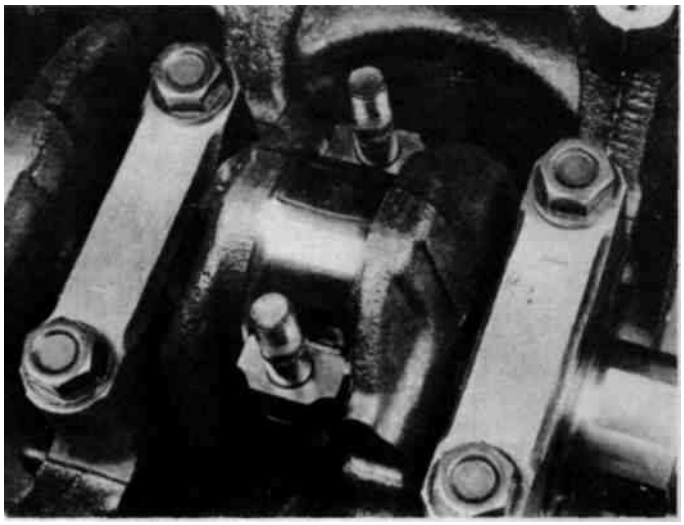
Refer to illustrations 22.10, 22.14, 22.16 and 22.20

1 Crankshaft installation is the first step in engine reassembly. It is assumed at this point that the engine block and crankshaft have been cleaned, inspected and repaired or reconditioned.
2 Position the engine with the bottom facing up.
3 Remove the main bearing cap bolts and lift out the caps. Lay them out in the proper order to ensure that they are installed correctly.
4 If they are still in place, remove the old bearing inserts from the block and the main bearing caps. Wipe the main bearing surfaces of the block and caps with a clean, lint free cloth. They must be kept spotlessly clean.
5 Clean the back sides of the new main bearing inserts and lay one bearing half in each main bearing saddle in the block. Lay the other bearing half from each bearing set in the corresponding main bearing cap. Make sure the tab on the bearing insert fits into the recess in the block or cap. Also, the oil holes in the block must line up with the oil holes in the bearing insert. Do not hammer the bearing into place and do not nick or gouge the bearing faces. No lubrication should be used at this time.
6 Clean the faces of the bearings in the block and the crankshaft main bearing journals with a clean, lint free cloth. Check or clean the oil holes in the crankshaft, as any dirt here can go only one way — straight through the new bearings.
7 Apply a light coat of grease to the backsides of the upper thrust washer halves to hold them in place and insert them into the recessed grooves on either side of the center main bearing saddle. Make sure that the oil grooves face outward.
8 Once you are certain that the crankshaft is clean, carefully place it in position in the block.
9 Before the crankshaft can be permanently installed, the main bearing oil clearance must be checked.
10 Trim several pieces of the appropriate size of Plastigage (they must be slightly shorter than the width of the main bearings) and place one piece on each crankshaft main bearing journal, parallel with the journal axis **(see illustration).**
11 Clean the faces of the bearings in the caps and install the caps in numerical order from front to rear — do not mix them up — with the arrows pointing toward the front of the engine. Do not turn the crankshaft or you will disturb the Plastigage.
12 Starting with the center main and working out toward the ends, tighten the main bearing cap bolts, in three steps, to the specified torque. Do not rotate the crankshaft at any time during this operation. **Note:** *It is not necessary at this time to install the lower thrust washer halves with the center main bearing.*
13 Remove the bolts and carefully lift off the main bearing caps. Keep them in order. Do not disturb the Plastigage or rotate the crankshaft. If any of the main bearing caps are difficult to remove, tap them gently from side-to-side with a soft-face hammer to loosen them.
14 Compare the width of the crushed Plastigage on each journal to the scale printed on the Plastigage container to obtain the main bearing oil clearance **(see illustration).** Check the Specifications to make sure it is correct.
15 If the measured clearance is outside the specified clearance, do not automatically assume that the bearings must be replaced. First, the bearing inserts may be the wrong size — which means that they must be swapped for the correct ones and the clearances remeasured. Second, before deciding that different inserts are needed, make sure that no dirt or oil has been trapped between the bearing inserts and the caps or block. Third, if the Plastigage is wider at one end than the other, the journal may be tapered (refer to Section 18).
16 If, after eliminating the above three possibilities, it remains clear that the oil clearances are incorrect, the bearings must be replaced. Make sure that you replace them with bearings of the same standard size. To determine the size of the bearings in your vehicle's engine, locate the five digit number stamped on the oil pan flange mating surface of the block at the right rear corner of the block **(see illustration).** These numbers denote the size of each main bearing from front to rear. There are three sizes of standard bearings, marked with a 1, 2 or 3, respectively. Replace the old bearings with new bearings of the same number.
17 Carefully scrape all traces of the Plastigage material off the main bearing journals and/or the bearing faces. Do not nick or scratch the bearing faces.
18 Carefully lift the crankshaft out of the engine. Clean the bearing faces in the block, then apply a thin, uniform layer of clean moly-base grease or engine assembly lube to each of the bearing surfaces. Be sure to coat the thrust faces as well as the journal face of the thrust bearing.
19 Make sure the crankshaft journals are clean, then lay the crankshaft back in place in the block. Clean the faces of the bearings in the caps, then apply engine assembly lube to them. Apply a dab of grease to the backsides of the lower thrust washer halves, insert them into their grooves on either side of the center main bearing and install the center main bearing cap. Install the caps in their respective positions with the arrows pointing toward the front of the engine. Install the bolts finger tight.
20 Tighten the main bearing cap bolts to the specified torque in two or three passes in the sequence shown **(see illustration).**
21 Rotate the crankshaft a number of times by hand to check for any obvious binding.
22 Measure the crankshaft end play with a feeler gauge or a dial indicator as described in Section 13. The end play should be correct if the crankshaft thrust faces are not worn or damaged and new bearings have been installed.

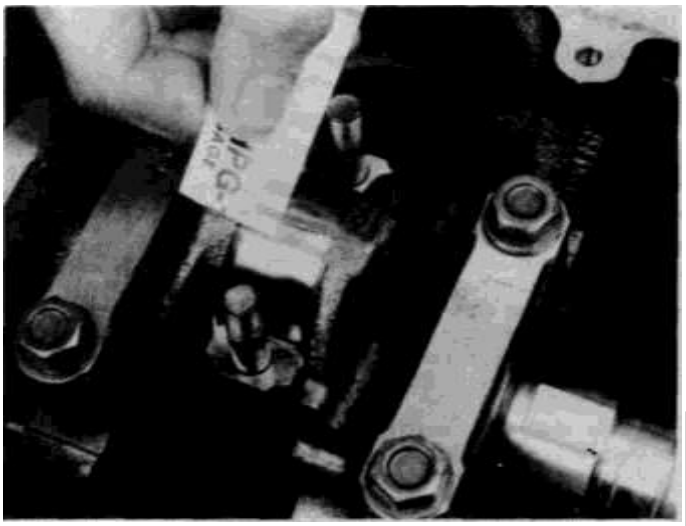
23 Piston/connecting rod assembly — installation and rod bearing oil clearance check

Refer to illustrations 23.5, 23.9, 23.11 and 23.13

1 Before installing the piston/connecting rod assemblies the cylinder walls must be perfectly clean, the top edge of each cylinder must be chamfered and the crankshaft must be in place.
2 Remove the connecting rod cap from the end of the number one connecting rod. Remove the old bearing inserts and wipe the bearing surfaces of the connecting rod and cap with a clean, lint free cloth. They must be kept spotlessly clean.
3 Clean the back side of the new upper bearing half, then lay it in place in the connecting rod. Make sure that the tab on the bearing fits into the recess in the rod. Do not hammer the bearing insert into place and be very careful not to nick or gouge the bearing face. Do not lubricate the bearing at this time.
4 Clean the back side of the new lower bearing insert and install it in the rod cap. Again, make sure the tab on the bearing fits into the recess in the cap, and do not apply any lubricant. It is critically important that the mating surfaces of the bearing and connecting rod are perfectly clean and oil free when they are assembled.
5 Position the piston ring gaps at 90° intervals around the piston **(see illustration),** then slip a section of plastic or rubber hose over each connecting rod cap bolt (refer to Section 12 if necessary).
6 Lubricate the piston and rings with clean engine oil and attach a ring compressor to the piston. Leave the skirt protruding about 1 /4-inch to guide the piston into the cylinder. The rings must be compressed until they are flush with the piston.
7 Rotate the crankshaft until the number one connecting rod journal is at BDC (bottom dead center) and apply a coat of engine oil to the cylinder walls.
8 With the notch on top of the piston facing to the front of the engine, gently insert the piston/connecting rod assembly into the number one cylinder bore and rest the bottom edge of the ring compressor on the engine block. Tap the top edge of the ring compressor to make sure it is contacting the block around its entire circumference.
9 Carefully tap on the top of the piston with the end of a wooden, rubber or plastic hammer handle **(see illustration)** while guiding the end of the connecting rod into place on the crankshaft journal. The piston rings may try to pop out of the ring compressor just before entering the cylinder bore, so keep some downward pressure on the ring compressor. Work slowly, and if any resistance is felt as the piston enters the cylinder, stop immediately. Find out what is hanging up and fix it before proceeding. Do not, for any reason, force the piston into the cylinder, as you will break a ring and/or the piston.
10 Once the piston/connecting rod assembly is installed, the connecting rod bearing oil clearance must be checked before the rod cap is permanently bolted in place.



23.11 Lay the Plastigage strips on each rod bearing journal, parallel to the crankshaft centerline



23.13 Compare the width of the crushed Plastigage with the calibrated scale printed on the wrapper to determine the rod bearing oil clearance

1**1** Cut a piece of the appropriate size Plastigage slightly shorter than the width of the connecting rod bearing and lay it in place on the number one connecting rod journal, parallel with the journal axis **(see illustration).** It must not cross the oil hole in the journal. 1 2 Clean the connecting rod cap bearing face, remove the protective hoses from the connecting rod bolts and install the rod cap. Make sure the mating mark on the cap is on the same side as the mark on the connecting rod. Install the nuts and tighten them to the specified torque, working up to it in three steps. Do not rotate the crankshaft at any time during this operation.

13 Remove the rod cap, being very careful not to disturb the Plastigage. Compare the width of the crushed Plastigage to the scale printed on the Plastigage container to obtain the oil clearance **(see illustration).** Compare it to the Specifications to make sure the clearance is correct. If the clearance is not as specified, the bearing inserts may be the wrong size (which means different ones will be required). Before deciding that different inserts are needed, make sure that no dirt or oil was between the bearing inserts and the connecting rod or cap when the clearance was measured. Also, recheck the journal diameter. If the Plastigage was wider at one end than the other, the journal may be tapered (refer to Section 18).

14 Carefully scrape all traces of the Plastigage material off the rod journal and/or bearing face. Be very careful not to scratch the bearing — use your fingernail or a piece of hardwood. Make sure the bearing faces are perfectly clean, then apply a uniform layer of clean moly-base grease or engine assembly lube to both of them. You will have to push the piston into the cylinder to expose the face of the bearing insert in the connecting rod — be sure to slip the protective hoses over the rod bolts first.

1 5 Slide the connecting rod back into place on the journal, remove the protective hoses from the rod cap bolts, install the rod cap and tighten the nuts to the specified torque. Again, work up to the torque in three steps.

16 Repeat the entire procedure for the remaining piston/connecting rod assemblies. Keep the back sides of the bearing inserts and the inside of the connecting rod and cap perfectly clean when assembling them. Make sure you have the correct piston for the cylinder and that the notch on the piston faces to the front of the engine when the piston is installed. Remember, use plenty of oil to lubricate the piston before installing the ring compressor. Also, when installing the rod caps for the final time, be sure to lubricate the bearing faces adequately.

17 After all the piston/connecting rod assemblies have been properly installed, rotate the crankshaft a number of times by hand to check for any obvious binding.

18 As a final step, the connecting rod end play must be checked. Refer to Section 1 2 for this procedure. Compare the measured end play to the Specifications to make sure it is correct. If it was correct before disassembly and the original crankshaft and rods were reinstalled, it should still be right. If new rods or a new crankshaft were installed, the end play may be too small. If so, the rods will have to be removed and taken to an automotive machine shop for resizing.

24 Initial start-up and break-in after overhaul

1 Once the engine has been installed in the vehicle, double-check the engine oil and coolant levels.

2 With the spark plugs out of the engine and the ignition switch feed wire (pink wire coming from the ignition coil) disconnected, crank the engine until oil pressure registers on the gauge.

3 Install the spark plugs, hook up the plug wires and reconnect the ignition switch feed wire.

4 Start the engine. It may take a few moments for the gasoline to reach the injectors, but the engine should start without a great deal of effort.

5 After the engine starts, it should be allowed to warm up to normal operating temperature. While the engine is warming up, make a thorough check for oil and coolant leaks.

6 Shut the engine off and recheck the engine oil and coolant levels.

7 Drive the vehicle to an area with minimum traffic, accelerate at full throttle from 30 to 50 mph, then allow the vehicle to slow to 30 mph with the throttle closed. Repeat the procedure 10 or 12 times. This will load the piston rings and cause them to seat properly against the cylinder walls. Check again for oil and coolant leaks.

8 Drive the vehicle gently for the first 500 miles (no sustained high speeds) and keep a constant check on the oil level. It is not unusual for an engine to use oil during the break-in period.

9 At approximately 500 to 600 miles, change the oil and filter.

10 For the next few hundred miles, drive the vehicle normally. Do not pamper it or abuse it.

11 After 2000 miles, change the oil and filter again and consider the engine fully broken in.

Chapter 3
Cooling, heating and air conditioning systems

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Specifications

Thermostat valve opening temperature	80 to 84°C (1 76 to 183°F)
Radiator water filler cap opening pressure	74 to 103 kPa (10.7 to 14.9 psi)
Minimum cooling system operating pressure.....	88 kPa (12.8 psi)
Radiator cooling fan motor operating current.....	5.8 to 7.4 amps
Engine room fan tempererature sensor resistance	
more than 380 ohms.....	less than 64°C (147°F)
less than 300 ohms	more than 80 °C (176°F)
Engine room fan motor operating current	1.5 to 2.7 amps
Drive belt tension	
alternator	
new belt	175 ± 5 lb
used belt	115 ± 20 lb
air conditioner	
new belt	160 ± 20 lb
used belt	105 ± 10 lb
Air conditioning system oil capacity	
compressor	
if only compressor is replaced	20 cc (0.7 oz)
if evaporator is replaced	40 to 50 cc (1.4 to 1.7 oz)
condenser.....	40 to 50 cc (1.4 to 1.7 oz)

Torque specifications	**Nm**	**Ft-lbs**
Water pump mounting bolts.....	15	11
Flexible hoses-to-compressor		
discharge line	25	18
suction line	25	18
Liquid tubes-to-accumulator.....	13	10
Tubes-to-condenser		
liquid	13	10
discharge.....	18	13
Expansion valve-to-evaporator inlet fitting.....	32	24
Liquid line-to-expansion valve inlet fitting	13	10
Liquid tube-to-cooling unit inlet fitting	13	10
Suction tube-to-cooling unit outlet fitting	32	**24**

1 General information

Refer to illustration 1.6

The cooling system consists of a radiator, coolant recovery bottle, a pair of thermostatically controlled cooling fans at the radiator, a single thermostatically controlled fan in the engine compartment, the thermostat, and a belt-driven water pump.

The cross-flow design radiator is located forward of the front luggage compartment. If your vehicle is equipped with an automatic transaxle, the radiator is fitted with inlet and outlet fittings which circulate transmission fluid through a heat exchanger inside the radiator. Vehicles equipped with air conditioning have a condenser mounted directly in front of the radiator.

A pressurized water filler cap, located in the engine compartment just in front of the coolant recovery bottle, allows a rated buildup of 0.9 bar (13 psi) in the cooling system.

A plastic recovery bottle is located in the right rear corner of the engine compartment, just behind the pressure cap/filler neck to which it is connected by an overflow hose. As the engine warms up, the coolant expands and flows from the filler neck into the recovery bottle. When the engine is stopped, the coolant is drawn back into the radiator, maintaining the proper level of coolant at all times.

Two radiator cooling fans, mounted just behind the radiator, are driven by electric motors activated by a coolant temperature fan switch or by the air conditioning system. An engine compartment fan, located at the air intake on the right side of the vehicle, blows cooling air over the hot (exhaust) side of the engine when activated either by an ambient air temperature sensor or a water temperature switch in the rear cover.

The water pump is mounted at the right rear corner of the engine block and is driven by a belt from the crankshaft pulley. The pump draws coolant from the radiator and circulates it through water jackets in the engine block and cylinder head. Coolant travels between the radiator and engine through stainless steel pipes **(see illustration)** running underneath the vehicle along the right side of the fuel tank.

Some of the heated coolant is diverted through the heater core located inside the dashboard on the right side of the passenger compartment. A fan blows the heated air through several heating ducts located in the dash.

Air conditioning is available as an option. The compressor is mounted on the front of the engine. The condenser is located in front of the radiator. The accumulator is mounted in the left rear corner of the luggage compartment and the evaporator is housed inside the dashboard with the heater core.

2 Antifreeze — general information

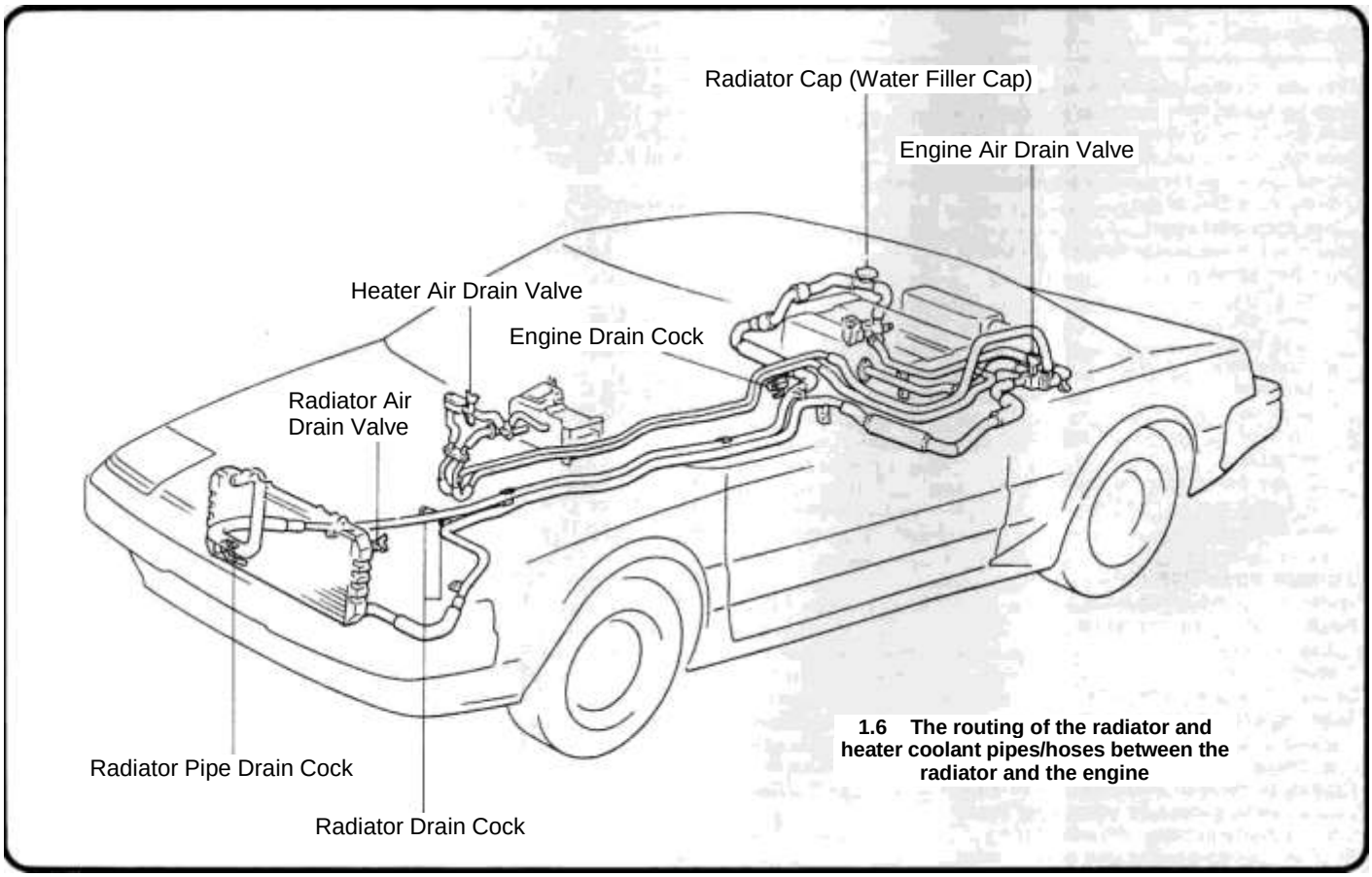
Warning: *Do not allow antifreeze to come in contact with your skin or painted surfaces of the vehicle. Flush contacted areas immediately with plenty of water. Do not store new coolant or leave old coolant lying around where it is easily accessible to children and pets, because they are attracted by its sweet taste. Ingestion of even a small amount can be fatal. Wipe up the garage floor and drip pan coolant spills immediately. Keep antifreeze containers covered and repair leaks in your cooling system immediately.*

The cooling system should be filled with a water/ethylene glycol based antifreeze solution which will prevent freezing down to at least -20 °F. It also provides protection against corrosion and increases the coolant boiling point.

The cooling system should be drained, flushed and refilled at least every other year (see Chapter 1). The use of antifreeze solutions for periods of longer than two years is likely to cause damage and encourage the formation of rust and scale in the system.

Before adding antifreeze to the system, check all hose connections. Antifreeze can leak through very minute openings.

The exact mixture of antifreeze to water which you should use depends on the relative weather conditions. The mixture should contain at least 50 percent antifreeze, but should never contain more than 70 percent antifreeze.



1.6 The routing of the radiator and heater coolant pipes/hoses between the radiator and the engine

3 Thermostat — removal and installation

Refer to illustrations 3.3, 3.4 and 3.6

1 Drain the engine coolant (refer to Chapter 1).
2 Remove the battery (refer to Chapter 1).
3 Disconnect the hose from the air bleeder valve **(see illustration).**
4 Remove both bolts and separate the water inlet housing halves **(see illustration).**
5 Remove the thermostat. If necessary, pry it loose with a small screwdriver.
6 Be sure to install a new O-ring on the new thermostat **(see illustration).**
7 Installation is the reverse of removal.

4 Thermostat — check

Refer to illustration 4.2

1 Remove the thermostat (refer to Section 3).
2 Immerse the thermostat in water **(see illustration)** and bring the water to a boil.
3 Note the temperature of the water at the moment that the valve opens and compare it to the specified valve opening temperature.
4 If the thermostat fails to open at the rated temperture, replace it.

5 Recovery bottle — removal and installation

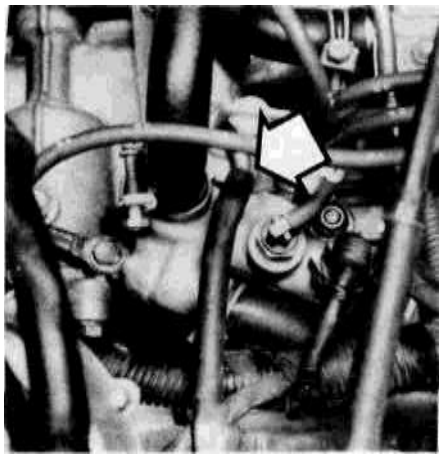
Refer to illustrations 5.2 and 5.3

1 Remove the recovery bottle cap — leave the overflow hose attached — and set it aside.
2 Disconnect the air bleeder valve hose from the left side of the bottle **(see illustration).**
3 Lift the bottle straight up and remove it **(see illustration).**
4 Installation is the reverse of removal.

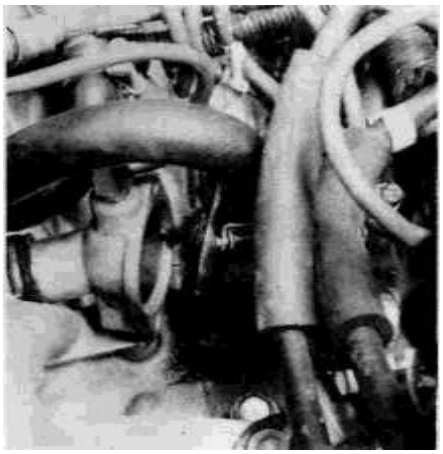
6 Radiator electric cooling fans — test, removal and installation

*Refer to illustrations 6.2, 6.5, 6.6a, 6.6b, 6.9, 6.12a, 6.12b, 6.**14,** 6.17a, 6.17b, 6.18 and 6.19*

Note: *MR2s without air conditioning have a single radiator fan (the right one). Air conditioning-equipped vehicles are fitted with a con-*

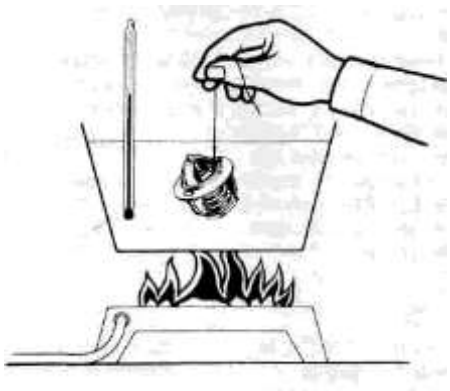


3.3 To remove the thermostat, disconnect the small rubber hose (arrow) from the air bleeder valve and remove the housing bolts

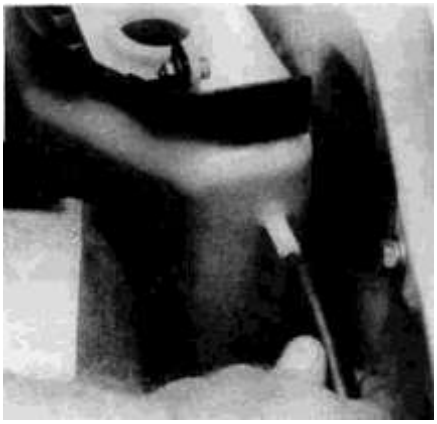


3.4 Split the water inlet housing halves apart, exposing the thermostat

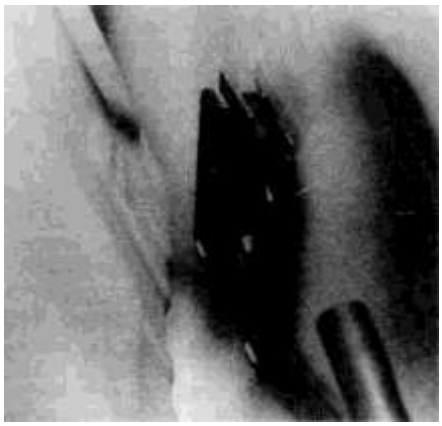
3.6 Be sure to install a new O-ring seal onto the new thermostat



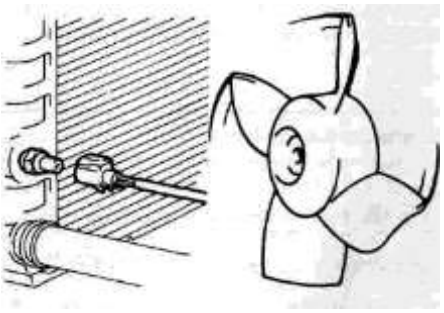
4.2 To test the thermostat, immerse it in water and gradually bring the water to a boil — if the valve doesn't open when the water reaches the specified temperature, replace the thermostat



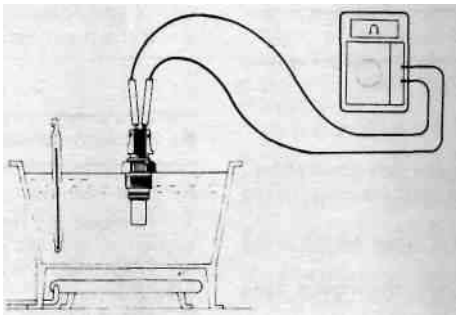
5.2 Detach the air bleeder valve hose from the left side of the recovery bottle



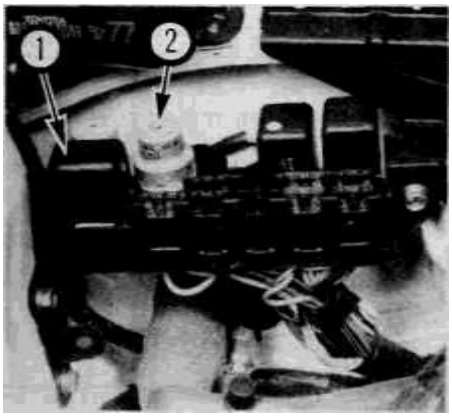
5.3 The back of the recovery bottle is slotted to slide on and off this metal bracket bolted to the engine compartment rear firewall — to separate the bottle, lift straight up; to install it, line up the bracket with the grooves and push straight down



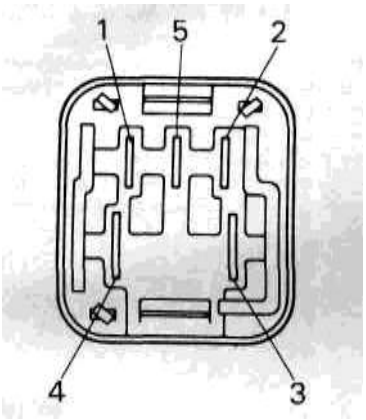
6.2 The temperature switch is located in the left rear side of the radiator, just above the radiator hose — when the electrical connector is unplugged and the key is turned to On, the fan should come on



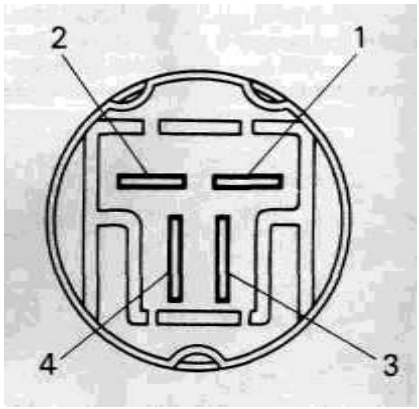
6.5 Below 83°C the temperature switch should have continuity between its two terminals



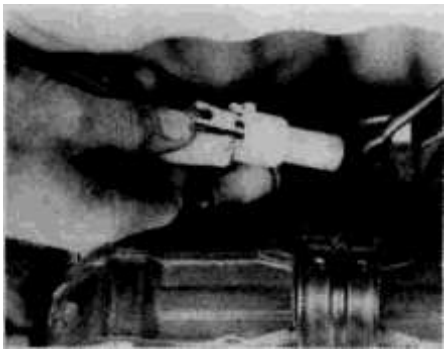
6.6a The No. 5 junction block is located in the right rear corner of the front luggage compartment — the fan main relay (1) and the No. 1 fan relay (2) must be tested for continuity and operation if the fan motor circuit malfunctions



6.6b The fan main relay has five terminals



6.9 The radiator fan relay No. 1 has four terminals



6.12a To test the fan motor, disconnect the electrical connector and attach a jumper wire between the battery and one terminal of the connector and another between the other terminal and ground

denser fan (the left one). The following tests apply to both fans, unless otherwise noted.

On-vehicle test

Low temperature (below 83°C or 181 °F)

1 Turn the ignition key to the On position (don't start the engine). The radiator fan should not be running. If it is, check the fan relays, the temperature switch and the circuit between the relay and the temperature switch for a separated connector or severed wire (refer to the wiring diagrams at the end of this manual).

2 Disconnect the electrical connector from the coolant temperature switch **(see illustration)** at the lower left side of the radiator. The fan should come on. If it doesn't, check the fan relay, fan motor, ignition relay and fuse, and check for a short circuit between the fan relay and temperature switch (refer to the wiring diagrams at the end of this manual).

3 Reconnect the temperature switch connector.

High temperature test (above 93°C or 199°F)

4 Start the engine and warm it to above 93 °C (199°F). You can determine the temperature of the coolant by inserting a thermometer in the filler neck. When the coolant exceeds 93 °C, the fan should come on. If it doesn't, check the temperature switch.

Temperature switch test

5 The easiest way to test the temperature switch is to check con tinuity between its two terminals with an ohmmeter while the switch is immersed in gradually heating water **(see illustration).** When the coolant temperature is below 83°C(181 °F), there should be continuity. When the coolant temperature is above 93 °C (199°F), there should be no continuity. If the switch fails either test, replace it. **Note:** *This test can also be done without removing the switch from the engine — just warm up the engine and check continuity as the coolant temperature rises.*

Fan main relay test

6 The fan main relay is located in the No. 5 junction block **(see illustration)** in the right rear corner of the front luggage compartment. When performing the following test, be sure to use the correct terminal numbers **(see illustration).**

7 Using an ohmmeter check the continuity between the following relay terminals: There should be continuity between terminals 1 and 2; there should be continuity between terminals 3 and 5; there should *not* be continuity between terminals 3 and 4. If the fan main relay fails any of the above three checks, replace it.

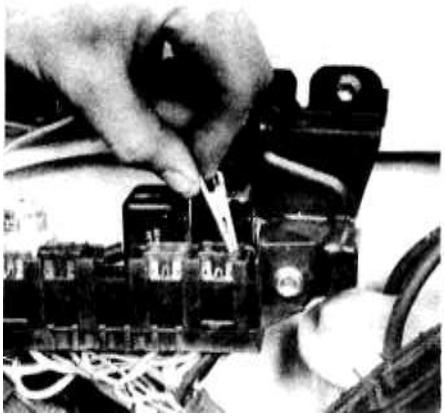
8 Check the operation of the relay by applying battery voltage across terminals 1 and 2: There should be continuity between terminals 3 and 4; there should be no continuity between terminals 3 and 5. If the relay fails either of these tests, replace it.

No. 1 fan relay checks

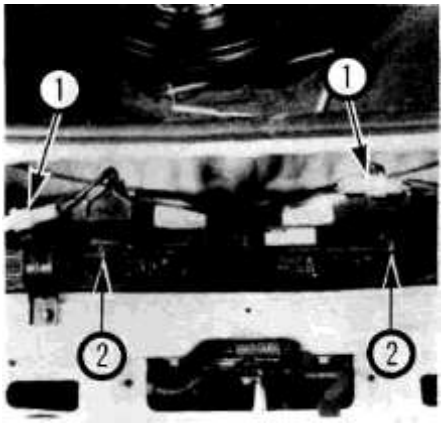
9 The No. 1 fan relay is located in the No. 5 junction block in the right rear corner of the front luggage compartment. When performing the following test be sure to use the correct terminal numbers **(see illustration).**

10 Using an ohmmeter, verify that there is continuity between terminals 1 and 2 and between terminals 3 and 4. If the No. 1 fan relay fails either continuity test, replace it.

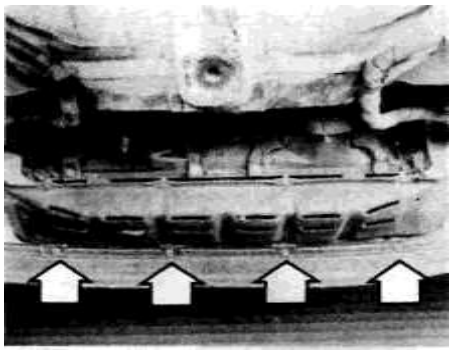
11 To check the operation of the No. 1 fan relay, apply battery voltage across terminals 1 and 2. There should be no continuity between terminals 3 and 4. If there is, replace the relay.



6.12b Any of the spade connectors protruding through the tops of the fuses provides a good power source for the jumper wire to the motor

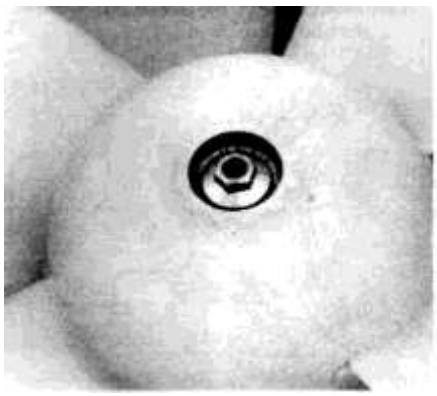


6.14 Disconnect the fan motor connectors (1) and remove the fan shroud-to-radiator bolts (2)

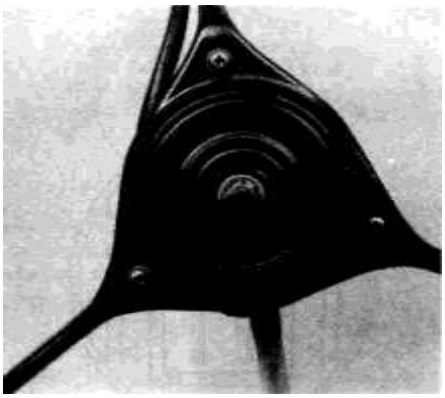


6.17a Remove the four bolts that attach the fan shroud assembly to the radiator

6.17b Carefully lower the fan/shroud assembly and remove it



6.18 Remove the fan nut



6.19 Remove the C-clip from the fan motor shaft and the three Phillips screws that attach the motor to the shroud frame

Fan motor check

12 To check the operation of the fan motor, disconnect the electrical connector from the wire harness, connect it to any available hot wire and ground it **(see illustrations).** The fan should come on. If it doesn't, replace the fan motor.

Fan motor replacement

13 Disconnect the cable from the negative terminal of the battery.
14 Remove the cooling fan electrical connectors **(see illustration).** 1
5 Remove the two bolts that attach the fan shrouds to the radiator.
16 Raise the front of the vehicle and place it securely on jackstands.
17 Remove the four bolts along the bottom edge of the fan shrouds **(see illustration),** lower the fan/shroud assembly and remove it **(see illustration).**
18 Remove the fan nut **(see illustration)** and remove the fan.
19 Pop off the fan motor shaft C-clip with a small screwdriver and remove the three motor mounting screws **(see illustration).** Remove the motor from the shroud.
20 Installation is the reverse of removal.

7 Engine compartment cooling fan — test, removal and installation

Refer to illustrations 7.2, 7.5, 7.6a, 7.6b, 7.9, 7.12 and 7.13

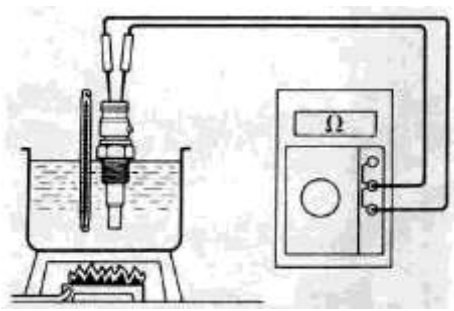
On-vehicle tests

Low temperature test (below 64°C or 147°F)

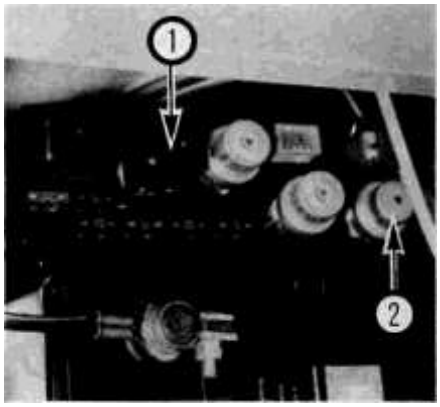
1 Turn on the ignition switch. Verify that the fan is not running. If it is, check the fan relay and temperature sensor and inspect the circuit for a separated connector or severed wire between the relay and the temperature sensor.

7.2 Locate the temperature sensor and electrical connector on the small bracket at the front left corner of the cylinder head — when this connector is unplugged, the fan should come on — if it doesn't, test the sensor

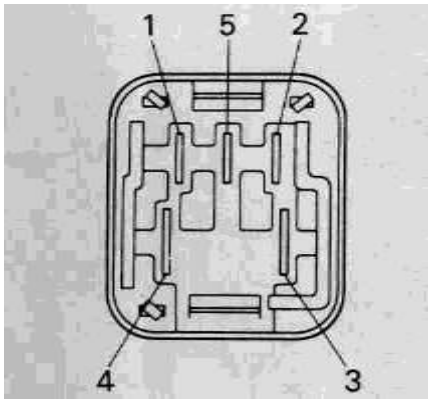
2 Disconnect the temperature sensor connector **(see illustration).** The fan should come on. If it doesn't, check the fan relay, fan motor, engine main relay, temperature sensor and cooling fan computer.
3 Connect the temperature sensor connector.



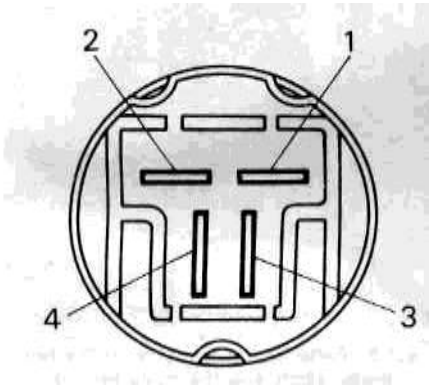
7.5 To measure the resistance of the sensor, remove it and immerse it in gradually heated water — when the water temperature is less than 64°C (147°F), the resistance should be more than 380 ohms. When the water temperature exceeds 80°C (176°F), resistance should be less than 300 ohms



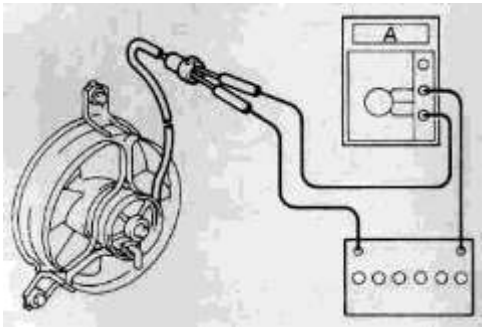
7.6a Junction block No. 2 is located in the left front corner of the engine compartment — if there is a problem with the engine compartment cooling fan, the engine main relay (1) and the vent fan relay (2) must be checked for continuity and operation to make sure that both are working properly



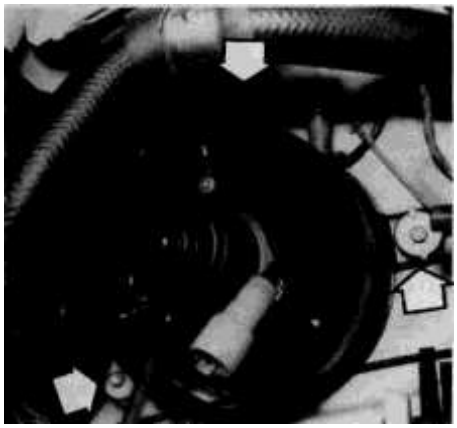
7.6b The engine main relay has five terminals



7.9 The vent fan relay has four terminals



7.12 To verify that the fan motor works, attach a jumper wire between the battery and the fan motor pigtail electrical connector and another wire between the connector and ground — if the fan does not run, replace the fan motor (Note that an ammeter can be used to determine that the motor is passing the specified current)



7.13 Disconnect the engine compartment cooling fan electrical connector and the three mounting bolts and washers

High temperature test (above 80°C or 176°F)

4 Start the engine. Raise the engine temperature to above 80 °C (176°F). The fan should now operate. If it doesn't, test the temperature sensor. **Note:** *The easiest way to determine the correct engine coolant temperature is to insert a thermometer into the filler neck.*

Temperature sensor test

5 Using an ohmmeter, immerse the temperature sensor in water and measure the resistance of the sensor while gradually bringing it to a boil **(see illustration).** When the temperature is less than 64°C (147°F), the resistance should be more than 380 ohms; when the temperature rises above 80°C (176°F), the resistance should be less than 300 ohms. If the sensor fails either test, replace it.

Engine main relay test

6 The engine main relay is located in the No. 2 junction block in the left front corner of the engine compartment **(see illustration).** Be sure to use the correct terminals for the following tests **(see illustration).**

7 To check relay continuity, use an ohmmeter to confirm that there is continuity between terminals 1 and 2 and between terminals 3 and 5; there should be *no* continuity between terminals 3 and 4. If the main relay fails any of these three tests, replace it.

8 To check the operation of the relay, apply battery voltage across terminals 1 and 2. Using an ohmmeter, verify that there is continuity between terminals 3 and 4 and no continuity between terminals 3 and 5. If the relay fails either test, replace it.

Vent fan relay test

9 The vent fan relay is also located in the No. 2 junction block in the left front corner of the engine compartment. When performing the following test, be sure to use the correct terminals **(see illustration).**

10 To check relay continuity, use an ohmmeter to confirm that there is continuity between terminals 1 and 2 and between terminals 3 and 4. If the relay fails either check, replace it.

11 To check relay operation, apply battery voltage across terminals 1 and 2. There should be no continuity between terminals 3 and 4. If there is, replace the relay.

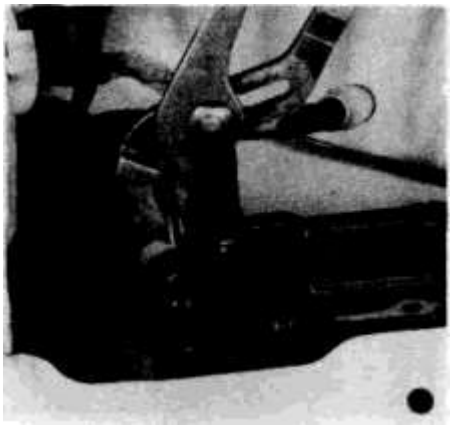
12 Connect the battery directly to the fan motor connector **(see illustration)** and ground the connector. If the fan does not operate, replace it.

Fan replacement

13 Remove the three bolts and spacer washers **(see illustration)** and disconnect the electrical connector. Remove the electric cooling fan assembly.

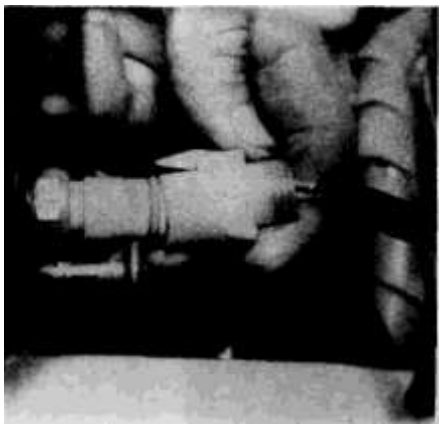
14 Remove the fan nut and the fan **(see illustration in Section 6).** 15 Remove the three fan motor mounting screws and remove the motor **(see illustration in Section 6).**

16 Assembly and installation are the reverse of removal.

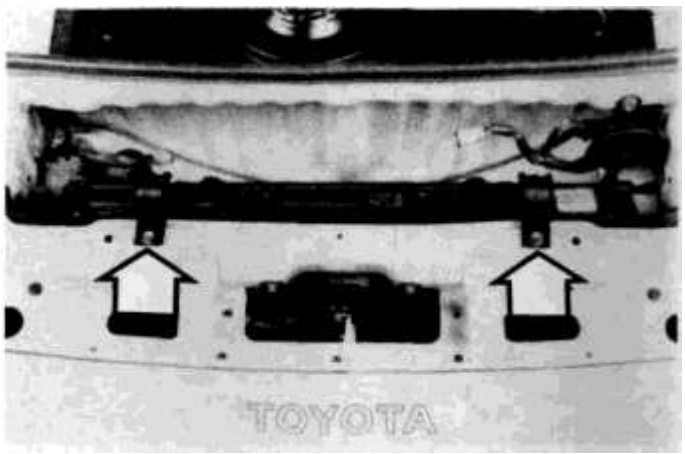


8.3a To remove the radiator, use a pair of channel lock pliers to pinch the radiator upper hose clamp and slide it back, then detach the hose from the radiator

8.3b Disconnect the lower radiator hose by squeezing the clamp



8.4 Unplug the electrical connector from the temperature switch located at the lower left backside of the radiator



8.5 Remove the radiator retaining bracket bolts and brackets and lift the radiator out of the vehicle

8 Radiator — removal, servicing and installation

Refer to illustrations 8.3a, 8.3b, 8.4, 8.5 and 8.12

Removal

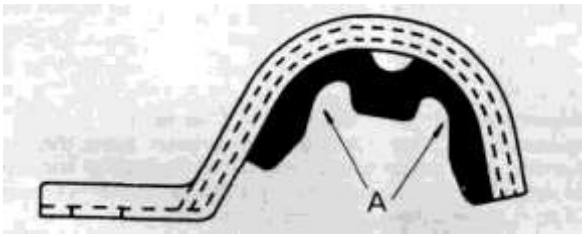
1 Drain the coolant (refer to Chapter 1).
2 Remove both electric cooling fans (refer to Section 6).
3 Disconnect the upper and lower radiator hoses **(see illustrations).**
4 Disconnect the temperature switch electrical connector from the lower left backside of the radiator **(see illustration).**
5 Remove both upper radiator support bolts and the supports **(see illustration).**
6 Remove the radiator from the vehicle.

Servicing

7 Carefully examine the radiator for evidence of leaks and damage. Any necessary repairs should be performed by a radiator repair shop.
8 With the radiator removed, brush accumulations of insects and leaves from the cooling fins.
9 Inspect the radiator hoses. If they have become cracked, swollen or otherwise deteriorated, replace them.
10 Flush the radiator as described in Chapter 1.
11 Replace the radiator cap with a new one of the same rating. If the cap is relatively new, have it pressure tested at a service station.

Installation

12 Installation is the reverse of removal. Make sure that the radiator support bracket rubber insulators are properly seated against the top



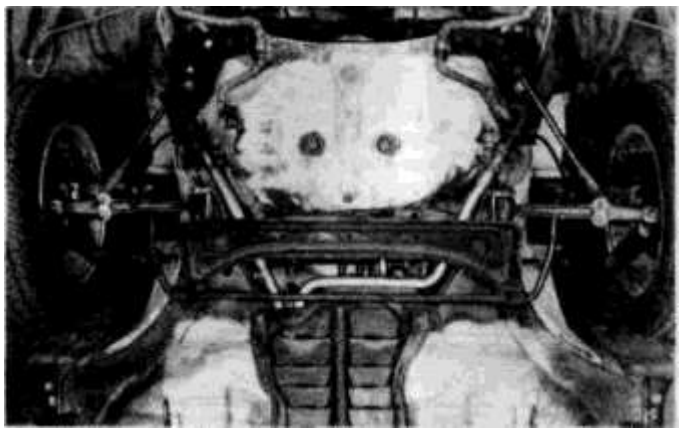
8.12 When reinstalling the radiator, make sure that the rubber cushions between the top of the radiator and the brackets are not pinched at A — if they are, the insulators will crack and the radiator will start rubbing against the brackets

of the radiator **(see illustration).** If they are pinched when the support bracket bolts are tightened, they will be damaged and will have to be replaced.

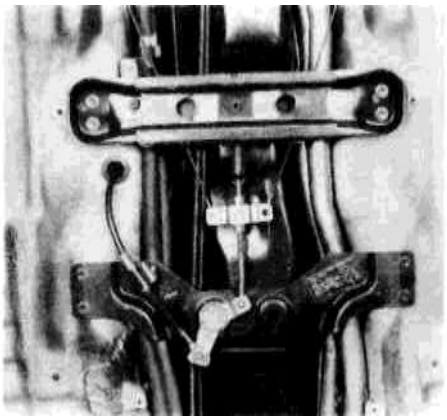
9 Coolant and heater pipes — removal and installation

Refer to illustrations 9.3, 9.6 and 9.8

1 Drain the coolant (refer to Chapter 1).
2 Remove the front and rear fuel tank protectors.
3 Remove the four front crossmember bolts and the crossmember **(see illustration).**

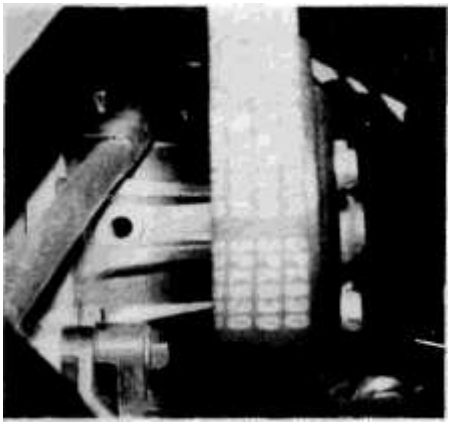


9.3 Remove the front crossmember bolts and the crossmember, then remove the swaybar bolts and the sway bar (refer to Chapter 10 for additional information regarding the sway bar)



9.6 Both the middle crossmember bolts and the parking brake cable support bracket bolts must be removed and the support bracket and crossmember set aside to get at the coolant pipes

9.8 Remove both pairs of front coolant pipe bracket bolts from the left (shown) and right undersides of the front luggage compartment well — you will also need to loosen the hose clamps and detach the coolant pipes from both radiator hoses



10.3 If the seal in the water-pump fails, coolant will drip out of the weep hole, which can be viewed by looking straight up from underneath the engine at the right rear corner of the block (use a flashlight)

4 Remove the front sway bar (refer to Chapter 10).
5 Disconnect the right parking cable bracket from the middle crossmember, slide the cable grommet out of the bracket and disconnect the right parking brake cable from the equalizer (refer to Chapter 9, if necessary, for illustrations of this procedure).
6 Remove the parking brake cable support bracket bolts **(see illustration)** and set the bracket to one side.
7 Remove the middle crossmember.
8 Remove the forward coolant pipe bracket bolts from both sides of the front luggage compartment well **(see illustration).**
9 Remove the middle coolant pipe bracket bolt.
10 Remove the rear bracket bolts.
11 Loosen the hose clamps and detach the coolant pipes from the engine coolant hoses.
1 2 Loosen the hose clamps and detach the coolant pipes from the radiator coolant hoses.
13 Remove the coolant pipe assembly.
14 Installation is the reverse of removal.

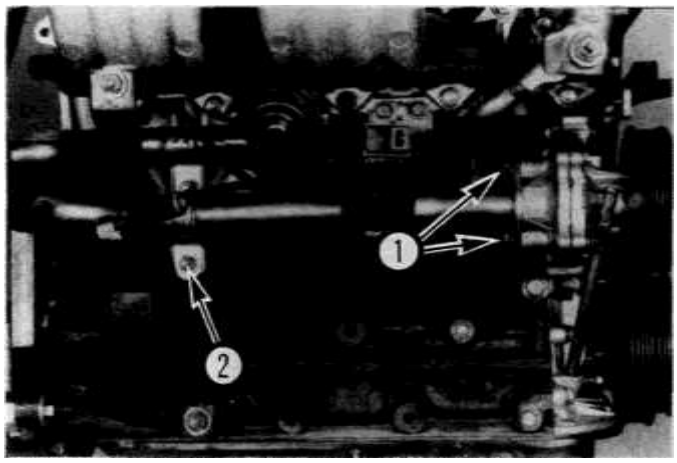
10 Water pump — check

Refer to illustration 10.3

1 A failure in the water pump can cause overheating and serious engine damage because a defective pump will not circulate coolant through the engine.
2 There are two ways to check the operation of the water pump while it is still installed on the engine. If either check indicates that the pump is defective, replace it with a new or rebuilt unit.
3 The water pump body has a "weep" hole in its underside **(see** illustration). If the pump seal fails, small amounts of coolant will leak through the weep hole. You will need to get underneath the water pump to see the weep hole, so raise the vehicle and place it on jackstands. Use a flashlight to help you determine whether there is evidence of leakage from the weep hole.
4 If the water pump shaft bearing fails it will usually emit a squealing sound (do not confuse drivebelt slippage, which makes a similar sound, with water pump bearing failure). Even before the bearing actually fails, shaft wear can be detected by grasping the pulley firmly and moving it up and down. If excessive side play is noted, the shaft and/or the bearing are worn and the pump should be replaced.

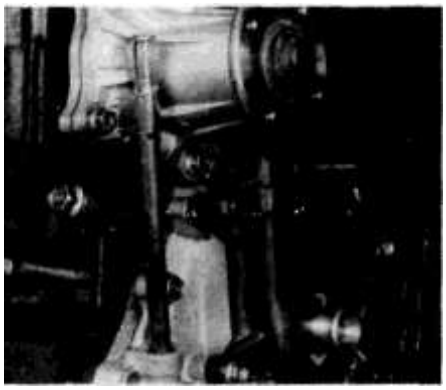
11 Water pump — **removal and installation**

Refer to illustrations 11.6, 11.8, 11.10 and 11.11 1
Drain the coolant (refer to Chapter **1**).

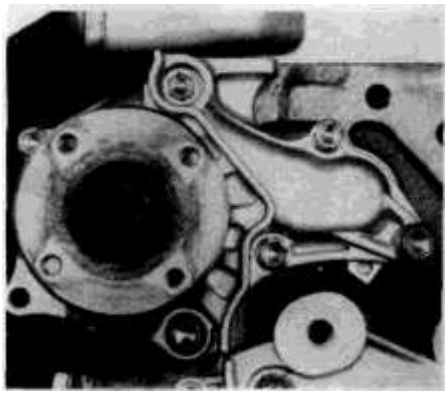


11 6 To disconnect the water inlet pipe from the water pump, remove the two bolts (1) that attach the water inlet pipe flange to the water pump, remove the inlet pipe bracket-to-block bolt (2) and pull the inlet pipe away from the pump

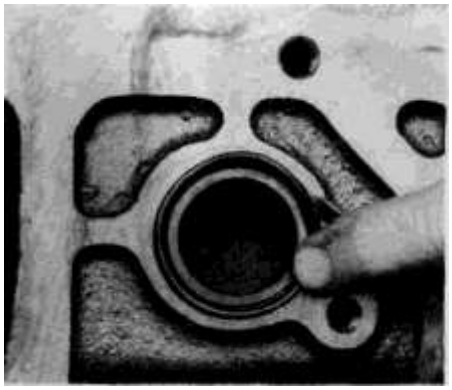
2 If your vehicle is equipped with air conditioning, loosen the idler pulley and remove the A/C compressor drivebelt (refer to Chapter 1 if necessary).
3 Loosen but do not remove the water pump pulley bolts.
4 Loosen the alternator adjustment bolt and pivot nut (refer to Chapter 5 if necessary). Pivot the alternator forward (toward the engine) and remove the drivebelt.
5 Remove the water pump pulley.
6 Remove the two nuts that attach the water inlet pipe flange to the water pump **(see illustration).**
7 Remove the water inlet pipe bracket bolt and pull the inlet pipe away from the water pump.
8 Remove the dipstick tube support bracket bolt **(see illustration)** and pull out the dipstick tube. Plug the dipstick hole in the top of the oil pump.
9 Remove the upper and middle timing belt covers (refer to Chapter 2 Part A).
10 Remove the water pump bolts **(see illustration)** and the pump.
11 Remove the water pump O-ring from the block **(see illustration).**
12 Install a new O-ring into the groove in the water pump mating surface on the block.
13 Installation is the reverse of removal.



11.8 To free the dipstick tube, simply remove the tube bracket bolt from the water pump (note that this bolt is also one of the bolts that holds the water pump halves together) and lift the tube out of the hole in the top of the oil pump housing — be sure to plug the hole in the oil pump with a rag until reassembly

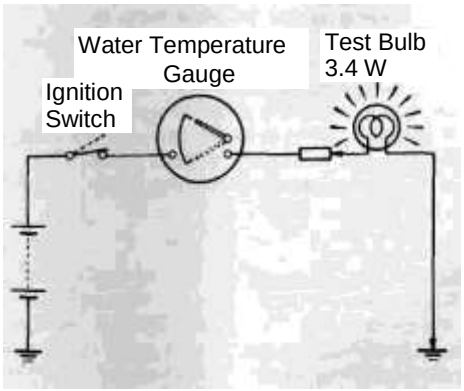


11.10 Remove these five bolts to separate the water pump from the block

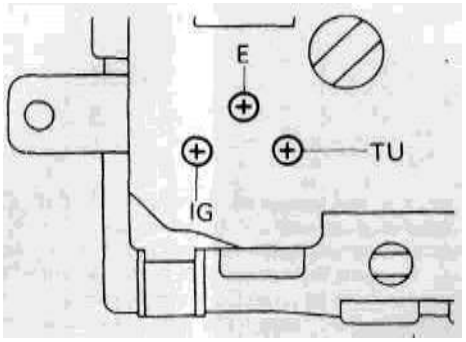


11.11 Always remove and discard the old O-ring when replacing the pump

12.1 The coolant temperature gauge sending unit is screwed into the water outlet at the right rear corner of the cylinder head right above the alternator



12.2 To test the operation of the gauge, detach the electrical connector from the sending unit and ground the terminal through a 3.4W bulb — when the ignition switch is turned on, the bulb should light and the gauge needle should operate — if it doesn't, remove the gauge (see Chapter 12) and measure the resistance between the terminals



12.4 The resistance between terminals IG and TU, TU and E and IG and E should be 145.8, 201.8 and 56 ohms, respectively — if the resistance between any two terminals is not as indicated, replace the gauge

12 Coolant temperature indicator circuit — check and sending unit replacement

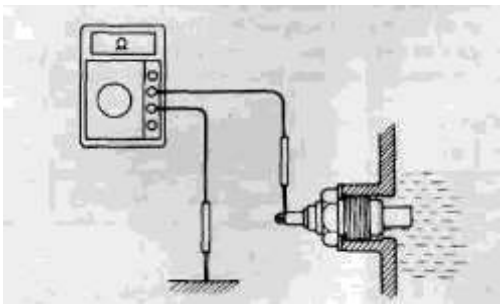
Refer to illustrations 12.1, 12.2, 12.4 and 12.5

1 Locate the temperature gauge sender unit electrical connector at the water outlet on the right rear corner of the cylinder head **(see illustration).**

2 Unplug the connector from the sender gauge and ground the connector terminal through a 3.4W light bulb **(see illustration).** Turn the ignition key to On. The bulb should light and the gauge needle should operate. If it doesn't, remove the gauge (see Chapter 12) and test it.

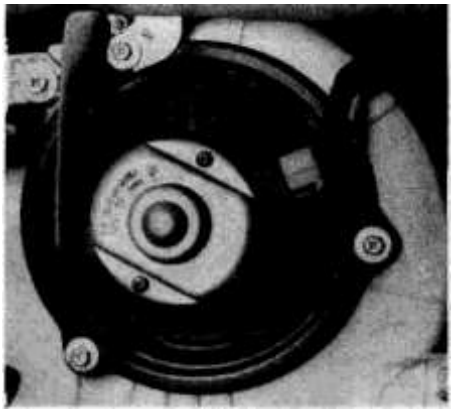
3 If you don't have a 3.4W bulb, turn the ignition key to On and disconnect the electrical connector from the sender unit — the temperature gauge needle should peg itself to the left side of the gauge (no current). Now ground the connector — the needle should peg itself to the right side of the gauge (full current). If it doesn't, remove the gauge (see Chapter 12) and test it.

4 To test the temperature gauge, use an ohmmeter to measure the resistance between terminals IG and TU, TU and E and IG and E **(see illustration).** The indicated values should be 145.8, 201.8 and 56 ohms, respectively. If all three resistance readings are not as indicated, replace the temperature gauge.

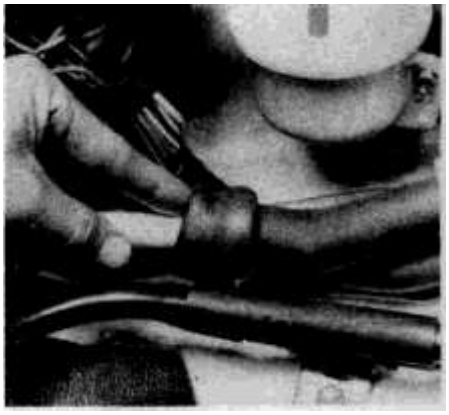


12.5 The resistance between the sending unit terminal and ground at 50°C (122°F) and 115°C (239°F) should be 192.4 to 259.6 ohms and 24.19 to 28.11 ohms, respectively — if the resistance values are not as indicated, replace the sending unit

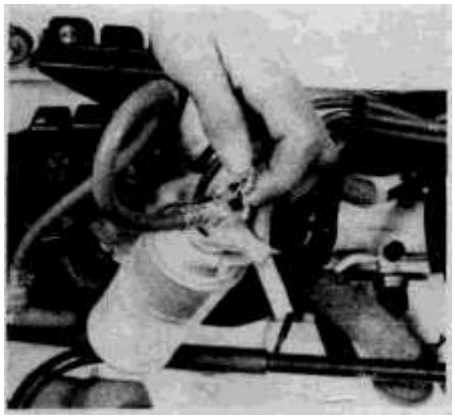
5 To test the sender unit, use an ohmmeter to measure the resistance between the terminal and ground **(see illustration)** as the engine coolant warms up. When the coolant temperature reaches 50 °C (122°F), the indicated resistance should be between 192.4 and 259.6 ohms. When



13.4 To remove the blower motor, unplug the electrical connector, disconnect the air cooling tube from the motor and remove the three mounting screws



14.9 To determine if there is sufficient refrigerant in the air conditioning system, peel back the insulation, place one hand on the evaporator inlet pipe as shown, place the other hand on the accumulator and compare the difference — if both feel about the same temperature and if both are a little cooler than the ambient temperature, the freon level is satisfactory. If the inlet pipe has frost on it or feels cooler than the accumulator, add freon



14.12 To add refrigerant to the air conditioning system, attach the hose fitting to the evaporator inlet pipe as shown and fill in accordance with the manufacturer's instructions

the coolant temperature reaches 115°C (239°F), the indicated resistance should be between 24.19 and 28.11 ohms. If both resistance values are not as indicated, replace the sender unit. 6 Remove the sender unit with a wrench. Before installing a new unit, be sure to wrap the threads with teflon sealing tape to prevent a coolant leak. Tighten the new unit securely, attach the electrical connector and warm up the engine to verify that the gauge is working properly.

13 Heater blower motor — removal and installation

Refer to illustration 13.4

1 Disconnect the cable from the negative terminal of the battery.
2 Remove the glove box lid, the glove box and the dash panel underneath the glove box (refer to Chapter 11).
3 Remove both vent duct screws and the vent duct.
4 Disconnect the blower motor electrical connector, remove the blower motor mounting screws and remove the blower motor **(see illustration).**
5 Installation is the reverse of removal.

14 Air conditioning system — check and maintenance

Refer to illustration 14.9 and 14.12

Warning: *The air conditioning system is under high pressure. Do not remove any component of the system before taking the system to a dealer or automotive air conditioning repair facility and having it discharged.*

1 The following maintenance steps should be performed on a regular basis to ensure that the air conditioner continues to operate at peak efficiency.

a) Check the tension of the drivebelt and adjust if necessary (Chapter 1).
b) Inspect the condition of the hoses. Check for cracking, hardening or other deterioration. **Warning:** *Do not replace A/C hoses until the system has been discharged by a dealer or air conditioning specialist.*
c) Inspect the fins of the condenser for leaves, bugs and any other foreign material. A soft brush and compressed air can be used to remove them. d) Maintain the correct refrigerant charge.

2 The A/C compressor should be run for about 10 minutes at least once a month. This is particularly important during the winter months because long-term non-use can cause hardening of the internal seals.
3 Because of the complexity of the air conditioning system and the special equipment required to effectively work on it, accurate troubleshooting and repair of the system should be left to a professional mechanic. One probable cause for poor cooling that can be determined by the home mechanic is low refrigerant charge. Should the system lose its cooling ability, the following procedure will help you pinpoint the cause.
4 Warm the engine to normal operating temperature.
5 The hood and doors should be open.
6 Press the A/C mode button.
7 Slide the temperature selector lever all the way to the left.
8 Turn the blower control selector knob to the *Hi position.*
9 With the compressor engaged, feel the evaporator inlet pipe **(see illustration)** between the orifice and the evaporator. Put your other hand on the surface of the accumulator can.
10 If both surfaces feel about the same temperature and if both feel a little cooler than the ambient temperature, the freon level is probably okay. The problem is elsewhere.
11 If the inlet pipe has frost accumulation or feels cooler than the accumulator surface, the freon charge is low. Add freon as follows.
12 Buy an automotive air conditioner recharge kit and hook it up to the evaporator inlet pipe fitting in accordance with the kit manufacturer's instructions **(see illustration).** Add freon until both the accumulator surface and the evaporator inlet pipe feel about the same temperature. Allow stabilization time between each addition.
13 Add one additional can of refrigerant.

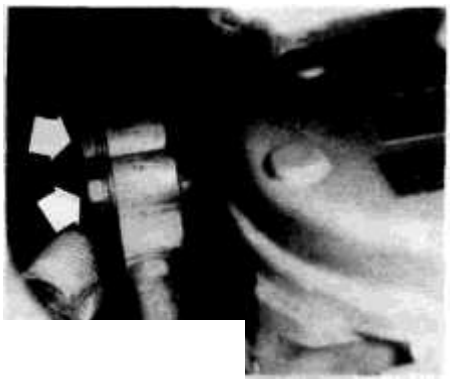
15 Air conditioning compressor — removal and installation

Refer to illustrations 15.3, 15.4 and 15.6

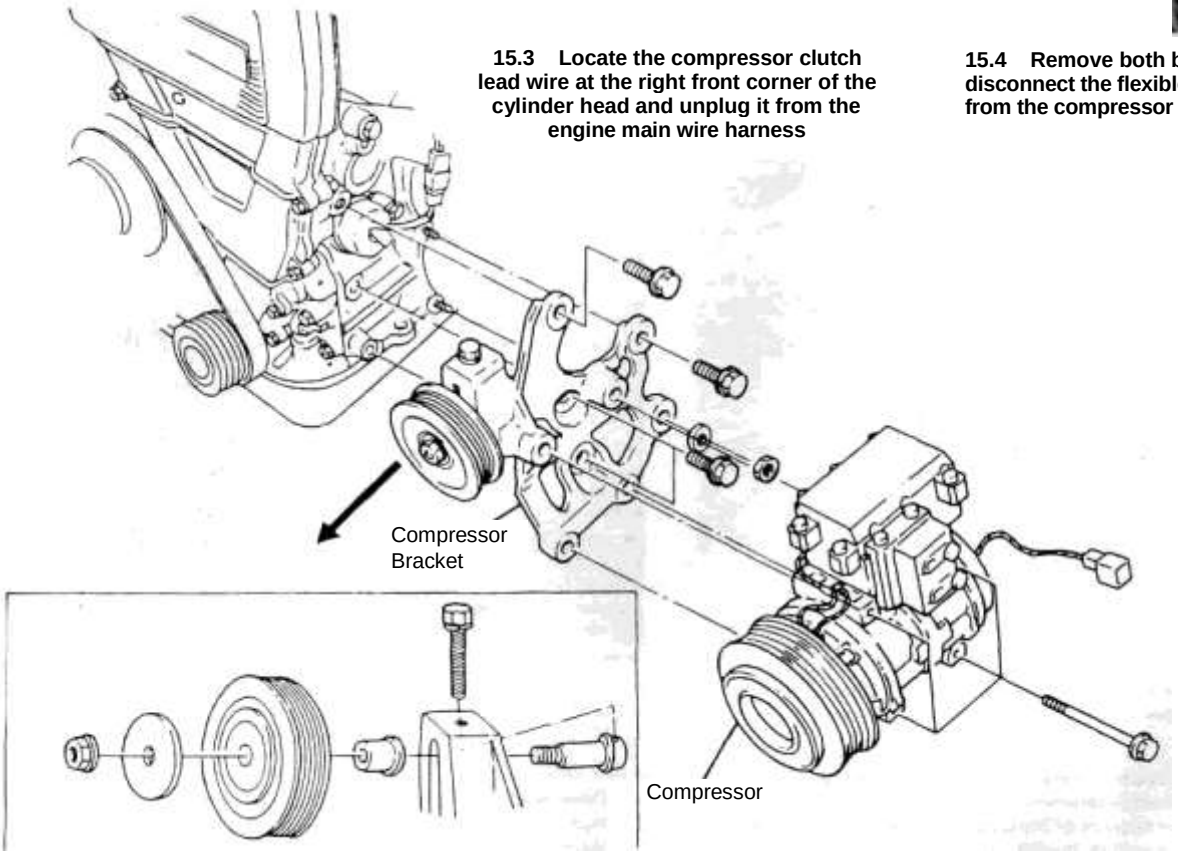
Warning: *Have the air conditioning system discharged by a dealer service department or an air conditioning specialist before beginning this procedure.*

1 Disconnect the cable from the negative terminal of the battery.
2 Remove the battery (refer to Chapter 1).
3 Locate the compressor clutch lead wire (the square white connec-

15.3 Locate the compressor clutch lead wire at the right front corner of the cylinder head and unplug it from the engine main wire harness



15.4 Remove both bolts (arrows) disconnect the flexible hose coupling from the compressor



15.6 Exploded view of the air conditioning compressor, bracket and mounting bolts

tor) at the front right corner of the cylinder head **(see illustration).** Disconnect it from the main engine wiring harness.

4 Disconnect the two flexible hoses from the compressor **(see illustration). Caution:** *Immediately cap the open fitting to prevent moisture from entering the system.*

5 Loosen the drivebelt idler pulley bolt and remove the drivebelt.

6 Remove the compressor mounting bolts and the compressor **(see illustration).**

7 Installation is the reverse of removal.

16 Air conditioning accumulator — removal and installation

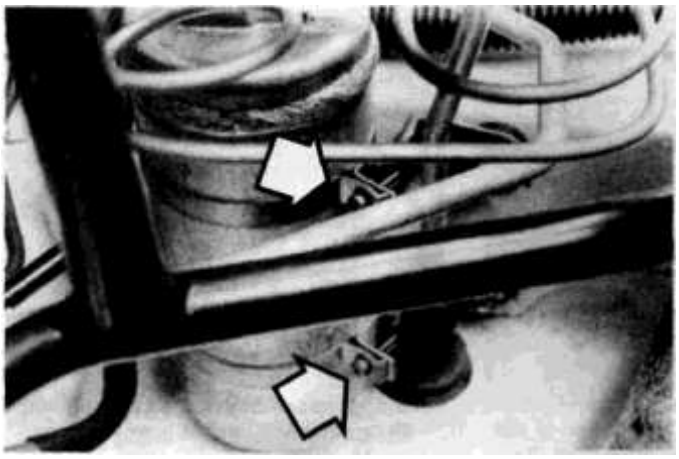
Refer to illustrations 16.2 and 16.3

Warning: *Have the air conditioning system discharged by a dealer service department or an air conditioning specialist before beginning this procedure.*

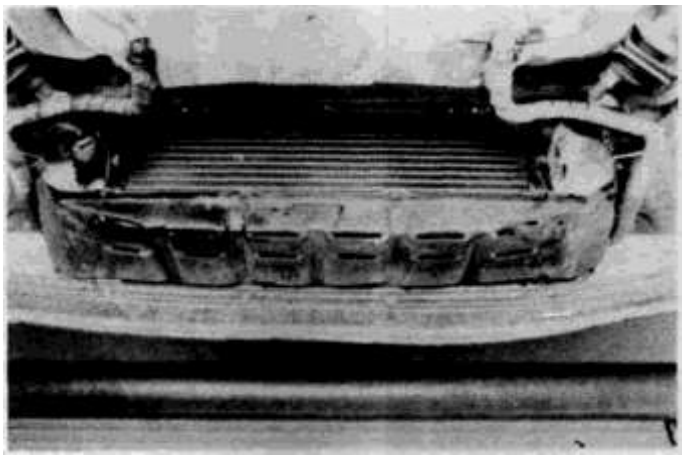
1 Remove the spare tire and trim cover.

2 Disconnect the two liquid line fittings from the accumulator **(see illustration). Caution:** *Cap the fittings immediately to prevent moisture from entering the system.*

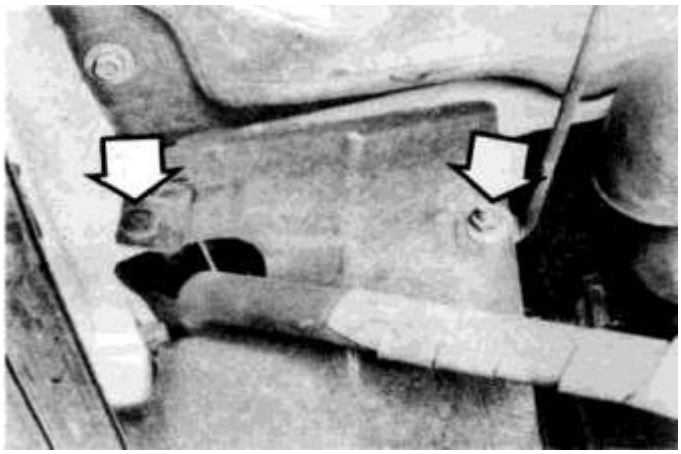
16.2 To remove the accumulator, disconnect the liquid line fittings (arrows)



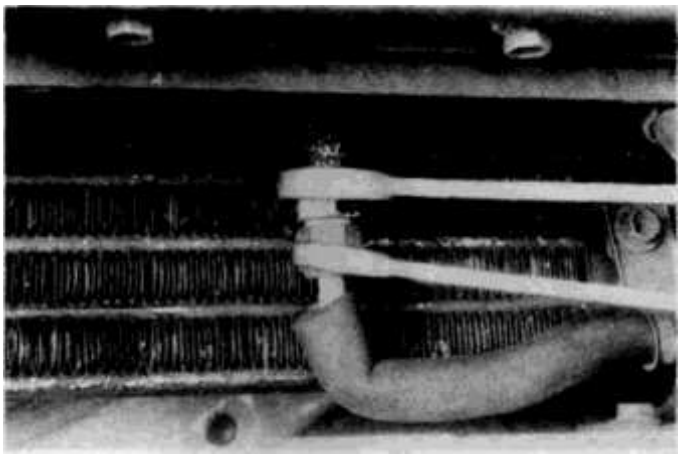
16.3 Loosen the retaining strap screws (arrows) — don't forget to have the system discharged before disconnecting these lines



17.4a To remove the condenser protector, remove the four screws and four hex bolts



17.4b Remove the flange nut and pop fastener (arrows) from each end of the protector



17.7 Disconnect both fittings (using two wrenches as shown)

3 Loosen the accumulator retaining strap screws **(see illustration)** and remove the accumulator.
4 Installation is the reverse of removal. Be sure to tighten the liquid line fittings to the specified torque.
5 If a new accumulator is being installed, add about 20 cc (0.7 oz) of compressor oil to the compressor.

17 Air conditioning condenser — removal and installation

Refer to illustrations 17.4a, 17.4b and 17.7

Warning: *Have the air conditioning system discharged by a dealer service department or an air conditioning specialist before beginning this procedure.*

1 Drain the engine coolant (refer to Chapter 1).
2 Remove the cooling fans/shroud assembly (refer to Section 6).
3 Remove the radiator (refer to Section 8).
4 Remove the four screws and four hex bolts from the protector **(see illustration).** Also remove the pop fastener and nut from each end of the protector **(see illustration).** Remove the protector.
5 Remove the lower condenser mount nuts.
6 Remove the plastic grille.
7 Disconnect the inlet and outlet tube fittings **(see illustration).**
8 Lower the vehicle.
9 Remove the upper condenser bracket bolts.
10 Remove the condenser.
11 Installation is the reverse of removal. ,

Chapter 4 Fuel and exhaust systems

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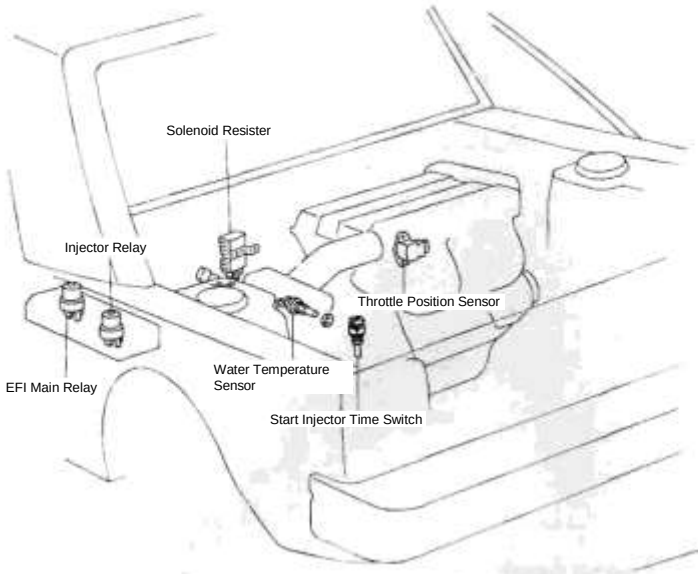
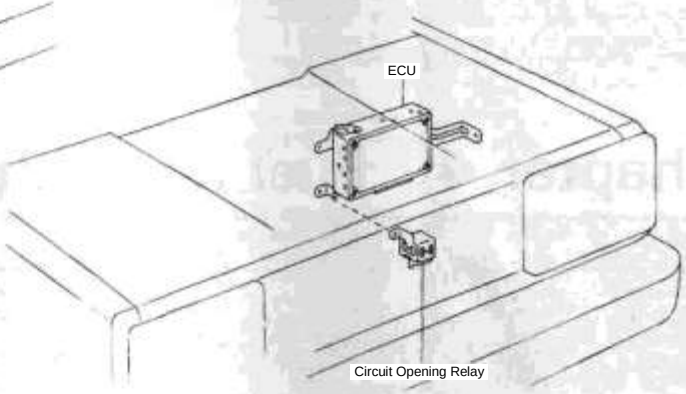
Specifications

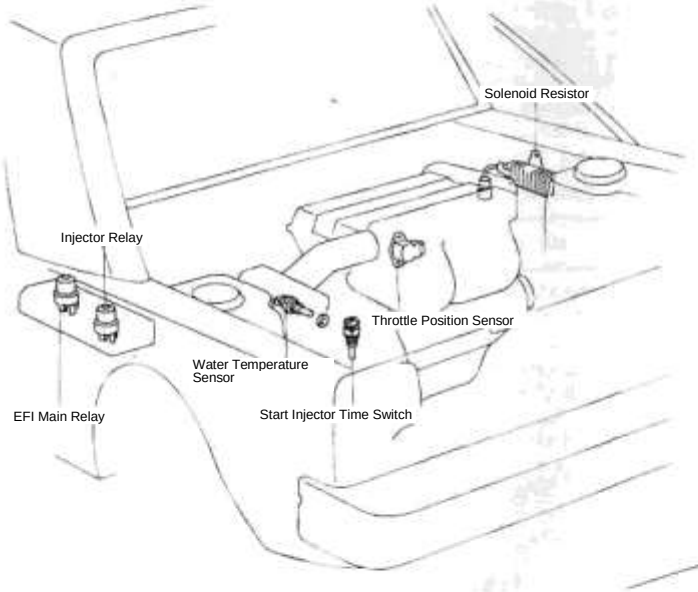
Fuel pressure at idle with service connector terminals Fp and + B bridged and pressure regulator vacuum sensing hose	
connected	226 to 275 kPa (33 to 40 psi)
disconnected	167 to 216 kPa (24 to 31 psi)
With fuel pressure up vacuum switching valve (FPU VSV) disconnected	167 to 216 kPa (24 to 31 psi)
Cold start injector resistance	3 to 5 ohms
Fuel injector resistance	1.5 to 3.0 ohms
Solenoid resistor resistance	3 ohms each
FPU VSV resistance	30 to 50 ohms

Torque specifications	**Nm**	**Ft-lbs**
Fuel tank support strap bolts	14	10
Fuel feed line threaded fitting (at fuel tank)	34	25
Fuel pump bracket screws	2.0 to 5.8	18 to 52 in-lbs
Cold start injector mounting bolts	9.3	82 in-lbs
Cold start injector pipe banjo bolt	18	13
Pressure regulator mounting bolts	9.3	82 in-lbs
Fuel pipe-to-pressure regulator fitting	29	22
Fuel rail retaining bolts	17	13
Pulsation damper-to-fuel rail	29	22
Throttle body mounting bolts and nuts	22	16
Start injection time switch	**34**	25

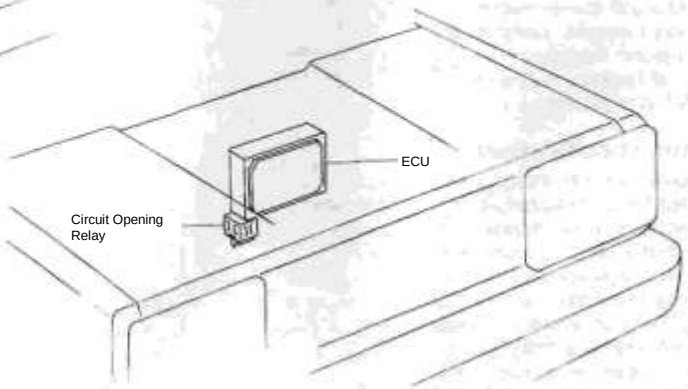


1.4a The electronic control system includes various information sensors that monitor the EFI system and relays that carry out the commands from the ECU to the fuel injection system





1.4b The solenoid resistor, electronic control unit (ECU) and circuit opening relay were relocated in 1987 vehicles



1 Fuel injection system — general information

Refer to illustrations 1.4a and 1.4b

The engine is equipped with an Electronic Fuel Injection (EFI) system. The EFI system is composed of three basic subsystems: fuel system, air system and electronic control system.

Fuel system

An electric fuel pump located inside the fuel tank supplies fuel under constant pressure to the fuel rail, which distributes fuel evenly to all four injectors. From the fuel rail, fuel is injected into the intake ports, just above the intake valves, by four fuel injectors. The amount of fuel supplied by the injectors is precisely controlled by an Electronic Control Unit (ECU). A fifth injector, known as the cold start injector, supplies extra fuel into the intake manifold for starting. A pressure regulator controls system pressure in relation to intake manifold vacuum. A fuel filter between the fuel pump and the fuel rail filters fuel to protect the components of the system.

Air system

The air system consists of an air filter housing, an air flow meter and a throttle body. The air flow meter is an information gathering device for the ECU. A potentiometer measures intake air flow and a temperature sensor measures intake air temperature. This information helps the ECU determine the amount (duration) of fuel to be injected by the injectors. The throttle plate inside the throttle body is controlled by the driver. As the throttle plate opens, the amount of air that can pass through the system increases, so the potentiometer opens further and the ECU signals the injectors to increase the amount of fuel delivered to the intake ports.

Electronic control system

The Toyota Computer Control System (TCCS) controls the EFI and other systems by means of an Electronic Control Unit (ECU), which employs a microcomputer. The ECU receives signals from a number of information sensors which monitor such variables as intake air volume, intake air temperature, coolant temperature, engine rpm, acceleration/deceleration and exhaust oxygen content. These signals help the ECU determine the injection duration necessary for the optimum air/fuel ratio. Some of these sensors and their corresponding ECU-controlled relays are not contained within EFI components, but are scattered throughout the engine compartment **(see illustrations).** This chapter includes the procedures for testing and replacing these devices. For further information regarding the ECU and its relationship to the engine electrical and ignition system, refer to Chapter 5.

2 General diagnosis

Warning: *Gasoline is extremely flammable, so extra precautions must be taken when working on any part of the fuel system. Do not smoke or allow open flames or bare light bulbs near the work area. Also, do not work in a garage if a natural gas-type appliance with a pilot light is present.*

The EFI system is not usually the source of engine problems. Trouble is usually caused by a bad contact in the wiring connectors. Always make sure that all connections are secure by tapping or wiggling the connectors to see if the signal changes. Make sure that the connector terminals are not bent and that the connectors are pushed completely together and locked.

Before troubleshooting the EFI system, always check the condition of the ignition system. Make sure that the battery, all fuses, fusible links and grounds, the igniter, the ignition coil, the high tension wire, the distributor, the plug wires and the spark plugs are all in good condition, properly connected and functioning correctly. Check the idle speed and the ignition timing. Never replace the ECU, which is an expensive component, until all other electrical devices have been eliminated as possible sources of trouble (with the exception of idle speed adjustment, which is in Chapter 1, information regarding all the above procedures is outlined in Chapter 5).

Check the air induction system for vacuum leaks. Removal of components such as the engine oil dipstick, oil filler cap, PCV hose, etc. can cause the engine to run out of tune.

Check the fuel delivery system for fuel leaks. Make sure that the fuel filter and fuel pump are both operating properly.

3 Fuel pressure relief

Warning: *Gasoline is extremely flammable, so extra precautions must be taken when working on any part of the fuel system. Do not smoke or allow open flames or bare light bulbs near the work area. Also, do not work in a garage if a natural gas-type appliance with a pilot light is present.*

1 Always relieve the fuel pressure before disconnecting any fuel system component.

2 Locate the 15A EFI fuse in the No. 2 junction block in the left front corner of the engine compartment. Pull this fuse and attempt to start the engine. Let it crank over five or six times. Reinstall the fuse.

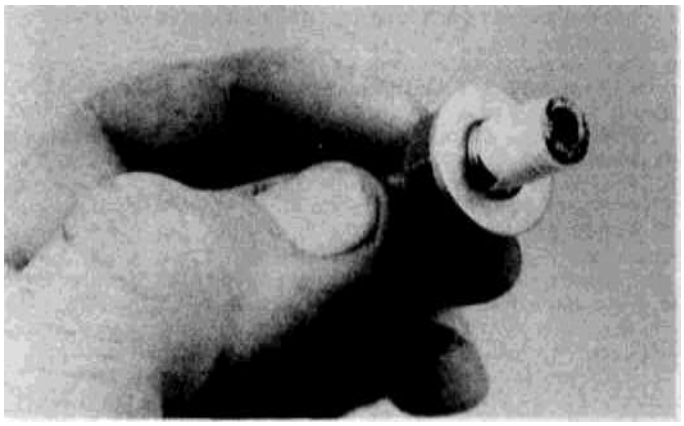
3 Even though fuel pressure should now be safely relieved, it's always a good idea to place a shop rag over any fuel fitting before loosening it.

4 Fuel pressure — check

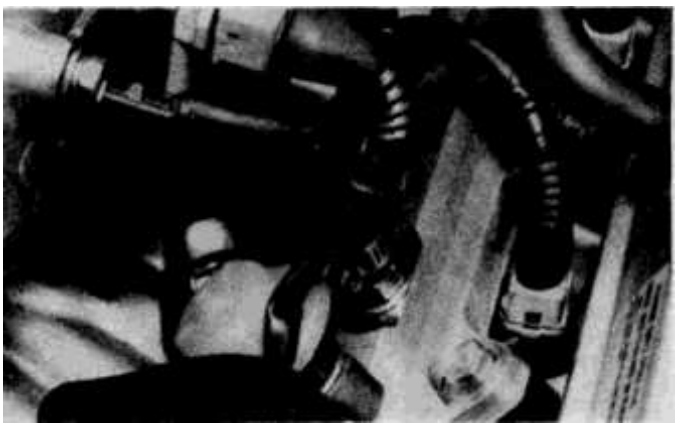
*Refer to illustrations **4.1**a, **4. 1**b and 4.9*

Warning: *Gasoline is extremely flammable, so extra precautions must be taken when working on an y part of the fuel system. Do not smoke or allow open flames or bare light bulbs near the work area. Also, do not work in a garage if a natural gas-type appliance with a pilot light is present.*

1 In order to attach a fuel pressure gauge to the fuel rail of this vehi-



4.1a To make an adapter to fit in place of the cold start hose banjo bolt, take an 8 X 1.0 mm bolt, drill it out and install a locknut and washer



4.1b Attach the adapter to the fuel pressure gauge with a hose clamp

cle, you will need to obtain an 8 mm bolt with a 1.0 mm thread pitch. Place the bolt in a bench vise and saw off the head with a hacksaw, then drill out the bolt so that it is hollow. Thread a locknut onto the bolt, place a large washer next to the nut and wrap the threads of the bolt with teflon sealing tape to prevent leakage. Attach the fuel pressure gauge hose to this adapter with a hose clamp **(see illustrations).** 2 Verify that battery voltage is above 12 volts (see Chapter 5, if necessary).
2 Relieve the fuel pressure (Section 3).
3 Disconnect the wiring connector from the cold start injector (Section 8).
4 Place a suitable container or shop towel under the banjo bolt fitting that attaches the cold start injector pipe to the fuel rail.
5 Slowly loosen the cold start injector pipe banjo bolt from the fuel rail and remove the bolt and two crush washers from the rail (refer to Section 10, if necessary).
6 Drain the fuel in the fuel rail into the container.
7 Using your homemade adapter, attach the fuel pressure gauge hose.
8 Wipe off any splattered gasoline.
9 Locate the service connector (right behind the air flow meter). Bridge terminals Fp and +B with a jumper wire **(see illustration).**
10 Turn on the ignition switch.
11 Measure the fuel pressure and compare your reading to the specified fuel pressure.
12 If the pressure is high, replace the regulator. If the pressure is low or there is no pressure, check the following components: the fuel hoses and connections, the fuel pump, the fuel filter, the vacuum sensing hose and the pressure regulator.
13 Remove the jumper wire from the service connector.
14 Start the engine.
15 Disconnect the vacuum sensing hose from the pressure regulator and pinch it (Section 9).
16 Measure the fuel pressure with the engine at idle. Compare your reading to the specified fuel pressure.
17 Reconnect the vacuum sensing hose to the pressure regulator.
18 If your vehicle is equipped with air conditioning, unplug the electrical connector from the fuel pressure up vacuum switching valve (FPU VSV) (Section 20).
19 Measure the fuel pressure with the engine idling. Compare your reading to the specified fuel pressure.
20 Repeat Step 12.
21 Stop the engine. Check that the
fuel pressure remains above 147kPa(21 psi)forfive minutes after the engine is turned off.
22 If it doesn't, check the fuel pump, pressure regulator and/or injectors.
23 After checking fuel pressure, relieve fuel pressure (Section 3).
24 Disconnect the battery ground cable.
25 Carefully remove the fuel pressure gauge to prevent gasoline from splashing.
26 Using new crush washers, reconnect the cold start injector hose to the fuel rail.
27 Connect the wiring connector to the cold start injector.
28 Connect the FPU VSV (Section 20).
29 Connect the battery ground cable.
30 Start the engine and check for fuel leakage.

5 Fuel tank — removal and installation

Refer to illustrations 5.3, 5.9, 5.10 and 5.11

Warning: *Gasoline is extremely flammable, so extra precautions must be taken when working on any part of the fuel system. Do not smoke or allow open flames or bare light bulbs near the work area. Also, do not work in a garage if a natural gas-type appliance with a pilot light is present.*

1 Relieve the fuel pressure (Section 3), then disconnect the cable from the negative terminal of the battery.
2 Remove the console (refer to Chapter 11).
3 Disconnect the electrical connectors for the fuel pump and the fuel gauge sending unit (see illustration) and push the connectors and their pigtails through the rubber grommet.
4 Raise the vehicle and secure it on jackstands.
5 Remove the fuel tank protectors (the louvered plastic panels bolted to the underside of the vehicle to protect the fuel tank).
6 Disconnect the right parking brake cable bracket from the middle crossmember, slide the cable grommet out of the bracket and disconnect the right parking brake cable from the equalizer (refer to Chapter 9, if necessary, for illustrations of this procedure).
7 Remove the parking brake cable support bracket bolts and the middle crossmember bolts and allow the bracket and crossmember to hang to one side from the remaining parking brake cable.
8 Disconnect the speedometer cable/throttle cable support bracket bolt.
9 Locate the fuel tank filler neck hose and the breather hose at the rear of the fuel tank, in the lower front part of the engine compartment **(see illustration).** Loosen the hose clamps and disconnect both hoses from the fuel tank.
10 Disconnect the fuel feed and return lines **(see illustration).** The fuel feed line is the one with the threaded fitting; the return line is right above it.
11 Immediately above the fuel feed and return line hoses are the fuel evaporative separator hoses **(see illustration).** Slide the hose clamps back and disconnect both hoses.
12 Remove the fuel tank support strap bolts and remove the tank from the vehicle.
13 Installation is the reverse of removal. Be sure to tighten the fuel tank support strap bolts and the fuel feed line threaded fitting to the specified torque.

6 Fuel tank — cleaning and repair

1 Any repairs to the fuel tank or filler neck should be carried out by a professional who has experience in this critical and potentially dangerous work. Even after cleaning and flushing of the fuel system, explosive fumes can remain and ignite during repair of the tank.
2 If the fuel tank is removed from the vehicle, it should not be placed in an area where sparks or open flames could ignite the fumes coming out of the tank. Be especially careful inside garages where a natural gas appliance is located, because the pilot light could cause an explosion.

7 Fuel pump and fuel gauge sending unit — removal and installation

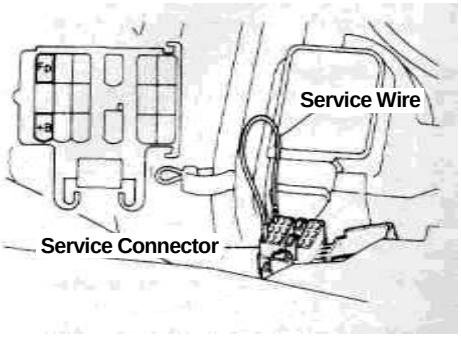
Refer to illustrations 7.7, *7.9 and 7.12*

Warning: *Gasoline is extremely flammable, so extra precautions must be taken when working on any part of the fuel system. Do not smoke or allow open flames or bare light bulbs near the work area. Also, do not work in a garage if a natural gas-type appliance with a pilot light is present.*

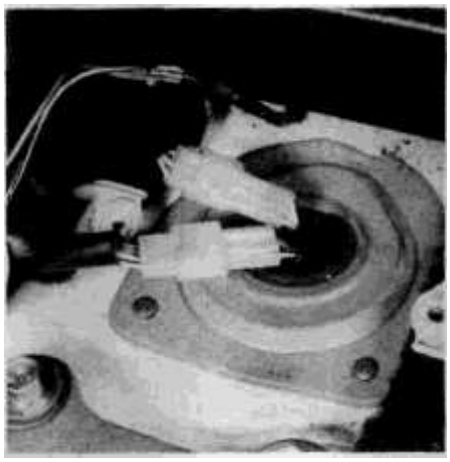
1 Relieve the fuel pressure (Section 3).
2 Disconnect the cable from the negative terminal of the battery.
3 Remove the fuel tank (Section 6) and place it on a workbench.

Fuel pump

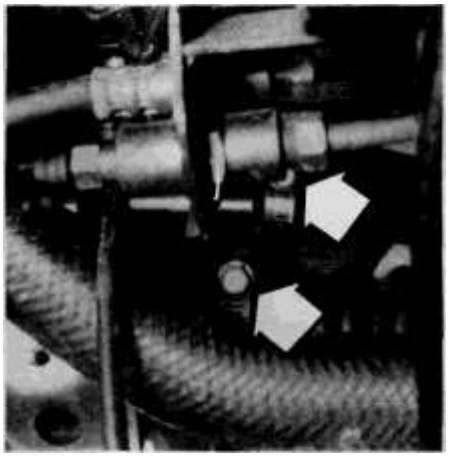
4 Remove the clamp bolt securing the fuel pump feed and return lines to the fuel tank.
5 Remove the five fuel pump retaining screws.
6 Carefully withdraw the fuel pump/bracket assembly from the fuel tank.
7 Pull the lower end of the fuel pump loose from the bracket **(see illustration).**
8 Remove the rubber cushion from the lower end of the fuel pump.
9 Remove the clip securing the filter to the pump **(see illustration).**
10 Pull out the filter and inspect it for contamination. If it is dirty, replace it.
11 If you are only replacing the fuel pump filter, install the new filter, the clip and the rubber cushion, push the lower end of the pump back into the bracket, install the pump/bracket assembly in the fuel tank and install the fuel tank (Section 5).
12 If you are replacing the fuel pump, loosen the hose clamp at the upper end of the pump and disconnect the pump from the hose **(see illustration).**
13 Disconnect the electrical wires from the pump terminals and remove the pump.
14 Installation is the reverse of removal.



4.9 Find the service connector behind the air flow meter and bridge terminals Fp and + B with a jumper wire



5.3 The fuel pump and fuel gauge sending unit pigtails are routed up through this hole in the fuel tank tunnel — be sure to disconnect them before removing the fuel tank (failure to do so will result in a disabled — and unrepairable — sending unit)

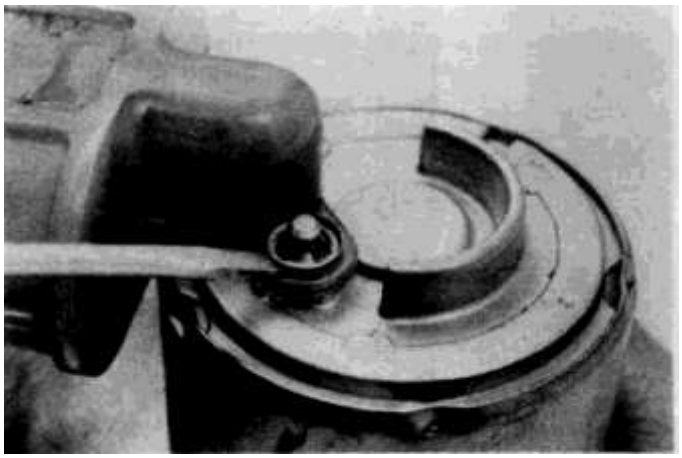


5.9 Loosen the fuel tank filler hose clamp and the breather hose clamp (arrows) and detach the hoses from the fuel tank

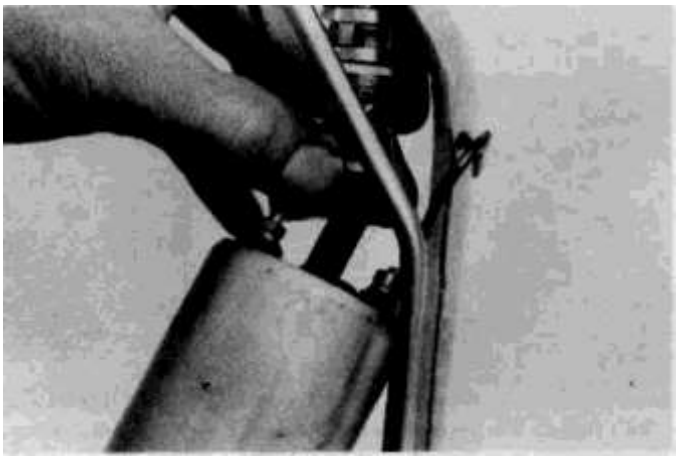
5.10 Disconnect the fuel feed line threaded fitting (1) and the fuel return line hose (2)

5.11 Loosen the hose clamps (arrows) and detach the evaporative separator hoses

7.7 Pull the lower end of the fuel pump loose from the bracket and remove the rubber cushion that insulates the bottom of the pump



7.9 Pry off the clip holding the strainer to the fuel pump and pull the strainer loose from the pump — replace the clip if it is a loose fit



7.12 Pull the fuel pump loose from the hose far enough to get at the electrical lead near the bracket

Fuel gauge sending unit

15 Follow Steps 1, 2 and 3.
16 Unscrew and carefully remove the fuel gauge sending unit.
17 Installation is the reverse of removal.

8 Cold start injector — test and replacement

Refer to illustrations 8.1, 8.5 and 8.8

Warning: *Gasoline is extremely flammable, so extra precautions must be taken when working on an y part of the fuel system. Do not smoke or allow open flames or bare light bulbs near the work area. Also, do not work in a garage if a natural gas-type appliance with* a *pilot light is present.*

Test

1 Disconnect the electrical connector from the cold start injector **(see illustration).**
2 Ground the connector with a test light. Turn the ignition key to Start. The light should come on if the circuit is good. If it doesn't, inspect the cold start injector electrical circuit for an open, a short or a bad connection (refer to the wiring diagrams at the end of this book).
3 Remove the two cold start injector mounting bolts and pull the injector out of the plenum. Do not disconnect the cold start tube banjo fitting at this time.
4 Plug the electrical connector back into the injector.
5 Place a small container under the injector **(see illustration)** and turn the ignition key to Start. If the injector is operating, it will squirt fuel into the container. If it doesn't, replace it.
6 Disconnect the electrical connector once more.
7 Check the injector for continuity with an ohmmeter. The resistance between terminals should be 3 to 5 ohms. If it isn't, replace the injector.

Replacement

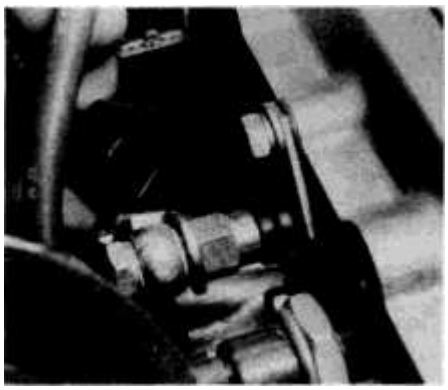
8 Temporarily install the injector mounting bolts and, using a backup wrench, break loose and disconnect the cold start injector tube banjo fitting **(see illustration).**
9 Disconnect the electrical connector.
10 Remove the two mounting bolts and remove the injector.
11 Installation is the reverse of removal.

9 Pressure regulator — removal and installation

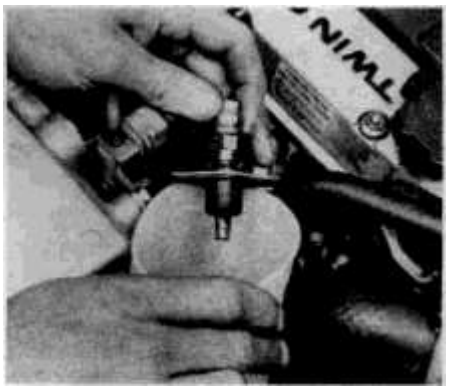
Refer to illustrations 9.4 and 9.5

Warning: *Gasoline is extremely flammable, so extra precautions must be taken when working on any part of the fuel system. Do not smoke or allow open flames or bare light bulbs near the work area. Also, do not work in a garage if a natural gas-type appliance with a pilot light is present.*

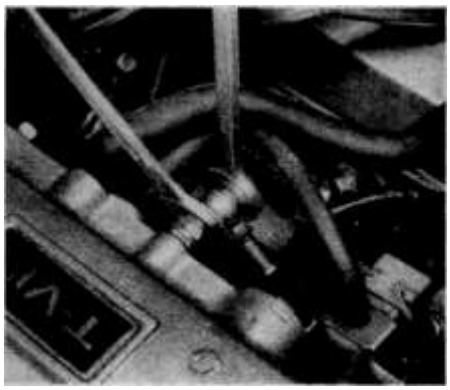
1 Check the fuel pressure (Section 4).
2 Relieve the pressure in the fuel system (Section 3).
3 Disconnect the cable from the negative terminal of the battery.
4 Disconnect the vacuum sensing hose from the pressure regulator **(see illustration).**
5 Place a suitable container or shop rag under the regulator and, using a backup wrench, disconnect the fuel pipe threaded fitting from the pressure regulator **(see illustration).**
6 Remove the two mounting bolts and remove the pressure regulator.
7 Installation is the reverse of removal.



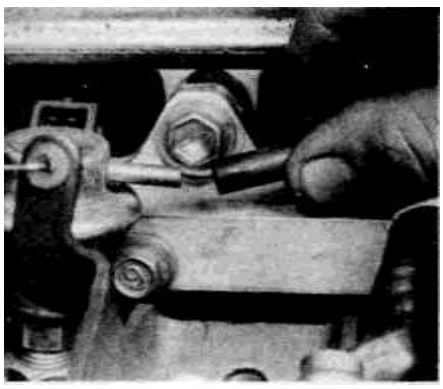
8.1 Disconnect the electrical connector plug from the cold start injector — note the wire clip that must be expanded before the plug can be unlocked from the injector terminal



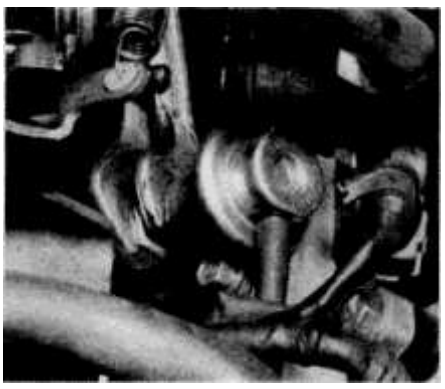
8.5 Place a small container under the cold start injector and turn the ignition key to Start — if the injector is operating properly, it should squirt fuel



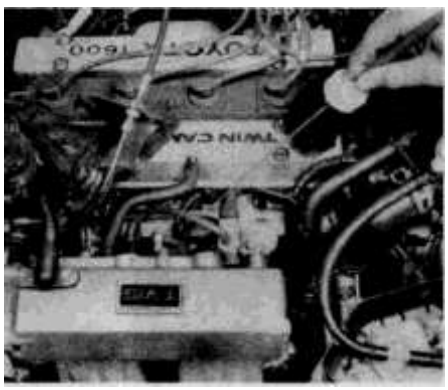
8.8 To disconnect the cold start injector pipe from the injector, use a backup wrench to prevent damage



9.4 Detach the vacuum hose between the pressure regulator and the cold start injector vacuum switching valve (VSV)

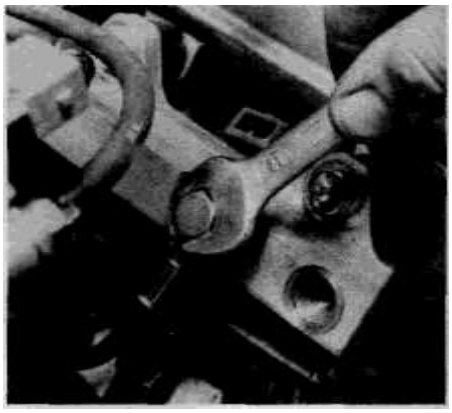


9.5 Using a backup wrench, disconnect the fuel return line threaded fitting from the pressure regulator — it's a good idea to place a shop rag under the fitting to mop up spilled fuel

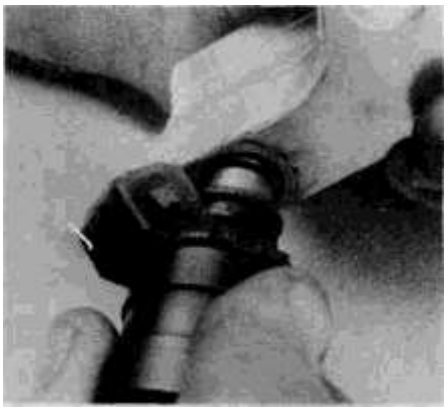


10.1 Use a stethoscope to determine if the injectors are working properly. They should make a steady clicking sound that rises and falls with the rpm of the engine

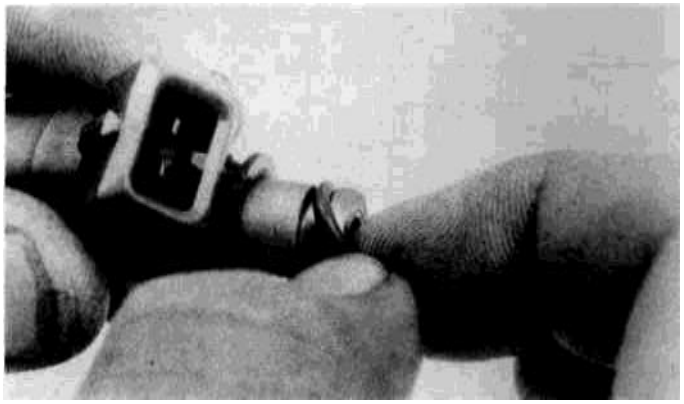
10.12 Remove the pulsation damper



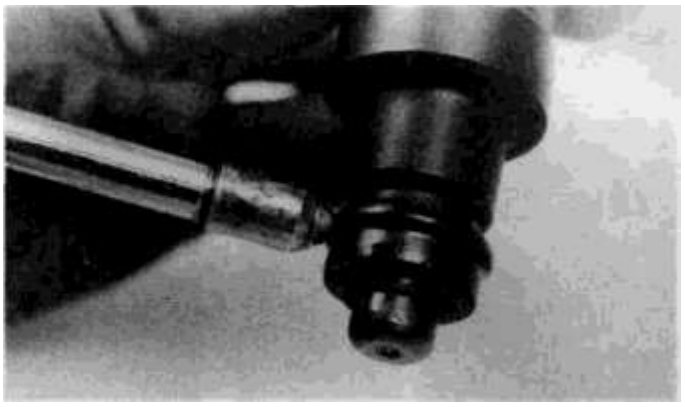
10.13 Remove the cold start tube banjo bolt and disconnect the cold start tube banjo fitting from the fuel rail



10.15 Use a side-to-side rocking motion to extract the fuel injectors from the fuel rail



10.16 Even if you're not replacing a leaky fuel injector O-ring seal, always use new O-ring seals when you are installing either the old injectors or new ones



10.18 A little lubrication on the injector nozzle seals makes it a lot easier to insert the injector nozzles back into their bores in the cylinder head

10 Fuel injector — test, removal and installation

Refer to illustrations 10.1, 10.12, 10.13, 10.15, 10.16 and 10.18
Warning: *Gasoline is extremely flammable, so extra precautions must be taken when working on any part of the fuel system. Do not smoke or allow open flames or bare light bulbs near the work area. Also, do not work in a garage if a natural gas-type appliance with a pilot light is present.*

Note: *It is possible for an injector to pass the following tests but still operate improperly. If you feel that an injector is still malfunctioning even though it checks out, take it to a dealer for a volume test. Such a test is beyond the scope of the home mechanic because it requires a number of specialized tools.*

Test

1 Using an automotive stethoscope, listen to each injector with the engine running **(see illustration).** It should emit a uniform clicking sound that rises and falls in proportion to engine rpm. If you don't have a stethoscope, place your finger on each injector and feel the vibration. If any injector sounds or feels different than the others, measure its resistance.

2 Disconnect the electrical connector from the suspect injector and, using an ohmmeter, check the resistance of the terminals. It should be 1.5 to 3.0 ohms. If it isn't, replace the injector.

Removal

3 Relieve the fuel pressure.

4 Disconnect the cable from the negative terminal of the battery.

5 Disconnect the throttle return spring.

6 Insert the tip of **a** screwdriver blade between the throttle linkage and the clip on the end of the throttle link rod and pop the link rod loose.

7 Remove the PCV hose.

8 Disconnect the electrical connectors from the fuel injectors.

9 Disconnect the electrical connector from the cold start injector vacuum switching valve (VSV).

10 Remove the VSV hose from the pressure regulator (Section 9).

11 Disconnect the fuel return line threaded fitting from the pressure regulator (Section 9).

12 Remove the pulsation damper **(see illustration)** and disconnect the fuel inlet hose from the fuel rail.

13 Remove the banjo bolt **(see illustration)** and disconnect the cold start injector pipe from the fuel rail.

14 Remove the three fuel rail mounting bolts, carefully pull the fuel rail free from the cylinder head and place it on a clean workbench. Be careful not to drop the injectors. Although their upper ends are inserted into the fuel rail and held in place by O-ring seals, they can fall out. Don't lose the three black plastic collars — one for each fuel rail bolt — that act as spacers between the fuel rail and the cylinder head.

15 Using a side-to-side rocking motion, extract the faulty injector from the fuel rail **(see illustration).**

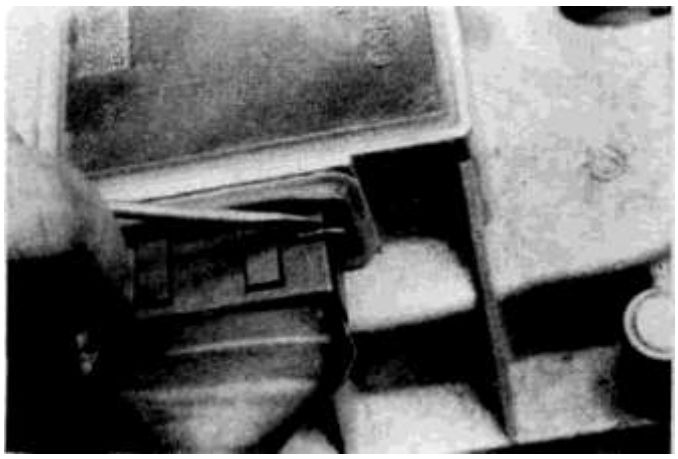
Installation

16 Whether you are installing a new injector or fixing a leaking one, replace the O-ring seal **(see illustration).**

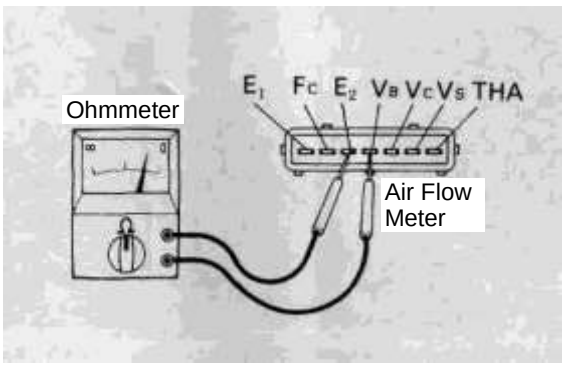
17 Apply a light coat of gasoline to the O-ring and insert the injector back into the fuel rail. Make sure it rotates smoothly once it is seated in its bore. If it doesn't, the O-ring is binding, maybe even torn. Extract the injector and repeat the procedure. The O-ring must be correctly installed or the injector will leak.

18 Lubricate the injector nozzle insulators **(see illustration)** with a little engine oil to make it easier to insert them back into the cylinder head.

19 Installation is the reverse of removal. Be sure to tighten the fuel rail bolts and the pulsation damper to the specified torque.



11.1 Pry the spring clips away from the plug and unplug the electrical connector from the air flow meter



11.2a Measure the resistance between each air flow meter electrical terminal

Between terminals	Resistance	Temperature
Vs -E_2	20 - 3,000 O (approx.	—
Vc -E_2	100 -300 Ω	—
V_B -E_2	200 - 400 Ω	—
THA - E_2	10 - 20 kΩ 4 - 7 kΩ 2 - 3 kΩ 0.9 - 1.3 kΩ 0.4 - 0.7 kΩ	- 20°C (-4°F) . 0°C (32°F) 20°C (68°F) 40°C (104°F) 60°C (140°F)
Fc -E,	Infinity	—

11.2b The resistance values between each pair of air flow meter terminals must be as specified in this table

11 Air flow meter — test, removal and installation

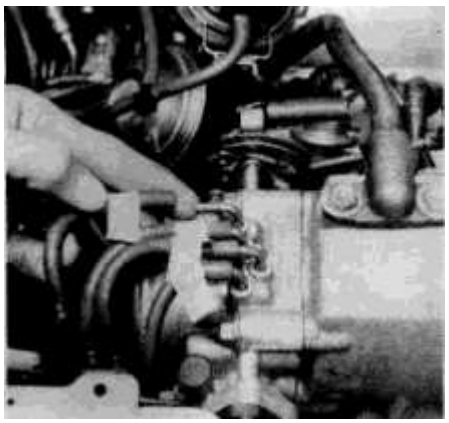
Refer to illustrations 11.1, 11.2a and 11.2b

1 Release the spring clip of the air flow meter electrical connector **(see illustration)** and unplug it.
2 Using an ohmmeter, measure the resistance between the terminals **(see illustrations).**
3 If the indicated measurements are not as specified in the accompanying chart, replace the air flow meter.
4 Loosen the clamps and remove the duct between the air flow meter and the throttle body.
5 Loosen the air flow meter bracket-to-body bolt, remove the bracket-to-air flow meter bolts and rotate the bracket out of the way.
6 Remove the air filter housing and air filter.
7 Remove the filter housing-to-air flow meter bolts.
8 Remove the air flow meter.
9 Installation is the reverse of removal.

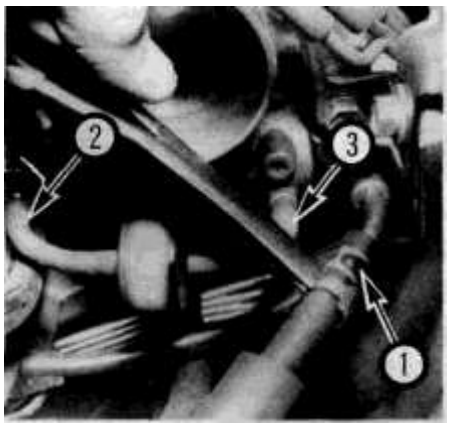
12 Throttle body — test, removal and installation

Refer to illustrations 12.2, 12.7, 12.8, 12.12, 12.14 and 12.15 1 Check the throttle linkage for smooth operation. If it binds, the problem may be a buildup of sludge behind the throttle plate caused by the PCV hose, which routes crankcase vapors into the plenum/intake manifold. Sometimes this buildup can be cleaned out by removing the duct between the air flow meter and the throttle body, opening the throttle plate wide open and carefully wiping out the sludge with a shop rag. If the problem persists, the throttle body will have to be removed and thoroughly washed in carburetor cleaner or solvent.
2 Remove the hose from vacuum port N and, with the engine running, feel for vacuum with your finger **(see illustration).** If there is no vacuum, remove the throttle body and blow out the ports with compressed air.
3 Disconnect the cable from the negative terminal of the battery.
4 Remove the duct between the air flow meter and the throttle body.
5 Disconnect the throttle return spring.
6 Insert the tip of a screwdriver blade between the throttle linkage and the clip on the end of the throttle link rod. Twist the screwdriver and pop off the link rod.
7 Label and disconnect the four vacuum hoses on the top of the throttle body **(see illustration).**
8 Loosen the hose clamp **(see illustration)** and disconnect the vacuum hose from the auxiliary air valve.
9 Disconnect the vacuum transmitting valve (VTV) hoses from the dashpot diaphragm and the auxiliary air valve.
10 Label and disconnect the two coolant hoses from the auxiliary air valve and the throttle body.
11 Remove the vacuum transmitting pipe bracket bolts from the throttle body and the intake manifold.
12 Pry the spring clip loose and unplug the throttle position sensor electrical connector **(see illustration).**
13 Remove the four throttle body mounting bolts and remove the throttle body.
14 Thoroughly remove the old gasket material from the plenum with a razor blade **(see illustration).** Failure to do so will result in an air leak when the throttle body is reinstalled.

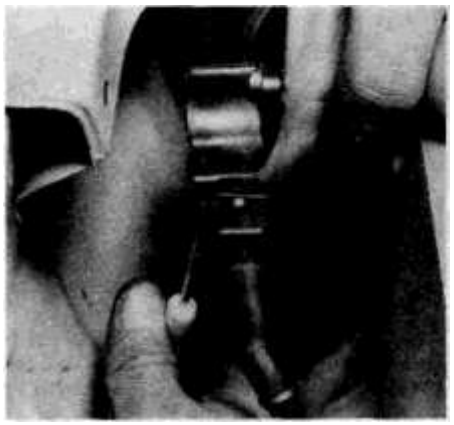
12.2 Remove the hose from vacuum port N (arrow) and, with the engine running, feel for vacuum with your finger — if there is no vacuum, the throttle body must be removed and the vacuum ports blown out with compressed air



12.7 Label and detach the four vacuum hoses from the vacuum ports on top of the throttle body

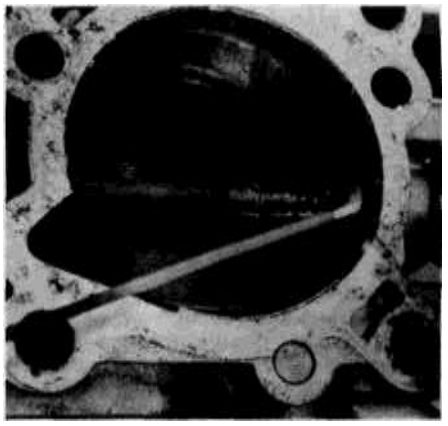


12.8 Label and disconnect the vacuum hose (1) from the auxiliary air valve vacuum elbow pipe underneath the throttle body, then detach the VTV vacuum hoses from the dashpot (2) and the auxiliary air valve (3)



12.12 Pry the spring clip up far enough to release the electrical connector plug from the throttle position sensor (TPS) and unplug the connector

12.14 Remove the old gasket material from the mating surfaces of the plenum (shown) and the throttle body itself — use a razor blade for best results and be sure to get all of it to prevent air leaks when the throttle body is reinstalled



12.15 Clean the throttle body casting thoroughly with solvent or carburetor cleaner — the area right behind the throttle plate is particularly susceptible to sludge buildup because the PCV hose vents crankcase vapors to the plenum

1 5 Wash all residue and sludge buildup from the throttle body with fresh solvent or carburetor cleaner. Pay particular attention to the throttle plate area **(see illustration). Caution:** *Do not immerse the throttle position sensor in solvent or cleaning fluid of any kind. The plastic housing and the electronic circuitry inside may be damaged.*

16 Blow out the vacuum passages with compressed air, if available.

17 Installation is the reverse of removal.

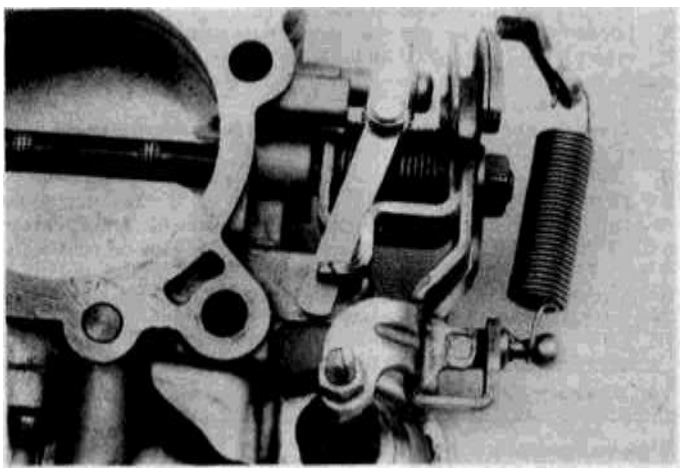
13 Throttle position sensor — check, adjustment and replacement

Refer to illustrations 13.2, 13.3a, 13.3b, 13.6 and 13.7 **Note:** *The TPS can be checked with the throttle body installed on the plenum. However, for the sake of clarity, the following photos have been taken on the workbench.*

Check

1 Loosen the spring clip with a screwdriver and unplug the TPS electrical connector.

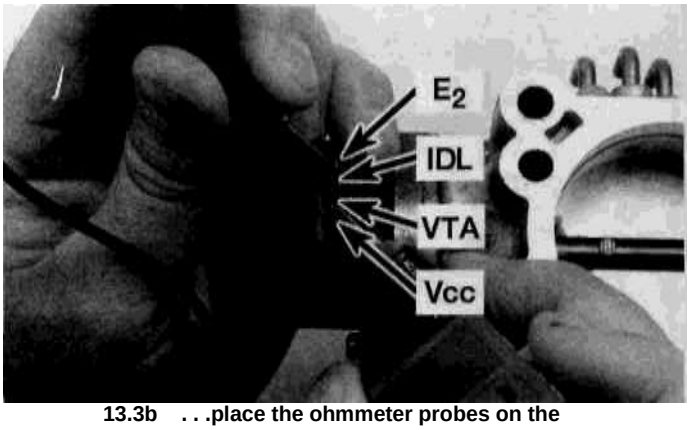
2 Insert a feeler gauge of the specified thickness (see chart) between the throttle stop screw and the throttle stop lever **(see illustration).**



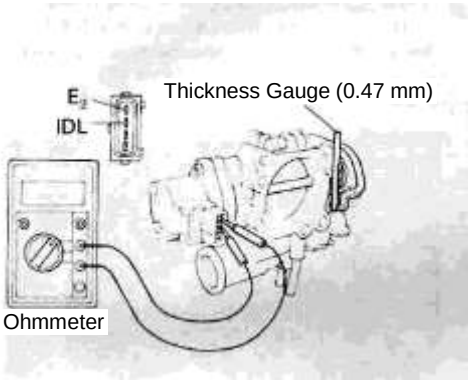
13.2 Place a feeler gauge of the specified thickness between the throttle stop screw and the stop lever

Clearance between lever and stop screw	Between terminals	Resistance
0 mm (0 in.)	VTA - E_2	0.2 - 0.8 kΩ
0.35 mm (0.0138 in.)	IDL - E_2	Less than 2 3 kΩ
0.59 mm (0.0232 in.)	IDL - E_2	Infinity
Throttle valve fully opened position	VTA - E_2	3.3-10 kΩ
-	Vcc - E_2	3 - 7 kΩ

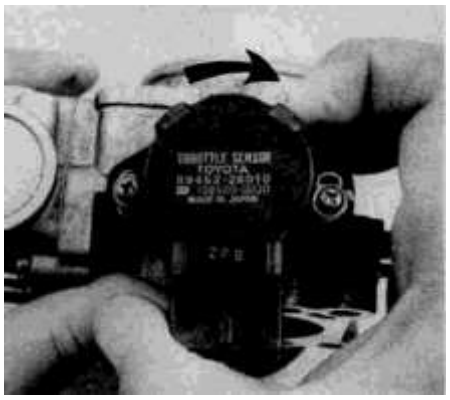
13.3a Using this table, . . .



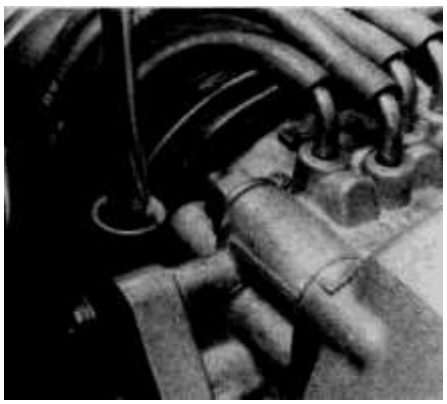
13.3b . . .place the ohmmeter probes on the indicated terminals



13.6 To adjust the TPS, insert a 0.47 mm (0.0185 in) feeler gauge between the throttle stop screw and stop lever and connect the ohmmeter to terminals IDL and E2



13.7 Loosen the two set screws and rotate the TPS clockwise until the ohmmeter needle deflects



14.2 To test the auxiliary air valve, turn the idle screw in until it bottoms, then note the rpm of the engine at idle before and after it warms up — it should drop when the coolant temperature is still low (warmup) and should die, or drop at least 600 rpm, once the coolant reaches operating temperature

3 Using an ohmmeter, check the resistance between each terminal and compare the indicated readings to the specified resistance values **(see illustrations).** If any terminals fail to check out, the TPS will have to be adjusted or replaced.

Adjustment and replacement

4 Remove the throttle body (Section 12).
5 Loosen the two sensor mounting/adjustment screws.
6 Insert a 0.47 mm (0.0185 in) feeler gauge between the throttle stop screw and the stop lever and connect the ohmmeter to terminals IDL and E2 **(see illustration).**
7 Gradually turn the sensor clockwise **(see illustration)** until the ohmmeter deflects. Tighten the sensor mounting/adjustment screws.
8 Recheck the continuity between terminals IDL and E2 by inserting a 0.35 mm (0.0138 in) feeler gauge between the throttle stop screw and stop lever. There should be continuity between IDL and E2. Insert a 0.59 mm (0.0232 in) feeler gauge — there should be no continuity. If the TPS fails either of these continuity checks, replace it.
9 Installation is the reverse of removal. Be sure to adjust the new TPS before installing the throttle body.

14 Auxiliary air valve — check, removal and installation

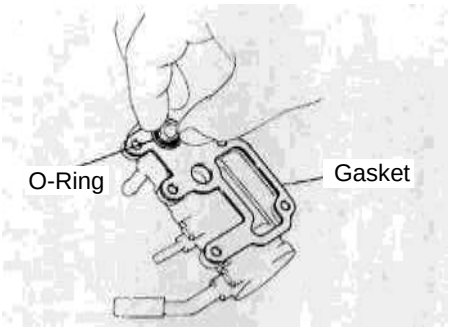
Refer to illustrations 14.2 and 14.8

1 Start the engine and remove the black rubber plug protecting the idle speed adjustment screw.
2 While the engine is still warming up (coolant temperature is still below 80°C or 176°F), turn the screw in **(see illustration)** until it bottoms. The engine rpm should drop. Turn the screw back out and allow the engine to warm up.
3 After the engine has warmed up, turn the screw in all the way again. The engine rpm should drop below 600 rpm or the engine should die.
4 If the auxiliary air valve fails to alter engine rpm during or after warm-up, replace it.
5 Remove the throttle body (Section 12).
6 Remove the five mounting screws and remove the auxiliary air valve.
7 Thoroughly remove the old gasket material from the mating surfaces of the throttle body and the auxiliary air valve with a razor blade.
8 Using a new O-ring and gasket **(see illustration),** install the new auxiliary air valve and five mounting screws.
9 Install the throttle body (Section 12).
10 Adjust the idle speed (Chapter 1).

15 EFI main relay — test and replacement

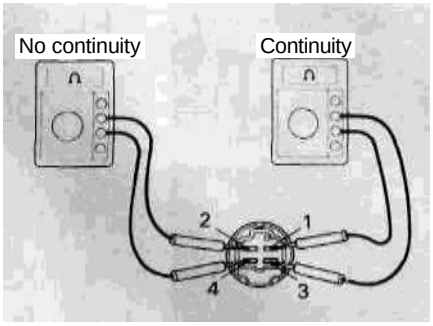
Refer to illustrations 15.1 and 15.2

1 Locate the EFI main relay in the No. 2 junction block in the front left corner of the engine compartment **(see illustration).** Listen to this relay while an assistant turns the ignition key to On. The relay should make a clicking sound. If it doesn't, it must be replaced.
2 Use an ohmmeter to check the EFI main relay terminals for continuity **(see illustration).** There should be continuity between terminals

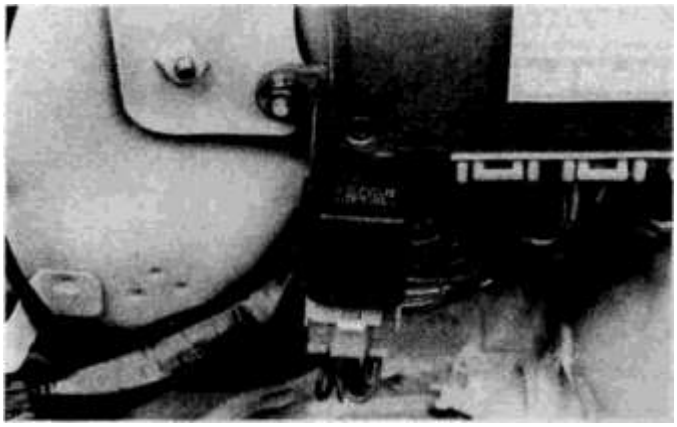


14.8 Be sure to use a new O-ring and gasket when installing the new auxiliary air valve

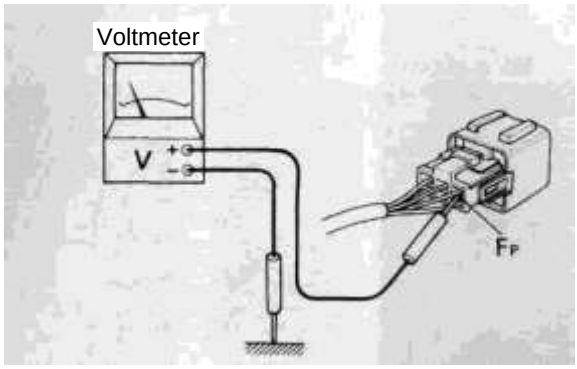
15.1 The EFI main relay (arrow) is located in the No. 2 junction block in the front left corner of the engine compartment



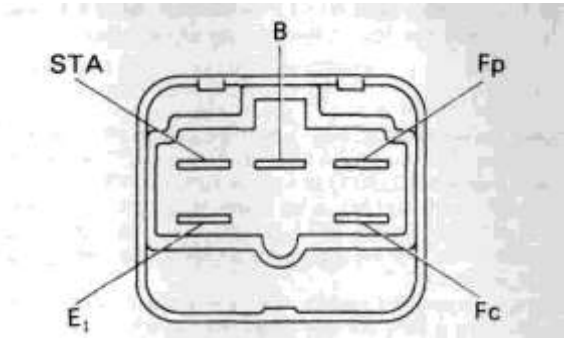
15.2 To check the EFI main relay for continuity, use an ohmmeter to verify that there is continuity between terminals 1 and 3 but none between terminals 2 and 4 and between terminals 3 and 4 — if the indicated continuity is not as specified, replace the relay



16.2 The circuit opening relay is located just below the ECU, which is hidden behind the carpet trim of the rear luggage compartment in the upper right corner



16.4 To check the circuit opening relay twist it so that the harness side of the plug is facing you, then probe terminal Fp of the electrical connector with a voltmeter to verify that it is getting voltage while the engine is being started and after it is running



16.5a A guide to the terminals of the circuit opening relay plug

Between terminals	Resistance (Ω)
STA - E, B - Fc B -FP	17-25 88- 132 Infinity

16.5b Measure the resistance between these terminals and compare your measurements to the specified resistance values

1 and 3, but no continuity between terminals 2 and 4 or between 3 and 4. If the indicated continuity is not as specified, replace the relay. 3 To check the operation of the EFI main relay, apply battery voltage to terminals 1 (positive) and 3 (negative). There should be continuity between terminals 2 and 4. If there isn't, replace the relay.

16 Circuit opening relay — test and replacement

Refer to illustrations 16.2, 16.4, 16.5a and 16.5b

1 Remove the carpet trim from the front right corner of the rear luggage compartment (refer to Chapter 11 if necessary).

2 Locate the circuit opening relay at the lower left corner of the Electronic Control Unit **(see illustration).**

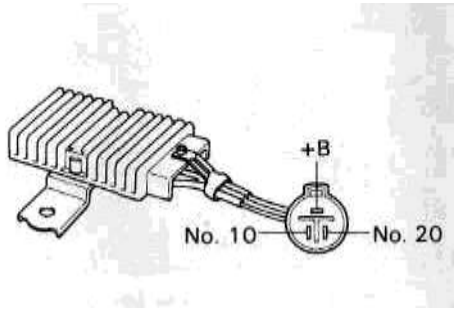
3 Remove the relay mounting bracket nut and hold the relay at an angle that allows access to the electrical connector, but do not disconnect the plug.

4 Using a voltmeter, check for voltage at terminal Fp **(see illustration)** while the engine is being started and once it is running.

5 Unplug the electrical connector and, using an ohmmeter, measure the resistance between each the indicated terminals **(see illustrations).**

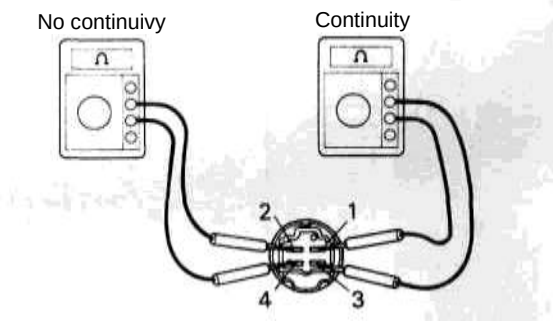
6 If the resistance between terminals is not as specified, replace the relay.

17.2 The solenoid resistor is bolted to the battery carrier support bracket

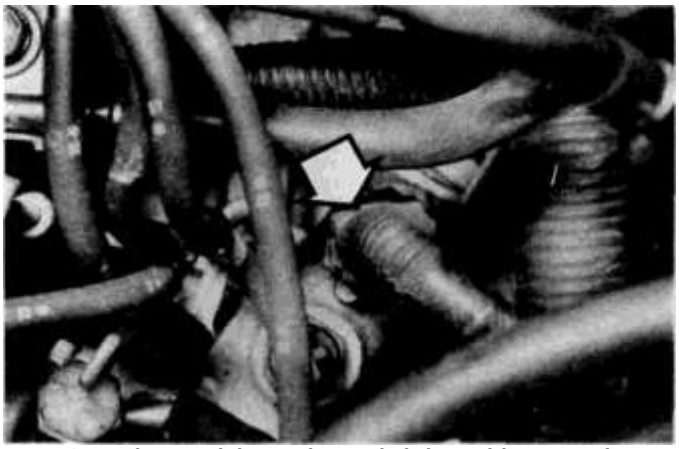


17.3 The resistance between terminal + B and the other two terminals of the solenoid resistor plug should be 3 ohms for each — if it isn't, replace the resistor

17.4 The injector relay (arrow) is located in the No. 2 junction block, which is situated just to the left of the battery in the front left corner of the engine compartment



17.5 Using an ohmmeter, verify that the injector relay has continuity between terminals 1 and 3, but not between terminals 2 and 4 or terminals 3 and 4 — if continuity is not as specified, replace the relay



18.1 The start injector time switch (arrow) is screwed into the top of the thermostat housing

17 Solenoid resistor and injector relay — test and replacement

Refer to illustrations 17.2, 17.3, 17.4 and 17.5

1 Remove the battery (Chapter 1).
2 The solenoid resistor **(see illustration)** is attached to a bracket bolted to the battery carrier support bracket.
3 Unplug the electrical connector and, using an ohmmeter, measure the resistance between + B and the other two terminals **(see illustration).** It should be 3 ohms for both. If it isn't, replace the solenoid resistor.
4 The injector relay **(see illustration)** is located in the No. 2 junction block at the front left corner of the engine compartment.
5 Remove the relay from the junction block and, using an ohmmeter, check relay continuity **(see illustration).** There should be continuity between terminals 1 and 3 but no continuity between terminals 2 and 4 and between terminals 3 and 4. If continuity is not as specified, replace the relay.
6 To check relay operation, apply battery voltage to terminals 1 (positive) and 3 (negative). There should be continuity between terminals 2 and 4. If there isn't, replace the relay.

18 Start injector time switch — test and replacement

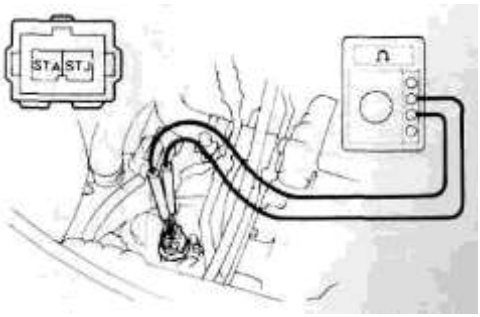
Refer to illustrations 18.1 and 18.2

1 Locate the start injector time switch **(see illustration)** in the top of the thermostat housing, which is located on top of the transaxle housing.
2 Unplug the electrical connector from the switch and, using an ohmmeter, measure the resistance between terminals STA and STJ **(see illustration)** below 30°C (86°F) and above 40°C (104°F). The resistance should be 20 to 40 and 40 to 60 ohms, respectively. Measure the resistance between terminal STA and ground. It should be 20 to 80 ohms. If the resistance values are not as specified, replace the start injector time switch.
3 Before replacing the switch, drain the coolant (Chapter 1) or be prepared to lose a little coolant when the switch is removed.
4 Using a deep socket of the correct size, remove the switch.
5 Install the new switch and tighten it to the specified torque.

19 Coolant temperature sensor — test and replacement

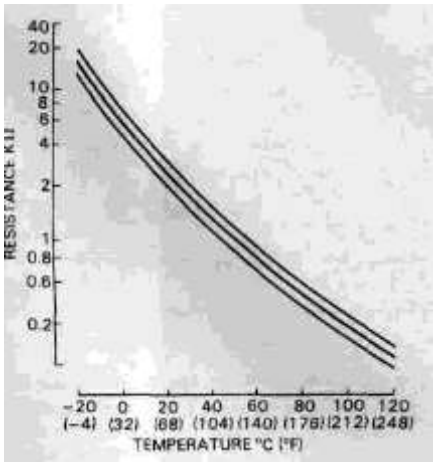
Refer to illustrations 19.1 and 19.2

1 Locate the coolant temperature sensor **(see illustration)** on the front side of the cylinder head rear cover.
2 To measure the resistance of the coolant temperature sensor, unplug the connector and, using an ohmmeter, measure the resistance between both terminals. Refer to the accompanying chart **(see illustration)** to determine whether the sensor is operating properly. If it isn't, replace it.
3 Drain the coolant (Chapter 1) or be prepared to lose a little coolant.

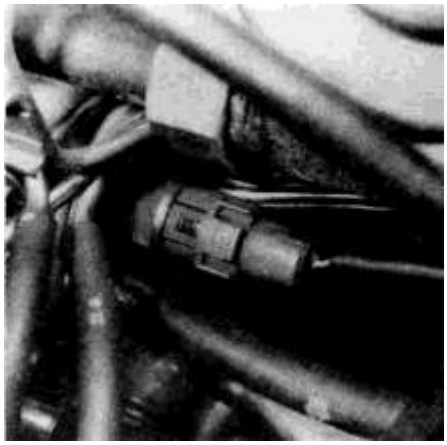


18.2 Unplug the connector from the switch and, using an ohmmeter, measure the resistance between terminals STA and STJ below 30°C (86°F) and above 40°C (104°F). The indicated resistance values should be from 20 to 40 and from 40 to 60 ohms, respectively — then measure the resistance between terminal STA and ground. The resistance should be 20 to 80 ohms — if continuity is not as specified, replace the switch

19.1 The coolant temperature sensor (arrow) is screwed into the front side of the cylinder head rear cover

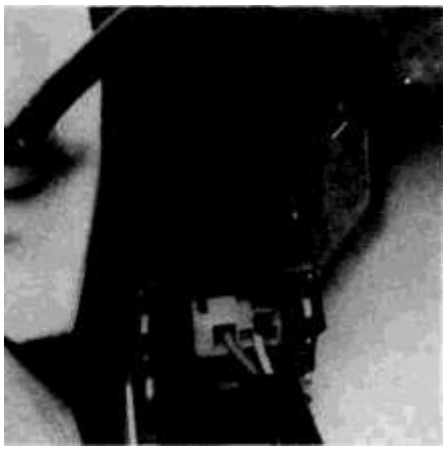


19.2 The coolant temperature sender resistance decreases as coolant temperature increases



20.1 The high temperature line pressure up system coolant temperature switch is located in the rear side of the cylinder head rear cover

20.3 The fuel pressure up vacuum switching valve (FPU VSV) switch is located on the front right side of the plenum



21.1 The idle up vacuum switch valve (VSV) is located on the left side of the engine compartment

4 Unscrew the sensor.

5 Install the new sensor and tighten it securely. Be sure to wrap the threads with teflon tape to prevent leaks.

20 High temperature line pressure up system (with A/C) — test and replacement

Refer to illustrations 20.1 and 20.3

1 The coolant temperature switch **(see illustration)** for the high temperature line pressure up system is located on the rear side of the cylinder head rear cover.

2 To measure the resistance of the switch, unplug the connector and, using an ohmmeter or a continuity tester, check the continuity between the switch terminal and the switch body during and after warm-up. There should be no continuity as long as the coolant temperature is below 103°C (217°F). After the coolant reaches 113°C (235°F), there should be continuity. If continuity is not as specified, replace the switch. **Note:** *To make sure that the coolant temperature reaches 113°C (235 °F), disconnect the electric cooling fans (refer to Chapter 3 if necessary). Keep an eye on the recovery bottle — if coolant begins to overflow the recovery bottle, plug in the fan electrical connectors and allow the engine to cool off.*

3 Locate the vacuum switching valve (VSV) on the plenum **(see illustration).**

4 Unplug the VSV connector and, using an ohmmeter, measure the resistance between both terminals. It should be 30 to 50 ohms. If it isn't, replace the VSV.

21 Idle up vacuum switching valve (VSV) — test and replacement

Refer to illustrations 21.1 and 21.3

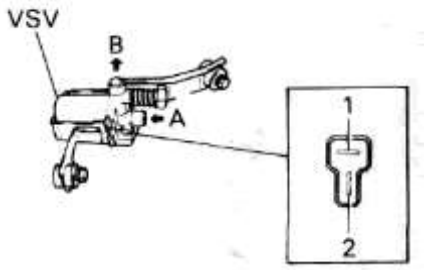
1 Only air conditioned vehicles are equipped with the idle up vacuum switching valve (VSV), which is located on the left inside wall of the engine compartment **(see illustration).**

2 Remove the VSV.

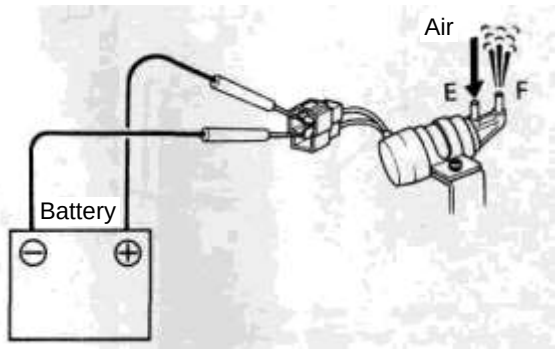
3 To check vacuum circuit continuity, blow into pipe A and verify that air does not come out of pipe B **(see illustration).**

4 Apply battery voltage between terminals 1 and 2, and blow into pipe A to verify that air comes out of pipe B.

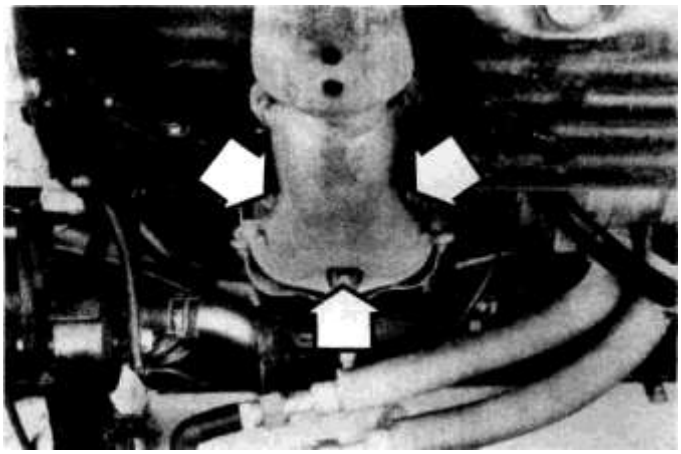
5 If the idle up VSV fails either of these tests, replace it.



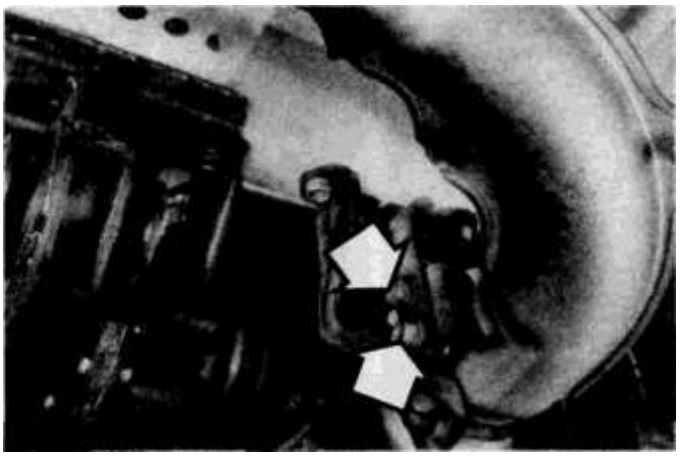
21.3 Blow into pipe A and verify that air does not come out of pipe B, then apply battery voltage between terminals 1 and 2 and blow into pipe A again to verify that air does come out of pipe B



22.3 Remove the VSV, connect the terminals to the battery terminals as shown and blow into pipe E to verify that air comes out of pipe F — disconnect the battery terminals and blow into pipe E again to verify that air does not come out of pipe F



23.3 Remove the three exhaust manifold-to-exhaust pipe nuts (arrows)



23.4 Remove the two exhaust pipe hanger bracket nuts (arrows)

22 Idle-up system (1987 vehicles) — test and replacement

Refer to illustration 22.3

1 Make sure that all accessories are turned off.
2 To check idle-up VSV battery voltage, use a voltmeter to verify that there is battery voltage during cranking and for ten seconds after the engine is started.
3 Remove the VSV and connect the terminals to the battery **(see** illustration). Blow into pipe E and verify that air comes out of pipe F.
4 Disconnect the battery and blow into pipe E again. Air should not come out of pipe F.
5 If the VSV fails either of the above tests, replace it.

23 Exhaust system — removal and installation

Refer to illustrations 23.3 and 23.4

1 Disconnect the cable from the negative terminal of the battery.
2 Raise the vehicle and place it securely on jackstands.
3 Remove the three exhaust manifold-to-exhaust pipe nuts **(see illustration).**
4 Remove the two nuts from the exhaust pipe hanger bracket **(see illustration).**
5 Slide the muffler assembly to the left to detach the two muffler hangers from their rubber grommets and remove the exhaust system.
6 Installation is the reverse of removal.

Chapter 5 Engine electrical systems

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Specifications

Primary coil resistance (cold)	0.5 to 0.7 ohms
Secondary coil resistance (cold)	11 to 16 ohms
Signal rotor-to-pickup coil projection air gap	0.2 to 0.4 mm (0.008 to 0.016 in)
G and Ne signal generator resistance (cold)	140 to 180 ohms
Ignition timing	
terminals T and E1 bridged	10° BTDC at idle
terminals T and E1 unbridged	more than 16° BTDC at idle
Standard specific gravity of battery	
fully charged, at 20°C (68°F)	1.25 to 1.27
Drivebelt tension	
new	175 + 5 lbs
used	11 5 + 20 lbs
Standard charging amperage, between idle and 2000 rpm, without a load	less than 10 amps
Standard charging voltage, between idle and 2000 rpm, without a load	13.5 to 15.1 volts
Standard charging amperage, between idle and 2000 rpm, with a load	more than 30 amps
Alternator exposed brush length	
minimum	4.5 mm (0.1 77 in)
standard	10.5 mm (0.413 in)

Torque specifications	Nm	Ft-lbs
Distributor adjustment/hold-down bolts	20	14
Starter motor bolts	**39**	29

1 Ignition system — general information and precautions

The ignition system includes the ignition switch, the battery, the exciter, the coil, the primary (low voltage) and secondary (high voltage) wiring circuits, the distributor and the spark plugs. The ignition system is controlled by the Electronic Control Unit (ECU). Using data provided by information sensors which monitor various engine functions (such as rpm, intake air volume, engine temperature, etc.), the ECU insures a perfectly timed spark under all conditions. This system is known as Electronic Spark Advance (ESA).

Precautions a) Do not keep the ignition switch on for more than 10 minutes if the engine will not start.

b) Always connect a tachometer in accordance with the manufacturer's instructions. Some tachometers may be incompatible with this ignition system. Consult your Toyota dealer before buying a tachometer for use with this vehicle.
c) Never allow the ignition coil terminals to touch ground. Grounding the coil could result in damage to the igniter and/or the ignition coil.
d) Do not disconnect the battery when the engine is running.
e) Make sure that the igniter is properly grounded.

2 Battery — removal and installation

1 Disconnect both cables from the battery terminals, the negative first and then the positive.

2 Remove the bolt at the front and the nut at the rear of the battery hold-down clamp and remove the clamp.
3 Lift out the battery.
4 Installation is the reverse of removal.

3 Battery — emergency jump starting

Refer to the booster battery (jump) starting procedure at the front of this manual.

4 Battery cables — check and replacement

1 Periodically inspect the entire length of each battery cable for damage, cracked or burned insulation and corrosion. Poor battery cable connections can cause starting problems and decreased engine performance.
2 Check the cable-to-terminal connections at the ends of the cables for cracks, loose wire strands and corrosion. The presence of white, fluffy deposits under the insulation at the cable terminal connection is a sign that the cable is corroded and should be replaced. Check the terminals for distortion, missing mounting bolts and corrosion.
3 If only the positive cable is to be replaced, be sure to disconnect the negative cable from the battery first.
4 Disconnect the positive cable from the starter (refer to Section 17) and/or the negative cable from the ground connection (thermostat housing bolt — refer to Chapter 3). Remove the cable. Make sure that the replacement cable is the same length and diameter.
5 Clean the threads of the starter or ground connection with a wire brush to remove rust and corrosion. Apply a light coat of petroleum jelly to the threads to ease installation and prevent future corrosion.
6 Attach the cable to the starter or ground connection and tighten the mounting nut securely.
7 Before connecting the new cable to the battery, make sure that it reaches the terminal without having to be stretched.
8 Connect the positive cable first, followed by the negative cable.

5 Ignition system — check

Refer to illustration 5.2

Warning: *Because of the high voltage generated by the ignition system, extreme care should be taken whenever an operation is performed involving ignition components. This not only includes the exciter, coil, distributor and spark plug wires, but related components such as spark plug connectors, tachometer and other test equipment.*

Ignition tester method

1 If the engine turns over but will not start, disconnect the spark plug wire from any spark plug and attach it to a spark tester (available at most auto parts stores).
2 Connect the clip on the tester to a ground such as a metal bracket **(see illustration),** crank the engine and observe the tip of the tester to see if a spark occurs.
3 If a spark occurs, sufficient voltage is reaching the plugs to fire the engine.

Alternative method

Note: *If you are unable to obtain a spark tester, the following method will enable you to determine whether the ignition system has spark but it will not tell you if there is enough voltage present to actually initiate combustion.*

4 Disconnect the spark plug boot from a spark plug. Using an insulated tool, hold the wire about 1 /4-inch from a good ground and have an assistant crank the engine.
5 If there is no spark, check another wire in the same "manner. A few sparks followed by no spark is the same condition as no spark at all.
6 If there is good spark, check the spark plugs (refer to Chapter 1) and the fuel system (refer to Chapter 4).

6 Igniter — check and replacement

Refer to illustrations 6.1, 6.2, 6.3a and 6.3b

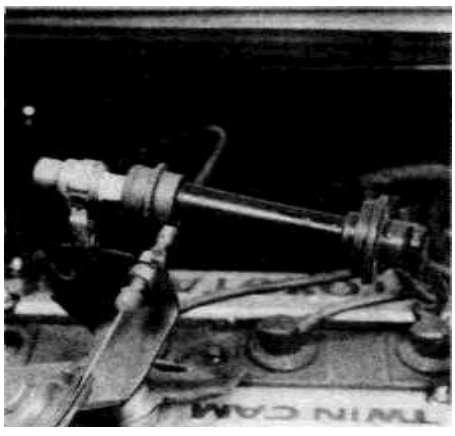
Check

Line source power voltage

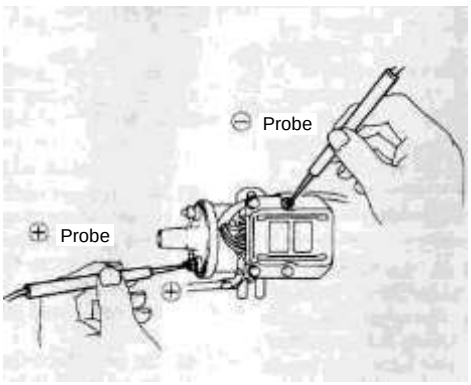
1 Use a voltmeter to check the line voltage to the igniter. Connect the positive probe to the ignition coil positive terminal and the negative probe to ground **(see illustration).** Turn the ignition switch to On. There should be approximately 12 volts indicated on the voltmeter. If there isn't, troubleshoot the igniter circuit (see the wiring diagrams at the end of this book).

Igniter power transistor

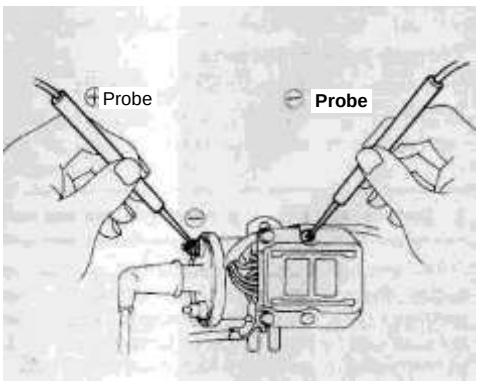
2 To check the power transistor in the igniter, connect the positive probe of the voltmeter to the ignition coil negative terminal and the negative probe to ground **(see illustration).** Again, the voltmeter should indicate approximately 12 volts. If it doesn't, replace the igniter.
3 Unplug the wiring connector of the ignition coil from the distributor. Using a dry cell battery rated at 3 to 5 volts, connect the positive pole of the battery to the pink wire terminal and the negative pole to the white wire terminal **(see illustration). Caution:** *Using a battery of more than 5 volts will destroy the diodes and applying voltage for more than five seconds will destroy the transistor in the igniter.* Using a voltmeter.



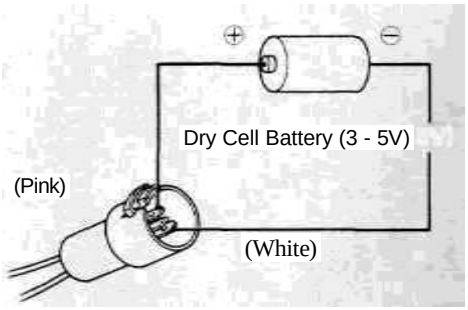
5.2 An ignition tester can tell you if the ignition system is generating sufficient voltage to fire the plugs



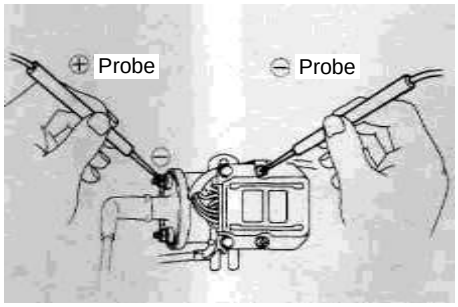
6.1 To check the line voltage of the power source for the igniter, connect the positive probe of a voltmeter to the ignition coil positive terminal and the negative probe to ground — there should be approximately 12 volts



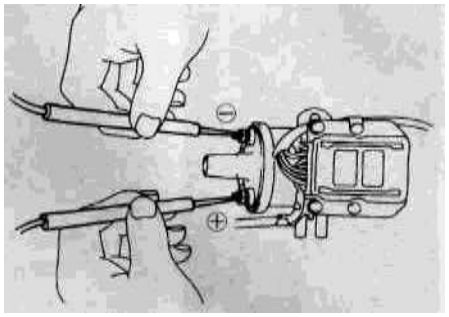
6.2 To check the power transistor in the igniter, connect the positive probe of a voltmeter to the ignition coil negative terminal and the negative probe to ground — there should be approximately 12 volts



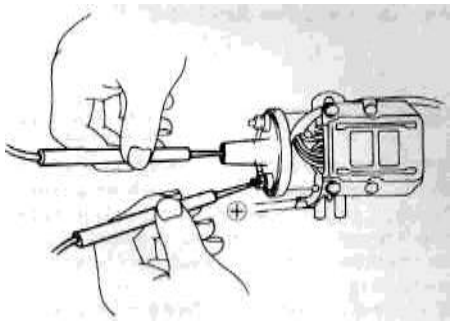
6.3a Using a dry cell battery rated at 3 to 5 volts, connect the positive pole of the battery to the pink wire terminal and the negative pole to the white wire terminal . . .



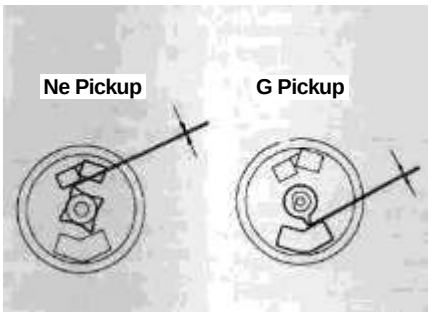
6.3b . . .then connect the positive probe of a voltmeter to the ignition coil negative terminal and the negative probe to ground — there should be approximately 7 to 10 volts



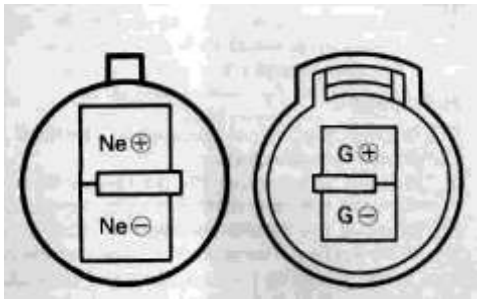
7.2 To check primary coil resistance. measure the resistance between the positive and negative terminals — the primary resistance should be between 0.5 and 0.7 ohms



7.3 To check secondary coil resistance, measure the resistance between the positive terminal and the high tension terminal — the secondary resistance should be between 11,000 and 16,000 ohms



8.3 Using a feeler gauge, measure the air gap between the signal rotor and the pickup coil projection — if the gap is not within specification, replace the distributor



8.4 Using an ohmmeter, check the resistance of the two signal generators by measuring the resistance across the terminals of the generator electrical connectors — the resistance between the positive and negative terminals of both the Ne and G signal generator plugs should be 140 to 180 ohms

connect the positive probe to the ignition coil negative terminal and the negative probe to ground **(see illustration).** The voltmeter should indicate 7 to 10 volts. If it doesn't, replace the igniter.

Replacement

4 Remove the coil protector (the plastic shroud around the coil secondary terminal).
5 Remove the coil primary terminal nuts and wires.
6 Unplug the two large green connectors to the igniter.
7 Remove the two igniter mounting screws.
8 Remove the igniter.
9 Installation is the reverse of removal.

7 Ignition coil — test and replacement

Refer to illustrations 7.2 and 7.3 Test

1 Disconnect the cable from the negative terminal of the battery. Disconnect the high tension wire from the ignition coil.
2 To check primary coil resistance, use an ohmmeter to measure the resistance between the positive and negative terminals **(see illustration).** The primary coil resistance should be 0.5 to 0.7 ohms.
3 To check secondary coil resistance, measure the resistance between the positive terminal and the high tension terminal **(see illustration).** The secondary coil resistance should be 11,000 to 16,000 ohms.
4 If the primary or secondary circuits of the coil do not check out as specified, replace the coil.

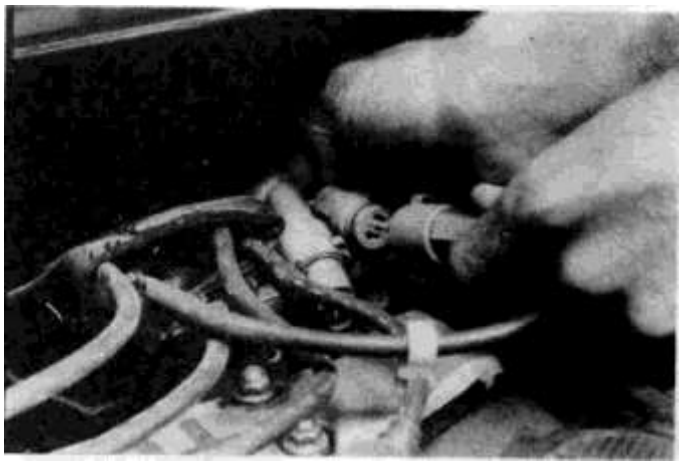
Replacement

5 Unplug the connectors to the igniter.
6 Remove the coil bracket bolts.
7 Remove the coil
8 Separate the coil and igniter (Section 6).
9 Attach the new coil to the old igniter.
10 Installation is the reverse of removal.

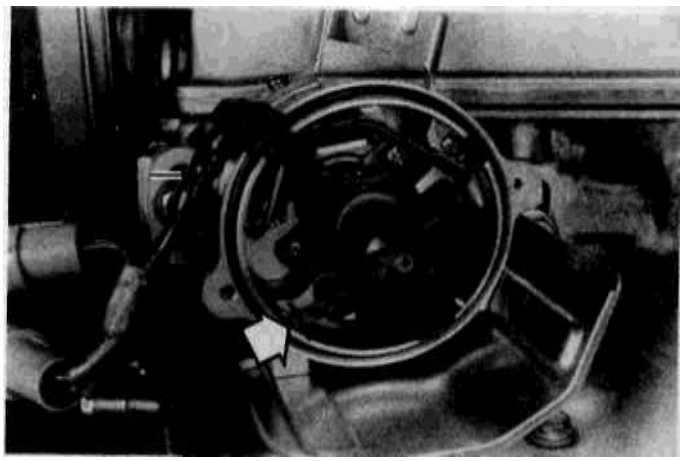
8 Distributor — test, removal and installation

Refer to illustrations 8.3, 8.4, 8.5, 8.9, 8.15 and 8.17 Test

1 Disconnect the cable from the negative terminal of the battery.
2 Remove and inspect the distributor cap and rotor for cracks, carbon tracks, burned or corroded terminals. Check the distributor center contact for wear (refer to Chapter 1 for further information regarding inspection of the distributor cap and rotor). If any of these conditions are noted, replace the cap or rotor.
3 Using a feeler gauge, measure the gap between the signal rotor and pickup coil projection **(see illustration).** Compare your measurement to the specified air gap and, if it's not within specification, replace the distributor.
4 Using an ohmmeter, check the resistance of the distributor signal generators **(see illustration).** The resistance for both the G and Ne signal generators should be 140 to 180 ohms. If the resistance is incorrect, replace the distributor.



8.5 Unplug the electrical connectors to the distributor signal generators



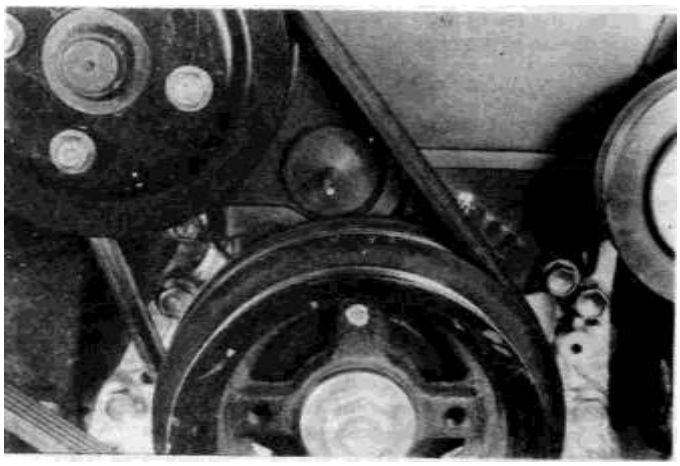
8.9 Mark the rotor in relation to the distributor housing (arrow) and the housing in relation to the cylinder head (line) before loosening the distributor

Removal

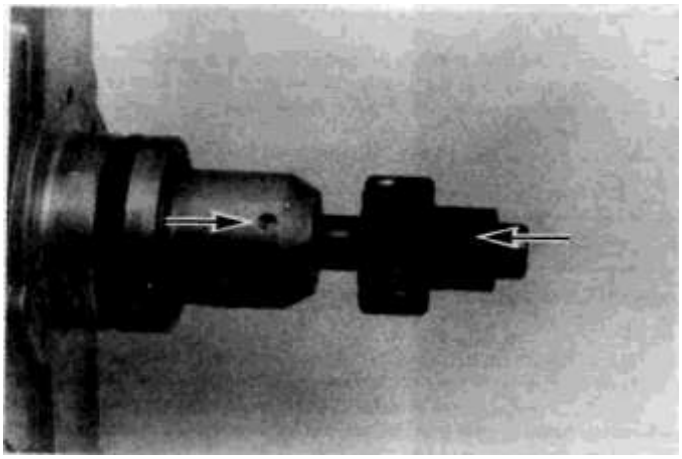
5 Unplug the signal generator electrical connectors from the distributor **(see illustration).**
6 Unsnap and remove the distributor terminal protector.
7 Remove the two distributor cap hold down bolts.
8 Remove the distributor cap.
9 Mark the rotors relationship to the distributor housing and the housings relationship to the cylinder head **(see illustration).**
10 Remove the distributor housing hold down bolts.
11 Pull the distributor from the cylinder head. **Caution:** *Do not rotate the crankshaft or camshafts while the distributor is removed from the head. If either is turned while the distributor is removed, you will have to time the rotor to the crankshaft before reinstalling the distributor.*
12 Remove the 0-ring from the distributor shaft.

Installation

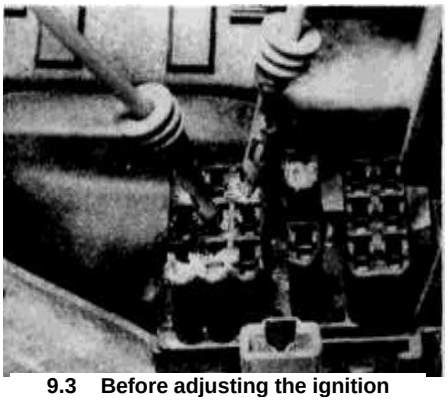
13 Install a new 0-ring on the distributor shaft.
14 If you did not move the crankshaft or camshaft while the distributor was removed, proceed to Step 19.
15 If you moved the crankshaft or camshaft while the distributor was removed, set the No. 1 piston to TDC on its compression stroke by turning the crankshaft pulley until the notch on the edge of the pulley is aligned with the 0 mark on the No. 1 timing belt cover **(see illustration).**
16 Remove the oil filler cap and verify that the detent in the intake camshaft is lined up with the edge of the baffle in the filler cap neck. This will indicate that the No. 1 piston is on the compression stroke. If the detent in the camshaft is not present the No. 1 piston is on the exhaust stroke. Turn the crankshaft one full revolution to bring the piston to TDC on the compression stroke.
17 Align the drilled mark on the driven gear with the cavity of the housing **(see illustration).**
18 Insert the distributor, aligning the center of each elongated hole in the flange with its corresponding bolt hole in the cylinder head. The rotor should be pointing at the distributor cap terminal for the No. 1 spark plug wire. Snug the bolts finger tight.
19 If you did not move the crankshaft or camshafts, insert the distributor and align the mark you made on the distributor housing and cylinder head. Snug the hold-down bolts finger tight.
20 Plug in the distributor electrical connector.
21 Install the distributor cap.
22 Connect the spark plug wires and the coil wire.
23 Adjust the ignition timing (Section 9).
24 Tighten the hold down bolts securely.



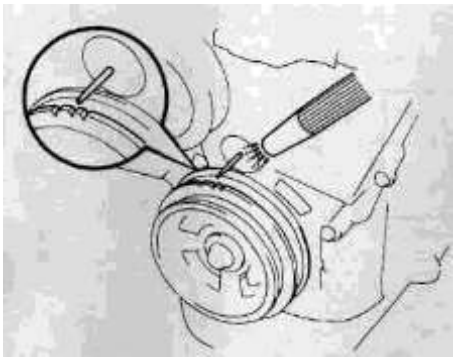
8.15 **If the crankshaft or either camshaft is rotated while the distributor** is **removed from the engine, return the No. 1** piston to TDC by **rotating the crank until the TDC mark on** the crank pulley is **aligned with the stationary marker on the timing belt cover**



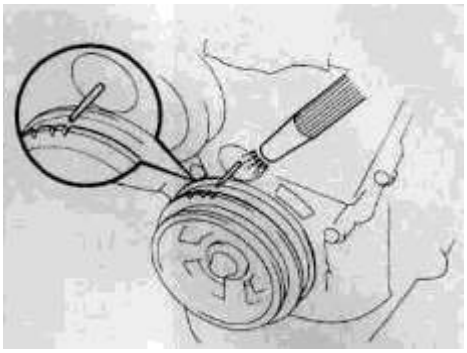
8.17 Make sure that the dimples on the driven gear (right arrow) and distributor housing (left arrow) line up and insert the distributor into the cylinder head — the rotor should be pointing at the No. 1 spark plug terminal



9.3 Before adjusting the ignition timing, bridge terminals T and E1 of the service connector (right behind the air flow meter) to temporarily eliminate computer control of engine rpm



9.5 With the transaxle in Neutral and terminals T and E1 of the service connector bridged, the ignition timing should be 10° BTDC at idle - if necessary, loosen the distributor bolt and turn the distributor until the space between the two advance marks is aligned with the stationary pointer on the timing belt cover



9.9 With the transaxle still in Neutral but the service connector terminals unbridged, the ignition timing should be more than 12° BTDC if your vehicle is equipped with an automatic transaxle and more than 16° BTDC if your vehicle is equipped with a manual transaxle — if necessary, loosen the distributor bolt and turn the distributor until the first advance mark is aligned with the stationary pointer on the timing belt cover

9 Ignition timing

Refer to illustrations 9.3, 9.5 and 9.9

Caution: *Some tachometers may not be compatible with this ignition system. Consult with the manufacturer before hooking up your tachometer.*

1 Connect a tachometer in accordance with the manufacturer's instructions.

2 Warm up the engine and allow it to reach normal operating temperature.

3 Locate the service connector right behind the air flow meter. Connect terminals T and E1 of the service connector with a jumper wire **(see illustration).**

4 Make sure that the transaxle is in Neutral.

5 Using a timing light **(see illustration),** check the ignition timing. It should be 10° BTDC at idle.

6 If necessary, loosen the distributor bolt and turn the distributor to align the marks.

7 Recheck the timing after tightening the distributor to the specified torque.

8 Remove the jumper wire from terminals T and E1 of the service connector.

9 Recheck the ignition timing. It should now be more than 12° BTDC if the vehicle has an automatic transaxle and more than 16° BTDC for manual transaxles **(see illustration).**

10 Engine main relay — check and replacement

Refer to illustrations 10.2, 10.3 and 10.4

1 Locate the engine main relay in the No. 2 junction block in the left front corner of the engine compartment.

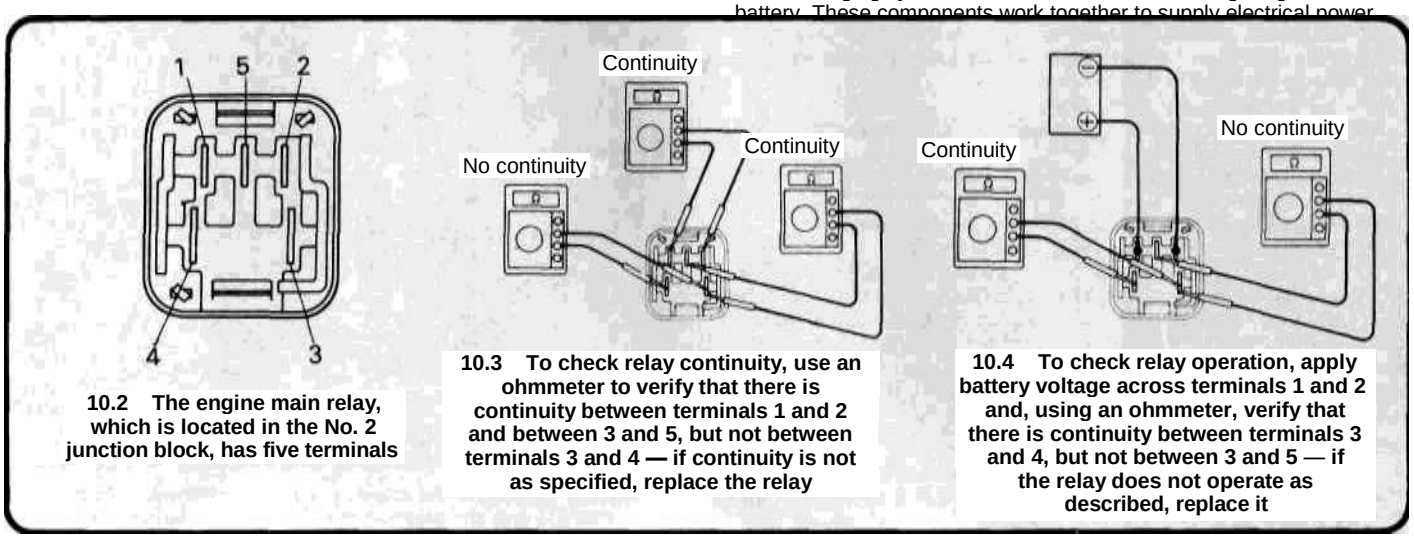
2 Remove the relay and note that it has five terminals **(see illustration).**

3 To check relay continuity, use an ohmmeter **(see illustration)** to verify that there is continuity between terminals 1 and 2 and between terminals 3 and 5, but not between terminals 3 and 4. If the continuity is not as specified, replace the relay.

4 To check relay operation, apply battery voltage to terminals **1** and 2 **(see illustration).** Use an ohmmeter to verify that there is continuity between terminals 3 and 4 but not between terminals 3 and 5. If the continuity is not as specified, replace the relay.

11 Charging system — general information and precautions

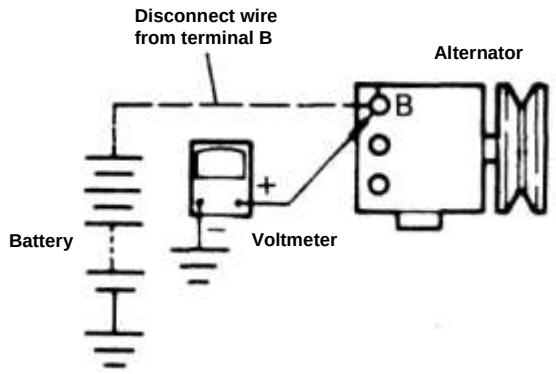
The charging system includes the alternator, voltage regulator and battery. These components work together to supply electrical power



10.2 The engine main relay, which is located in the No. 2 junction block, has five terminals

10.3 To check relay continuity, use an ohmmeter to verify that there is continuity between terminals 1 and 2 and between 3 and 5, but not between terminals 3 and 4 — if continuity is not as specified, replace the relay

10.4 To check relay operation, apply battery voltage across terminals 1 and 2 and, using an ohmmeter, verify that there is continuity between terminals 3 and 4, but not between 3 and 5 — if the relay does not operate as described, replace it



12.4 Connect the positive lead of a voltmeter to terminal B of the alternator and the negative lead of the voltmeter to ground — with the engine running between idle and 2000 rpm, the voltage should be between 13.5 and 15.1 volts

for the ignition system, lights, radio, etc. The alternator is driven off the front of the crankshaft by a drivebelt.

The purpose of the voltage regulator is to limit the alternator's voltage to a preset value. This prevents power surges, circuit overloads, etc., during peak voltage output. On all models with which this manual is concerned the voltage regulator is contained within the alternator housing.

The charging system does not ordinarily require periodic maintenance. The drivebelt, electrical wiring and connections should, however, be inspected at the intervals suggested in Chapter 1.

Take extreme care when making circuit connections to a vehicle equipped with an alternator and note the following. When making connections to the alternator from a battery, always match correct polarity. Before using arc welding equipment to repair any part of the vehicle, disconnect the wires from the alternator and the battery terminals. Never start the engine with a battery charger connected. Always disconnect both battery leads before using a battery charger.

12 Charging system — check

Refer to illustrations 12.4 and 12.6

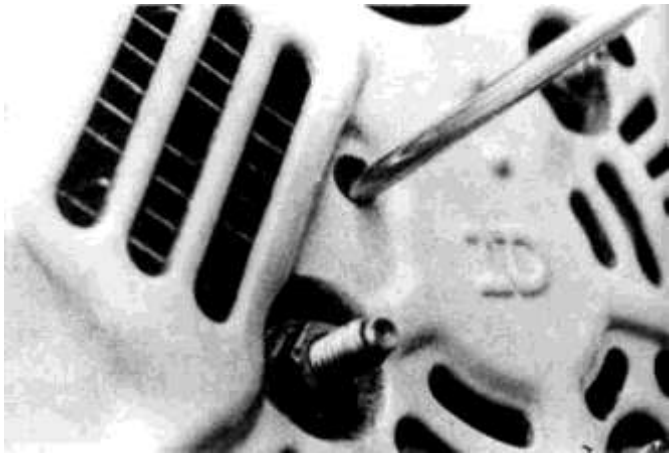
1 If a malfunction occurs in the charging circuit, do not immediately assume that the alternator is causing the problem. First, check:

a) The specific gravity of each cell. The standard specific gravity, when fully charged at 68°F (20°C), is 1.25 to 1.27.
b) The electrolyte quantity in each cell. If the level of any cell is low, refill it with distilled water.
c) The battery voltage with the engine off. It should be approximately 12 volts.
d) The battery ground cable and starter cable (positive) connections at the battery and at their respective body and starter ends. They should be clean and tight.
e) The fusible link for continuity.
f) The 10 amp engine, 5 amp charging and 7.5 amp AM2 fuses. Replace blown fuses.
g) The alternator wiring harness and connectors, which should be in good condition.
h) The condition and tension of the drivebelt (Chapter 1). i) The alternator mounting bolts for a tight fit. j) The engine and alternator, while running, for abnormal noise.

2 Check the discharge warning light circuit: Warm up the engine and then turn it off. Turn off all accessories. Turn the ignition switch to On. Check that the discharge warning light is lit. Start the engine. Verify that the light goes out. If the light does not come on and go off as specified, troubleshoot the warning light circuit (refer to the wiring diagrams at the end of this book).

Checking charging circuit without a load

3 To check the charging circuit without a load, connect a battery/ alternator tester, if available, to the charging circuit in accordance with the manufacturer's instructions.



12.6 To check the voltage regulator, stick the blade of a small screwdriver into the test hole on the back of the alternator, grounding terminal "F" to the end cover. With the engine running, note the voltage reading for terminal B of the alternator. If it's lower than 13.5 volts, check the alternator. If it's higher than 15.1 volts, replace the voltage regulator

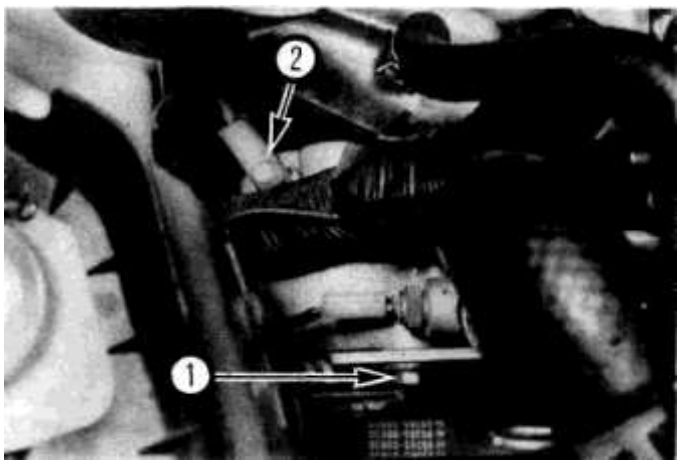
4 If a tester is not available, connect the positive lead of a voltmeter to terminal B of the alternator and the negative lead of the voltmeter to ground **(see illustration).**

5 Note the reading on the voltmeter (with the engine running between idle and 2000 rpm) and compare your readings to the specified voltage. If the voltage is greater than standard, replace the voltage regulator.

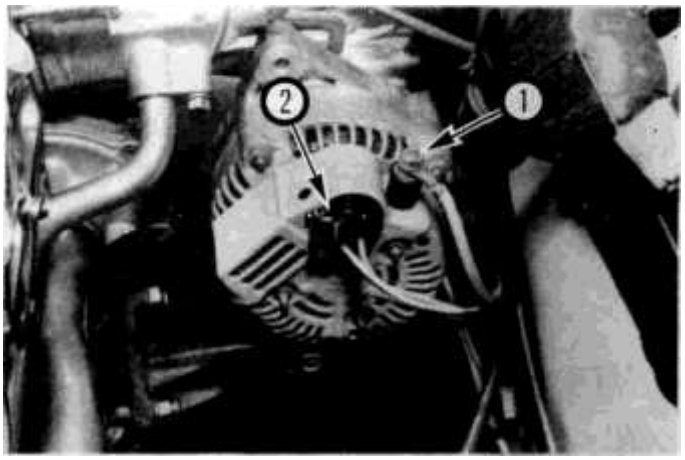
6 If the voltage reading is less than standard, check the regulator and alternator as follows. Locate the test hole in the back of the alternator and ground terminal F (the tab located inside the hole) by inserting a screwdriver blade into the hole and touching the tab and the case at the same time **(see illustration). Caution:** *Do not run the engine with the tab grounded any longer than is necessary to obtain a voltmeter reading. If the alternator is charging, it is running unregulated during the test. This condition may overload the electrical system and cause damage.*

7 With terminal F grounded, start the engine and check the voltage reading of terminal B. If the voltage reading is greater than standard, replace the voltage regulator (Section 14). If the voltage reading is less than standard, the alternator is faulty and must be replaced (Section **1**3). **Checking the charging circuit with a load**

8 With the engine running at 2000 rpm, turn on the high beam head-lights, turn on the radio and place the heater fan control switch at HI. Check the reading on the ammeter. If the ammeter reading is less than 30 amps, repair the alternator.



13.2 To remove the alternator, remove the adjustment bolt (1) and the plastic boot (2) covering terminal B



13.4 Remove the nut (1) to disconnect the wire from terminal B of the alternator and unplug the large electrical connector (2) from the end cover

13.8 Remove the through bolt (arrow) from the alternator mounting bracket

13 Alternator — removal and installation

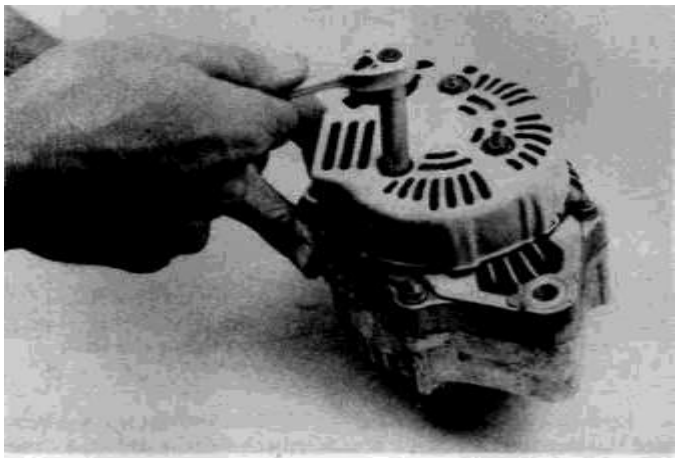
Refer to illustrations 13.2, 13.4 and 13.8

1 Disconnect the cable from the negative terminal of the battery.
2 Remove the adjustment bolt **(see illustration).**
3 Remove the plastic cover from terminal B.
4 Remove the nut and wire from terminal B **(see illustration).**
5 Unplug the large round electrical connector from the alternator end cover.
6 Raise the vehicle and place it securely on jackstands.
7 Disconnect the exhaust pipe from the exhaust manifold and from the hanger bracket (refer to Chapter 4).
8 Remove the pivot nut and through-bolt from the alternator mounting bracket **(see illustration)**
9 Remove the alternator.
10 Installation is the reverse of removal.

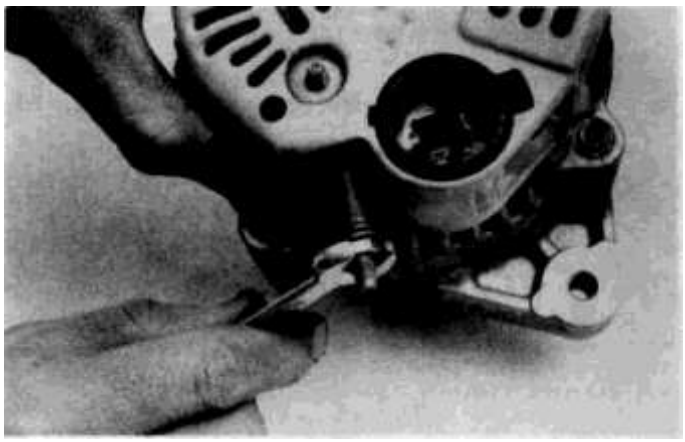
14 Voltage regulator and alternator brushes — replacement

Refer to illustrations 14.2a, 14.2b, 14.3, 14.4a, 14.4b, 14.5 and 14.7 1 Remove the alternator (Section 13) and place it on a clean workbench.

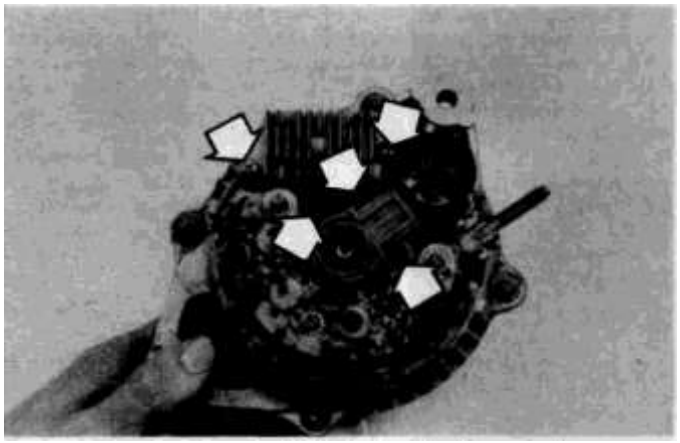
2 Remove the three rear end cover nuts, the nut and terminal insulator and the rear end cover **(see illustrations).**
3 Remove the five voltage regulator and brush holder mounting screws **(see illustration).**



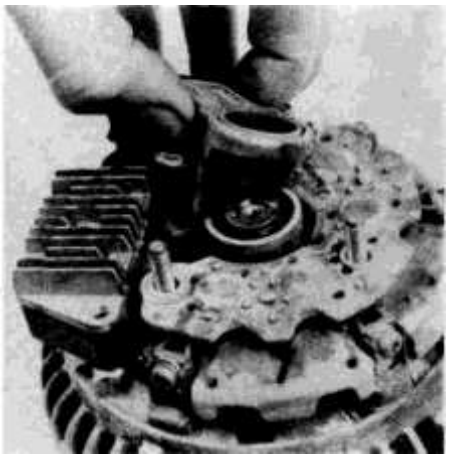
14.2a Remove the three nuts from the rear end cover



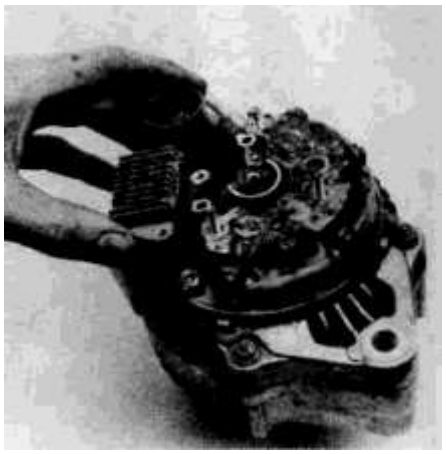
14.2b Take the nut, washer and insulator off terminal B and remove the alternator end cover



14.3 Once the rear end cover is removed, remove the five screws (arrows) that retain the voltage regulator and the brush holder

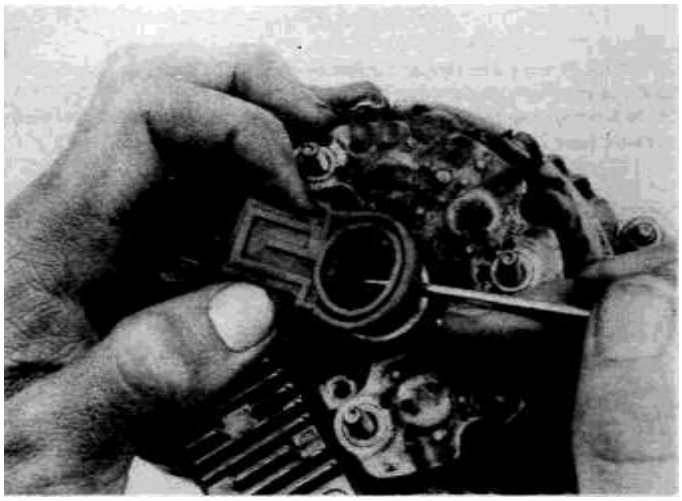


14.4a Remove the brush holder



14.4b Remove the regulator

14.5 Measure the exposed length of the brushes and compare your measurements to the specified minimum exposed length to determine whether they have service life remaining in them



14.7 To facilitate installation of the brush holder, depress each brush with a small screwdriver to clear the shaft

4 Remove the brush holder and the regulator from the rear end frame **(see illustrations).** If you are simply replacing the regulator, proceed to Step 8, install the new unit, reassemble the alternator and install it on the engine (Section 13). If you are going to replace the brushes, proceed with the next step.
5 Measure the exposed length of each brush **(see illustration)** and compare it to the specified minimum exposed length. If the length of either brush is less than the specified minimum, replace the brushes.
6 Make sure that each brush moves smoothly in the brush holder.
7 Install the brush holder by depressing each brush with a small screwdriver to clear the shaft **(see illustration).**
8 Install the voltage regulator and brush holder screws into the rear end frame.
9 Install the rear end cover and tighten the three nuts securely.
10 Install the terminal insulator and tighten it with the nut.
11 Install the alternator (Section **13).**

15 Starting system — general information

The function of the starting system is to crank the engine. The starting system is composed of a starter motor, solenoid and battery. When the ignition switch is turned to Start, electrical energy is supplied by the battery to the solenoid, which completes the circuit to the starter motor, cranking the engine over by turning the ring gear on the flywheel.

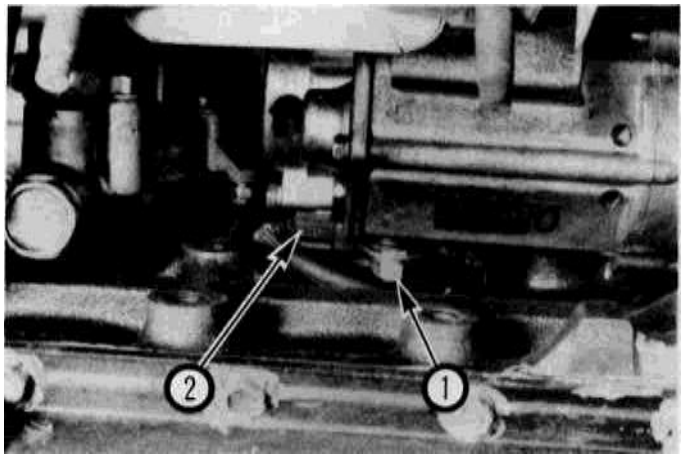
A neutral start switch is incorporated into the starting system so that the starter motor can only be operated when the clutch pedal is depressed (manual transaxle) or the shift lever is in Park or Neutral (automatic transaxle).

Never operate the starter motor for more than 30 seconds at a time without pausing to allow it to cool for at least two minutes. Excessive cranking can cause overheating, which can seriously damage the starter.

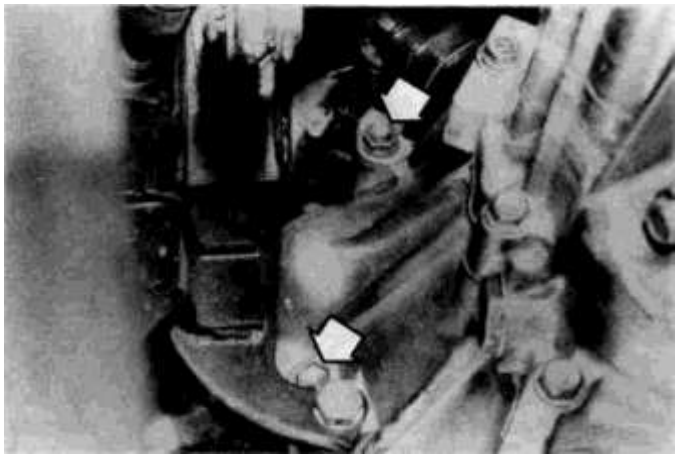
16 Starter motor — testing in vehicle

Note: *Before diagnosing starter problems, make sure that the battery is fully charged.*

1 If the starter motor does not turn at all when the switch is operated, make sure that the shift lever is in Park (automatic transmission) or that the clutch pedal is depressed (manual transmission).
2 Make sure that the battery is charged and that all cables, both at the battery and starter solenoid terminals, are secure.
3 If the starter motor spins but the engine is not cranking, then the overrunning clutch in the starter motor is slipping and the starter motor must be replaced.
4 If, when the switch is actuated, the starter motor does not operate at all but the solenoid clicks, then the problem lies with either the battery, the main solenoid contacts or the starter motor itself.
5 If the solenoid plunger cannot be heard when the switch is actuated, the solenoid itself is defective or the solenoid circuit is open.
6 To check the solenoid, connect a jumper lead between the battery positive terminal and the terminal on the solenoid. If the starter motor now operates, the solenoid is OK and the problem is in the ignition switch, neutral start switch or in the wiring.
7 If the starter motor still does not operate, remove the starter/solenoid assembly and have it repaired or replace it.
8 If the starter motor cranks the engine at an abnormally slow speed, first make sure that the battery is charged and that all terminal connections are tight. If the engine is partially seized, or has the wrong viscosity oil in it, it will crank slowly.
9 Run the engine until normal operating temperature is reached, then disconnect the coil wire from the distributor cap and ground it on the engine.
10 Connect a voltmeter positive lead to the starter motor terminal of the solenoid and connect the negative lead to ground.
11 Turn the ignition switch to Start and take a voltmeter reading as soon as a steady figure is indicated. Do not allow the starter motor to turn for more than 30 seconds at a time. A reading of 9 volts or more, with the starter motor turning at normal cranking speed, is normal. If the reading is 9 volts or more but the cranking speed is slow, the motor is faulty. If the reading is less than 9 volts and the cranking speed is slow, the solenoid contacts are probably burned.



17.2 Remove the nut (1) to disconnect the lead wire from the solenoid terminal and unplug the other electrical connector (2)

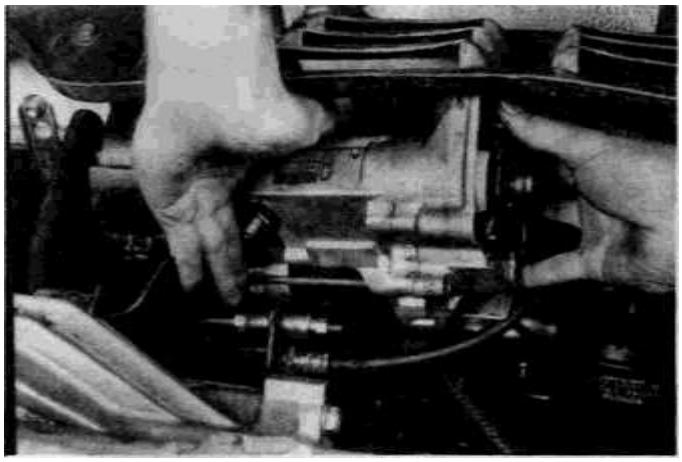


17.3 Remove the two starter motor mounting bolts (arrows)

17 Starter motor — removal and installation

Refer to illustrations 17.2, 17.3 and 17.5

1 Disconnect the cable from the negative terminal of the battery.
2 Remove the nut and disconnect the battery cable from the solenoid and unplug the connector from the starter motor **(see illustration).**
3 Remove the two starter motor mounting bolts **(see illustration).**
4 Disconnect the exhaust pipe from the exhaust manifold (refer to Chapter 4, if necessary).
5 Remove the starter motor/solenoid assembly **(see illustration).**
6 Installation is the reverse of removal. Be sure to tighten the starter motor mounting bolts to the specified torque.

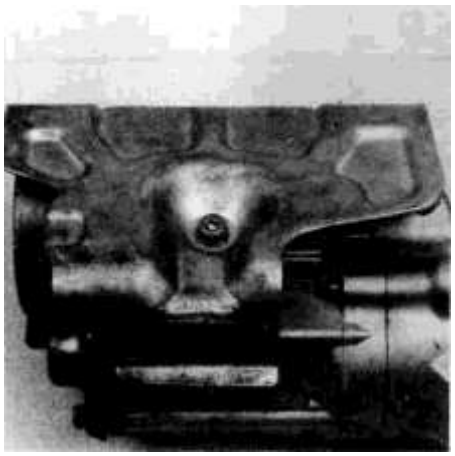


17.5 Remove the starter through the space between the under cover and the engine

18 Starter solenoid — removal and installation

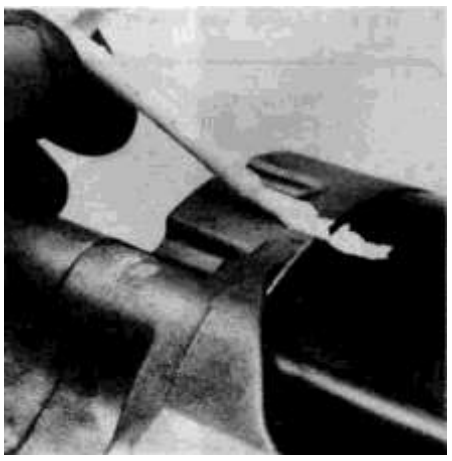
Refer to illustrations 18.2, 18.3, 18.4, 18.5, 18.6, 18.7, 18.8a and 18.8b

1 Remove the starter motor (Section 17).
2 Remove the heat insulator **(see illustration)** from the starter motor.
3 Remove the nut and lead wire **(see illustration)** from the solenoid .
4 Mark the starter motor and gear housing **(see illustration).**

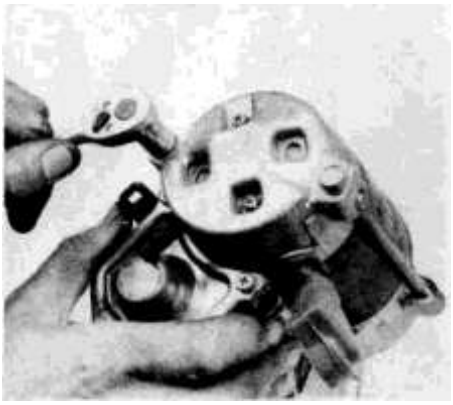


18.2 Remove the retaining bolt and the heat insulator

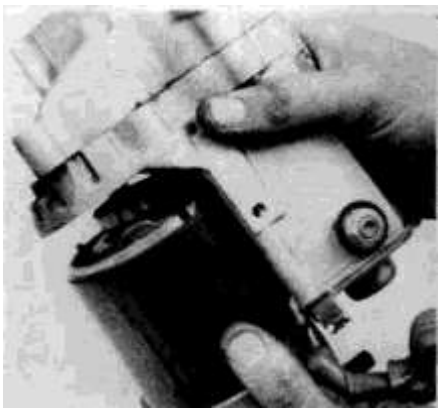
18.3 Remove the terminal nut and disconnect the starter motor lead from the solenoid terminal



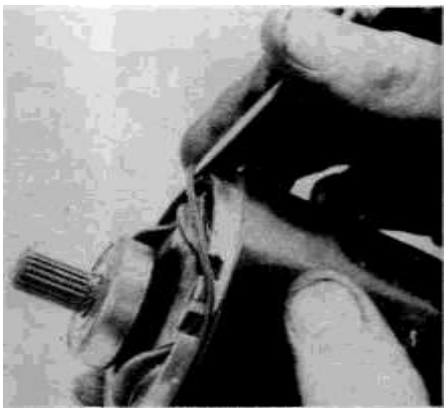
18.4 Mark the starter motor and gear housing to insure proper reassembly



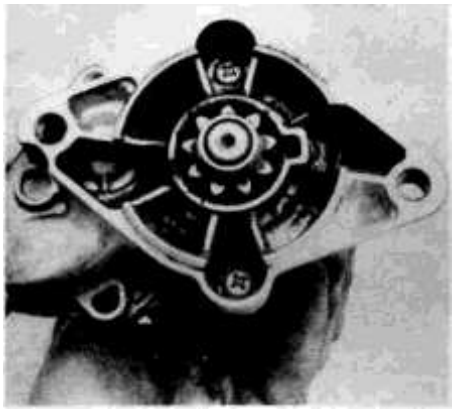
18.5 Remove the starter motor through-bolts



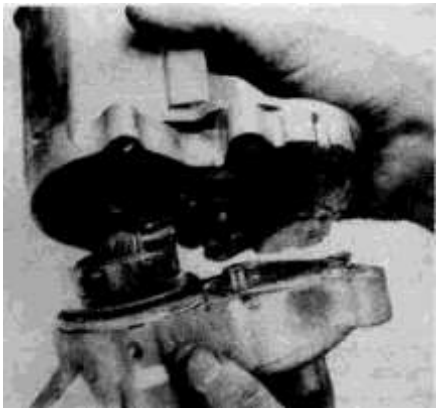
18.6 Separate the starter motor from the gear housing



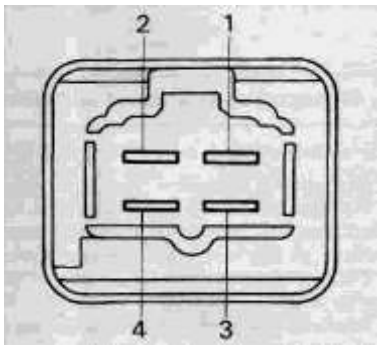
18.7 Remove the old starter motor CD-ring with a small screwdriver — always install a new O-ring when installing the starter motor



18.8a Remove these two screws . . .



18.8b . . .and separate the solenoid housing from the starter housing



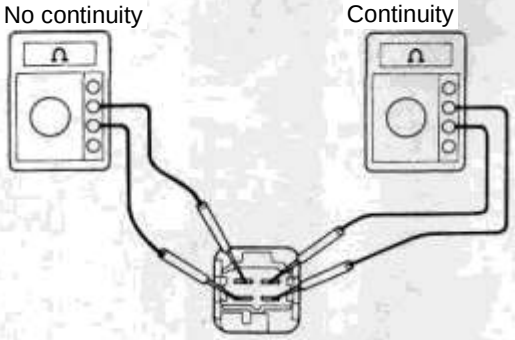
19.1 The starter relay is located in the No. 2 junction block at the left front corner of the engine compartment — it has four terminals

5 Remove the two through bolts **(see illustration).**
6 Separate the starter motor from the gear housing **(see illustration).**
7 Remove the starter motor O-ring **(see illustration).**
8 Remove the two screws **(see illustration)** and separate the gear housing from the solenoid housing **(see illustration).**
9 Installation is the reverse of removal.

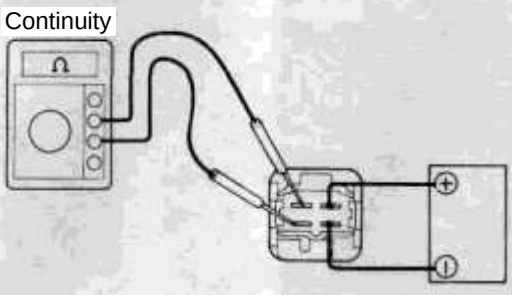
19 Starter relay — check and replacement

Refer to illustrations 19.1, 19.2 and 19.3

1 The starter relay **(see illustration)** is located in the No. 2 junction block in the left front corner of the engine compartment.
2 To check relay continuity, use an ohmmeter to verify that there is continuity between terminals 1 and 3 but not between terminals 2 and 4 **(see illustration).** If the continuity is not as specified, replace the relay.
3 To check relay operation, apply battery voltage to terminals 1 and 3 and, using an ohmmeter, verify that there is continuity between terminals 2 and 4 **(see illustration).** If continuity is not as specified, replace the relay.



19.2 To check starter relay continuity, verify that there is continuity between terminals 1 and 3 but not between 2 and 4 — if continuity is not as specified, replace the relay



19.3 To check starter relay operation, apply battery voltage to terminals 1 and 3, then verify that there is continuity between terminals 2 and 4 — if the relay does not operate as described, replace it

Chapter 6 Emissions control systems

Contents

Dashpot system — description, check and component replacement 7
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Electronic control systems — general information and precautions 2
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Positive Crankcase Ventilation (PCV) hose — check and replacement 5
Three-way catalyst system — description, check and component replacement 9

Specifications

Dashpot setting speed	1800 rpm
EGR vacuum switching valve resistance	33 to 39 ohms at 20° C (68 °F)

Torque specifications	**Nm**	**Ft-lbs**
Catalyst-to-exhaust pipe bolts	43	32
Catalyst heat protector bolts	19	**14**

1 General information and precautions

Refer to illustrations 1.1 and 1.6

To minimize pollution of the atmosphere from incompletely burned and evaporating gases and to maintain good driveability and fuel economy, a number of emission control systems are used on this vehicle **(see illustration).** They include the:

Positive Crankcase Ventilation (PCV) system — which reduces blow-by gas (hydrocarbons)

Evaporative Emission Control (EVAP) system — which reduces evaporative hydrocarbons

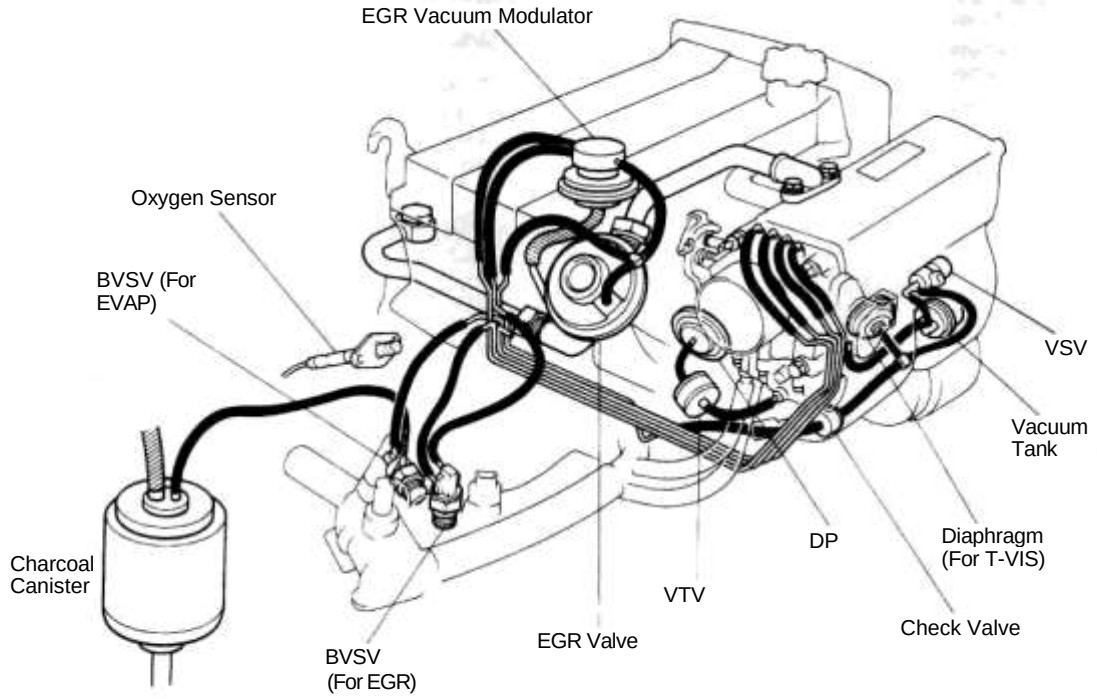
Dashpot system - which reduces hydrocarbons and carbon monoxide

Exhaust Gas Recirculation (EGR) system - which reduces oxides **of** nitrogen

Three way catalyst system — which reduces hydrocarbons, carbon monoxide and nitrous oxides

Electronic Fuel Injection (EFI) system — which reduces all exhaust emissions by regulating operating conditions of engine (refer to Chapter 4 for further information on the EFI system).

The sections in this chapter include general descriptions, checking procedures within the scope of the home mechanic and component replacement procedures (when possible) for each of the systems listed above.



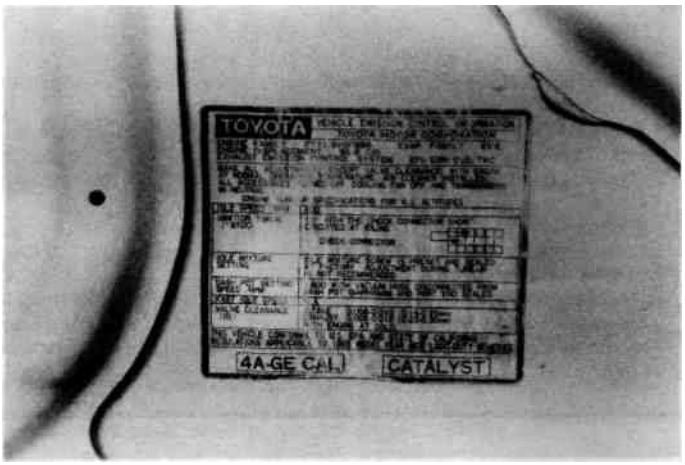
1.1 The location and routing of vacuum hoses for emission control components

Before assuming that an emissions control system is malfunctioning, check the fuel (Chapter 4) and ignition (Chapter 5) systems carefully. The diagnosis of some emission control devices requires specialized tools, equipment and training. If checking and servicing become too difficult or if a procedure is beyond the scope of your skills, consult your dealer service department.

This doesn't mean, however, that emission control systems are particularly difficult to maintain and repair. You can quickly and easily perform many checks and do most of the regular maintenance at home with common tune-up and hand tools. **Note:** *The most frequent cause of emissions problems is simply a loose or broken electrical connector or vacuum hose, so always check the electrical connectors and vacuum hoses first.*

Pay close attention to any special precautions outlined in this chapter. It should be noted that the illustrations of the various systems may not exactly match the system installed on your vehicle because of changes made by the manufacturer during production or from year-to-year.

A Vehicle Emissions Control Information label is located in the engine compartment **(see illustration).** This label contains important emissions specifications and setting procedures, as well as a vacuum hose schematic with emissions components identified. When servicing the engine or emissions systems, the VECI label in your particular vehicle should always be checked for up-to-date information.



1.6 The Vehicle Emission Control Information (VECI) label is located on the underside of the engine compartment lid

2 Electronic control system — general information and precautions

General information

The Toyota Computer Control System (TCCS) controls the fuel injection system, the spark advance system, the diagnosis system, the cooling fans, etc. by means of a microcomputer known as the Electronic Control Unit (ECU).

The ECU receives signals from various sensors which monitor changing engine operating conditions such as intake air volume, intake air temperature, coolant temperature, engine rpm, acceleration/deceleration, exhaust oxygen content, etc. These signals are utilized by the ECU to determine the correct injection duration and ignition timing.

The system is analogous to the central nervous system in the human body: The sensors (nerve endings) constantly relay signals to the ECU (brain), which processes the data and, if necessary, sends out a command to change the operating parameters of the engine (body).

Here's a specific example of how one portion of this system operates: An oxygen sensor, located in the exhaust manifold, constantly monitors the oxygen content of the exhaust gas. If the percentage of oxygen in the exhaust gas is incorrect, an electrical signal is sent to the ECU. The ECU takes this information, processes it and then sends a command to the fuel injection system, telling it to change the air/fuel mixture. This happens in a fraction of a second and it goes on continuously when the engine is running. The end result is an air/fuel mixture ratio which is constantly maintained at a predetermined ratio, regardless of driving conditions.

In the event of a sensor malfunction, a backup circuit will take over to provide driveability until the problem is identified and fixed (Section 3).

Precautions

a) Always disconnect the power by either turning off the ignition switch or disconnecting the battery terminals before removing EFI wiring connectors.
b) When installing a battery, be particularly careful to avoid reversing the positive and negative battery cables.
c) Do not subject EFI or emissions related components or the ECU to severe impact during removal or installation.
d) Do not be careless during troubleshooting. Even slight terminal contact can invalidate a testing procedure and even damage one of the numerous transistor circuits.
e) Never attempt to work on the ECU or open the ECU cover. The ECU is protected by a government mandated extended warranty that will be nullified if you tamper with or damage the ECU.
f) If you are inspecting electronic control system components during rainy weather, make sure that water does not enter any part. When washing the engine compartment, do not spray these parts or their connectors with water.

3 Diagnosis system — general information and obtaining diagnosis codes

Refer to illustration 3.3

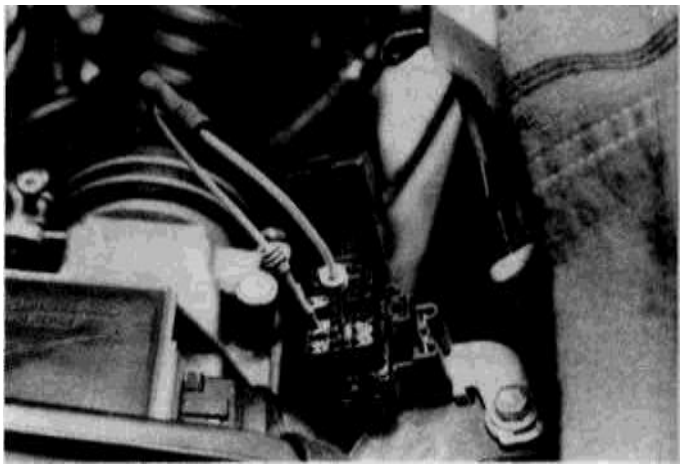
General information

The ECU contains a built-in self-diagnosis system which detects and identifies malfunctions occurring in the network. When the ECU detects a problem, three things happen: the *Check Engine* light comes on, the trouble is identified and a diagnostic code is recorded and stored. The ECU stores the failure code assigned to the specific problem area until the diagnosis system is cleared by removing the AM2 fuse with the ignition switch off. **Check Engine warning light**

The Check Engine warning light, which is located on the instrument panel, comes on when the ignition switch is turned to On and the engine is not running. When the engine is started, the warning light should go out. If the light remains on, the diagnosis system has detected a malfunction in the system.

Obtaining diagnosis code output

1 To obtain an output of diagnostic codes, verify first that the battery voltage is above 11 volts, the throttle is fully closed, the transaxle is in neutral, the accessory switches are off and the engine is at normal



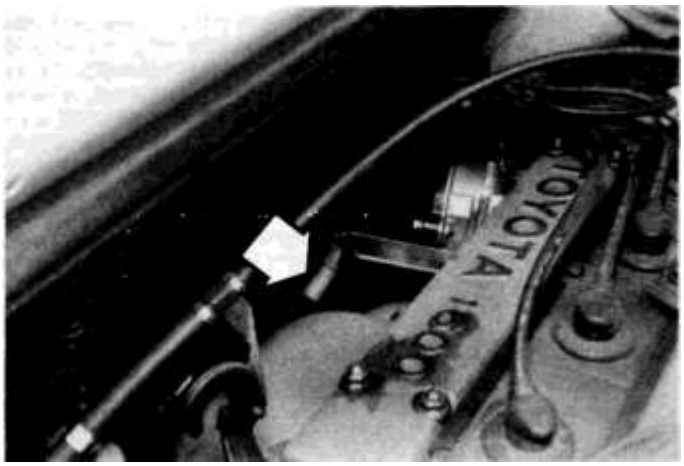
3.3 To display the diagnostic code output use a jumper wire to bridge terminals T and E1 of the service connector (just behind the air flow meter)

operating temperature.
2 Turn the ignition switch to On. Do not start the engine.
3 Use a jumper wire to bridge terminals T and E1 of the service connector, located behind the air flow meter (see **illustration).**
4 Read the diagnosis code as indicated by the number of flashes of the warning light.
5 Normal system operation will be indicated by Code No. 1 (no malfunction). The light will blink once every five seconds.
6 If there is a malfunction, the light will blink the requisite number of times for the indicated trouble code with a 2.5 second delay between each indicated code (if there is more than one code to display).
7 After the code with the largest number of flashes has been displayed, there will be a 4.5 second delay and then the sequence will begin all over again.

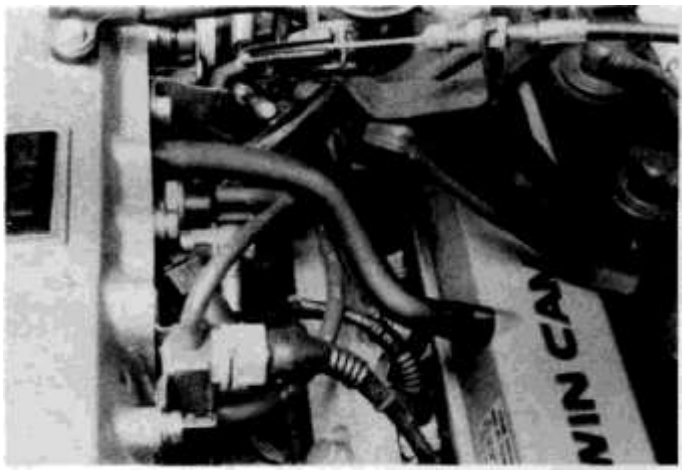
Cancelling the diagnostic code
8 After the trouble area is repaired/replaced, the diagnosis code stored in the ECU memory must be cancelled by removing the 7.5A AM2 fuse located behind the driver's kick panel for 10 seconds or more, depending on ambient temperature (the lower the temperature, the longer the fuse must be left out) with the ignition switch off.
9 Cancellation can also be effected by removing the cable from the battery negative terminal, but other memory systems (such as the clock) will also be cancelled.
10 If the diagnosis code is not cancelled it will be stored by the ECU and appear with any new codes in the event of future trouble.
11 Should it become necessary to work on engine components requiring removal of the battery terminal, first check to see if a diagnostic code has been recorded.

Code No.	Number of blinks "CHECK ENGINE"	System	Diagnosis	Trouble area
1	**1 Flash, Pause, 1 Flash, Pause, Etc.**	Normal	This appears when none of the other codes (2 thru 11) are identified	**-**
2	**2 Flashes, Pause, 2 Flashes, Pause, Etc.**	Air flow meter signal	Open circuit in VC, VS, VB or E2 Short circuit in VC	1. Air flow meter circuit 2. Air flow meter 3. ECU
3	**3 Flashes, Pause, 3 Flashes, Pause, Etc.**	Ignition signal	No signal from igniter four times in succession	1. Ignition circuit (+B. IGF) 2. Igniter 3. ECU
4	**4 Flashes, Pause, 4 Flashes, Pause, Etc.**	Water temp. sensor signal	Open or short circuit in coolant temperature sensor signal.	1. Coolant Temp. sensor circuit 2. Coolant Temp. sensor 3. ECU
5	**5 Flashes, Pause, 5 Flashes, Pause, Etc.**	Oxygen sensor signal	Open circuit in Oxygen Sensor signal (only lean indication)	1. Oxygen sensor circuit 2. Oxygen sensor 3. ECU
6	**6 Flashes, Pause, 6 Flashes, Pause, Etc.**	RPM signal	No "Ne", "G" signal to ECU within several seconds after engine is cranked.	1. Distributor circuit 2. Distributor 3. Igniter 4. Starter signal circuit 5. ECU
7	**7 Flashes, Pause, 7 Flashes, Pause, Etc.**	Throttle position sensor signal	Open or short circuit in throttle position sensor signal.	1. Throttle position sensor circuit 2. Throttle position sensor 3. ECU
8	**8 Flashes, Pause, 8 Flashes, Pause, Etc.**	Intake air temp. sensor signal	Open or short circuit in intake air temperature sensor.	1. Air temp. sensor circuit 2. ECU
10	**10 Flashes, Pause, 10 Flashes, Pause, Etc.**	Starter signal	No STA signal to ECU when engine is running over 800 rpm.	1. Starter relay circuit 2. IG switch circuit (starter) 3. IG Switch 4. ECU
11	**11 Flashes, Pause, 11 Flashes, Pause, Etc.**	Switch signal	Air conditioner switch ON or idle switch OFF during diagnosis check.	1. Air con. S/W 2. ECU 3. Idle S/W

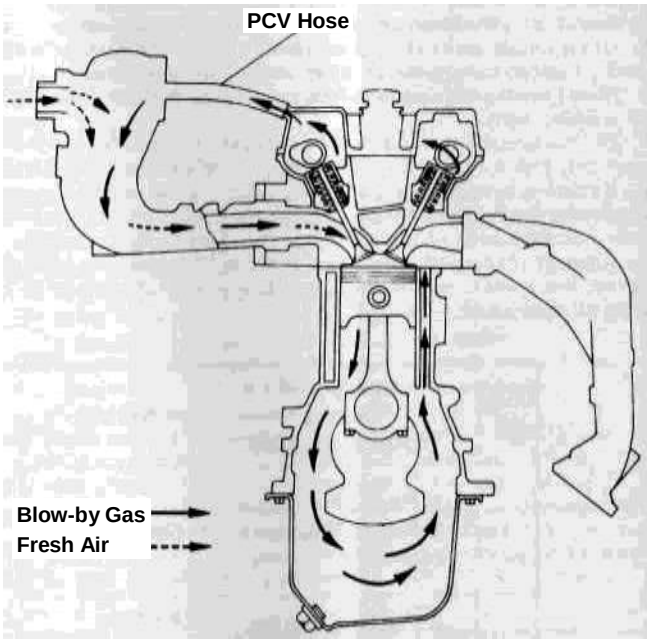
NOTE: • There is no diagnosis code No. 9.
• Diagnosis code No. 10 will be indicated if the vehicle is push started.



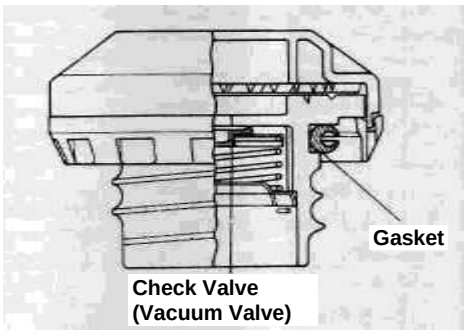
4.3 Before raising the vehicle, unplug the oxygen sensor connector — it's the round, yellow connector (arrow) just below and in front of the distributor



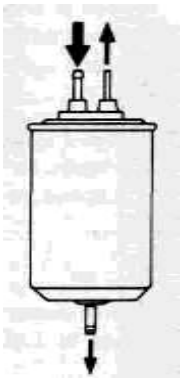
5.2 The PCV hose should be periodically inspected for cracks and dryness

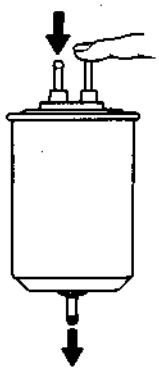


5.1 The Positive Crankcase Ventilation (PCV) system. Crankcase blow-by gases are routed to the intake manifold, where they are mixed with incoming fresh air before being burned in the combustion chambers



6.2 Inspect the fuel tank filler neck cap gasket for deformation — if it's damaged, replace it





6.3 The charcoal canister is located in the lower left portion of the forward engine compartment firewall

6.5 To test the charcoal canister, blow into the tank pipe with low pressure compressed air and verify that air flows without resistance from the other pipes, then blow into the purge pipe and verify that air does not flow from the other pipes

6.6 To clean the filter, blow compressed air into the tank pipe while holding the other upper canister pipe closed

4 Oxygen sensor — removal and installation

Refer to illustration 4.3

1 Disconnect the cable from the negative terminal of the battery.
2 Raise the vehicle and place it securely on jackstands.
3 Unplug the electrical connector **(see illustration)** between the oxygen sensor pigtail and the engine compartment wire harness.
4 Carefully remove the oxygen sensor from the exhaust manifold.
5 Installation is the reverse of removal. Be sure to coat the threads of the sensor with anti-seize compound before installation.

5 Positive crankcase ventilation (PCV) hose — check and replacement

Refer to illustrations 5.1 and 5.2

1 To reduce hydrocarbon (HC) emissions, crankcase blow-by gas is routed to the intake manifold for combustion in the cylinders **(see illustration).**
2 Check the PCV hose **(see illustration)** for cracks, leaks or damage. If any of these symptoms are evident, replace the hose.
3 Visually inspect the hoses, connections and gaskets that affect the PCV system. Tighten, repair or replace the causes of potential leaks.

6 Fuel Evaporative Emission Control (EVAP) system — description, check and component replacement

Refer to illustrations 6.2, 6.3, 6.5, 6.6, 6.11 and 6.13

Description

1 To reduce hydrocarbon emissions, evaporated fuel from the fuel tank is routed through the charcoal canister to the intake manifold for burning in the cylinders.

Check and replacement **Hoses**

2 Periodically inspect the fuel vapor lines for loose connections, sharp bends or damage. Check the fuel tank plumbing for deformation, cracks or fuel leakage. Check the fuel filler cap **(see illustration)** for a damaged or deformed gasket. **Canister**

3 Remove the charcoal canister **(see illustration).**
4 Inspect the canister for cracks or damage.
5 Using low pressure compressed air, blow into the fuel tank pipe and verify that air flows without resistance from the other pipes **(see illustration).** Blow into the purge pipe and verify that air does not flow from the other pipes. If the canister fails to perform as described, replace it.
6 Clean the canister filter by blowing compressed air (43 psi maximum) into the tank pipe while holding the other upper canister pipe closed **(see illustration). Caution:** *Do not attempt to wash the canister.*
7 Installation of the canister is the reverse of removal.

Bimetal Vacuum Switching Valve (BVSV)

8 Locate the bimetal vacuum switching valve in the front of the thermostat housing **(see illustration 1.1).**
9 Drain the coolant from the engine into a suitable container and remove the valve.
10 Cool the valve to below 35 °C (95 °F) with cold water.
11 Blow air into a pipe and verify that the valve is closed **(see illustration).**
12 Heat the valve to above 54 °C (129°F) with hot water.
13 Blow air into a pipe and verify that the valve is open **(see illustration).**
14 If the valve fails either of these checks, replace it.
15 Apply sealer to the threads of the valve.
16 Install the valve, tighten it securely and reattach the vacuum hoses.
17 Fill the engine with coolant.

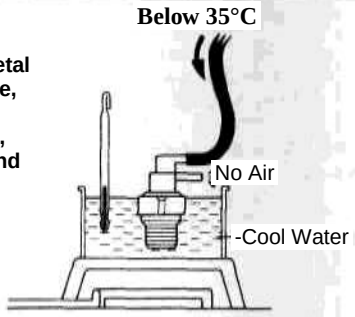
7 Dashpot system — description, check and component replacement

Refer to illustrations 7.1, 7.4, 7.5, 7.6, 7.8, 7.9, 7.10 and 7.11

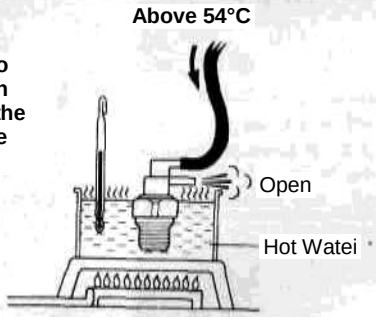
Description

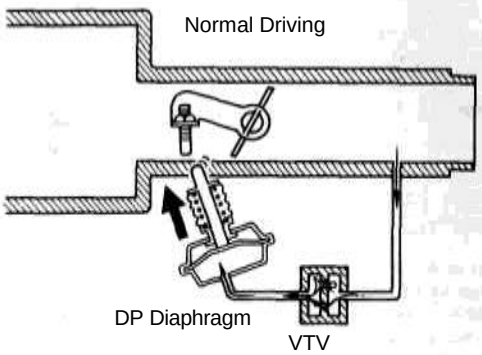
1 To reduce hydrocarbon and carbon monoxide emissions, the dashpot opens slightly more during deceleration than it does at idle, promoting a more complete burn of the air/fuel mixture **(see illustration).**

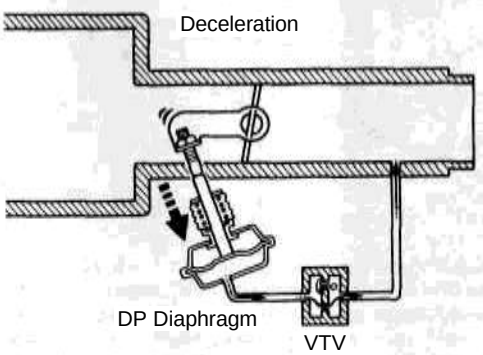
6.11 To check the bimetal vacuum switching valve, cool it to below 35°C (95°F) with cold water, blow air into the pipe and verify that the valve is closed



6.13 Heat the valve to above 54°C(129°F) with hot water, blow air into the pipe and verify that the valve is open







7.1 During normal driving the dashpot diaphragm, pushed out by the diaphragm spring, is open — during deceleration, pushed in by the return force of the throttle valve, it's closed

*Check **and replacement***

Dashpot

2 Warm up the engine.

3 Check and, if necessary, adjust the idle speed (Chapter 1).

4 With the engine running at 3000 rpm, disconnect the vacuum hose from the dashpot diaphragm and plug the port **(see illustration).**

5 Release the throttle and verify that the engine speed drops to 1800 rpm **(see illustration).** If it does, the dashpot is properly adjusted.

6 If engine speed does not drop to the specified rpm, adjust the dashpot adjusting screw **(see illustration)** and recheck.

7 Reconnect the vacuum hose.

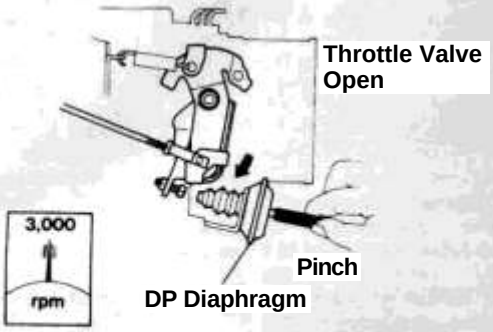
Vacuum Transmitting Valve (VTV)

8 With the engine running at 3000 rpm, pinch the vacuum hose between the dashpot and the vacuum transmitting valve **(see illustration).**

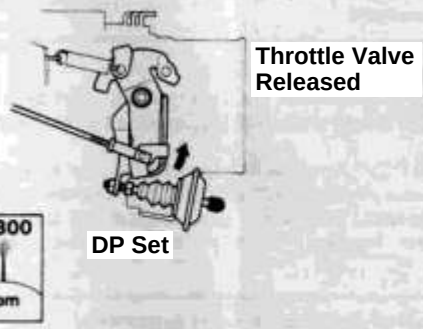
9 Release the throttle and note whether the engine speed drops to 1800 rpm **(see illustration).**

10 Release the pinched hose **(see illustration)** and verify that the engine returns to normal idle speed in 0.5 to 5 seconds.

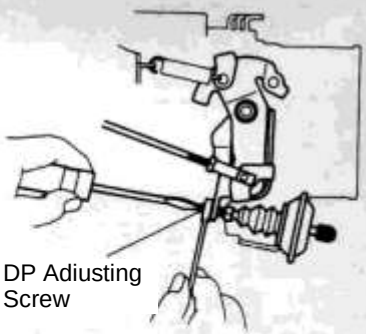
11 If the engine rpm fails to respond as specified, remove the valve and check it by blowing air into each side **(see illustration).** Air should flow without resistance from B to A, but with difficulty from A to B. If the valve fails either check, replace it.



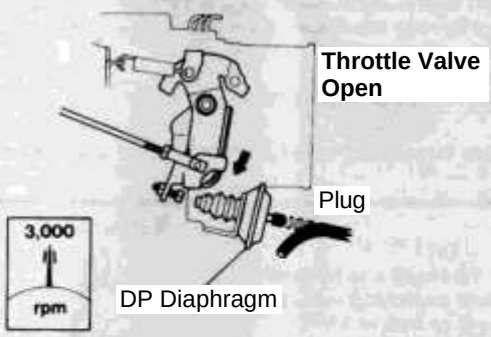
7.4 To check the dashpot setting speed, bring the engine speed to 3000 rpm, disconnect the vacuum hose from the diaphragm and plug the port



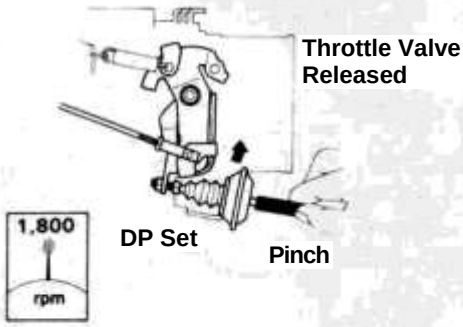
7.5 Release the throttle and note whether the engine rpm drops to the specified setting speed of 1800 rpm



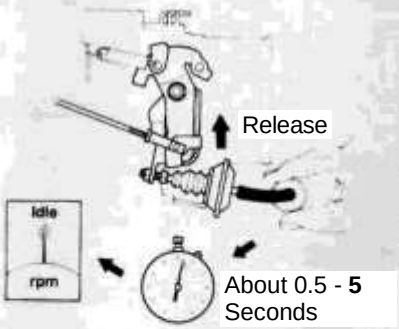
7.6 If the engine speed does not drop to 1800 rpm when the throttle is released with the vacuum hose pinched, turn the adjusting screw until the rpm is at 1800 rpm



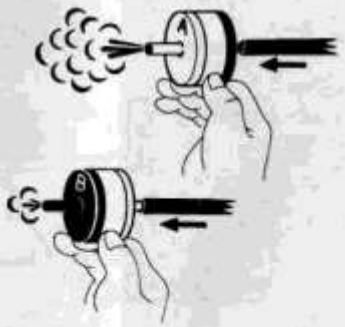
7.8 To check the operation of the Vacuum Transmitting Valve (VTV), pinch the vacuum hose between the dashpot and the valve with the engine running at 3000 rpm



7.9 Release the throttle and note whether the engine rpm drops to 1800 rpm



7.10 Release the pinched hose and note whether the engine returns to idle speed in 0.5 to 5 seconds — if the system performs as described, the vacuum transmitting valve is functioning properly



7.11 To check the vacuum transmitting valve, blow air into each side. Air should flow without resistance from B to A but with difficulty from A to B

8 Exhaust Gas Recirculation (EGR) system — description, check and component replacement

Refer to illustrations 8.2a, 8.2b, 8.3, 8.7, 8.14, 8.16, 8.30, 8.34, 8.35 and 8.36

Description

1 To reduce nitrous oxide emissions, some of the exhaust gases are recirculated through the EGR valve to the intake manifold to lower com bustion temperatures.

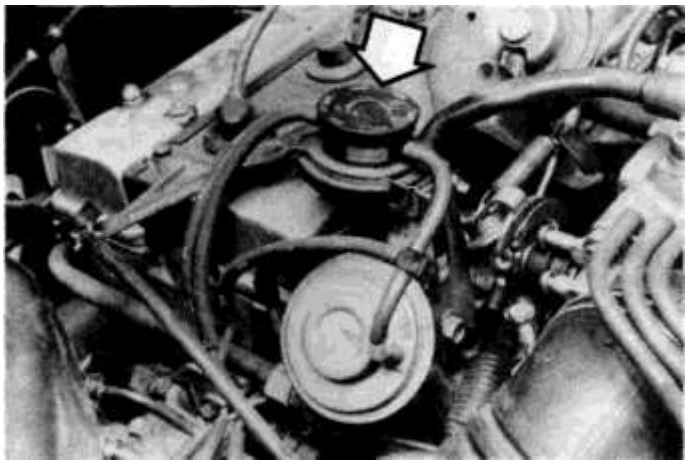
Check and replacement

EGR system

2 Label and disconnect the vacuum hoses **(see illustration),** remove the EGR vacuum modulator from its bracket, pull off the cover and check the filters **(see illustration)** for contamination. Clean them with compressed air. Reinstall the filters, the cover, the modulator and the vacuum hoses.

3 Using a three-way connector, connect a vacuum gauge to the hose between the EGR valve and the EGR vacuum modulator **(see illustration).**

4 Start the engine and verify that the idle speed is correct.



8.2a The EGR vacuum modulator is the flat, cylindrical plastic device situated just above and ahead of the EGR valve (arrow) — to remove it, label and disconnect the vacuum hoses, then slide the modulator forward to pop it loose from the bracket

5 To determine whether the bimetal vacuum switching valve functions correctly when the engine is cold, note the vacuum gauge reading while the engine coolant temperature is still below 35°C (95 °F). It should indicate zero vacuum at 3500 rpm.

6 To determine whether the bimetal vacuum switching valve, vacuum switching valve and EGR vacuum modulator function properly when the engine is hot, warm up the engine, then note the vacuum readings at 3500 and 5000 rpm, respectively. At 3500 rpm, the vacuum reading should be low. At 5000 rpm, it should be zero.

7 Disconnect the vacuum hose from the R port of the EGR vacuum modulator and connect the R port directly to the intake manifold with another hose **(see illustration).**

8 Verify that the vacuum gauge indicates high vacuum at 3500 rpm. **Note:** *As a large amount of EGR gas enters, the engine will slightly misfire.*

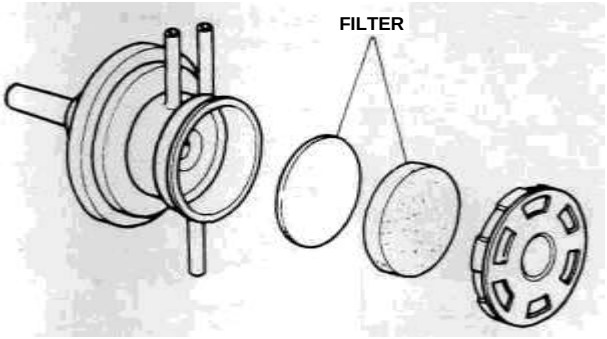
9 Disconnect the vacuum gauge and reconnect the vacuum hoses to the proper locations.

10 To check the EGR valve, apply vacuum directly to the EGR valve with the engine at idle. Note whether the engine runs rough or dies. Reconnect the vacuum hoses to their respective ports.

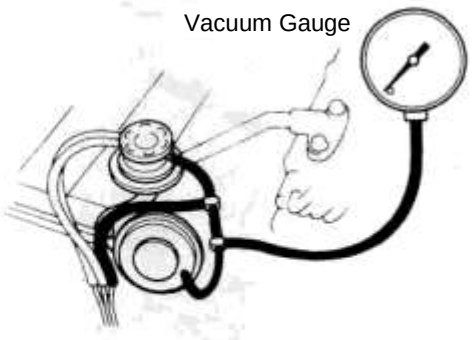
11 If everything has checked out thus far, the EGR system is okay and no further testing is necessary. If any of the above system checks indicates a problem is present, the system must be checked part by part. **EGR valve**

12 Disconnect the threaded fitting that attaches the EGR pipe to the EGR valve, remove the two EGR valve mounting bolts, remove the EGR valve from the cylinder head and check it for sticking and heavy carbon deposits. If the valve is sticking or clogged with deposits, replace it. **EGR vacuum modulator**

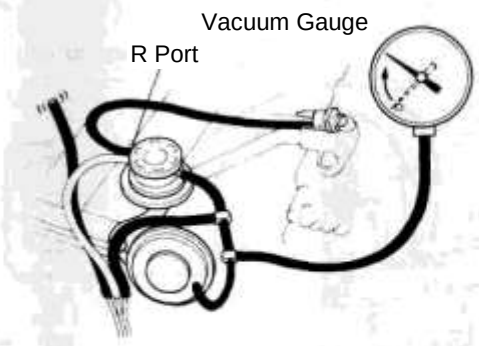
13 Label and disconnect the hoses from ports P, Q and R of the vacuum modulator.



8.2b The EGR vacuum modulator consists of a cover, two filters and the modulator itself — the filters can be cleaned with low pressure compressed air



8.3 Using a three-way connector, connect a vacuuum gauge to the hose between the EGR valve and the EGR vacuum modulator

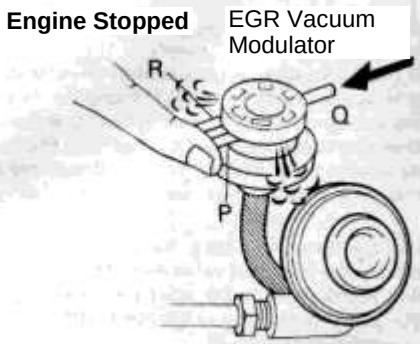


8.7 Disconnect the vacuum hose from the R port of the EGR vacuum modulator and connect the port directly to the intake manifold with another hose — at 3500 rpm the vacuum gauge should indicate high vacuum

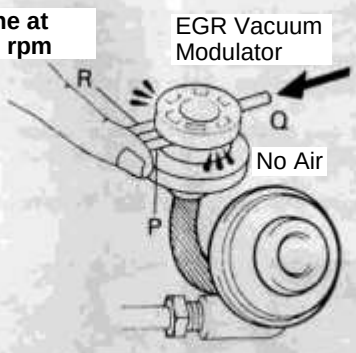
14 Plug ports P and R with your finger **(see illustration).**
15 Blow air into port Q. Verify that air passes through freely to the air filter side.
16 Start the engine and, with the engine running at a constant 2500 rpm, repeat the above test. Verify that there is a strong resistance to air flow **(see illustration).**
17 If the vacuum modulator fails either of the above checks, replace it.

Bimetal Vacuum Switching Valve (BVSV)

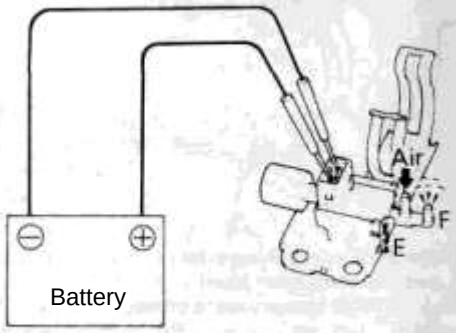
18 Drain the coolant from the engine into a suitable container.
19 Locate the bimetal vacuum switching valve on the top of the thermostat housing (refer to illustration 1.1).
20 Label and disconnect the vacuum hoses attached to the valve.
21 Remove the valve.
22 Cool the valve to below 35 °C (95 °F) with cold water.
23 Blow air into the pipe and verify that the valve is closed (refer to the illustrations in Section 6 if necessary).
24 Heat the valve to above 54 °C (129°F) in hot water.
25 Blow air into the pipe and verify that the valve is open.
26 If the valve fails either of the above tests, replace it.



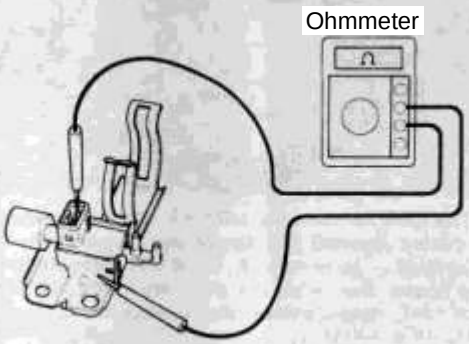
8.14 To check the operation of the EGR vacuum modulator, disconnect the vacuum hoses from ports P, Q and R, block ports P and R with your finger and blow air into port Q — verify that air passes freely to the air filter side



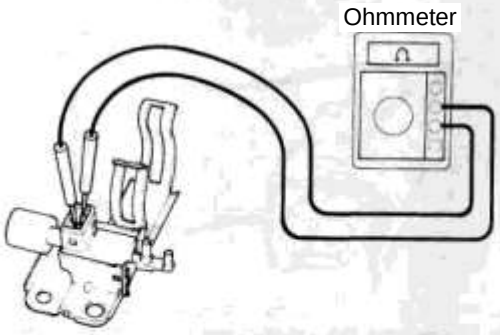
8.16 With the engine running at 2500 rpm, repeat the test — there should be a strong resistance to air flow



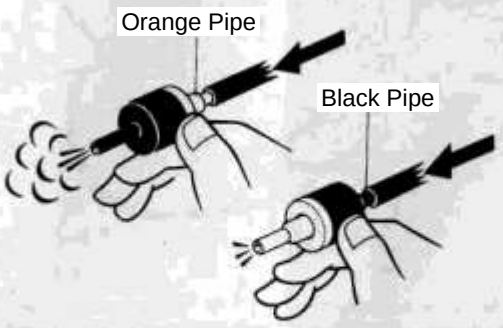
8.30 Connect the vacuum switching valve terminals to the battery terminals as illustrated, then blow into pipe E and verify that air comes out of pipe F



8.34 Using an ohmmeter, verify that there is no continuity between the terminal and the vacuum switching valve body



8.35 Using an ohmmeter, measure the resistance between the vacuum switching valve terminals — if the resistance is not within 33 to 39 ohms, replace the valve



8.36 Check the check valve by verifying that air flows from the orange pipe to the black pipe but not from the black pipe to the orange pipe

27 Apply sealer to the threads of the valve and reinstall it.

28 Fill the engine with coolant.

Vacuum Switching Valve (VSV)

29 Connect the vacuum switching valve terminals to the battery terminals.

30 Blow into pipe E and verify that air comes out of pipe F **(see illustration).**

31 Disconnect the battery.

32 Blow into pipe E and verify that air comes out of the air filter.

33 If the valve does not perform as it should, replace it.

34 Using an ohmmeter, verify that there is no continuity between the terminal and the valve body **(see illustration).** If there is, replace the valve.

35 Using an ohmmeter, measure the resistance between the valve terminals to check for an open in the circuit **(see illustration).** If the resistance is not within specification, replace the valve.

Check valve

36 Verify that air flows from the orange pipe to the black pipe, but not from the black pipe to the orange pipe **(see illustration).** If the check valve does not perform correctly, replace it.

9 Three-way catalyst system — description, check and component replacement

Refer to illustrations 9.6 and 9.7

Description

1 To reduce hydrocarbon, carbon monoxide and nitrous oxide emis sions, the three-way catalyst system, commonly known as a catalytic converter, oxidizes and reduces these chemicals, converting them into harmless nitrogen, carbon dioxide and water.

Check

2 Periodically inspect the catalytic converter-to-exhaust pipe mating flanges and bolts. Make sure that there are no loose bolts and no leaks between the flanges.

3 Look for dents in or damage to the catalytic converter protector. If any part of the protector is damaged or dented enough to touch the converter, repair or replace it.

4 Inspect the heat insulator for damage. Make sure that there is adequate clearance between the heat insulator and the catalytic converter.

Replacement

5 To replace the catalytic converter, jack up the vehicle and place it securely on jackstands.

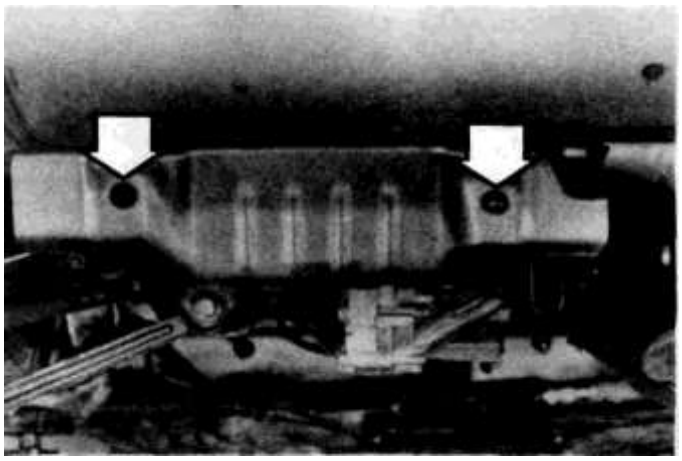
6 Make sure that the converter is cool, then remove the heat protector **(see illustration).**

7 Detach the mounting bolts from each end of the converter **(see illustration).**

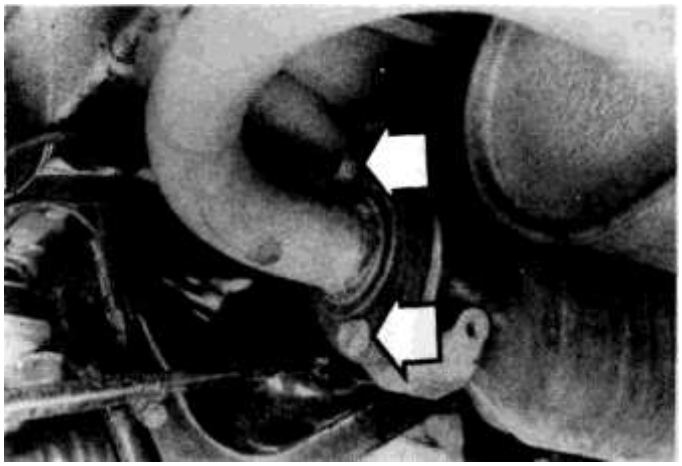
8 Remove the converter and gaskets.

9 To install the new converter, place new gaskets on the front and rear exhaust pipes, place the converter in position between the exhaust pipes and tighten the exhaust pipe-to-catalytic converter bolts to the specified torque.

10 Install the heat protector and tighten the bolts to the specified torque.



9.6 To remove the catalytic converter heat protector, remove the two bolts (arrows) and the two just like them on the forward side of the protector



9.7 Remove the exhaust pipe-to-catalytic converter flange bolts (arrows) from both ends of the converter

Chapter 7 Part A Manual transaxle

Contents

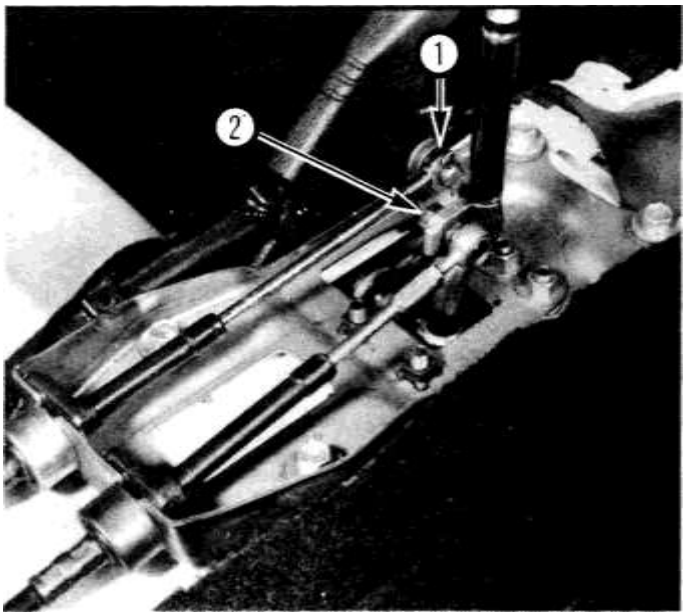
General information 1
Shift lever bushing inspection and replacement 2
Transaxle input shaft seal replacement 6
Transaxle mounts check and replacement 4
Transaxle overhaul general information 7
Transaxle removal and installation 5
Transaxle shift cables removal and installation 3

Specifications

Transaxle gear oil	
grade	API GL-4 or GL-5, SAE 75W-90
capacity	2.3 L (2.4 qts)
5th gear end play	
standard	0.10 to 0.57 mm (0.0039 to 0.0224 in)
maximum	0.65 mm (0.0256 in)
4th gear end play	
standard	0.10 to 0.55 mm (0.0039 to 0.0217 in)
maximum	0.60 mm (0.0236 in)
3rd gear end play	
standard	0.10 to 0.35 mm (0.0039 to 0.0138 in)
maximum	0.40 mm (0.01 57 in)
2nd gear end play	
standard	0.10 to 0.45 mm (0.0039 to 0.0177 in)
maximum	0.50 mm (0.0197 in)
1st gear end play	
standard	0.10 to 0.40 mm (0.0039 to 0.0157 in)
maximum	0.45 mm (0.0177 in)

Input shaft minimum outer diameter	
Part A	24.870 mm (0.9791 in)
Part B	26.470 mm (1.0421 in)
Part C	30.970 mm (1.2193 in)
Part D	24.970 mm (0.9831 in)
Input shaft maximum runout	0.05 mm (0.0020 in)
Output shaft minimum outer diameter	
Part A	32.970 mm (1.2980 in)
Part B	37.970 mm (1.4949 in)
Part C	31.970 mm (1.2587 in)
Output shaft maximum runout	0.05 mm (0.0020 in)
Gear oil clearance (all gears)	
standard	0.02 to 0.05 mm (0.0008 to 0.0020 in)
maximum	0.07 mm (0.0028 in)
Synchro rings minimum clearance	0.6 mm (0.024 in)
Shift fork and hub sleeve maximum clearance	1.0 mm (0.039 in)
Speedometer driven gear oil seal drive-in depth	25 mm (0.98 in)
Side gear standard backlash	0.05 to 0.20 mm (0.0020 to 0.0079 in)

Torque specifications	**Nm**	**Ft-lbs**
Back-up light switch	40	30
Bearing lock plate bolt	11	8
Control cable No. 2 control		
cable bracket		
slave cylinder side	18	13
transaxle side	64	47
shift cable-to-shift lever bolt	4.9	43 in-lbs
select cable-to-selecting bellcrank nut	12	9
Differential side bearing (starting) preload		
new bearing	0.8 to 1.6	6.9 to 13.9 in-lbs
reused bearing	0.5 to 1.0	4.3 to 8.7 in-lbs
Drain plug	39	29
Driveaxle-to-side gear shaft bolts	36	27
Exhaust pipe assembly nuts	62	46
Fifth driven gear		
lock nut	118	87
bolt	16	12
Filler plug	39	29
Front bearing retainer	11	8
Lock ball assembly	39	29
Oil receiver	17	13
Output shaft bearing lock plate	11	8
Rear bearing retainer	19	14
Reverse idler gear		
lock nut	24	17
shaft lock bolt	39	29
Reverse restrict pin holder	20	14
Reverse shift arm bracket bolts	17	13
Ring gear set bolts	97	71
Shift and select lever assembly	20	14
Shift fork shaft		
lock bolts	16	12
straight screw plug	25	18
Shift lever		
retainer bolt nut	12	9
selecting bellcrank support bolts	19	14
Shift lever pinch bolt nut	12	9
Speedometer driven gear lock plate	11	8
Straight screw plug (shift fork shaft)	25	18
Transaxle rear mounts		
insulator through-bolt	78	58
bracket bolts	52	38
Transaxle front mount		
insulator through-bolt	78	58
bracket bolts	52	38
Left mounting bracket bolts	52	38
Transaxle protector bolts	13	9
Transaxle-to-engine bolts (12 mm)	64	47
Transaxle-to-rear end plate bolts (10 mm)	46	34
Transaxle-to-starter bolts	39	29
Transmission case-to-transaxle case bolts	29	22
Transmission case cover-to-transmission case bolts	18	13
Water inlet-to-transaxle bolts	20	14



2.3 To remove the shift lever retainer plate, disconnect the shift control cable (1) from the shift lever, disconnect the select control cable (2) from the selecting bellcrank and remove all four shift lever retainer bolts

2.4 To remove the shift lever retainer plate, pry both clips loose with a screwdriver — they also have to come off if you intend to replace either or both control cables

1 General information

The vehicles covered by this manual are equipped with either a five-speed manual or a four-speed automatic transaxle (automatics were not available in the 1985 model year). Information on the manual transaxle is included in this part of Chapter 7. Service procedures for the automatic are in Chapter 7 Part B.

Because of the complexity, unavailability of replacement parts and a number of special tools, internal repair procedures for the manual transaxle are not recommended for the home mechanic. For those readers who wish to tackle a transaxle rebuild, exploded views, complete overhaul specifications and a brief general information Section on overhaul are included. The information contained within this manual is otherwise limited to removal and installation procedures.

2 Shift lever bushing — inspection and replacement

Refer to illustrations 2.3, 2.4, 2.6a, 2.6b, 2.7and 2.8

1 Push straight down on the shift lever. There should be no vertical play. If there is, replace the shift lever bushing.

2 Remove the rear console box and the console (refer to Chapter 11).

3 Disconnect the select control cable from the selecting bellcrank and disconnect the shift control cable from the shift lever **(see illustration).**

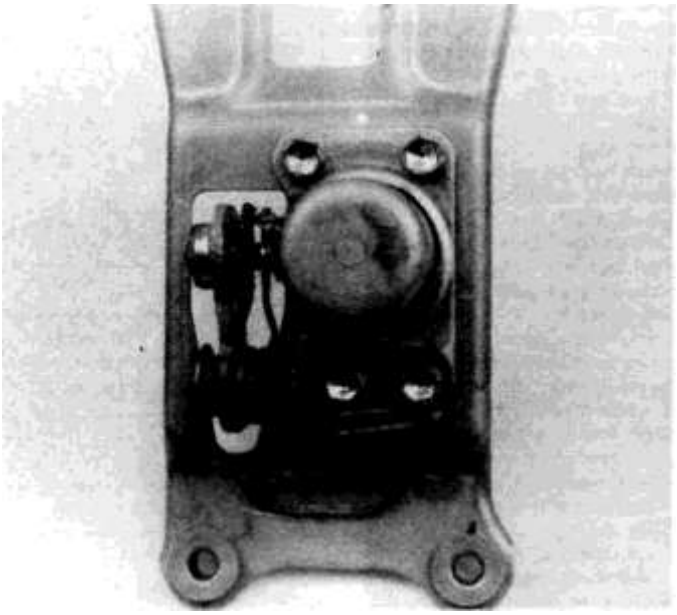
4 Disconnect the select and shift control cable clips from the shift lever retainer **(see illustration)** and set the control cables aside.

5 Remove the shift lever retainer bolts. Remove the shift lever retainer and shift lever assembly from the vehicle and place it on a clean working space.

6 Turn the shift lever retainer upside down, remove the four shift lever cap bolts **(see illustration)** and separate the shift lever/ball seat/cap assembly from the shift lever retainer **(see illustration).**

7 Note how the shift lever is attached to the selecting bellcrank. Lift the shift lever/snap ring/ball seat assembly out of the shift lever cap **(see illustration).**

8 The rubber bushing is in the bottom of the cap. Remove and discard the old bushing **(see illustration).**



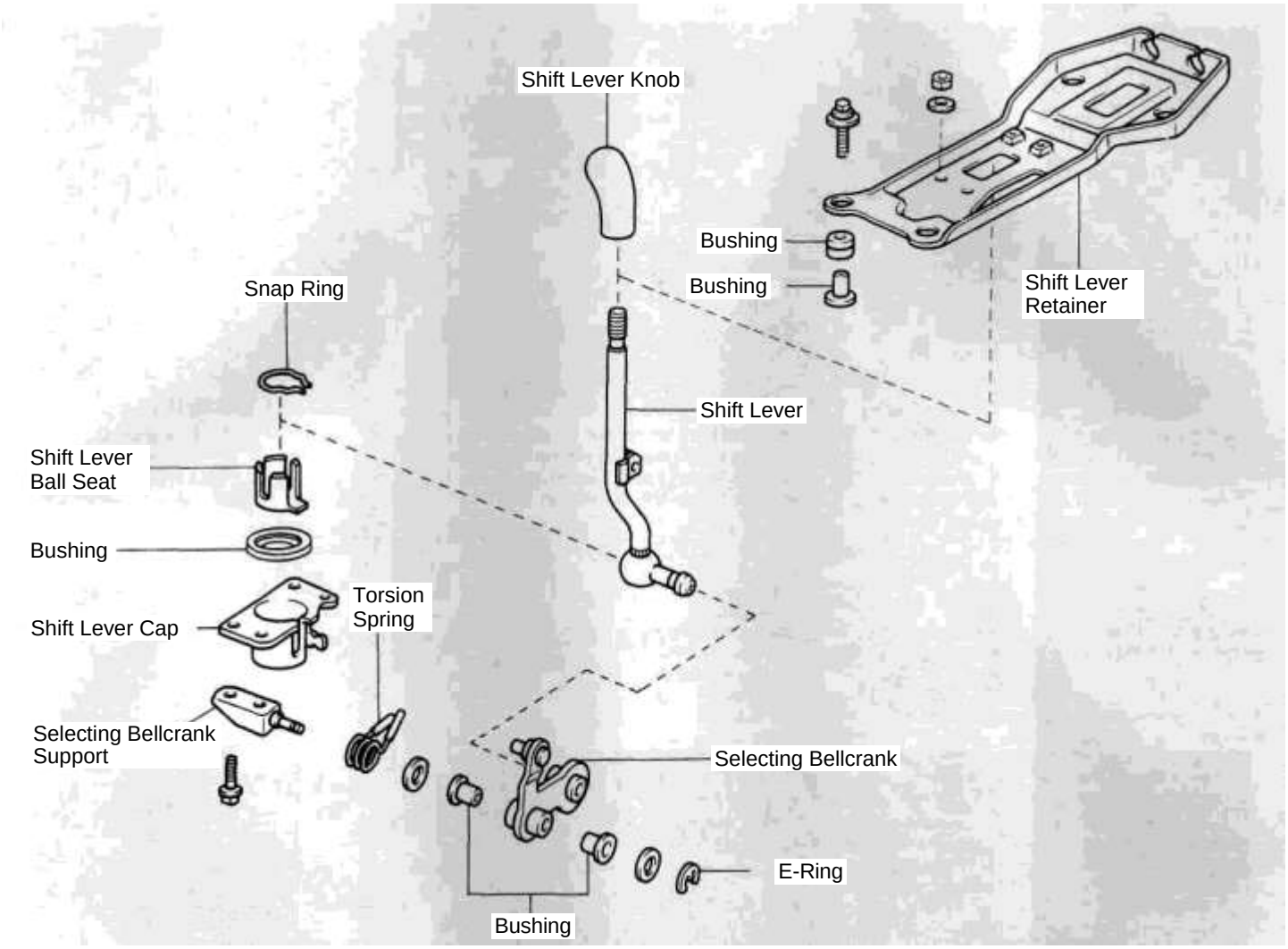
2.6a Once the shift lever retainer has been removed from the vehicle, flip it over and remove the four shift lever cap bolts

9 Installation is the reverse of removal. Be sure to coat the new bushing with moly based multipurpose grease.

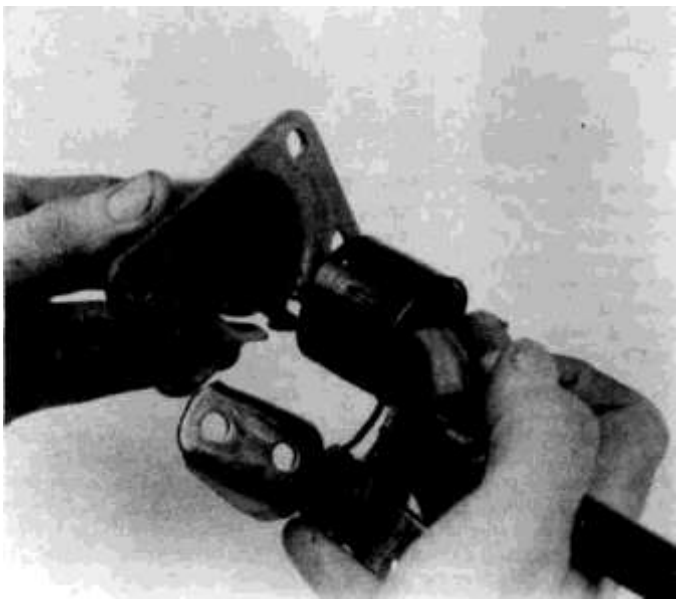
3 Transaxle shift cables — removal and installation

Refer to illustrations 3.2, 3.4a, 3.4b and 3.5

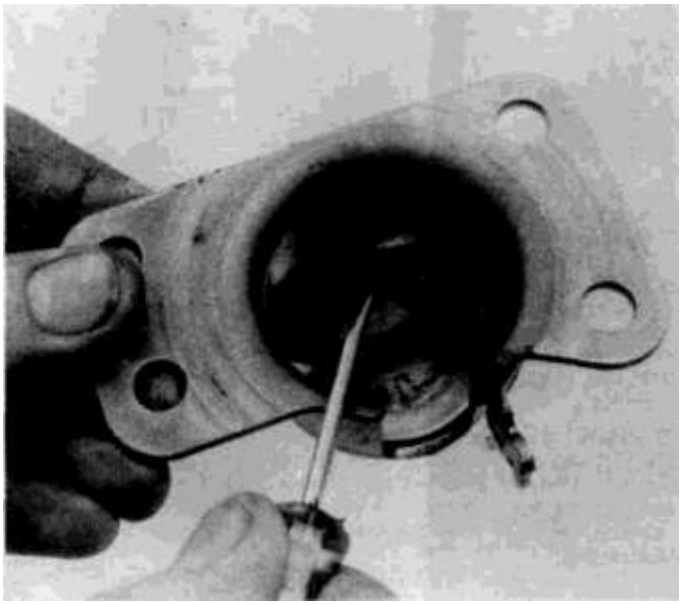
1 Remove the rear console box and the console from the passenger compartment (refer to Chapter 11).



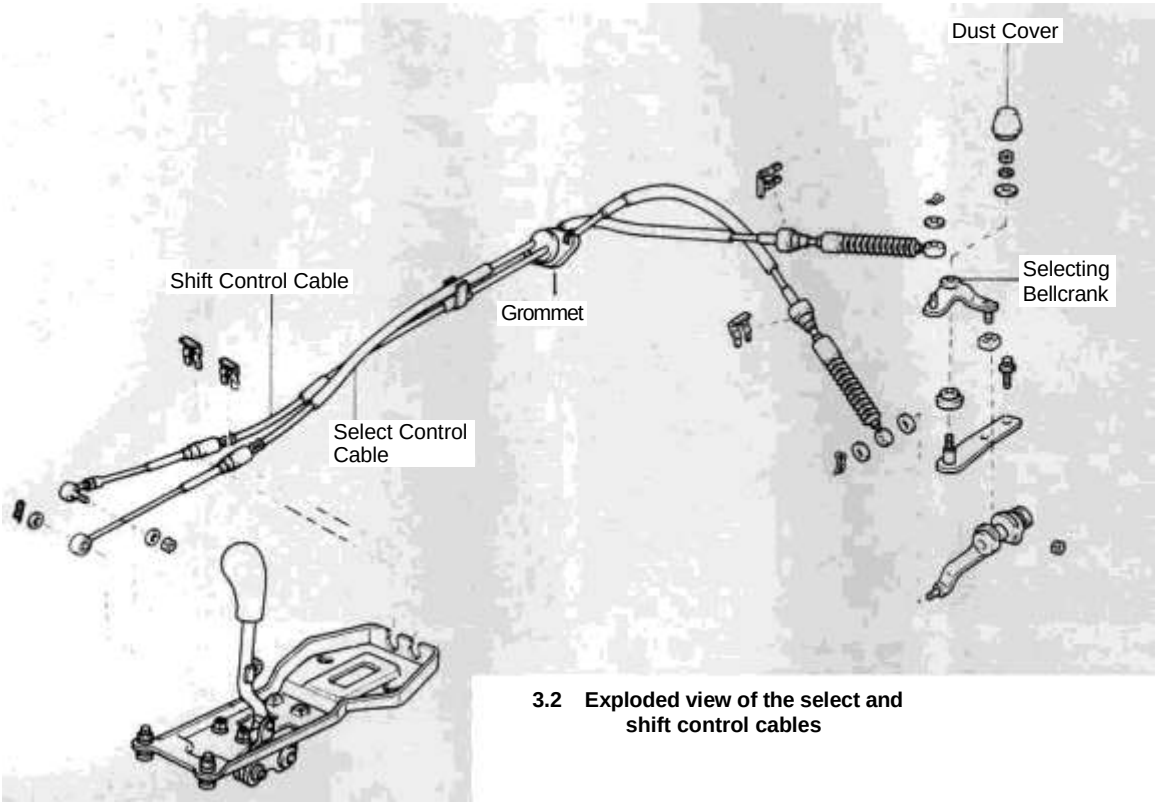
2.6b This exploded view of the shift lever assembly may be helpful during reassembly



2.7 Separate the shift lever/ball seat/selecting bellcrank assembly from the shift lever cap



2.8 There is a rubber bushing in the bottom of the shift lever cap — it can be peeled off the bottom with a small screwdriver — be sure to liberally coat the replacement bushing with multipurpose grease



3.2 Exploded view of the select and shift control cables

3.4a The select control cable is attached to the selecting bellcrank on the top of the transaxle by a small clip — to separate the cable from the bellcrank, simply remove the clip and the upper washer (it's a good idea to reinstall the clip and upper washer until the new cable is attached, so they don't get lost)

3.4b The shift control cable is attached to the shift lever on the lower front of the transaxle by a small clip — to separate the cable from the lever, simply remove the clip and the outer washer (it's a good idea to reinstall the clip and outer washer until the new cable is attached, so they don't get lost)

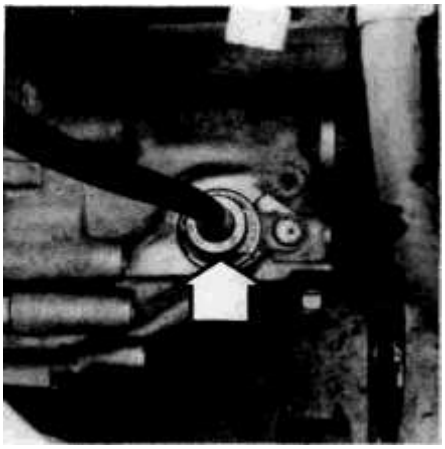
3.5 Both the select and shift control cables are attached to the control cable bracket by small clips identical to the clips used to secure the cables to the shift lever retainer plate — in this photo, the shift control cable clip (arrow) is visible (the select control cable clip is obscured by the clutch bleeder fitting)

2 If you are replacing the select control cable, remove the retainer clip that secures the cable to the selecting bellcrank and disconnect the cable from the bellcrank **(see illustration 2.3 in Section 2).** If you are replacing the shift control cable, remove the nut that secures the cable to the shift lever and detach the cable from the lever **(see illustration).**

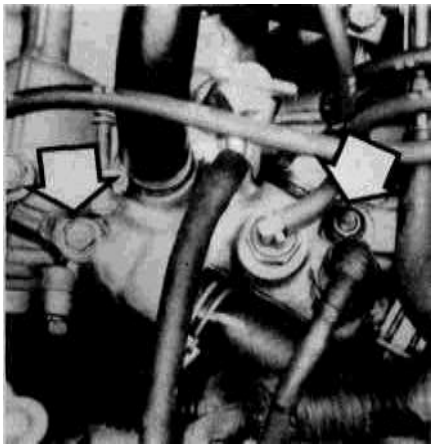
3 If you are replacing the select control cable, pry loose the left clip that secures the cable to the shift lever retainer plate **(see illustration 2.4 in Section 2)** and detach the cable from the shift lever retainer. If you are replacing the shift control cable, pry loose the right clip and detach the cable from the shift lever retainer.

4 Open the engine compartment lid and locate the selecting bellcrank and shift lever assemblies on the front of the transaxle. If you are replacing the select control cable, remove the clip that secures the cable to the selecting bellcrank **(see illustration)** and disconnect the cable from the bellcrank. If you are replacing the shift control cable, remove the clip that secures the cable to the shift lever, remove the outer washer and disconnect the cable from the lever **(see illustration). Note:** *The shift control lever is easier to reach from underneath the engine compartment.*

5 Each cable is secured to the control cable bracket with a clip **(see illustration)** identical to the clips used at the shift lever retainer inside the passenger compartment. Depending on which cable you are replacing, pry either or both clips loose from the bracket.

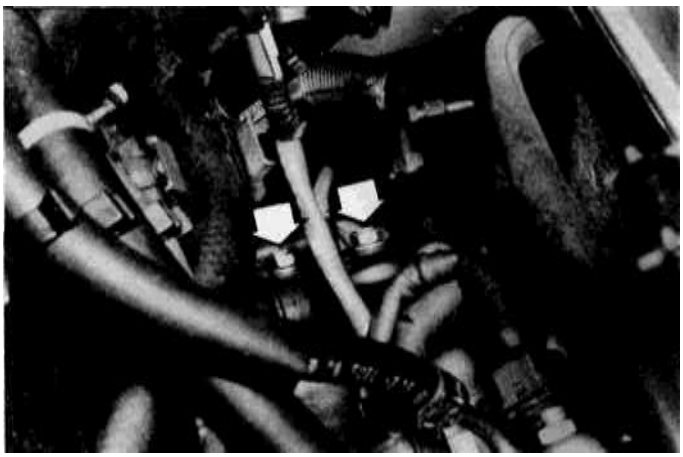


5.3 Unscrew the threaded collar (arrow) around the end of the speedometer cable and disconnect the cable from the transaxle



5.4 Remove the water inlet mounting bolt (left arrow) and nut (right arrow) — when reinstalling, don't forget to attach the ground wire to the mounting bolt

5.5 The back-up light switch is at the end of a short pigtail and connector underneath the inlet housing, by which it is generally hidden from view — the inlet has been removed for clarity in this photo



5.7 The clutch slave cylinder and control cable bracket are bolted to the transaxle — remove both bolts (arrows)

6 Pull the cable through the rubber grommet in the firewall Between the passenger compartment and the engine compartment and remove it.
7 Installation is the reverse of removal.

4 Transaxle mounts — check and replacement

Refer to the illustrations in Section 16 of Chapter 2 Part A

Check

1 To check the transaxle mounts, raise the vehicle and place it securely on jackstands.
2 There are three mounts — the left, front and rear mounting insulators — attached to the transaxle housing. Each mounting insulator assembly consists of two brackets. One is bolted to the vehicle and one to the transaxle. Each pair of brackets is connected by a rubber insulator and through-bolt. With age, the rubber insulators dry out and crack.
3 Carefully inspect each mounting insulator for obvious cracks. Dried out and cracked insulators must be replaced.
4 Even if an insulator doesn't look dried out or cracked, it may still be worn out. To check it, place a pry bar between the two brackets and apply leverage. The brackets will be easily deflected if the mounting insulator is worn out. If they are, replace the insulator.

Replacement

5 To replace a mounting insulator, place a floor jack under the oil pan, put a block of wood between the floor jack head and the pan, then raise the engine just enough to take the weight off the mounting insulators.
6 Remove the through-bolt from the worn out insulator.
7 Remove the bracket bolts and the bracket half containing the worn out insulator and discard it (the new insulator comes with its own bracket).
8 Install the new mounting insulator bracket and tighten the bracket-to-body bolts to the specified torque.
9 Install the through-bolt to connect the mounting insulator bracket to the transaxle bracket. Adjust the floor jack up or down slightly to align the holes in the bracket with the bolt hole in the insulator. Tighten the through-bolt to the specified torque.
10 When replacing the front mounting insulator, bounce the engine to confirm that the insulator is mounted on the middle of the insulator bracket before tightening the through-bolt to the specified torque.
11 Lower and remove the floor jack.
12 Remove the jackstands and lower the vehicle.

5 Transaxle — removal and installation

Refer to illustrations 5.3, 5.4, 5.5, 5.7, 5.13a, 5.13b, 5.15, 5.19a, 5.19b and 5.20

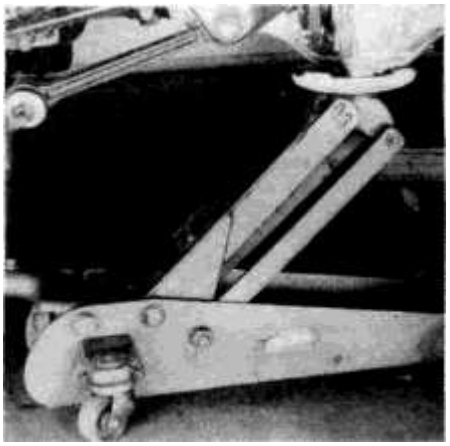
Removal

1 Remove the battery.
2 Remove the duct between the air flow meter and the throttle body.
3 Disconnect the threaded fitting of the speedometer cable from the transaxle **(see illustration).**
4 Remove the water inlet bolts **(see illustration)** and detach the inlet from the transaxle.
5 Unplug the back-up light switch connector **(see illustration).** The switch itself is hidden beneath the water inlet, but once the inlet is detached from the transaxle, you can lift up the inlet, reach underneath, find the switch pigtail and unplug it.
6 Remove the clip that secures the select control cable to the selecting bellcrank, remove the outer washer and disconnect the cable from the bellcrank (see Section 3).
7 Remove the control cable bracket/clutch slave cylinder mounting bolts **(see illustration).**
8 Raise the vehicle and support it securely on jackstands.
9 Remove the engine undercover bolts and the engine undercover.
10 Remove the exhaust pipe (refer to Chapter 4).
11 Remove the driveaxles (refer to Chapter 8).
12 Remove the clip that secures the shift control cable to the shift lever, remove the outer washer and disconnect the shift control cable

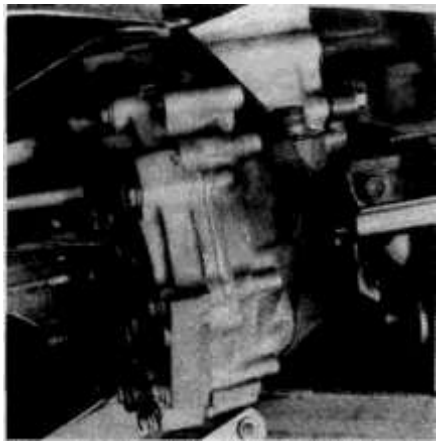
5.13a At its lower end, the control cable bracket is attached to a transaxle-to-engine block bolt (arrow) — remove it . . .

5.13b ... and the bracket stay bolt (arrow) from the left side of the front mounting insulator bracket

5.15 Remove the rear end plate-to-transaxle bolts (arrows)



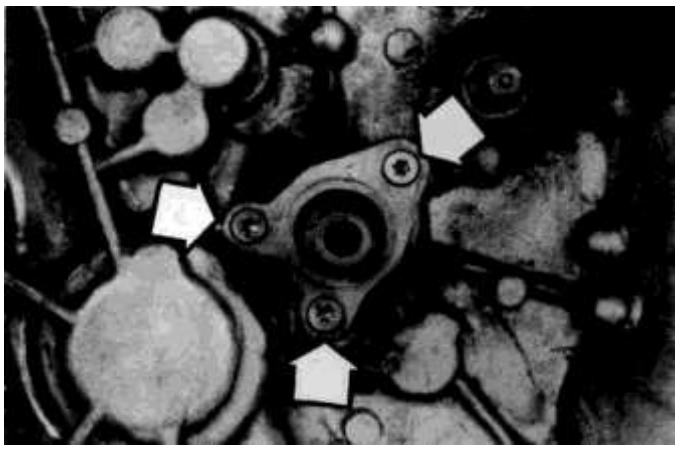
5.19a Place a floor jack underneath the transaxle with the handle pointed toward the left side of the vehicle — make sure that the lowest point of the transaxle is in the dished out part of the jack head



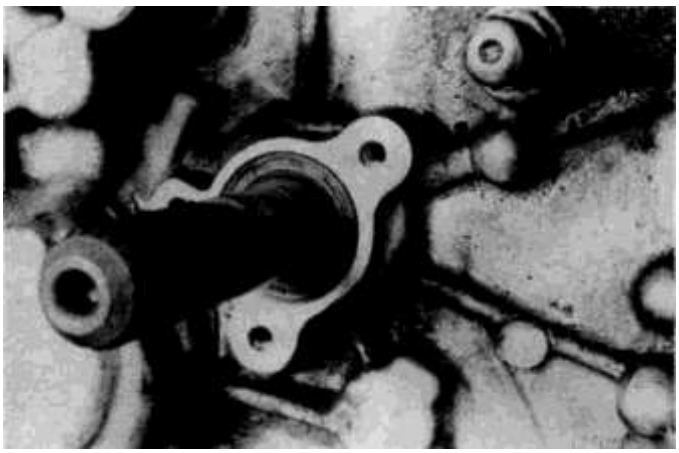
5.19b Wrap a sturdy strap — such as this motorcycle tie-down — around the transaxle and secure it to the jack to prevent it from slipping off the jack head during removal

5.20 Using the lifting hooks provided by the manufacturer at the left front and right rear corners of the cylinder head covers, attach an engine hoist lifting chain to the engine

from the shift lever (see Section 3).
13 Remove the control cable bracket mounting bolts and detach the bracket **(see illustrations).**
14 Remove the flywheel inspection cover.
15 Remove the rear end plate-to-transaxle bolts just behind the engine block **(see illustration).**
16 Remove the starter motor (refer to Chapter 5).
17 Drain the gear oil from the transaxle (refer to Chapter 1).
18 Remove the two rear fuel tank protector bolts and pull down the rear edge of the protector.
19 Support the transaxle with a floor jack **(see illustration).** It is helpful to strap the transaxle to the floor jack to prevent it from slipping off the jack head during removal **(see illustration).**
20 Support the engine with an engine hoist **(see illustration).** If an engine hoist is not available, place another floor jack under the engine oil pan. Use a wooden block between the jack and the oil pan.
21 Raise the engine hoist and transaxle floor jack slightly.
22 Loosen but do not remove the transaxle-to-engine block bolts.
23 Remove the front engine mounting insulator bracket bolts and detach the bracket from the vehicle (refer to illustrations in Chapter 2 Part A).
24 Remove the rear engine mounting insulator bracket bolts and detach the bracket from the body (refer to illustrations in Chapter 2 Part A).
25 Remove the left engine mounting insulator bracket bolts and detach the bracket from the body (refer to illustrations in Chapter 2 Part A).
26 Lower the left end of the engine slightly (because it is only attached to the vehicle by the right mounting insulator, the engine will pivot from that mount, allowing the left end of the engine to drop when the engine hoist is lowered). Lower the transaxle floor jack slightly. Alternate between the engine hoist and the transaxle floor jack, gradually lowering the engine and transaxle assemblies until the top of the transaxle housing clears the vehicle. It is important to keep the engine and transaxle aligned with one another as they are lowered in order to prevent difficulty in separating the transaxle input shaft from the clutch disc splined hub.
27 Remove the transaxle-to-engine block bolts.
28 Pry the transaxle and engine apart. Once they are pried apart far enough to disengage the transaxle input shaft from the splined hub in the clutch disc, pull the transaxle away from the engine, lower the floor jack and roll the transaxle out from under the vehicle. **Note:** ***It*** *will be helpful to have an assistant standing by to keep the transaxle balanced on top of the floor jack head — the underside of the transaxle is highly irregular and does not balance well on the floor jack.*



6.3 Remove these three bolts (arrows) and the front bearing retainer



6.4 The input shaft seal is easy to remove with a small screwdriver, but be careful not to scratch the input shaft or the seal bore — when installing the new seal, make sure that seal lip is not damaged by the splined end of the shaft

Installation

29 The most difficult aspect of installation is aligning the transaxle input shaft with the splined hub of the clutch. Take your time and don't try to force it. Insert a couple of punches to align the bolt holes of the engine and transaxle. Make sure that the dowel pins on the block are aligned with the holes in the transaxle. The engine and the transaxle must be aligned along the same axis. Slide the input shaft into the splined clutch disc hub (if necessary, have an assistant move the flywheel ring gear slightly). Shove the transaxle into place against the engine block/rear end plate. Make sure that the the dowel pins align with their respective bores in the transaxle.

30 Once the transaxle and engine are aligned and the input shaft is inserted through the splined center of the clutch, install the transaxle-to-engine block and transaxle-to-rear end plate bolts and tighten them to the specified torque.

31 Install the left mounting insulator bracket-to-body bolts and tighten them to the specified torque.

32 Install the rear mounting insulator bracket-to-body bolts and tighten them to the specified torque.

33 Install the fron. mounting insulator bracket-to-body bolts and tighten them to the specified torque.

34 Install the starter motor (refer to Chapter 5).

35 Install the control cable bracket bolt and bracket stay bolt and tighten them securely.

36 Attach the shift control cable to the shift lever and install the clip. Don't forget to install the washers on both sides of the shift cable.

37 Install the flywheel inspection cover and tighten the bolts securely.

38 Install the driveaxles (refer to Chapter 8).

39 Install the exhaust pipe (refer to Chapter 4).

40 Install the engine undercover.

41 Install the wheels and tighten the lug nuts finger tight.

42 Lower the vehicle and tighten the wheel lug nuts.

43 Install the control cable bracket/clutch slave cylinder mounting bolts and tighten them to the specified torque. Make sure that the slave cylinder pushrod is properly mated with the cupped end of the release lever.

44 Attach the select control cable to the selecting bellcrank and install the retaining clip. Don't forget to install the washers on both sides of the select cable.

45 Plug in the backup light switch connector to the main engine wire harness.

46 Install the water inlet housing to the transaxle and tighten the bolts to the specified torque. Don't forget to attach the ground strap to the rear mounting bolt.

47 Install the speedometer cable fitting to the transaxle.

48 Install the duct between the air flow meter and the throttle body.

49 Install the battery.

50 Fill the transaxle with hypoid gear oil (refer to Chapter 1).

51 Drive the vehicle and check for proper shifter operation and oil leaks.

6 Transaxle input shaft seal — replacement

Refer to illustrations 6.3 and 6.4

1 Remove the transaxle from the engine (refer to Section 5).

2 Remove the clutch throwout bearing and release arm assembly (refer to Section 7 of Chapter 8).

3 Remove the front bearing retainer bolts **(see illustration)** and the retainer.

4 The input shaft oil seal **(see illustration)** can be pried out with a small screwdriver. Make sure that you do not scratch either the input shaft or the bore.

5 Drive the new seal into place with a section of pipe with an outside diameter slightly smaller than the outside diameter of the seal. Make sure that the pipe is long enough to clear the end of the input shaft.

6 Installation is otherwise the reverse of removal.

7 Transaxle overhaul — general information

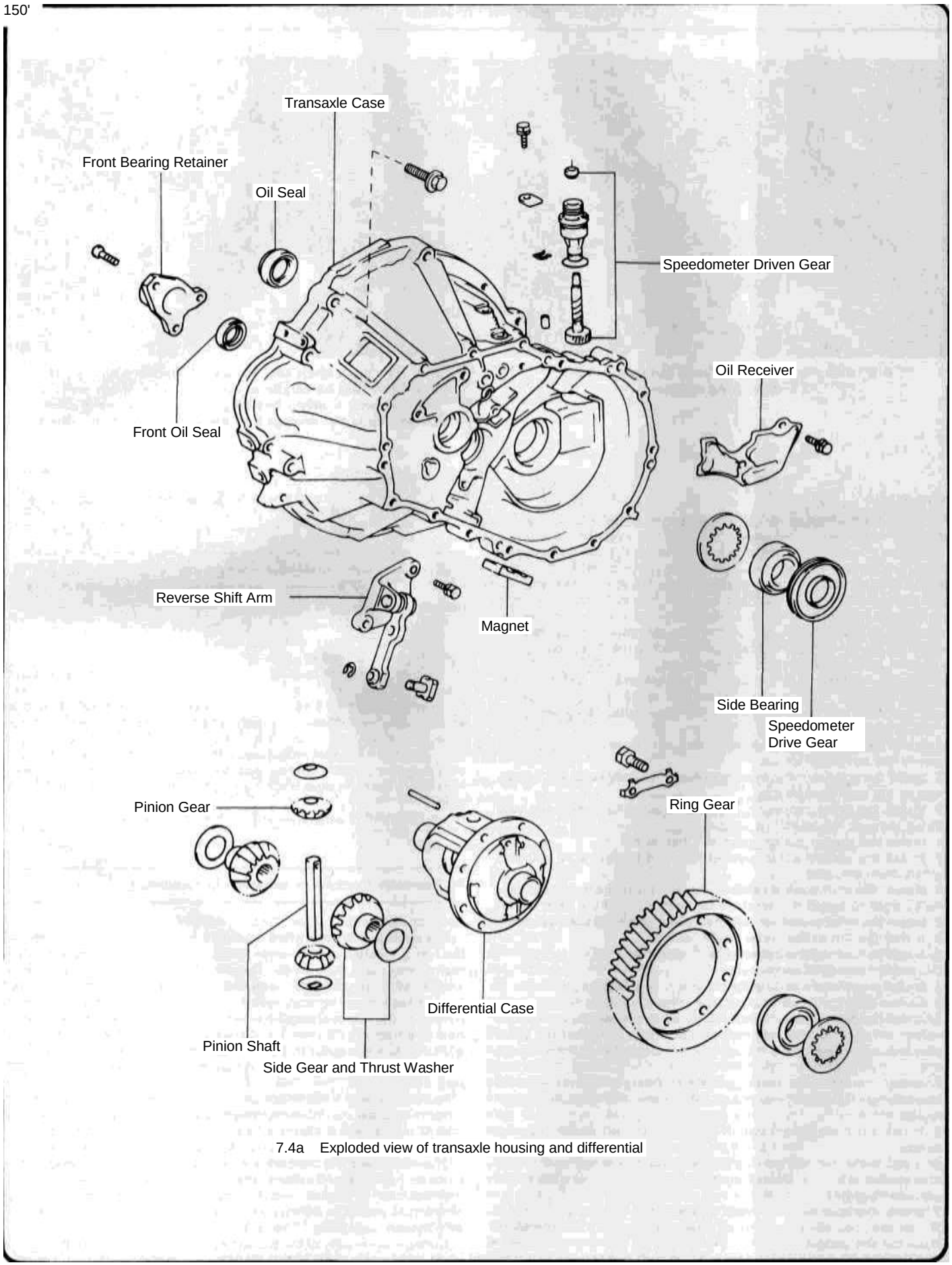
Refer to illustrations 7.4a, 7.4b, 7.4c, 7.4d and 7.4e

The overhaul of a manual transaxle is a somewhat difficult job for the home mechanic. It involves the disassembly and reassembly of many small parts. Numerous clearances must be precisely measured and, if necessary, adjusted with selective fit spacers and snap-rings. For this reason, we strongly recommend that the home mechanic limit himself to the removal and installation of the transaxle and leave overhaul to a transmission repair shop. Exchange transaxles are available at reasonable prices for this vehicle and the time and money involved in the at home overhaul is almost sure to exceed the cost of a rebuilt unit.

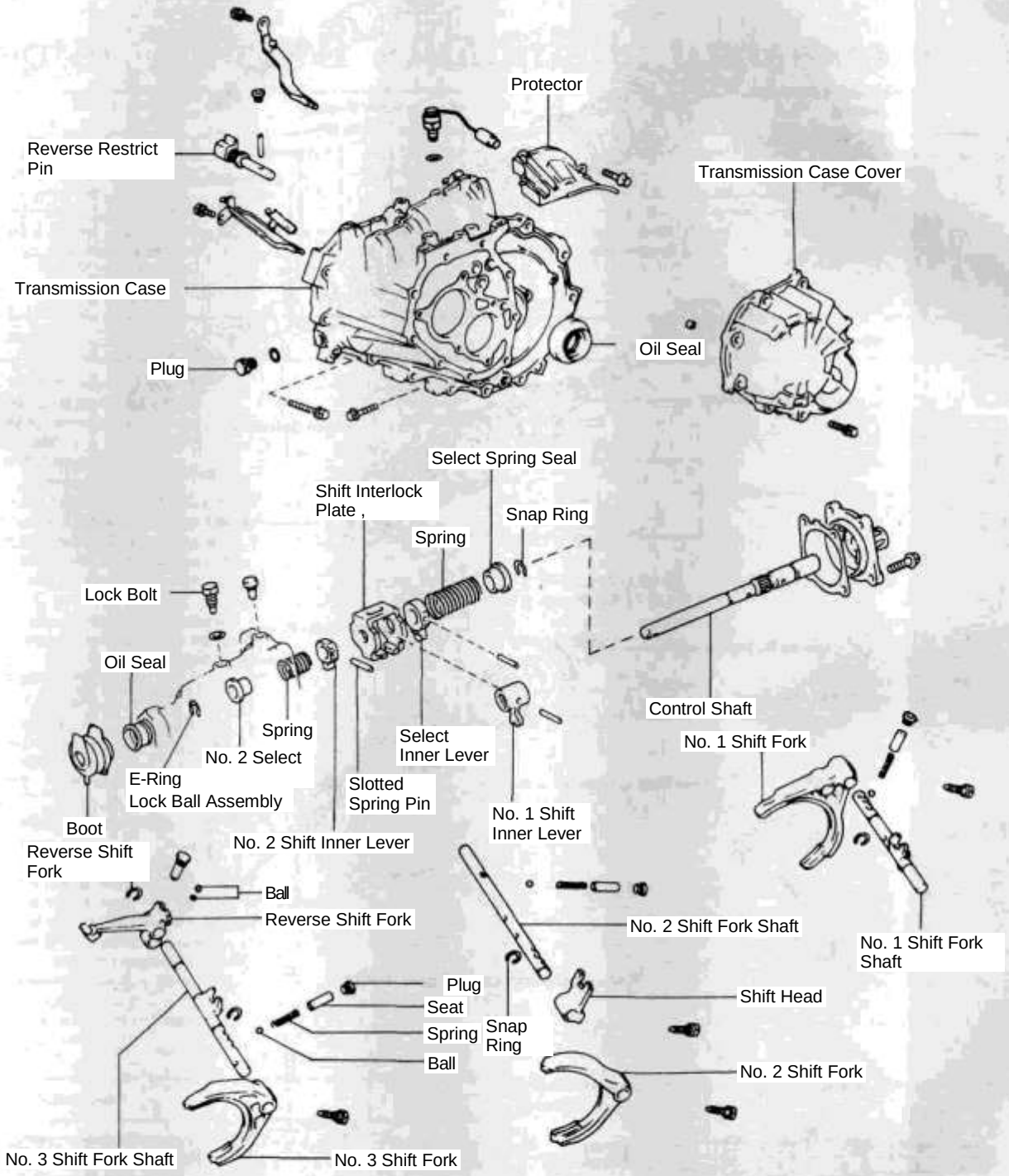
Nevertheless, it's not impossible for the home mechanic to rebuild a transaxle if the specialized tools are available, care is taken to ensure that all the clearances are set to specification and the job is done in a deliberate step-by-step manner so that nothing is overlooked.

The essential tools necessary for the overhaul of this transaxle include both internal and external snap-ring pliers, a bearing puller, a slide hammer, a set of various sized pin punches, a dial indicator and possibly a hydraulic press. In addition, a large, sturdy workbench and a vise or transaxle stand will be required.

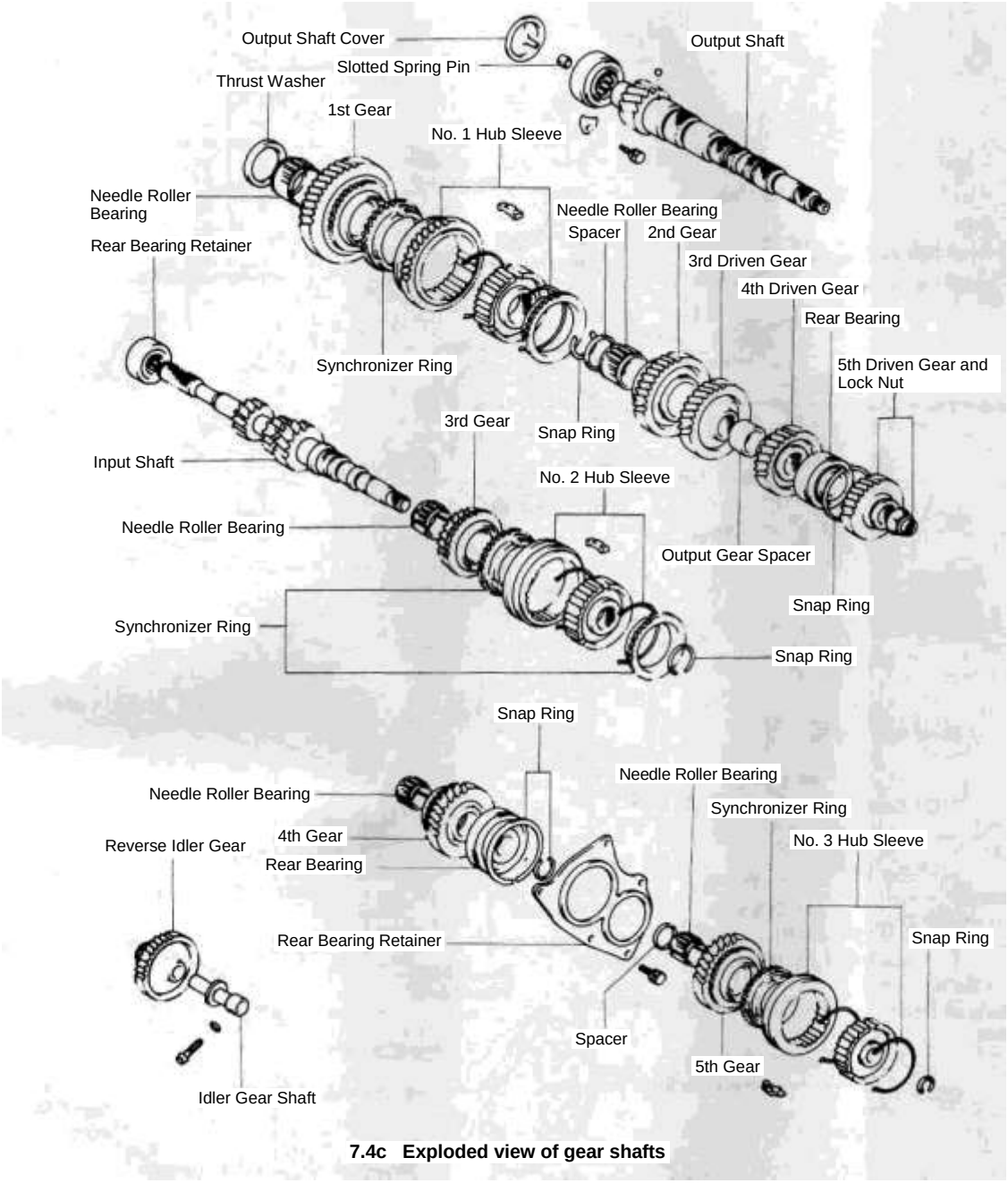
During disassembly of the transaxle, make careful notes of how each piece comes off, where it fits in relation to other pieces and what holds



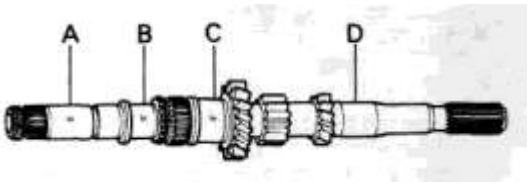
7.4a Exploded view of transaxle housing and differential



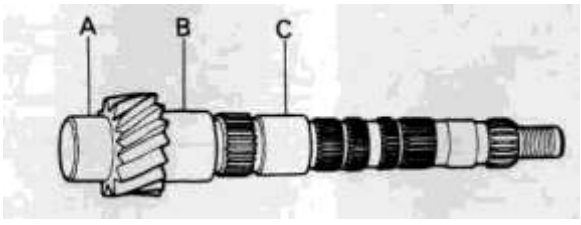
7.4b Exploded view of shift fork assemblies



7.4c Exploded view of gear shafts



7.4d These sections of the input shaft must be measured (see Specifications)



7.4e These sections of the output shaft must be measured (see Specifications)

it in place. Exploded views are included **(see illustrations)** to show where the parts go — but actually noting how they are installed when you remove the parts will make it much easier to get the transaxle back together.

Before taking the transaxle apart for repair, it will help if you have some idea of what area of the transaxle may be malfunctioning. Certain problems can be closely tied to specific areas in the transaxle, which can make component examination and replacement easier. Refer to the Troubleshooting section at the front of this manual for information regarding possible sources of trouble.

Chapter 7 Part B Automatic transaxle

Contents

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Automatic transaxle fluid checking ..... See Chapter 1
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Side gear shaft (driveaxle) oil seal — replacement 8
Speed sensor — removal, inspection and installation 9
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Throttle valve cable — replacement 7
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Specifications

Transaxle fluid type	ATF Dexron II
Transaxle fluid capacity	
after rebuild (transaxle empty)	5.6 L (5.9 qts)
drain and refill	2.4 L (2.5 qts)
Differential fluid type	ATF Dexron II
Differential fluid capacity	
after rebuild (differential empty)	1.4 L (1.5 qts)
after on-vehicle replacement of oil seal	1.1 L (1.2 qts)
after replacement of speed sensor	0.7 L (0.7 qts)
Throttle valve cable standard boot and cable stopper distance	0 to 1 mm (0 to 0.04 in)
Driveaxle endplay	2 to 3 mm (0.08 to 0.12 in)
Torque converter installation distance (between converter face and transaxle)	20 mm (0.79 in)

Torque specifications	**Nm**	**Ft-lbs**
Neutral start switch bolts	5.4	48 in-lbs
Valve body bolts	10	7
Manual valve bolts	10	7
Oil strainer bolts	10	7
Oil pan bolts	4.9	43 in-lbs
Drain plug	49	36
Transaxle housing mounting bolts		
12 mm bolts	64	47
10 mm bolts	46	34
Transaxle mounting insulator bracket bolts	113	83
Front and rear mounting insulator bracket bolts	52	38
Driveaxle-to-side gear shaft bolts	36	27
Rear axle carrier-to-lower arm bolt	113	83
Suspension arm-to-rear axle carrier bolt	49	36
Torque converter mounting bolts	27	20
Stiffener plate bolts	37	27
Exhaust pipe-to-exhaust manifold nuts	62	46

1 General information

Because of the complexity of its design, the special tools and skills necessary to rebuild an automatic transaxle, it is recommended that the home mechanic have all major repairs performed by a dealer service department or automatic transmission specialist. Also, unlike a conventional oil pressure control type automatic transaxle, the four speed automatic transaxle for this vehicle is controlled by a microcomputer. The troubleshooting procedures are complex and well beyond the scope of the home mechanic. The procedures in this chapter are therefore limited to general diagnosis, routine adjustments, on-vehicle replacement of a few components and transaxle removal and installation.

You can adjust the throttle valve cable, shift control cable and neutral start switch and replace a worn or damaged driveaxle oil seal or speed sensor. But if the transaxle requires internal repairs or an overhaul, take it to a dealer service department or a transmission repair shop. You will save money, however, by removing and installing the transaxle yourself.

2 Diagnosis — general

Note: *Automatic transmission malfunctions may be caused by five general conditions: poor engine performance, improper adjustments, hydraulic malfunctions, mechanical malfunctions or malfunctions in the computer or its signal network. Diagnosis of these problems should always begin with a check of the easily repaired items: fluid level and condition (Chapter 1), shift linkage adjustment and throttle linkage adjustment. Next, perform a road test to determine if the problem has been corrected or if more diagnosis is necessary. If the problem persists after the preliminary tests and corrections are completed, additional diagnosis should be done by a dealer service department or transmission repair shop.*

Preliminary checks

1 Warm up the engine and transaxle to normal operating temperature.
2 Check the fluid level as described in Chapter 1:

a) If the fluid level is unusually low, add enough fluid to bring the level within the crosshatched area of the dipstick, then check for external leaks.
b) If the fluid level is abnormally high, drain off the excess fluid, then inspect the excess fluid for contamination by coolant.
c) If the fluid is foaming, drain it and refill the transaxle, then check for water in the fluid or a high fluid level.

3 Check the engine idle speed. **Note:** *If the engine is not performing properly, do not attempt to proceed with the preliminary checks before first correcting any engine malfunctions.*
4 Check the throttle valve cable for freedom of movement and returnability at the cable activating lever. Check to be sure that the throttle valve cable is adjusted to the proper length (Section 3). **Note:** *The throttle cable may function properly when the engine is shut off and cold, but it may malfunction once the engine is hot. So check it both cold and at normal operating temperature.*
5 Inspect the shift control cable (Section 5). Make sure that it is properly adjusted and that the linkage operates smoothly without binding.

Fluid leak diagnosis

6 Most fluid leaks are easy to locate visually. Repair usually consists of replacing or repairing the leaking part. If a leak is difficult to find, the following procedure may help.
7 Identify the fluid. Make sure it is transaxle fluid and not engine oil or hydraulic brake or clutch fluid.
8 Try to pinpoint the source of the leak. Run the vehicle at normal operating temperature, then park it over a large sheet of paper. After a minute or two, you should be able to pinpoint the leak by determining the source of the fluid dripping onto the paper.
9 Make a careful visual inspection of the suspected component and the area immediately around it. Pay particular attention to gasket mating surfaces. A mirror is often helpful for finding leaks in areas that are hard to see.
10 If the leak still cannot be found, clean the suspected area thoroughly with a degreaser, steam or spray solvent, then dry it.
11 Drive the vehicle for several miles at normal operating temperature and varying speeds. After driving the vehicle, visually inspect the suspected component again.
12 Once the leak has been located, the cause must be determined before it can be properly repaired. If a gasket is replaced but the sealing flange is bent, the new gasket will not repair the leak. The bent flange must also be repaired.
13 Before attempting to repair a leak, check to make sure that the following conditions are corrected or they may cause another leak. **Note:** *Some of the following conditions (a leaking torque converter, for instance) cannot be fixed without highly specialized tools and expertise. Such problems must be referred to a transmission specialist or a dealer service department.*

Gasket leaks

14 Inspect the pan periodically. Make sure that the bolts are tight, no bolts are missing, the gasket is in good condition and the pan is flat (dents in the pan may indicate damage to the valve body inside).
15 If the pan gasket is leaking, the fluid level or the fluid pressure may be too high, the vent may be plugged, the pan bolts may be too tight, the pan sealing flange may be warped, the sealing surface of the transaxle housing may be damaged, the gasket may be damaged or the transaxle casting may be cracked or porous.

Seal leaks

16 If a transaxle seal is leaking, the fluid level or pressure may be too high, the vent may be plugged, the seal bore may be damaged, the seal itself may be damaged or improperly installed, the surface of the shaft protruding through the seal may be damaged or a loose bearing may be causing excessive seal wear.
17 Make sure that the dipstick tube seal is in good condition and that the tube is properly seated. Periodically inspect the area around the speed sensor for leakage. If transmission fluid is evident, check the sensor O-ring for damage. Also inspect the side gear shaft oil seals for leakage.

Case leaks

18 If the case itself appears to be leaking, the casting is porous and will have to be repaired or replaced.
19 Make sure that the the oil cooler hose fittings are tight and in good condition.

Fluid comes out vent pipe or fill tube

20 If this condition occurs, the transaxle is overfilled, there is water in the fluid, the case is porous, the dipstick is incorrect, the vent is plugged or the drain back holes are plugged.

3 Throttle valve cable — adjustment

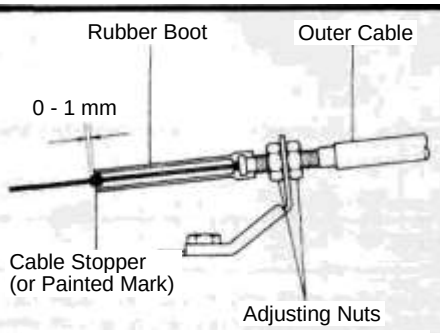
Refer to illustration 3.2

1 Depress the accelerator and verify that the throttle valve opens all the way. If it doesn't, adjust the throttle link rod.
2 While an assistant depresses the accelerator pedal as far as it will go, loosen the adjustment nuts **(see illustration)** and adjust the cable housing so that the distance between the end of the boot and the stopper on the cable is within the specified distance.
3 Tighten the nuts and recheck your adjustment.

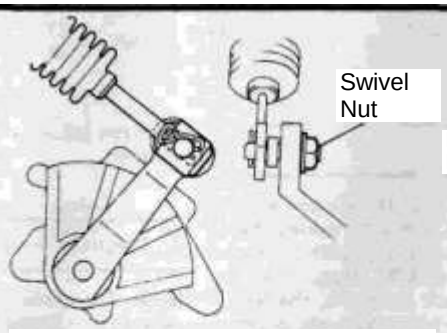
4 Shift control cable — adjustment

Refer to illustration 4.1

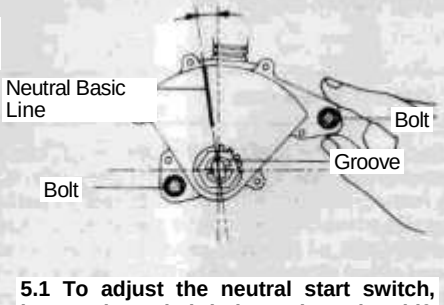
1 Loosen the swivel nut on the manual shift lever **(see illustration).**
2 Push the lever as far as it wil go toward the right side of the vehicle.
3 Return the lever two notches to the Neutral position.



3.2 While an assistant depresses the gas pedal all the way to the floor, loosen the throttle valve cable adjusting nuts and adjust the cable housing so that the distance between the end of the boot and the stopper on the cable is within the specified distance



4.1 To adjust the shift control cable, loosen the swivel nut on the manual shift lever, push the manual lever toward the right side of the vehicle as far as it will go, return the lever two notches to the Neutral position, set the shift lever to the N position and tighten the swivel nut



5.1 To adjust the neutral start switch, loosen the switch bolts and set the shift selector to the N range, align the groove and neutral basic line, hold the switch in place and tighten the bolts to the specified torque

4 Set the shift lever to the N position.
5 While holding the lever lightly toward the R range side, tighten the swivel nut.

5 Neutral start switch — adjustment and replacement

Refer to illustration 5.1

Note: *If the engine will start with the shift selector in any range other than N or P, adjustment is required.*

1 Loosen the neutral start switch bolts **(see illustration)** and set the shift selector to the N range.
2 Align the groove and neutral basic line.
3 Hold the switch in place and tighten the bolts to the specified torque.
4 If the switch cannot be adjusted to prevent the engine from starting in any range other than N or P, replace it.
5 Remove the clips and disconnect the transaxle control cable from the manual shift lever.
6 Remove the manual shift lever locknut and the lever.
7 Remove the switch bolts and the switch.
8 Install the new switch.
9 Install the manual shift lever.
10 Adjust the switch.
11 Connect the transaxle control cable.

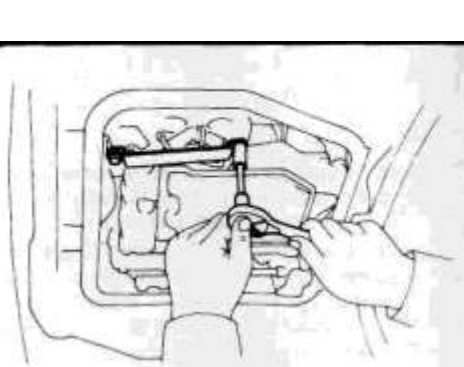
6 Oil pan — removal and installation

1 Disconnect the cable from the negative terminal of the battery.
2 Raise the vehicle and place it securely on jackstands.
3 Thoroughly clean the exterior surfaces of the transaxle near the pan to prevent dirt from contaminating transaxle internal components while the pan is removed.
4 Drain the transaxle fluid (refer to Chapter 1, if necessary).
5 Remove the pan bolts and carefully lower the pan. Discard the old gasket.
6 Remove all old gasket material from the mating surfaces of the transaxle housing and the pan by scraping them clean with a razor blade.
7 Thoroughly wash the pan with clean solvent.
8 Install the pan with a new gasket. **Note:** *There is a magnet in the bottom of the pan which prevents harmful metal particles from contaminating the fluid. Make sure it is installed before the pan is bolted to the transaxle.*
9 Install the pan bolts and tighten them to the specified torque.
10 Install the drain plug and tighten it to the specified torque.
11 Fill the transaxle with two liters of ATF Dexron II, then start the engine and allow the fluid in the transaxle to circulate and build pressure, then recheck it and fill it to the specified level (refer to Chapter 1, if necessary).

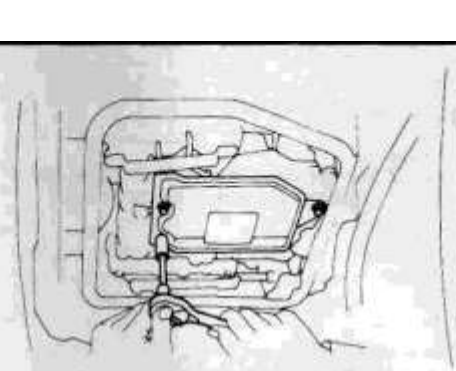
7 Throttle valve cable — replacement

Refer to illustrations 7.7, 7.8, 7.9, 7.10, 7.12, 7.13, 7.14, 7.15, 7.16, 7.17, 7.18, 7.19, 7.20, 7.21, 7.22, 7.23, 7.25 and 7.29

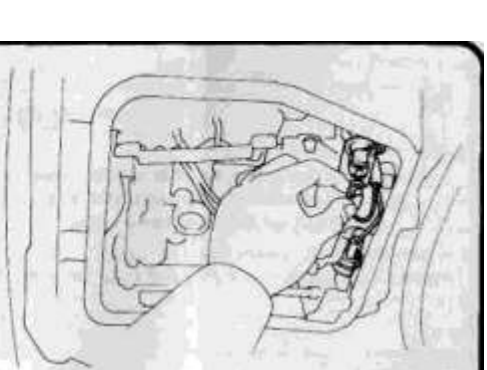
1 Disconnect the cable from the negative terminal of the battery.
2 Disconnect the throttle valve cable housing from the bracket.
3 Disconnect the cable from the throttle linkage.
4 Disconnect the cable from the clamps.
5 Remove the neutral start switch (Section 5).
6 Remove the oil pan (Section 6).
7 Remove the two bolts and the apply tube bracket **(see illustration).**
8 Remove the three oil strainer mounting bolts **(see illustration)** and the oil strainer. **Caution:** *Some oil will come out when the strainer is removed.*
9 Disconnect the solenoid connectors **(see illustration).**
10 Pry up the tube ends with a large screwdriver **(see illustration)** and remove the oil tubes.
11 Remove the manual detent spring.
12 Remove the manual valve and valve body **(see illustration).**
13 Remove the valve body mounting bolts **(see illustration),** pull the valve body away from the transaxle and disconnect the throttle valve cable.



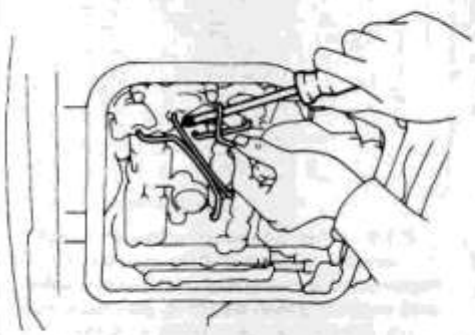
7.7 Remove both bolts and the apply tube bracket



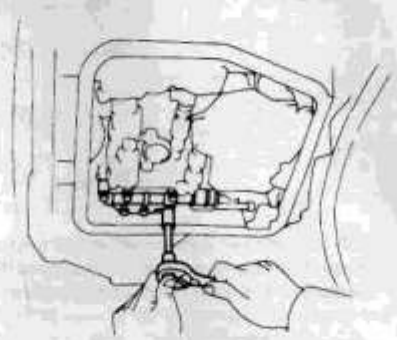
7.8 Remove the three oil strainer bolts and the strainer



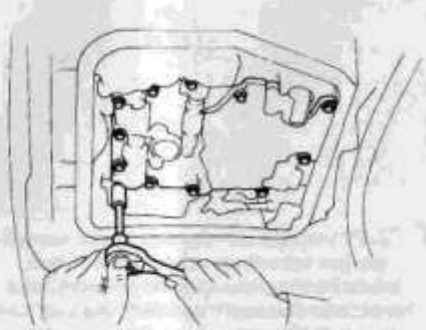
7.9 Unplug the solenoid connectors



7.10 Pry up the tube ends with a large screwdriver and remove the oil tubes



7.12 Remove the manual valve and valve body



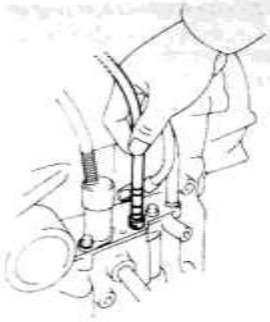
7.13 Remove the valve body mounting bolts and pull the valve body away from the transaxle

14 Remove the bolt and retaining plate **(see** illustration) and pull the cable out of the transaxle case.
1 5 Remove the second brake apply gasket (governor apply gasket) **(see illustration).**
16 Install the throttle valve cable in the transaxle case **(see illustration).** Be sure to push it in all the way. Install the retaining plate and bolt.
17 Install the second brake apply gasket (governor apply gasket) and, while holding the cam down with your hand **(see illustration),** slip the cable end into the slot and place the valve body in position. Be careful not to entangle the solenoid wires.
18 Finger tighten the valve body bolts then tighten them to the specified torque **(see illustration).** Note that each bolt length is indicated in the accompanying illustration. Do not mix up the bolts.
19 Connect the solenoid wiring **(see illustration).** The No. 1 solenoid connector is the white and shorter wire; the No. 2 solenoid connector is the black and longer wire.
20 Align the manual valve with the pin on the manual shift lever **(see illustration)** and place the manual valve and body in position.
21 Finger tighten the four bolts first, then tighten them to the specified torque **(see illustration).** Note that each bolt length is indicated in the accompanying illustration. Do not mix up the bolts.
22 Install the detent spring. Finger tighten both bolts first, then tighten them with a torque wrench **(see illustration).** Note that the bolt length of each bolt is indicated in the accompanying illustration. Make sure that the manual valve lever is in contact with the center of the roller at the tip of the detent spring.
23 Install the oil tubes **(see illustration)** by tapping them into position with a plastic hammer. **Caution:** *Be careful not to bend or damage the tubes.*
24 Install the apply tube bracket.
25 Install the oil strainer and tighten each bolt to the specified torque **(see illustration).** Note that each bolt length is indicated in the accompanying illustration.
26 Install the oil pan (Section 6).
27 If the throttle valve cable is new, bend the cable so that there is a radius of about 200 mm (7.87 in).
28 Pull the inner cable lightly until a slight resistance is felt, and hold it.
29 Stake the stopper **(see illustration)** 0.8 to 1.5 mm (0.031 to 0.059 in) from the outer cable as shown.
30 Connect the throttle valve cable to the throttle linkage.
31 Connect the cable housing to the bracket.
32 Connect the cable to the clamps.
33 Adjust the throttle valve cable (Section 3).
34 Install the neutral start switch (Section 5).
35 Connect the transaxle control cable.
36 Test drive the vehicle.

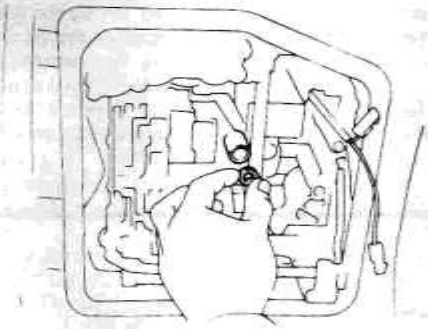
8 Side gear shaft (driveaxle) oil seal — replacement

Refer to illustrations 8.3, 8.5 and 8.8

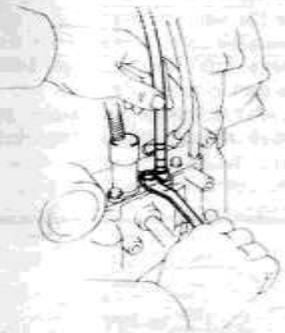
1 Drain approximately one liter of fluid from the differential (refer to Chapter 1, if necessary).



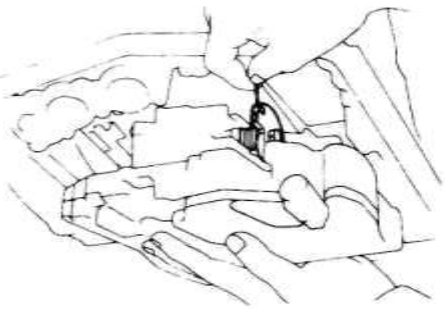
7.14 Remove the throttle valve cable bolt and retaining plate and pull the cable out of the transaxle case



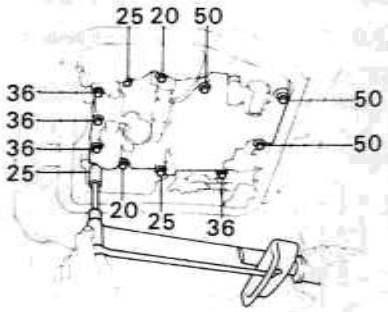
7.15 Remove the second brake apply gasket (governor apply gasket)



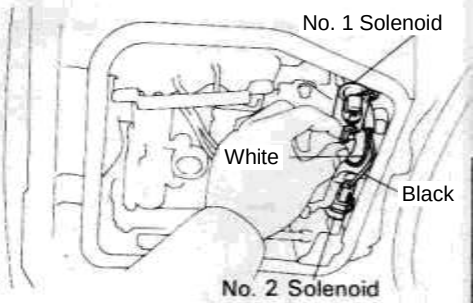
7.16 Push the throttle valve cable into the transaxle case then install the retaining plate and bolt



7.17 Install the second brake apply gasket (governor apply gasket) and, while holding the cam down with your hand, slip the cable end into the slot and place the valve body in position

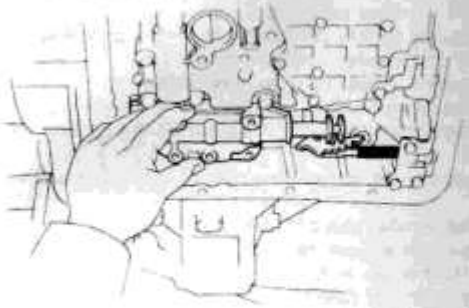


7.18 Finger tighten all valve body bolts, then tighten them to the specified torque — the bolt lengths are indicated

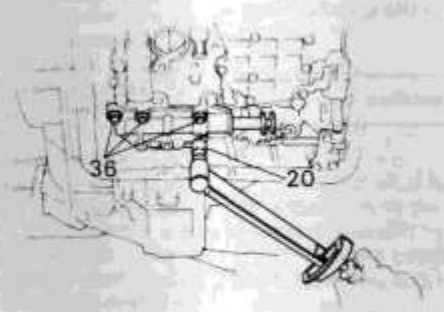


7.19 When connecting the solenoid wiring, remember that the No. 1 connector is the white and shorter wire and the No. 2 connector is the black and longer wire

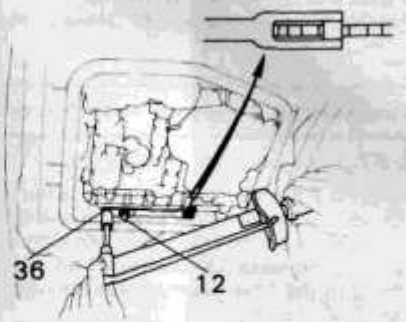
2 Remove the driveaxle (Chapter 8).
3 Push the side gear shaft into the differential as far as it will go, then measure the distance between the transaxle case and the side gear shaft **(see illustration)** to insure that the shaft is reinstalled with the same clearance.
4 Use a slide hammer to drive out the side gear shaft.
5 Use a two-jaw puller and slide hammer **(see illustration)** to pull the old seal out of its bore in the differential. If you don't have access to these tools, use a large screwdriver to pry out the old seal. Be careful not to nick or gouge the seal bore when using a screwdriver.
6 Drive in a new seal with a large socket slightly smaller in diameter than the outside diameter of the seal.
7 Coat the lip of the new seal with multipurpose grease.
8 Install a new snap ring into the groove of the side gear shaft **(see illustration)** and carefully tap the side gear shaft into the differential with a plastic or rubber mallet until it makes contact with the pinion shaft (you will know when it makes contact by the change in sound it makes when it strikes the pinion shaft).



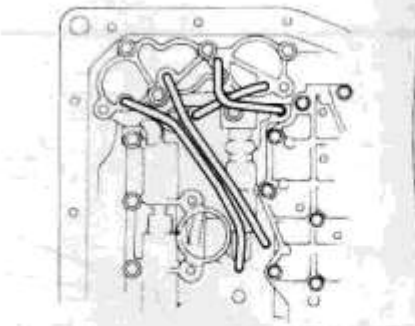
7.20 Align the manual valve with the pin on the manual shift lever and place the manual valve and body in position



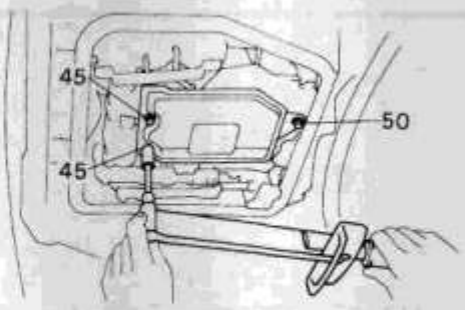
7.21 Finger tighten the four bolts first, then tighten them to the specified torque — the bolt lengths are indicated



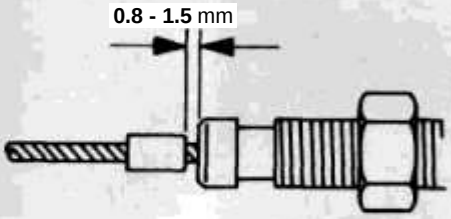
7.22 Install the detent spring, making sure that the manual valve lever is in contact with the center of the roller at the tip of the detent spring, then tighten the bolts to the specified torque — the bolt lengths are indicated



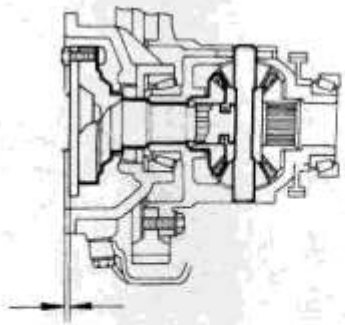
7.23 Install the oil tubes by tapping them into position with a plastic hammer — be careful not to bend or damage the tubes



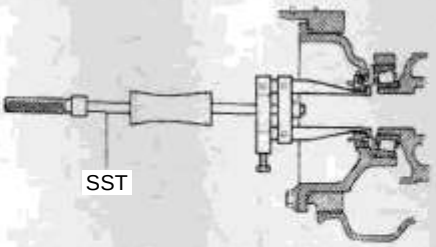
7.25 Install the oil strainer and tighten the bolts to the specified torque — the bolt sizes are indicated



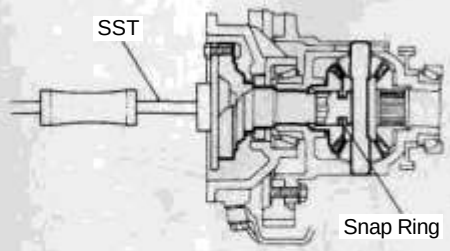
7.29 Stake the stopper 0.8 to 1.5 mm (0.031 to 0.059 in) from the outer cable



8.3 Push the side gear shaft as far as it will go into the differential, then measure the distance between the transaxle case and the side gear shaft to ensure proper reassembly



8.5 Use a two-jaw puller and slide hammer to remove the old seal from the bore in the differential



8.8 Install a new snap ring into the groove of the side gear shaft and carefully tap the side gear shaft into the differential with a plastic or rubber hammer until it strikes the pinion shaft

9 Using a dial gauge mounted to the differential housing, measure side gear shaft endplay by pushing the shaft all the way into the differential until it bottoms, zeroing the gauge probe against the face of the side gear shaft flange and pulling the shaft out of the differential until it binds. Make sure that the side gear shaft has 2 to 3 mm (0.08 to 0.12 in) of endplay
10 Verify that the side gear shaft will not come out by pulling hard on the flange with your hands.
11 Push the side gear shaft all the way into the differential and measure the distance between the side gear shaft and the transaxle case. Compare your measurement with the one you made before removing the side gear shaft. They should be the same.
12 Install the driveaxle (Chapter 8).
13 Fill the differential with ATF Dexron II fluid to the specified level.

9 Speed sensor — removal, inspection and installation

Refer to illustrations 9.3, 9.5 and 9.6

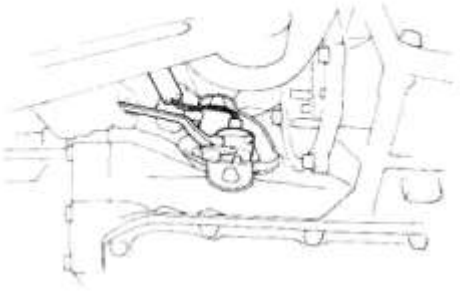
1 Drain 0.7 liters of fluid from the differential (Chapter 1).
2 Disconnect the left driveaxle from the side gear shaft (Chapter 8).
3 Remove the speed sensor bolt and retaining plate **(see illustration).**
4 Unplug the electrical connector from the speed sensor.
5 Remove the speed sensor **(see illustration)** and peel off the old O-ring.
6 Connect an ohmmeter to the speed sensor **(see illustration)** and verify that the meter deflects when the sensor is repeatedly brought close to a magnet.
7 Coat a new O-ring with Dexron II ATF and install it on the speed sensor.
8 Install the speed sensor and plug in the electrical connector.
9 Install the retaining plate and bolt.
10 Connect the left driveaxle to the side gear shaft (Chapter 8).
11 Add 0.7 liters (0.7 quarts) of ATF Dexron II to the differential.
12 Check the differential fluid level (Chapter **1).**

10 Transaxle — removal and installation

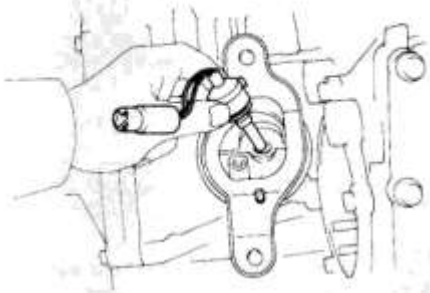
Refer to illustrations 10.6, 10.9, 10.14a, 10.14b, 10.15, 10.18, 10.19, 10.20, 10.22, 10.23, 10.25, 10.26, 10.27, 10.28 and 10.33

Removal

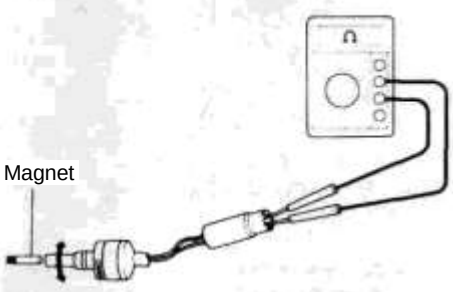
1 Disconnect the cable from the negative terminal of the battery.
2 Remove the duct between the air flow meter and the throttle body.
3 Remove the air flow meter (refer to Chapter 4).
4 Disconnect the speed sensor connector from the speed sensor.
5 Disconnect the throttle valve cable (Section 7).
6 Remove the transaxle protector **(see illustration).**
7 Remove the water hose bracket.
8 Disconnect the thermostat housing (Chapter 3) and ground cable from the transaxle.
9 Remove the upper transaxle mounting insulator bracket bolt **(see illustration).**
10 Loosen but do not remove the left rear wheel lug nuts. Raise the vehicle and place it securely on jackstands. Remove the left rear wheel. Drain the transaxle fluid (refer to Chapter 1).
11 Remove the engine under cover.
12 Disconnect the speedometer cable.
13 Disconnect the oil cooler hoses.
14 Pull off the retaining clip, remove the retainer, disconnect the control cable from the bracket and remove the control cable bracket **(see illustrations).**
15 Disconnect the two neutral start switch connectors and the solenoid connector **(see illustration).**
16 Remove the starter motor mounting bolts and the starter/solenoid



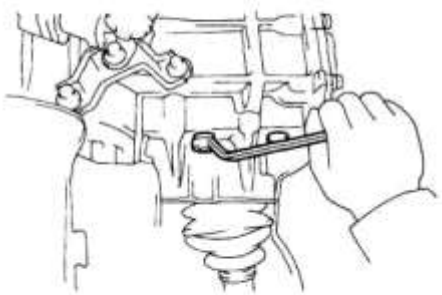
9.3 After removing the left driveaxle, remove the speed sensor bolt and retaining plate



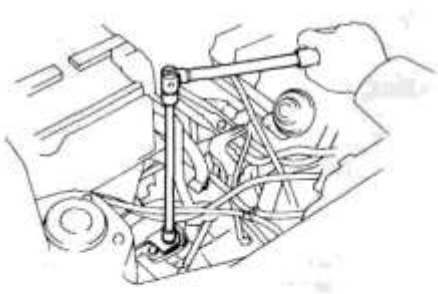
9.5 Remove the speed sensor and peel off the old O-ring



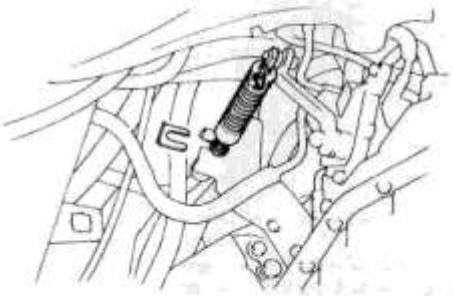
9.6 Connect an ohmmeter to the speed sensor and verify that the meter needle deflects when the sensor is brought close to a magnet



10.6 Remove the transaxle protector



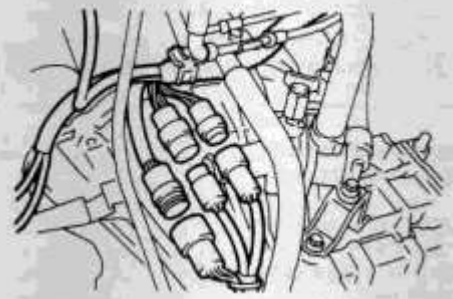
10.9 Remove the upper transaxle mounting insulator bracket bolt



10.14a Pull off the retaining clip, remove the retainer and disconnect the control cable from the bracket

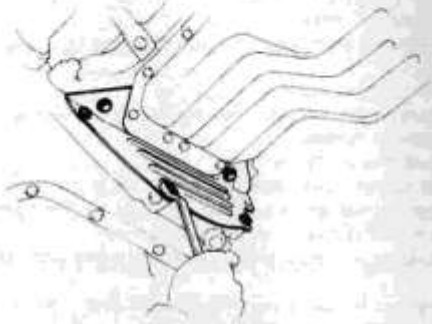
assembly (refer to Chapter 5).
17 Remove the exhaust pipe (refer to Chapter 4).
18 Remove the stiffener plate **(see illustration).**
19 Remove the engine rear plate **(see illustration).**
20 Turn the crankshaft to gain access to each bolt, then hold the crankshaft pulley nut with a wrench and remove the six torque converter mounting bolts **(see illustration).**
21 Apply the parking brake, remove the nuts attaching the right driveaxle to the side gear shaft, disconnect it from the side gear shaft and suspend the driveaxle with wire (refer to Chapter 8).
22 On the left side, disconnect the suspension arm from the rear axle carrier **(see illustration).**
23 Disconnect the rear axle carrier from the lower arm **(see illustration).**
24 Unbolt the left driveaxle from the side gear shaft and suspend the driveaxle with wire.
25 Support the engine and transaxle with two jacks **(see illustration).**
26 Remove the two lower transaxle mounting insulator bracket bolts **(see illustration).**

10.14b Remove the control cable bracket

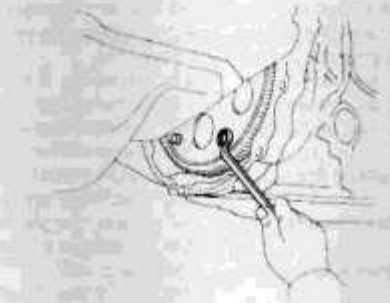


10.15 Disconnect the two neutral start switch connectors and the solenoid connector

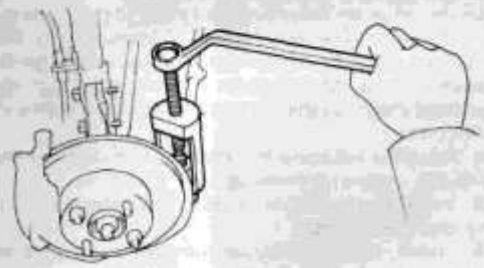
10.18 Remove the stiffener plate



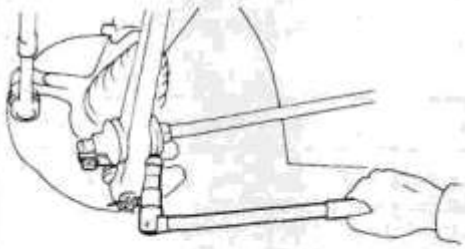
10.19 Remove the engine rear plate



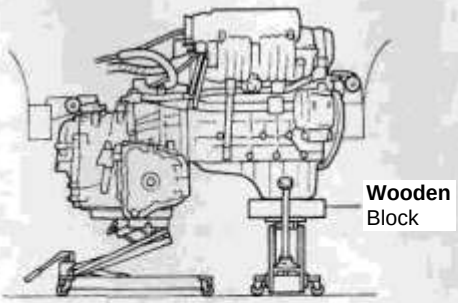
10.20 Turn the crankshaft to gain access to each bolt, hold the crankshaft pulley nut with a wrench and remove the six torque converter mounting bolts



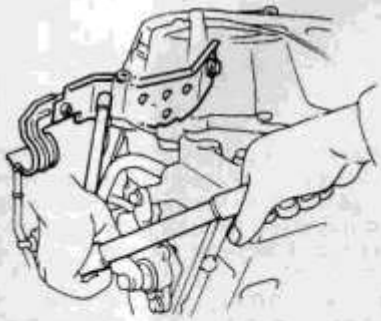
10.22 Disconnect the left suspension arm from the left rear axle carrier



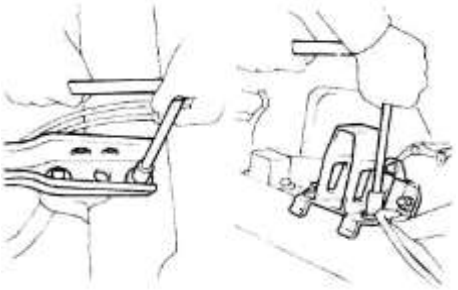
10.23 Disconnect the rear axle carrier from the lower arm



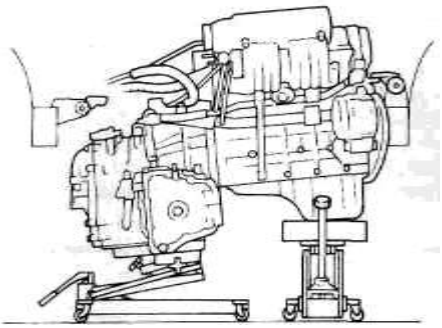
10.25 Support the engine and transaxle with two jacks



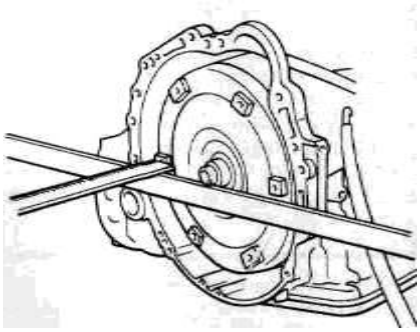
10.26 Remove the two lower transaxle mounting insulator bracket bolts



10.27 Disconnect the front and rear mounting insulator brackets



10.28 Lower the rear of the transaxle and remove the housing bolts



10.33 Using calipers and a straightedge, measure the distance between the surface of the torque converter-to-driveplate mounting bolt pads and the front surface of the transaxle housing — if this distance does not equal or exceed the specified distance, the converter is not fully seated

27 Disconnect the front and rear mounting insulators **(see illustration).**

28 Lower the rear of the transaxle **(see illustration)** and remove the transaxle housing bolts.

29 Making sure that neither the throttle cable nor the wire harnesses snag on the anything inside the engine compartment, move the transaxle back and forth, from front to rear, and detach it from the engine.

30 Remove the transaxle from the engine compartment.

31 Unless you are planning to install a new or rebuilt transaxle that includes another torque converter, remove the torque converter from the old transaxle and have it professionally drained and washed by a dealer service department or a transmission repair shop.

Installation

32 If you are installing the old torque converter in a new or rebuilt transaxle, fill the converter with new ATF Dexron II and install it in the transaxle.

33 Using a ruler and a straight edge, measure from the surface of the torque converter mounting bolt pads to the front surface of the transaxle housing **(see illustration).** Compare your measurement to the specified distance. If the distance between the front surface of the converter and the transaxle housing does not equal or exceed the specified distance, the converter is not fully seated and must be pushed in farther.

34 Raise the transaxle into position and align the two pins on the block with the converter housing.

35 Install the transaxle housing mounting bolts and tighten them to the specified torque.

36 Install the transaxle mounting insulator bracket bolts and tighten them to the specified torque.

37 Install the front and rear mounting insulator bolts and tighten them to the specified torque.

38 Connect the left driveaxle to the side gear shaft, install the six mounting nuts and tighten them to the specified torque.

39 Connect the rear axle carrier to the lower arm and tighten the bolt to the specified torque.

40 Connect the suspension arm to the rear axle carrier and tighten the bolt to the specified torque.

41 Connect the right driveaxle to the side gear shaft and tighten the mounting nuts to the specified torque.

42 Install the torque converter mounting bolts. Be sure to install the gray bolt first, and then the five black bolts. Tighten the bolts evenly and gradually to the specified torque.

43 Install the engine rear plate.

44 Install the stiffener plate and tighten the bolts to the specified torque.

45 Install the exhaust pipe (refer to Chapter 4).

46 Install the starter motor (refer to Chapter 5).

47 Connect the two neutral start switch connectors and the solenoid connector.

48 Install the control cable bracket.

49 Connect the control cable, install the retainer and the clip.

50 Connect the oil cooler hoses.

51 Connect the speedometer cable.

52 Install the engine under cover and the transaxle protector.

53 Install the left rear wheel and snug the lug nuts finger tight.

54 Lower the vehicle and tighten the left rear wheel lug nuts.

55 Install the transaxle mounting insulator bracket bolts and tighten them securely.

56 Install the thermostat housing mounting bolts and connect the ground strap (reefer to Chapter 3 if necessary).

57 Install the water hose bracket to the transaxle housing.

58 Connect the throttle valve cable to the throttle linkage and bracket.

59 Adjust the throttle valve cable (Section 3).

60 Connect the speed sensor connector (Section 9).

61 Install the air flow meter (Chapter 4).

62 Install the duct between the air flow meter and the throttle body.

63 Connect the cable to the negative terminal of the battery.

64 Fill the transaxle with ATF Dexron II (refer to Chapter 1).

Chapter 8 Clutch and driveaxles

Contents

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Specifications

Clutch diaphragm wear pattern	
maximum depth	0.6 mm (0.024 in)
maximum width	5.0 mm (0.197 in)
Clutch disc minimum rivet depth.....	0.3 mm (0.012 in)
Flywheel runout.....	0.1 mm (0.004 in)
CV joint grease	
type	supplied in boot replacement kit
capacity	
outboard joint	120 gms (0.26 lb)
inboard joint	212 gms (0.47 lb)
Boot/driveaxle length (driveaxle at standard length)	
A.....	685 mm (26.97 in)
B (length between damper and outboard joint)	202 mm (7.95 in)
C	439 mm (1 7.28 in)

See *illustration in text showing above lengths*

Torque specifications	**Nm**	**Ft-lbs**
Clutch master cylinder		
mounting nuts.....	13	9
reservoir retaining bolt	25	18
Clutch slave cylinder		
mounting bolt.....	18	13
bleeder plug	11	8
Pressure plate bolts	19	14
Clutch release fork pivot stud	37	27
Axle bearing lock nut.....	186	137
Driveaxle-to-side gear shaft bolts	36	27

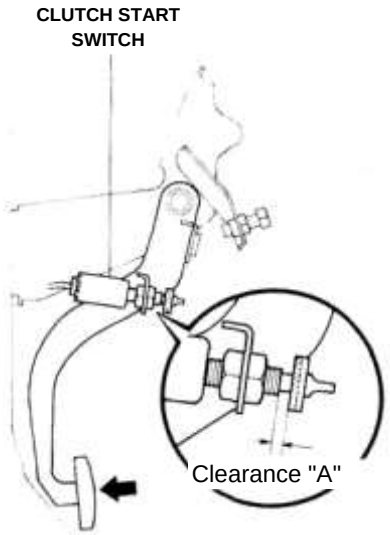
1 Clutch — general information

All vehicles with a manual transaxle use a single dry plate, diaphragm spring type clutch. The clutch disc has a splined hub which allows it to slide along the splines of the transaxle input shaft. The clutch and pressure plate are held in contact by spring pressure exerted by the diaphragm in the pressure plate.

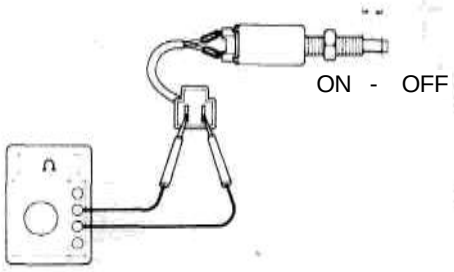
The clutch release system is operated by hydraulic pressure and consists of the clutch pedal, the clutch master cylinder, the hydraulic lines and hoses, the slave cylinder, the release fork and the release bearing. The hydraulic clutch system provides automatic clutch adjustment. Clutch pedal height and free play are, however, adjustable (refer to Chapter 1).

When pressure is applied to the clutch pedal to release the clutch, hydraulic pressure is exerted against the outer end of the clutch release lever. As the fork pivots on its shaft, its inner end pushes against the release bearing. The bearing pushes against the diaphragm levers of the pressure plate assembly, which releases the clutch from the flywheel.

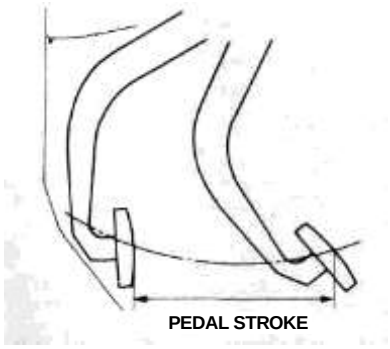
It should be noted that the terminology used in this manual to describe various components of the clutch system may vary somewhat from that used by dealership parts departments. For example, you will see such terms as *slave cylinder, pressure plate* and *throwout bearing* in this Chapter. A dealer, however, might substitute the terms *release cylinder, clutch cover* and *release bearing,* respectively, for the above terms. The important thing to keep in mind is that the terms above, and others, are interchangeable. They mean the same thing.



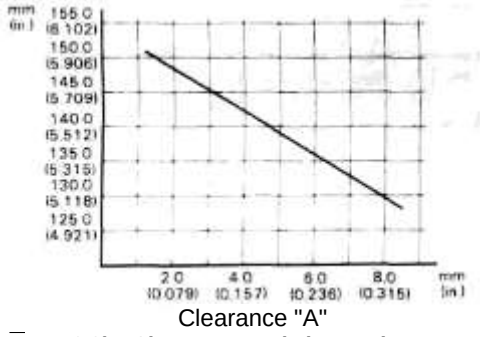
2.4 When the clutch is fully depressed, clearance "A" must be greater than 1 mm (0.04 in). If it isn't, adjust or, if necessary, replace the switch



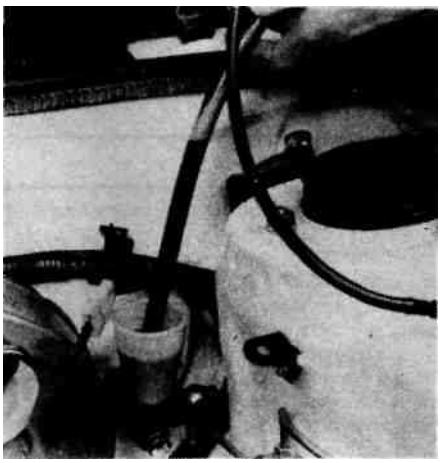
2.5 To check the continuity of the clutch start switch, verify that there is continuity between the terminals when the switch is On (pushed) and that there is no continuity when the switch is Off (free) — if the continuity is not as specified, replace the switch



2.8a Pedal stroke is the distance between the position of the pedal at its full height and its fully depressed position



2.8b Clearance "A" is inversely proportional to pedal stroke — in other words, the longer the pedal stroke, the shorter is clearance "A"



3.2 Before disconnecting or removing anything, remove the fluid from the clutch master cylinder reservoir tank with a syringe or vacuum pump

3.3 To release the clutch pushrod from the clutch pedal, remove the clip and clevis pin from the clutch pedal

2 Clutch start system — inspection and adjustment

Refer to illustrations 2.4, 2.5, 2.8a and 2.8b

1 Check the pedal height, pedal free play and push rod play (refer to Chapter 1).
2 Verify that the engine will not start when the clutch pedal is released.
3 Verify that the engine will start when the clutch pedal is fully depressed.
4 Measure clearance "A" **(see** illustration). It must be a specified distance (see Step 8), but it must also be greater than 1 mm (0.04 in) when the clutch is fully depressed. If it is not, adjust or replace the clutch start switch.
5 Verify that there is continuity between the clutch start switch terminals when the switch is *On* **(see** illustration).
6 Check that there is no continuity between the clutch start switch terminals when the switch is *Off.*
7 If the clutch start switch fails either of the above two tests, replace it.
8 To adjust the clutch start switch, measure the pedal stroke **(see illustration)** and calculate switch clearance "A" using the chart (see **illustration).**
9 Loosen and adjust the switch position.
10 Verify again that the engine does not start when the clutch pedal is released.

3 Clutch master cylinder — removal, overhaul and installation

Refer to illustrations 3.2, 3.3, 3.4, 3.6, 3.7 and 3.8

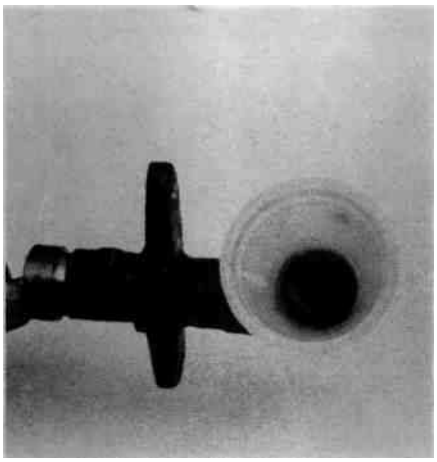
Removal

1 Remove the spare tire, spare tire guard and luggage trim panel.
2 Remove the clutch master cylinder cap and float, then remove the fluid from the reservoir tank with a syringe or pump **(see illustration).**
3 Inside the passenger compartment, remove the clevis pin clip and remove the clevis pin from the clevis and clutch pedal **(see illustration).**
4 Disconnect the clutch line tube banjo bolt **(see illustration).**
5 Remove the two master cylinder mounting nuts, pull the master cylinder from the firewall and remove it from the vehicle.

Overhaul

6 Remove the nut in the bottom of the reservoir tank and separate the tank from the master cylinder **(see illustration).**
7 Pull back the boot. Remove the snap ring **(see illustration)** and pull out the push rod.
8 Tap the master cylinder gently against a block of wood **(see illustration)** to extract the piston. If the piston won't come out, it may be necessary to use compressed air to remove it. **Warning:** *Always point the piston opening away from your body when applying the compressed air, as the piston could be ejected with some force. Note the orientation of the piston assembly to the master cylinder bore.*
9 Wash the master cylinder in clean solvent and blow dry. Inspect

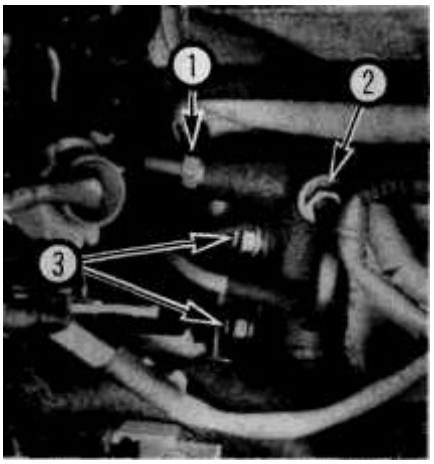
3.4 Remove the hydraulic line banjo fitting from the clutch master cylinder and discard the crush washers — use new washers when reinstalling the master cylinder assembly



3.6 The reservoir tank is attached to the master cylinder with a large nut in the bottom of the tank which must be removed to separate the tank from the master cylinder

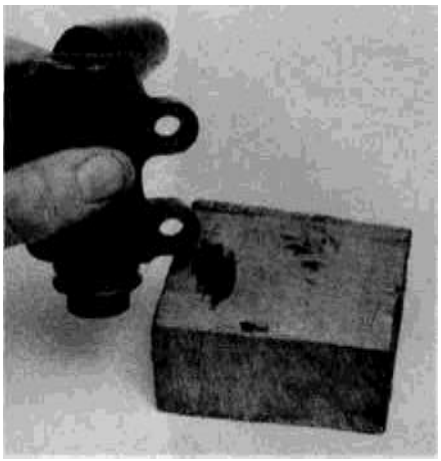
3.7 Using a pair of snap ring pliers, remove the snap ring to free the clutch master cylinder internals — don't try to use a screwdriver or you may damage the bore

3.8 The piston assembly should come out when the master cylinder body is gently tapped on a piece of wood — if it doesn't, the piston is probably stuck in the bore because of a buildup of varnish or sludge and it will have to be forced out with compressed air



4.1 To remove the clutch slave cylinder, remove the following items

1 Clutch line fitting
2 Bleeder tube fitting
3 Mounting bolts



4.5 To remove the piston and spring from the bore of the clutch slave cylinder, a few taps on a block of wood should be sufficient - if that doesn't do it, put your thumb over the bleeder tube hole and blow a little compressed air into the clutch line hole

the master cylinder bore for nicks and galling. If any damage is evident, replace the master cylinder.
10 Coat the parts with lithium soap base glycol grease, if available. Brake fluid is also suitable.
11 Insert the piston into the cylinder.
12 Install the push rod assembly and secure it with the snap ring.
13 Install the reservoir tank and tighten the nut securely.

Installation

14 Install the master cylinder onto the firewall and tighten the mounting nuts securely.
15 Connect the clutch line tube banjo bolt and tighten it securely. Use new crush washers.
16 Insert the clevis pin through the clevis and clutch pedal and secure it with the clip.
17 Fill the clutch reservoir tank with brake fluid and bleed the clutch system (refer to Section 5).
18 Install the luggage trim panel, spare tire guard and spare tire.
19 Check for leaks.
20 Check and adjust the clutch pedal (refer to Chapter 1 and Section 2 in this Chapter).

4 Clutch slave cylinder — removal, overhaul and installation

Refer to illustrations 4.1 and 4.5

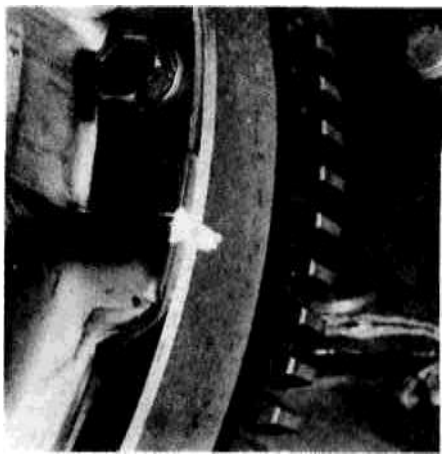
Removal

1 Disconnect the clutch line and bleeder tube from the slave cylinder **(see illustration).**
2 Remove the two slave cylinder mounting bolts and pull off the slave cylinder.

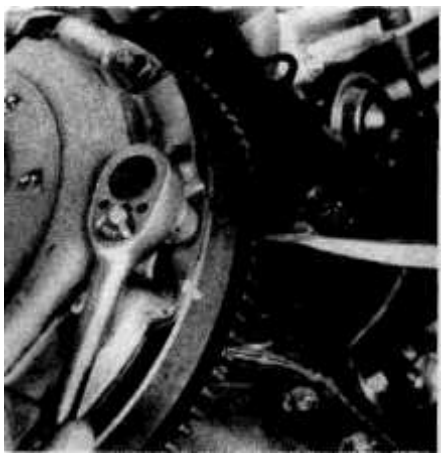
Overhaul

3 Remove the boot.
4 Pull out the push rod.
5 Tap the slave cylinder against a block of wood to break the piston loose **(see illustration).** If necessary, remove the piston with compressed air. **Warning:** *Always point the piston end of the cylinder away from your body when applying compressed air, as the piston may be ejected with some force. Note the orientation of the piston assembly to the slave cylinder bore. Remove the spring.*
6 Wash the slave cylinder in clean solvent and inspect the bore for

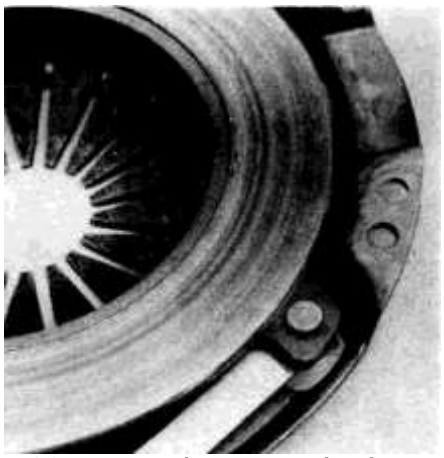
5.3 To bleed the clutch hydraulic system, attach a plastic tube to the bleeder fitting located just to the left of the front transaxle mounting insulator bracket and submerge the other end of the tube in a container partially filled with hydraulic fluid



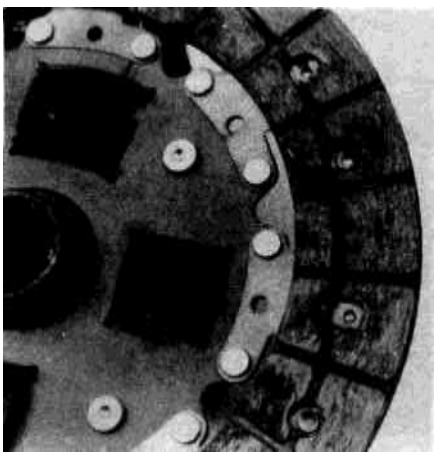
6.2a Index the pressure plate to the flywheel (just in case you are going to reuse the same pressure plate)



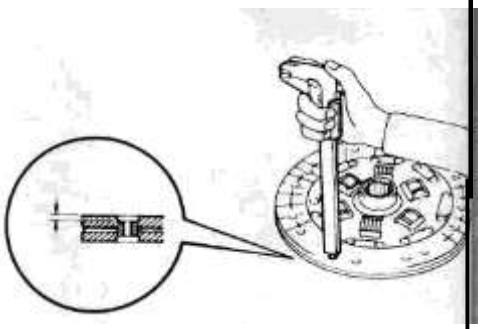
6.2b To immobilize the flywheel while breaking loose the pressure plate bolts, wedge a large screwdriver or prybar between this dowel pin and the flywheel ring gear



6.3a Inspect the pressure plate for signs of galling, scoring or overheating (blue-yellow spots)



6.3b Examine the clutch disc for evidence of excessive wear, such as smearing of the friction material and chewed up rivets



6.4 Measure the depth of each rivet head with a caliper — if the depth is less than the specified minimum, replace the disc

nicks and galling. If any damage is evident, replace the slave cylinder.
7 Coat the new piston with lithium soap base glycol grease, if available. Brake fluid is also acceptable.
8 Insert the spring and piston assembly into the cylinder.
9 Install the boot and insert the push rod.

Installation

10 Install the slave cylinder and tighten the two mounting bolts securely.
11 Connect the bleeder tube fitting and tighten it securely.
12 Connect the clutch line fitting and tighten it securely.
13 Fill the clutch reservoir with brake fluid and bleed the clutch system (see Section 5).
14 Check for leaks.

5 Hydraulic clutch system bleeding

Refer to illustration 5.3

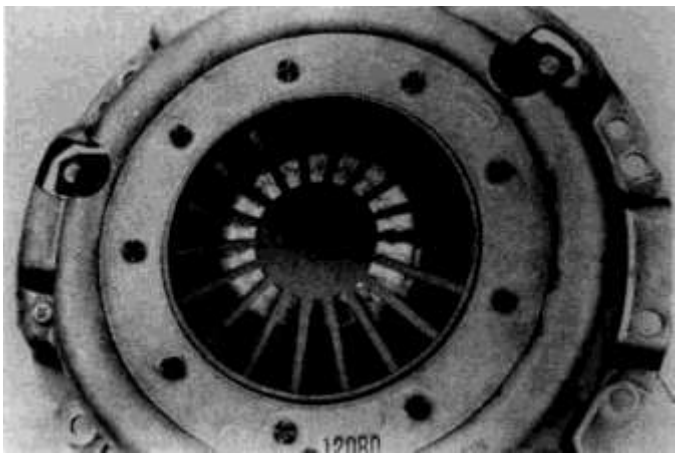
1 Any time work is done on the clutch system or air is suspected in the clutch lines or hoses, bleed the system of air.
2 Fill the clutch reservoir with brake fluid (refer to Chapter 1, if necessary).
3 Connect a vinyl tube to the bleeder plug located on the control cable bracket **(see illustration).** Insert the other end of the tube into a half-filled container of brake fluid.
4 Have an assistant slowly pump the clutch pedal several times, then hold the pedal down as far as it will go. When the pedal is held down, loosen the bleeder plug until fluid starts to run out. When fluid stops running from the hose close the bleeder plug. Make sure your assistant does not release the clutch pedal until after the bleeder plug is closed. Repeat this procedure until there are no more air bubbles ejected from the slave cylinder.

6 Clutch — removal, inspection and installation

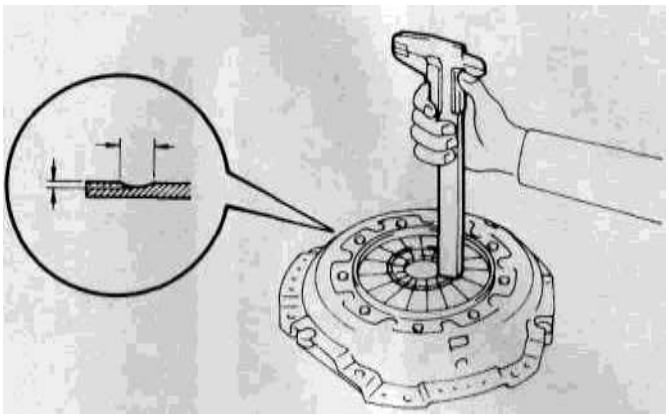
Refer to illustrations 6.2a, 6.2b, 6.3a, 6.3b, 6.4, 6.6a, 6.6b and 6.1

Removal

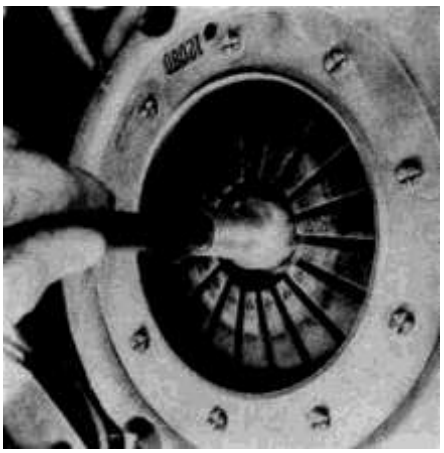
1 Remove the transaxle from the engine (refer to Chapter 7 Part A).
2 Index the pressure plate to the flywheel **(see illustration)** and remove the pressure plate bolts. The easiest way to immobilize the flywheel while loosening the pressure plate bolts is wedge a large screwdriver between the ring gear teeth and the dowel pin **(see illustration).** Loosen each bolt one turn at a time until spring tension is released. Remove the bolts and pull off the pressure plate and clutch disc.



6.6a Examine the diaphragm for excessive wear patterns — if the diaphragm is obviously scored or damaged, replace the pressure plate



6.6b Measure the depth of the wear pattern on the diaphragm with a caliper — if the measured depth exceeds the specified maximum, replace the pressure plate



6.7 Center the clutch disc in the pressure plate with a clutch alignment tool

7.3 To remove the throwout bearing, pull it toward you as far as it will go and then, with a slight twisting motion, disconnect one end of the spring clip from the release arm fork tip and then continue pulling the bearing off the input shaft. The other end of the spring clip will release from the other fork tip

7.4 This is how the throwout bearing spring clip attaches to the backside of the clutch release arm — it's important to visualize this relationship during reassembly

Inspection

3 Inspect the pressure plate and clutch disc for wear or damage **(see illustrations).** If wear or damage are evident, replace the clutch disc.
4 Measure the rivet head depth **(see illustration)** and compare your measurement with the specified rivet head depth. If the rivet head depth is less than the specified minimum, replace the clutch disc.
5 Check flywheel runout with a dial indicator. If runout is excessive, replace the flywheel (see Section 8).
6 Inspect the diaphragm **(see illustration)** for wear. Check the depth and width of the wear pattern with vernier calipers **(see illustration).** If the diaphragm is obviously worn or if the measured depth and width of the wear pattern exceed the specified maximum depth and width, replace the pressure plate.

Installation

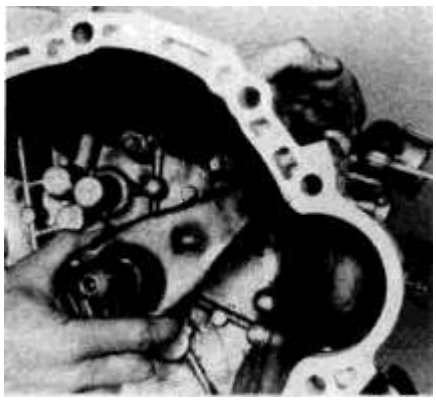
7 Place the clutch disc and pressure plate in position on the flywheel. Center the clutch disc with a clutch alignment tool **(see illustration).**
8 Tighten the bolts evenly and gradually while keeping the clutch alignment tool centered.
9 Apply moly base grease to the release fork and hub contact point, the release fork and push contact point, the release fork pivot point, the clutch disc spline and the throwout bearing hub inside the groove.
10 Install the throwout bearing on the fork and install them in the transaxle.
11 Install the boot.
12 Install the transaxle to the engine (refer to Chapter 7 Part A).

7 Clutch throwout bearing and release arm — removal, inspection and installation

Refer to illustrations 7.3, 7.4, 7.6, 7.8, 7.10, 7.11a, 7.11b, 7.11c and 7.12

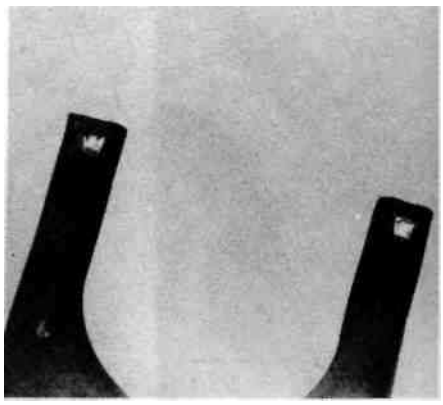
Removal

1 Remove the transaxle (refer to Chapter 7 Part A).
2 Place the transaxle on a clean, solid work surface.
3 Slide the throwout bearing on the input shaft toward you as far as it will go **(see illustration).**
4 Rotate one end of the spring clip until it clears the release arm **(see illustration).**
5 With a twisting motion, slightly cock the bearing to remove the other end of the spring clip from the release arm fork. Remove the bearing.



7.6 To remove the clutch release arm, pull it toward you with one hand while simultaneously pushing it toward the input shaft with the other hand

7.8 To check the operation of the throwout bearing, hold it by the outer cage and rotate the inner race while applying axial thrust to it — the bearing should turn smoothly and easily — if it doesn't, replace it

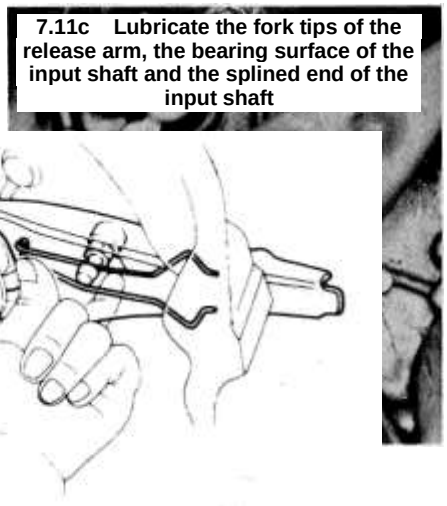


7.10 Inspect the fork tips of the clutch release arm for excessive wear — if they are damaged, replace the release arm

7.11a Before reassembling the throwout bearing and release arm, apply moly base or multipurpose grease to the inner hub and thrust side (where the fork tips contact it) of the throwout bearing

7.11b Grease the release lever fulcrum stud

7.11c Lubricate the fork tips of the release arm, the bearing surface of the input shaft and the splined end of the input shaft



7.12 Though you can't actually see it, this is how the spring on the backside of the clutch release arm attaches to the fulcrum stud when the release arm is installed

6 Use one hand to pull the clutch release arm toward you (away from the transaxle) while simultaneously pushing it toward the input shaft with the other hand to release it from the fulcrum stud **(see illustration).** Remove the release arm.

Inspection

7 Clean the bearing thoroughly by wiping it with a clean, soft shop rag (the throwout bearing is sealed — do not soak it in solvent).

8 To inspect the throwout bearing, hold it one hand and turn the inner race while applying force in the axial direction with the other hand **(see illustration).** If it feels gritty or is hard to turn, replace it. The bearing is sealed and cannot be cleaned or lubricated.

9 Clean the release arm in solvent and blow dry with compressed air.

10 Inspect the release arm fork tips for wear **(see illustration).** If either tip is worn, replace the release lever.

11 Be sure to coat the backside and the inner hub of of the throwout bearing, the clutch disc spline, the release arm fulcrum stud and the release arm fork tips with moly base or multipurpose grease **(see illustrations).**

Installation

12 Installation is the reverse of removal. Be careful to install the release arm spring in the proper relationship to the fulcrum stud **(see illustration).**

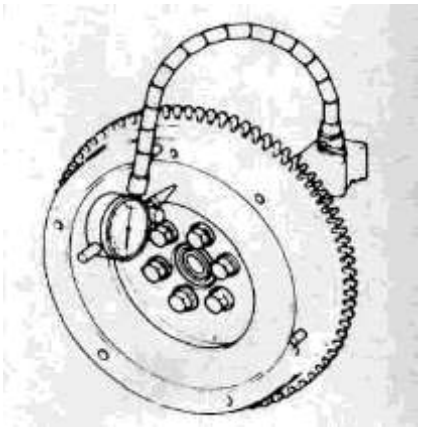
8 Flywheel — removal, inspection and installation

Refer to illustrations 8.3, 8.4, 8.5 and 8.6

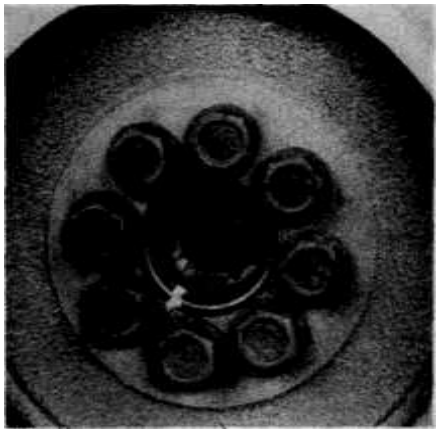
1 Remove the transaxle (refer to Chapter 7 Part A).

2 Remove the pressure plate and clutch disc (refer to Section 6).

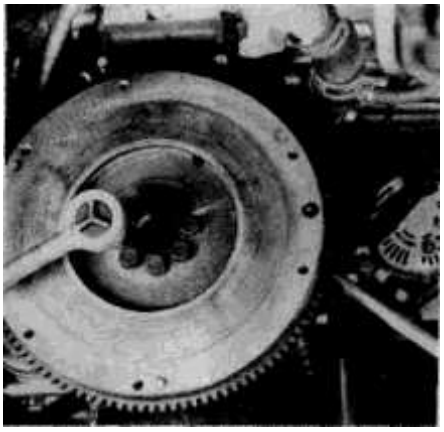
3 Measure flywheel runout with a dial gauge **(see illustration).** If the



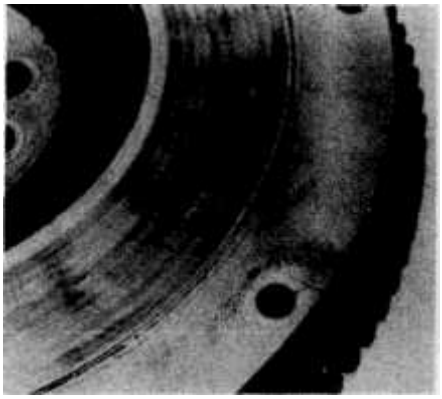
8.3 Before removing the flywheel, set up a dial indicator on the engine and measure runout — if the runout exceeds the specified maximum, the flywheel must be either resurfaced or replaced



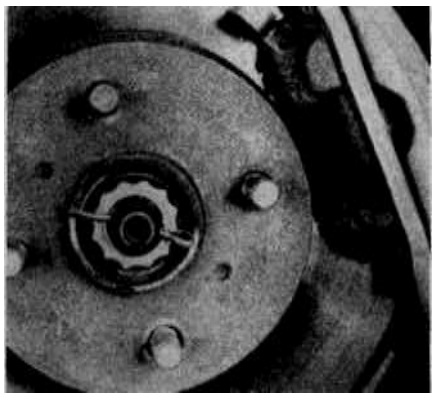
8.4 Before removing the flywheel, index it to the crankshaft



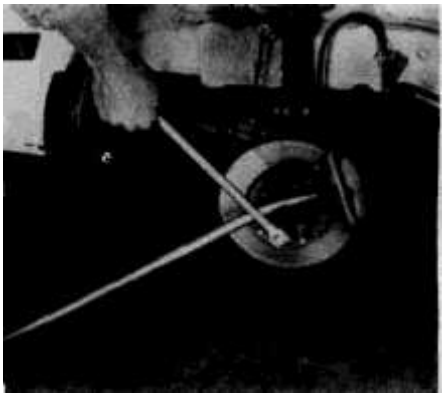
8.5 To prevent the flywheel from turning while loosening (or tightening) the flywheel bolts, wedge a large screwdriver or pry bar between the flywheel ring gear and the dowel pin



8.6 Carefully examine the friction surface of the flywheel for signs of uneven or excessive wear — if the surface looks excessively worn, it must be either resurfaced or the flywheel must be replaced



10.6 Remove the cotter pin and axle lock nut cap



10.7 Immobilize the hub with a large screwdriver or pry bar wedged between a couple of wheel studs and loosen the nut with a large breaker bar and socket

measured runout exceeds the specified maximum, replace the flywheel.
4 Index the flywheel to the crankshaft **(see illustration).**
5 Remove the eight flywheel bolts. The easiest way to immobilize the flywheel while loosening the bolts is to wedge a large screwdriver between the dowel pin and the ring gear teeth **(see illustration).**
6 Carefully inspect the friction surface of the flywheel **(see illustration).** If it shows signs of smearing, overheating (blue-yellow spots) or excessive wear, replace it.
7 Installation is the reverse of removal.

9 Driveaxle — general information

Power is transmitted from the transaxle to the rear wheels through a pair of driveaxles. The inboard end of each driveaxle is connected to the transaxle by a side gear shaft (flanged stub axle) splined to the differential. The side gear shafts are lightly press fitted and can be easily driven out if it becomes necessary to replace the side gear shaft oil seals (Section 11). The outboard ends of the driveaxles are splined to the axle hubs for a press fit and locked in place by a conventional axle nut.

The splined inboard ends of the driveaxles are fitted with sliding tripod joints, which are capable of both angular and axial motion. Each inboard joint assembly consists of a tripod bearing and a joint tulip (housing) in which the tripod is free to slide in and out as the driveaxle moves up and down with the wheel. The inboard joints are rebuildable (Section 12).

Each outer joint, which consists of ball bearings running between an inner race and an outer cage, is capable of angular but not axial movement. The outboard joints are neither rebuildable nor removable. Should one of them fail, a new driveaxle/outboard joint assembly must be installed.

The boots should be periodically inspected for damage, leaking lubricant and cuts. Damaged CV joint boots must be replaced quickly or the joints can be damaged. Boot replacement involves removal of the driveaxle (Section 10). The most common symptom of worn or damaged CV joints, besides lubricant leaks, is a clicking noise in turns, a clunk when accelerating from a coasting condition or vibration at highway speeds.

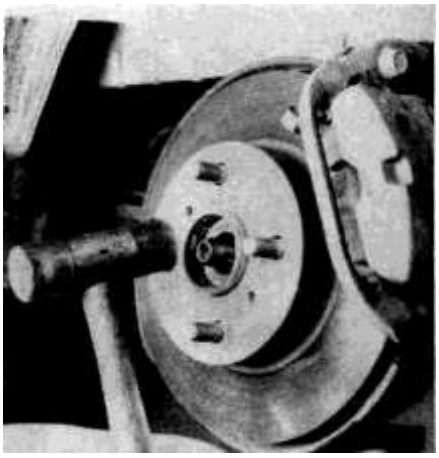
10 Driveaxle — removal and installation

Refer to illustrations 10.6, 10.7, 10.8a, 10.8b and 10.9

1 Disconnect the cable from the negative terminal of the battery.
2 Set the parking brake.
3 Loosen but do not remove the rear wheel lug nuts.
4 Raise the rear of the vehicle and place it securely on jackstands.
5 Remove the rear wheel.
6 Remove the cotter pin and bearing lock nut cap from the driveaxle lock nut **(see illustration).**
7 Using an air tool if available, remove the bearing lock nut and washer from the axle. If air is not available, use a breaker bar while immobilizing the hub with a large screwdriver wedged between two

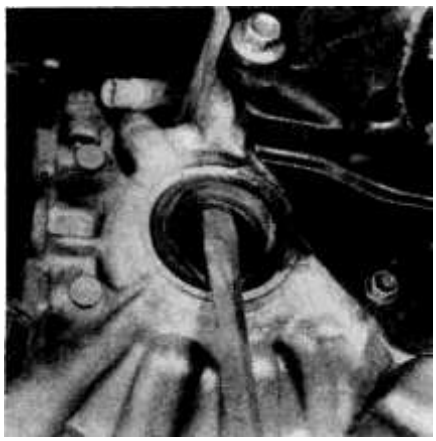
10.8a The inboard joint tulip is attached to the side gear shaft flange with six bolts

10.8b Separate the joint from the side gear shaft flange



10.9 Grasp the driveaxle with one hand and tap it out of the axle hub with a plastic mallet

11.2 Separate the side gear shaft from the differential by driving it out with a hammer and drift



11.3 Pry out the old seal from the side gear shaft bore with a large screwdriver — do not touch the bore with the screwdriver tip or you may nick it

11.4 Drive the new seal into the side gear shaft bore with a large socket or a short section of pipe slightly smaller in diameter than the outside diameter of the seal

of the wheel studs **(see illustration).**
8 Remove the six nuts that attach the tripod joint to the differential side gear shaft **(see illustration)** and detach the tripod joint from the side gear shaft **(see illustration).**
9 Drive out the driveaxle from the axle hub with a plastic hammer **(see illustration)** and remove the driveaxle. **Caution:** *Should it become necessary to move this vehicle while the driveaxle is removed, the hub bearing could be damaged when subjected to the vehicle weight. If it is absolutely necessary to place the vehicle weight on the hub bearing, support it first with a special tool (SST 09608-16041) available from Toyota dealers.*
10 Installation is the reverse of removal.

11 Side gear shaft oil seal — replacement

Refer to illustrations 11.2, 11.3, 11.4, 11.5 and 11.6

1 Remove the driveaxle (refer to Section 10).
2 Using a hammer and drift, carefully knock the side gear shaft loose **(see illustration).**
3 Pry out the side gear shaft oil seal with a large screwdriver **(see illustration).**
4 Using a socket slightly smaller in diameter than the outside diameter of the seal, drive the new seal into place with a hammer **(see illustration).**
5 Coat the seal lip with multipurpose grease **(see illustration).**
6 Tap the side gear shaft into the transaxle with a brass hammer **(see illustration).**
7 Install the driveaxle (refer to Section 10).

12 Driveaxle boot replacement and CV joint overhaul

Refer to illustrations 12.2, 12.3a, 12.3b, 12.4, 12.5, 12.6, 12.7, 12.11, 12.12a, 12.12b and 12.13

1 Remove the driveaxle (refer to Section 10).
2 Paint a pair of match marks on the joint tulip and the driveaxle **(see illustration).**
3 Pry the outer (larger) clamps loose with a small screwdriver **(see illustration)** and slide them off the ends of the driveaxle. Cut the inner (smaller) clamps and the drive shaft damper clamp with a pair of diagonal cutters **(see illustration)** and discard them.
4 Separate the inboard joint tulip from the tripod joint **(see illustration).**
5 Remove the tripod joint snap ring with a pair of snap ring pliers **(see illustration).**
6 Punch match marks on the tripod and the driveaxle **(see illustration).**
7 Using a hammer and brass punch, drive the tripod joint from the driveaxle **(see illustration).**
8 Slide the inboard joint boot, damper and outboard joint boot,

11.5 Liberally grease the seal lip with multipurpose grease

11.6 Tap the side gear shaft into the differential with a large brass or rubber mallet — if it resists, don't force it because the splines are probably not quite aligned — instead, rotate the shaft slightly and try again

12.2 Paint (do not punch) match marks on the inboard joint tulip and the driveaxle

12.3a The large boot clamps can be pried open with a small screwdriver

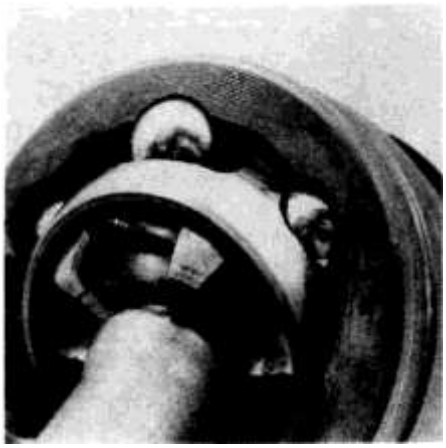
12.3b The small boot clamps are harder to pry open — cut them off with a pair of diagonal cutters

12.4 Remove the inboard joint tulip from the driveaxle, then remove the inboard joint boot, the driveaxle damper (if you are overhauling the right driveaxle) and the outboard joint boot

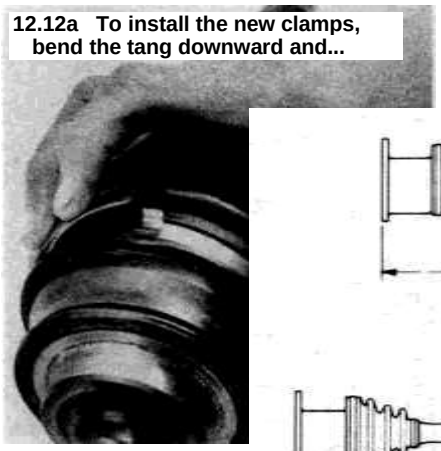
12.5 Remove the snap ring that retains the inboard joint tripod with a pair of snap ring pliers

12.6 Punch match marks (arrows) on the tripod and the driveaxle to insure that they are reassembled properly

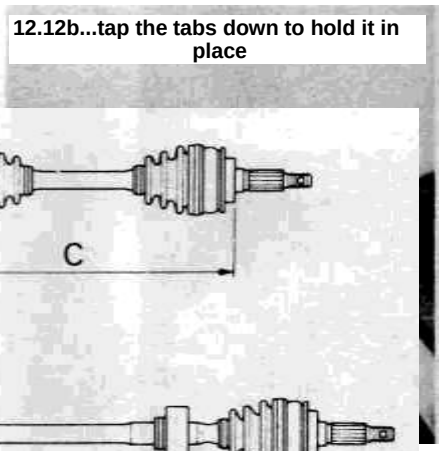
12.7 Drive the tripod from the driveaxle with a brass punch and hammer — be careful not to damage the bearing surfaces



12.11 After the old grease has been rinsed away and the cleaning solvent has been blown out with compressed air, rotate the outboard joint housing through its full range of motion and inspect the bearing surfaces for wear or damage — if any of the balls, the race or the cage look damaged, replace the driveaxle and outboard joint



12.12a To install the new clamps, bend the tang downward and...



12.12b...tap the tabs down to hold it in place

12.15 Measure these three dimensions and compare your measurements to the specified dimensions to make sure that the boots are properly positioned — dimensions A and C must be correct to avoid clearance problems. If you are overhauling the right driveaxle, dimension B is critical because it determines the position of the driveaxle damper

respectively, off the driveaxle.

9 Thoroughly wash the inboard and outboard CV joints in clean solvent and blow dry with compressed air, if available. **Note:** *Because the outboard joint cannot be disassembled, it is difficult to wash away all the old grease and to rid the bearing of solvent once it's clean. But it is imperative that the job be done thoroughly, so take your time and do it right.*

10 Inspect the inboard tripod joint for signs of wear or damage. If the tripod is obviously worn or damaged, replace it, along with the tulip, as an assembly.

11 Bend the outboard CV joint housing at an angle to the driveaxle to expose the bearings, inner race and cage **(see illustration).** Inspect the bearing surfaces for signs of wear. If the bearings are damaged or worn, replace the driveaxle.

12 Slide the new outboard boot onto the driveaxle. It's a good idea to wrap vinyl tape around the spline of the shaft to prevent damage to the boot. When the boot is in position, add the specified amount of grease (included in the boot replacement kit) to the outboard joint and the boot (pack the joint with as much grease as it will hold and put the rest into the boot). Slide the boot on the rest of the way and install the new clamps **(see illustrations).**

13 If you are overhauling the right driveaxle, install the damper. Position it the specified distance from the outer edge of the outboard CV joint housing **(see illustration).** Attach the damper clamp.

14 Slide the inboard boot onto the driveaxle. Align the match marks you made before removing the joint and, using a brass bar and hammer, tap the tripod onto the driveaxle. Install the snap ring. Fill the inboard joint tulip with grease and install it over the tripod joint. Slide the boot into place and install the boot clamps.

1 5 Measure the boot length with the driveaxle at standard length to make sure that the boot is not stretched or contracted beyond the specified length **(see illustration).**

16 Install the driveaxle between the side gear shaft and the axle hub (refer to Section 10).

17 Install the outboard joint side of the driveaxle to the axle hub. Be careful not to damage the boots.

18 Finger tighten the six nuts between the driveaxle and the side gear shaft.

19 Install the bearing lock nut and tighten it to the specified torque. Install the lock nut cap and, using pliers, install a new cotter pin.

20 Tighten the six nuts holding the rear driveaxle to the differential side shaft.

Chapter 9 Brakes

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Specifications

General

Brake fluid type	See Chapter 1
Pedal height from floor	154 to 164 mm (6.06 to 6.46 in)
Pedal free play	3 to 6 mm (0.12 to 0.24 in)
Pedal reserve travel at 110 lbs (50 kg)	70 mm (2.76 in)
Booster push rod to piston clearance	(0.0 mm (0.0 in)

Brakes

Disc thickness	
front	1 7.0 mm (0.669 in)
rear	10.0 mm (0.394 in)
Disc runout	0.1 5 mm (0.006 in)
Minimum pad thickness	1.00 mm (0.040 in)
Parking brake lever travel	5 to 8 clicks

Torque specifications	Nm	Ft-lb
Brake booster to pedal bracket	13	9
Brake booster retaining nuts	13	9
Disc brake cylinder bolt		
front	25	18
rear	20	14
Brake tube union bolt	15	11
Bleeder plug	8.3	74 in-lbs
Reservoir union bolt	54	40
Reservoir retaining bolt	25	18
Cylinder outlet plugs	44	33
Piston stopper bolt	10	7

1 General information

The brake system is four wheel hydraulically actuated with disc brakes at the front and rear. The disc brakes require no adjustment.

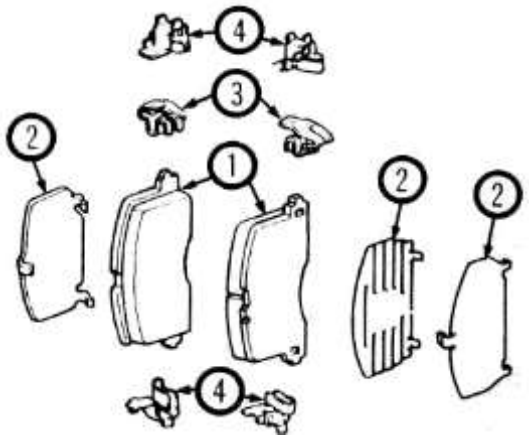
The hydraulic system is a dual circuit type. In the event of a failure in one circuit, the other is still operational. Both circuits are assisted by a vacuum booster unit.

The parking brake operates on the rear wheels only through a cable connected to the parking brake lever located between the seats.

Precautions

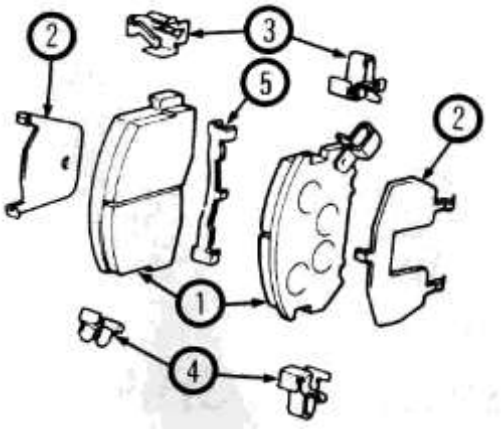
There are some general notes and cautions involving the brake system on this vehicle:

a) Use only DOT 3 brake fluid in this system.
b) The brake pads and linings contain asbestos fibers which are hazardous to your health if inhaled. Whenever you work on brake system components, carefully wipe all parts clean with a water dampened cloth. Do not allow the fine asbestos dust to become airborne.



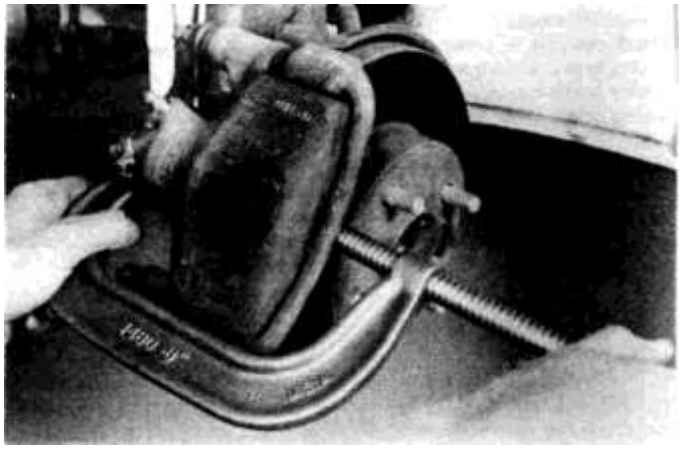
2.4a Along with the front pads remove the

1) *Brake pads*
2) *Anti-squeal shims*
3) *Pad wear indicator plates*
4) *Support plates*

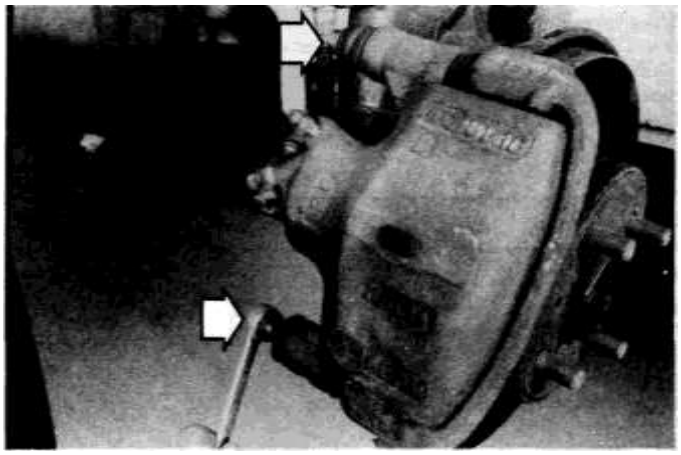


2.4b Along with the rear pads remove the

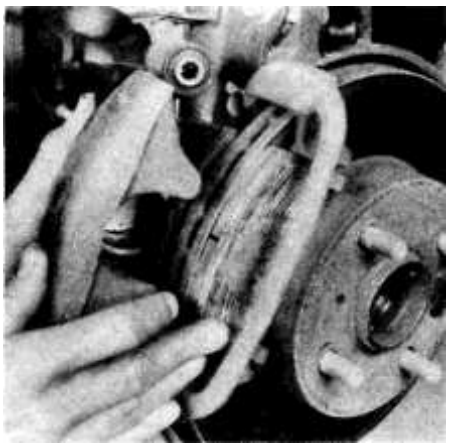
1) *Brake pads*
2) *Anti-squeal shims*
3) *Anti-rattle springs*
4) *Pad support plate*
5) *Pad guide plate*



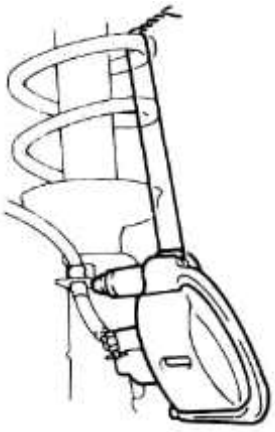
2.4c Using a large C-clamp, push the piston back into the caliper bore. Note that one end of the clamp is on the flat area near the fluid inlet fitting and other is pressing against the flat, raised portion of the outboard pad. Moderate force is all that is required (front only)



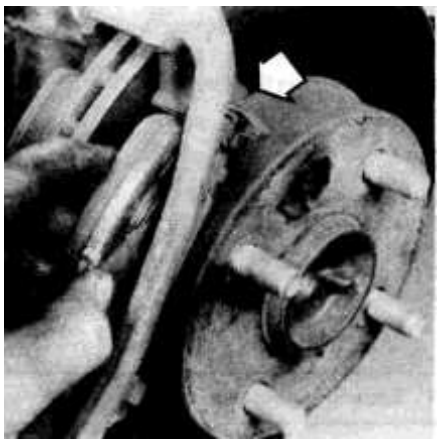
2.4d On the front caliper, remove the lower and upper installation bolts (arrows) from the bracket. The rear caliper has only one lower installation bolt and a guide pin to pivot on at the top



2.4e After the installation bolts have been removed, lift the caliper off the bracket. The pads will remain with the rotor



2.4f Using wire or a length of coat hanger, suspend the caliper so as not to stretch or kink the brake hose (front caliper only)



2.4g Separate the two pads from the rotor. As this is done, notice the position of the pad components, such as the wear indicator (arrow). Take careful note of this because the new pads will have to go in the same way

2.4h On the rear calipers, after removing the lower installation bolt, pivot the caliper up on the upper guide pin and separate the pads from the rotor. Note the position of the wear indicator and the other pad components to aid in installation

2.4i When installating the rear pads it may be necessary to push back the caliper piston. Use needle nose pliers to move the piston. Turn the piston clockwise while pushing it in until it locks

c) Safety should be paramount whenever any servicing of the brake components is performed. Do not use parts or fasteners which are not in perfect condition, and be sure that all clearances and torque specifications are adhered to. If you are at all unsure about a certain procedure, seek professional advice. Upon completion of any brake system work, test the brakes carefully in a controlled area before putting the vehicle into normal service. If a problem is suspected in the brake system, do not drive the vehicle until the fault is corrected.

2 Brake pads — replacement

Refer to illustrations 2.4a through 2.4i

Note: *The following information applies to both the front and rear brakes.*

Warning: *Disc brake pads must be replaced on both wheels at the same time — never replace the pads on only one wheel. Also, brake system dust contains asbestos, which is harmful to your health. Never blow it out with compressed air and do not inhale any of it. Do not, under any circumstances, use petroleum-based solvents to clean brake parts. Use brake cleaner or denatured alcohol only.*

1 Remove about two-thirds of the fluid from the master cylinder reservoir.

2 Raise the vehicle, support it securely on jackstands, and remove the wheels.

3 Inspect the rotor as outlined in Section 4. If machining is necessary, follow the information in that section to remove the rotor, at which time the pads can be removed from the calipers as well.

4 Follow the accompanying photos for the actual pad replacement procedure. Be sure to stay in order and read the information in the caption under each illustration.

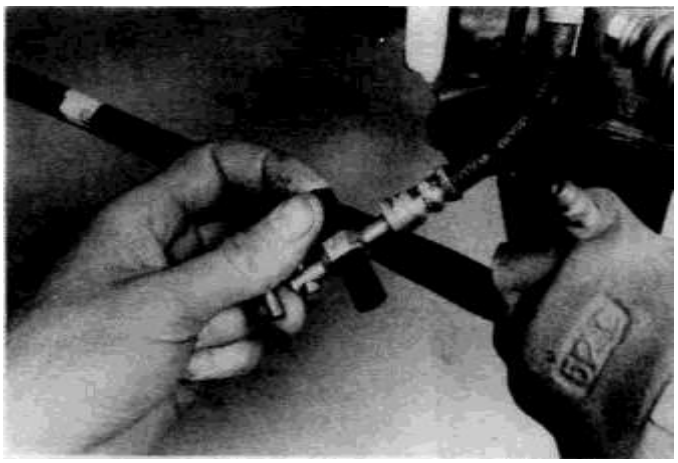
5 Once the new pads are in place and the two caliper bolts have been replaced and properly tightened, install the wheels and lower the vehicle. **Note:** *If the fluid inlet was disconnected from the caliper for any reason, the brake system must be bled to remove all air as described in Section 13.*

6 Fill the master cylinder reservoir with new brake fluid and slowly pump the brakes a few times to seat the pads against the rotor.

7 Check the fluid level in the master cylinder reservoir one more time and then road test the vehicle carefully before placing it into normal service.

3 Caliper — removal, overhaul and installation

Refer to illustrations 3.1, 3.4a, 3.4b, 3.5, 3.7, 3.8a and 3.8b **Note:** *The following procedure applies to both the front and rear*



3.1 Using an appropiate sized piece of rubber hose, plug the brake line

calipers. If an overhaul is indicated (usually because of fluid leakage) explore all options before beginning the job. New and factory rebuilt calipers are available on an exchange basis, which makes this job quite easy. If it is decided to rebuild the calipers, make sure that a rebuild kit is available before proceeding.

Removal

1 Disconnect the brake line from the caliper and plug it to keep contaminants out of the brake system and to prevent losing any more brake fluid than is necessary **(see illustration).**

2 Refer to Section 2 for either front or rear caliper removal procedures.

3 On the rear caliper, disconnect the parking brake by removing the clevis pin and the C-clip (see Section 7), then slide the caliper off the caliper guide pin.

Overhaul

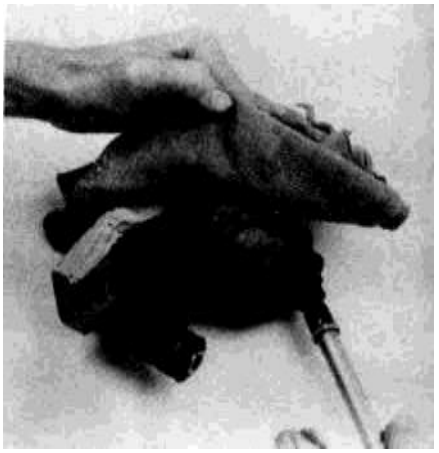
Warning: *Do not, under any circumstances, use petroleum-based solvents to clean brake parts. Use only clean brake fluid or denatured alcohol. Allow all parts to dry, preferably using compressed air to blow out all passages. Make sure the compressed air is filtered, as a harmful lubricant residue will be present in unfiltered systems.*

Front

4 To overhaul the caliper, remove the rubber boot retaining ring and

3.4a Using a screwdriver, remove the cylinder boot set ring

3.4b Remove the boot from the cylinder



3.5 Apply compressed air to the brake fluid hose connection on the caliper body. Position a wood block between the piston and caliper to prevent damage

3.7 Using a small screwdriver, remove the piston seal. Take care not to scratch or gouge the cylinder bore

3.8a On each side of the caliper, push the sliding bushing up through the boot and pull it free, then remove the dust boots

3.8b Push the bushing sleeve out of the caliper

the rubber boot **(see illustrations).** Before you remove the piston, place a wood block between the piston and caliper to prevent damage as it is removed.

5 To remove the piston from the caliper, apply compressed air to the brake fluid hose connection on the caliper body **(see illustration). Warning:** *Be careful not to place your fingers between the piston and the caliper as the piston may come out with some force.*

6 Inspect the mating surfaces of the piston and caliper bore wall. If there is any scoring, rust, pitting or bright areas, replace the complete caliper unit with a new one.

7 If these components are in good condition, remove the rubber seal from the caliper bore using a small screwdriver. Be careful not to damage the cylinder bore **(see illustration).**

8 Push the sliding bushing out of the caliper housing **(see illustration)** and remove the two rubber boots from both ends. Slide the bushing sleeve out of the caliper housing **(see illustration).**

9 Wash all the components in clean brake fluid or alcohol.

10 To reassemble the caliper, you should already have the correct rebuild kit for your vehicle. **Note:** *During reassembly apply silicone based grease (supplied with the rebuild kit) between the sliding bushing and the bushing sleeve.*

11 Submerge the new rubber seal and the piston in brake fluid and install them into the caliper bore. Do not force the piston into the bore, but make sure that it is squarely in place, then apply firm (but not excessive) pressure to install it.

12 Install the new rubber boot and retaining ring.

Rear

13 **Note:** *Since disassembly and overhaul of the rear disc brake caliper requires special tools not usually available to the home mechanic, it should be left to your Toyota dealer service department. You can, however, remove it yourself and reinstall it after it is overhauled lor replace it with a rebuilt unit).*

14 Raise the rear of the vehicle and support it securely on jackstands. Block the front wheels to keep the vehicle from rolling. Remove the rear wheels.

15 For the rest of the caliper removal procedure refer to Section 2.

Installation

16 Install the caliper by reversing the removal procedure. Remember to replace the copper sealing washer on the brake line union bolt (comes with the rebuild kit).

17 Bleed the brake circuit according to the procedure in Section 13.

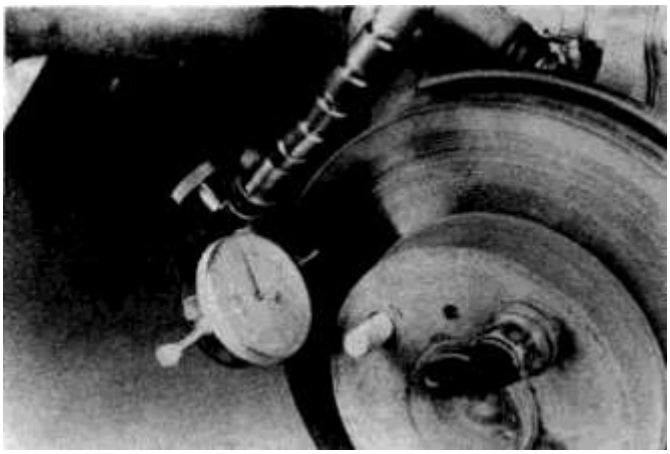
4 Brake rotor — inspection, removal and installation

Refer to illustrations 4.3, 4.4, 4.5a, 4.5b and 4.6

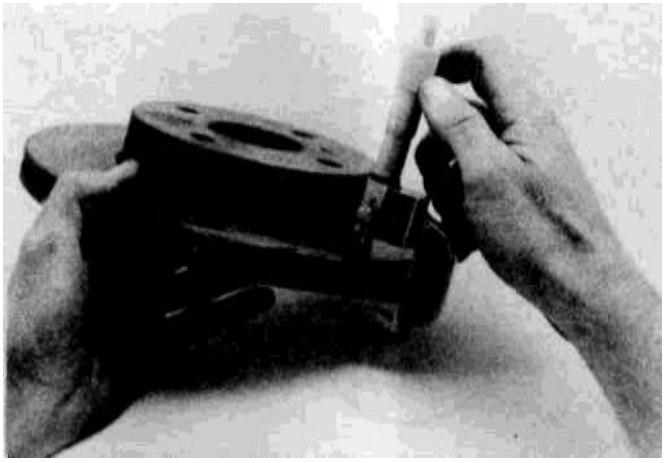
Note: *The following information applies to both the front and rear brakes.*

Inspection

1 Raise the vehicle and support it securely on jackstands. Remove

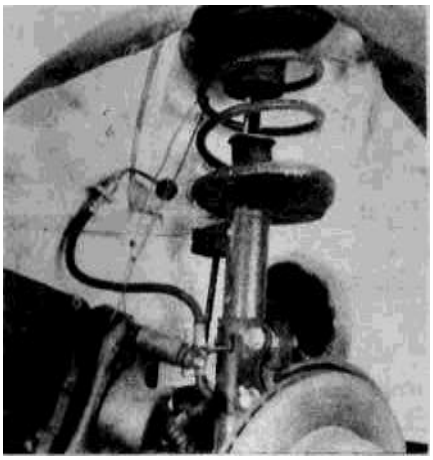


4.3 To check runout, a dial indicator is attached to the caliper with the indicator just touching the rotor. Compare the reading to the Specifictions

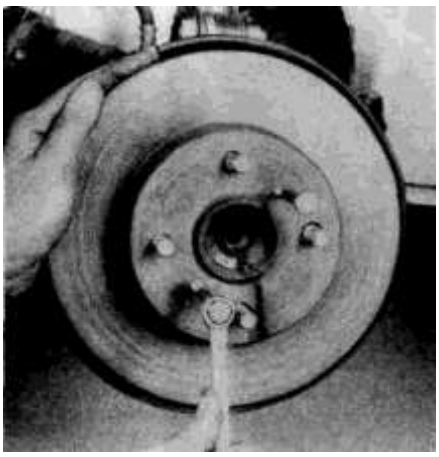


4.4 A micrometer is used to measure the thickness of the rotor. This can be done on the bench (as shown) or on the vehicle. The minimum thickness is stamped on the rotor

4.5a Remove the two bracket retaining bolts (arrows) to separate the caliper assembly from the rotor



4.5b Suspend the caliper assembly using heavy wire or a length of coat hanger. Do not let the caliper hang by the brake hose and do not disconnect the hose



4.6 To help free the rotor, thread the appropriate size bolts into the provided holes. Alternate between the bolts, tightening them several turns at a time until the rotor pops free

the wheel and hold the rotor in place with two lug nuts.

2 Visually inspect the rotor surface for score marks and other damage. Light scratches and shallow grooves are normal after use and are not detrimental to brake operation. Deep scoring requires rotor removal and refinishing by an automotive machine shop. Be sure to check both sides of the rotor.

3 To check rotor runout, position a dial indicator at a point about 1 /2-inch from the outer edge **(see illustration).** Set the indicator to zero and turn the rotor. The indicator reading should not exceed the specified runout. If it does, the rotor should be refinished by an automotive machine shop.

4 A micrometer is used to measure the thickness of the rotor **(see illustration).** This can be done on the bench or on the vehicle. Compare your reading with the Specifications. The minimum thickness is also stamped on the rotor.

Removal

5 Have a piece of heavy wire or a length of coat hanger ready, and remove the bracket bolts located on the back of the caliper mounting bracket **(see illustration).** Lift the bracket (with the caliper attached) away from the rotor (see Section 2) and use the wire or coat hanger to suspend the caliper assembly **(see illustration). Caution:** *Do not allow the caliper to hang by the brake hose and do not disconnect the hose from the caliper.*

6 Remove the two lug nuts which were put on to hold the rotor in place and detach the rotor. To separate the rotor, thread two bolts into the provided holes. Alternate between the bolts, tightening them several turns at a time until the rotor pops free **(see illustration).**

Installation

7 Place the rotor in position over the threaded studs.

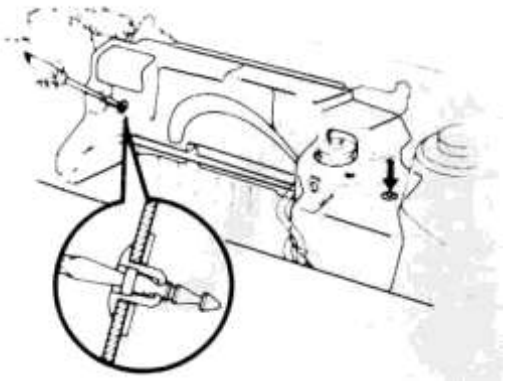
8 Install the caliper assembly over the rotor and secure it with the bracket bolts. Tighten the bolts to the proper torque.

9 Install the wheel, then lower the vehicle to the ground. Depress the brake pedal a few times to bring the brake pads into contact with the rotor. Bleeding of the system will not be necessary unless the brake hose was disconnected from the caliper. Check the operation of the brakes carefully before placing the vehicle into normal service.

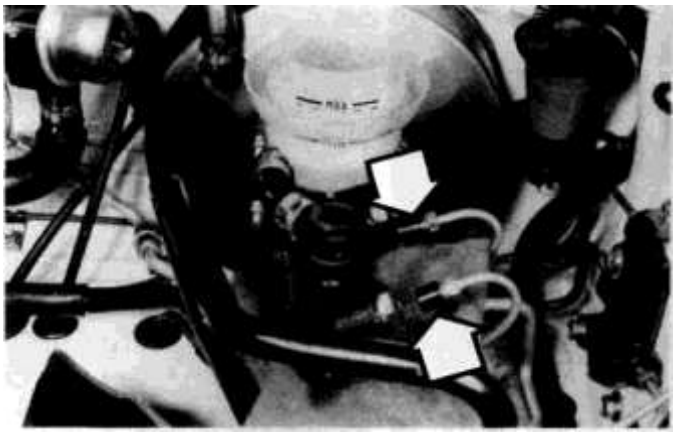
5 Master cylinder — removal, overhaul and installation

Refer to illustrations 5.1, 5.3, 5.4, 5.8a, 5.8b, 5.9, 5.10, 5.11a, 5.11b, 5.11c and 5.26

Note: *Before deciding to overhaul the master cylinder, check on the availability and cost of a new or factory rebuilt unit and also the availability of a rebuild kit.*

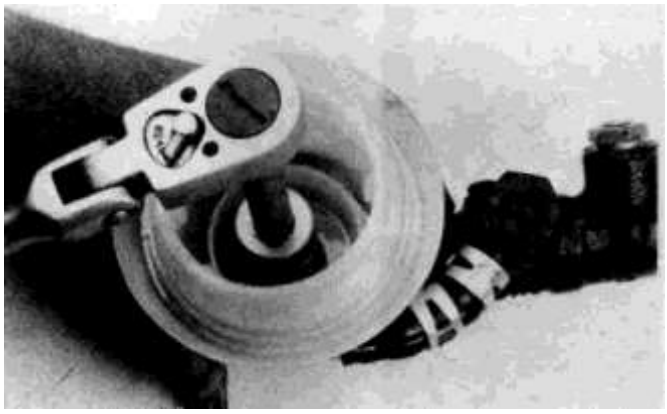


5.1 Release the two clips to remove the cover

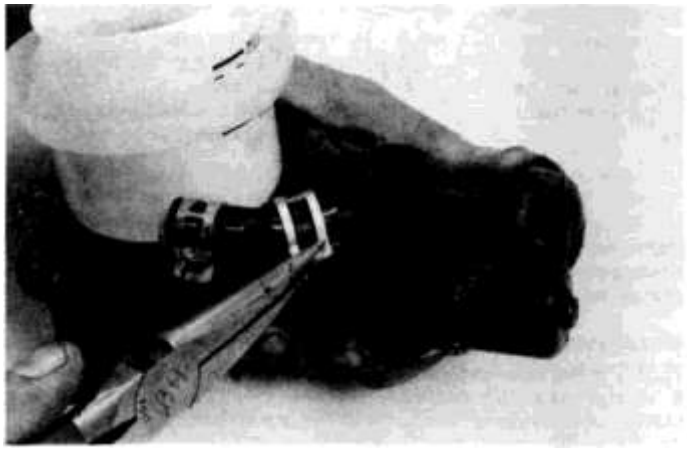


5.3 If available, place caps over the fluid fittings (arrows) to prevent brake fluid loss. Plastic bags secured tightly around the fittings will also work

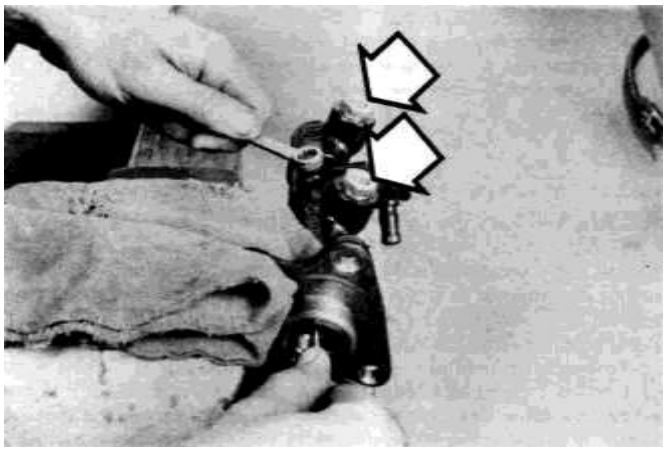
5.4 To prevent rounding the flats on the fittings, use a flare nut wrench to loosen the nuts



5.8a Remove the set bolt inside the reservoir



5.8b Use pliers to release the hose clamp, then separate the reservoir hose from the master cylinder and remove the reservoir



5.9 Push the pistons in all the way and remove the piston stopper bolt and the copper gasket. Remove the two outlet plugs (arrows) and gaskets

Removal

1 The master cylinder is located in the front luggage compartment behind the trim cover. To remove the two clips securing the cover, disengage them by pressing in on the center of the clip with a small screwdriver **(see illustration).**

2 Remove as much fluid as you can from the reservoir with a syringe.

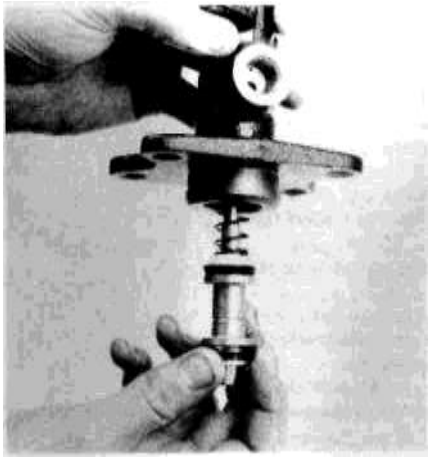
3 Place rags under the fluid fittings and prepare caps or plastic bags to cover the ends of the lines once they are disconnected **(see illustration). Caution:** *Brake fluid will damage paint. Cover all body parts and be careful not to spill fluid during this procedure.*

4 Loosen the tube nuts at the ends of the brake lines where they enter the master cylinder. To prevent rounding off the flats on these nuts, the use of a flare nut wrench, which wraps around the nut, is preferred **(see illustration).**

5 Pull the brake lines slightly away from the master cylinder and plug the ends to prevent contamination.

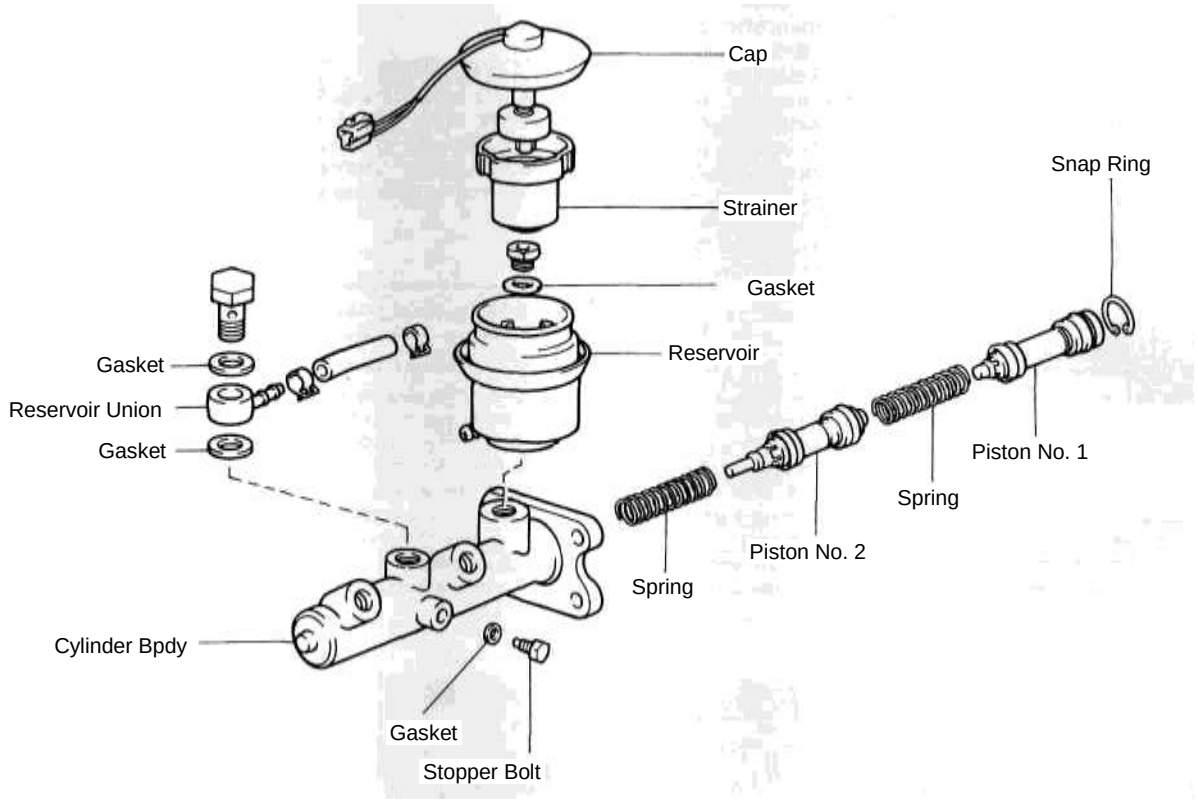
6 Disconnect the electrical connector at the master cylinder, then remove the four nuts attaching the master cylinder to the power booster. Pull the master cylinder off the studs and out of the luggage compartment. Again, be careful not to spill the fluid as this is done.

5.10 Push the pistons in and use snap ring pliers to remove the snap ring



5.11a Tilt the cylinder and remove the No. 1 piston and spring

5.11b To free the No.2 piston and spring, tap the cylinder firmly on a block of wood



5.11c Master cylinder — exploded view

Overhaul

7 Before attempting the overhaul of the master cylinder, obtain the proper rebuild kit, which will contain the necessary replacement parts and also any instructions which may be specific to your model.

8 Inspect the reservoir grommet for indications of leakage near the base of the reservoir. Remove the reservoir **(see illustrations).**

9 Place the cylinder in a vise and use a wooden dowel to fully depress the pistons until they bottom against the other end of the master cylinder. Hold the pistons in this position and remove the stop bolt on the side of the master cylinder. Remove the two outlet plugs and the copper gaskets **(see illustration).**

10 Carefully remove the snap ring at the end of the master cylinder (see illustration).

11 The internal components can now be removed from the cylinder bore **(see illustrations).** Make a note of the proper order of the components so they can be returned to their original locations. **Note:** *The two springs are of different tension, so pay particular attention to their order.*

12 Carefully inspect the inside bore of the master cylinder. Any deep scoring or other damage will mean a new master cylinder is required.

13 Replace all parts included in the rebuild kit, following any instructions in the kit. Clean all reused parts with clean brake fluid or denatured alcohol. Do not use any petroleum-based cleaners. During assembly, lubricate all parts liberally with clean brake fluid. Be sure to tighten all fittings and connections to the specified torque.

14 Push the assembled components into the bore, bottoming them against the end of the master cylinder, then install the stop bolt.

15 Install the new snap ring, making sure it is seated properly in the groove.

Bench bleeding procedure

16 Before installing the new master cylinder it should be bench bled. Because it will be necessary to apply pressure to the master cylinder piston and, at the same time, control flow from the brake line outlets, it is recommended that the master cylinder be mounted in a vice. Use caution not to clamp the vice too tightly, or the master cylinder body might be cracked.

17 Insert threaded plugs into the brake line outlet holes and snug them down so that there will be no air leakage past them, but not so tight that they cannot be easily loosened.

18 Fill the reservoir with brake fluid of the recommended type (see *Recommended fluids and lubricants).*

19 Remove one plug and push the piston assembly into the master cylinder bore to expell the air from the master cylinder. A large Phillips screwdriver can be used to push on the piston assembly.

20 To prevent air from being drawn back into the master cylinder the plug must be replaced and snugged down before releasing the pressure on the piston assembly.

21 Repeat the procedure until only brake fluid is expelled from the brake line outlet hole. When only brake fluid is expelled, repeat the procedure with the other outlet hole and plug, Be sure to keep the master cylinder reservoir filled with brake fluid to prevent the introduction of air into the system.

22 Since high pressure is not involved in the bench bleeding procedure, an alternative to the removal and replacement of the plugs with each stroke of the piston assembly is available. Before pushing in on the piston assembly, remove the plug as described in Step 19. Before releasing the piston, however, instead of replacing the plug, simply put your finger tightly over the hole to keep air from being drawn back into the master cylinder. Wait several seconds for brake fluid to be drawn from the reservoir into the piston bore, then depress the piston again, removing your finger as brake fluid is expelled. Be sure to put your finger back over the hole each time before releasing the piston, and when the bleeding procedure is complete for that outlet, replace the plug and snug it before going on to the other port.

Installation

23 Install the master cylinder over the studs on the power brake booster and tighten the attaching nuts only finger tight at this time.

24 Thread the brake line fittings into the master cylinder. Since the master cylinder is still a bit loose, it can be moved slightly in order for the fittings to thread in easily. Do not strip the threads as the fittings are tightened.

25 Fully tighten the brake fittings and the mounting nuts.

26 Fill the master cylinder reservoir with fluid, then bleed the master cylinder (only if the cylinder has not been bench bled) and the brake system as described in Section 13. To bleed the cylinder on the vehicle,

5.26 Have an assistant pump the brake pedal several times, then hold it to the floorboard. Loosen the fitting nut, allowing air and fluid to escape. Repeat this procedure on both fittings until the fluid is clear of air bubbles

have an assistant pump the brake pedal several times and then hold the pedal to the floor. Loosen the fitting nut to allow air and fluid to escape. Repeat this procedure on both fittings until the fluid is clear of air bubbles **(see illustration).** Test the operation of the brake system carefully before placing the vehicle in normal service.

6 Brake booster — inspection, removal and installation

Refer to illustrations 6.4, 6.7 and 6.8

1 The brake booster unit requires no special maintenance apart from periodic inspection of the vacuum hose and the case.

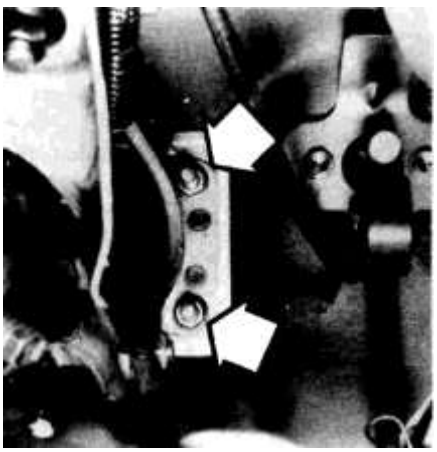
2 Dismantling of the power unit requires special tools and cannot be performed by the home mechanic. If a problem develops, it is recommended that a new or factory rebuilt unit be used.

3 Remove the master cylinder as described in Section 5.

4 Disconnect the vacuum hose where it attaches to the brake booster **(see illustration).**

5 From the passenger compartment, remove the instrument lower

6.4 Use pliers to remove the hose clamp, then pull the vacuum hose from the booster



6.7 Visible are two of the four retaining bolts (arrows), located under the dashboard and above the steering column

6.8 Turn the adjusting screw on the end of the brake push rod until the specified clearance is reached

finish panel and air duct (refer to Chapter 11).
6 Disconnect the brake pedal return spring and the push rod from the pedal arm (see Section 10).
7 Unscrew the four retaining nuts and withdraw the booster unit from the luggage compartment **(see illustration).**
8 Installation is the reverse of the removal procedure, but before assembling the master cylinder to the booster, check the clearance between the back of the piston and the brake push rod. Using a depth micrometer or vernier caliper, measure the distance from the bottom of the piston bore to the master cylinder mounting flange. Measure the distance from the end of the brake pushrod to the surface on the booster assembly that the master cylinder mounting flange is in contact with when installed. Subtract the two measurements to get the clearance. If the clearance is more or less than specified, turn the adjusting screw on the end of brake push rod until the clearance is within the specified limit **(see illustration)** Be sure to lock the jam nut on the adjusting screw when the adjustment is completed.
9 Upon installation, place the booster into position and tighten the retaining nuts. Connect the brake pedal.
10 Install the master cylinder and vacuum hose.
11 Carefully test the operation of the brakes before placing the vehicle in normal operation.

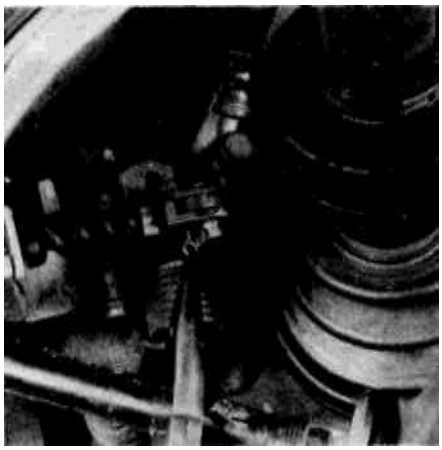
7 Parking brake cable — replacement

Refer to illustrations 7.4a, 7.4b, 7.5, 7.7a, 7.7b, 7.8, 7.10 and 7.12

1 Refer to Chapter 1 for a general inspection of the brake cables.
2 To remove the cables, the front and rear fuel protectors and engine undercover must first be removed.

Equalizer to caliper

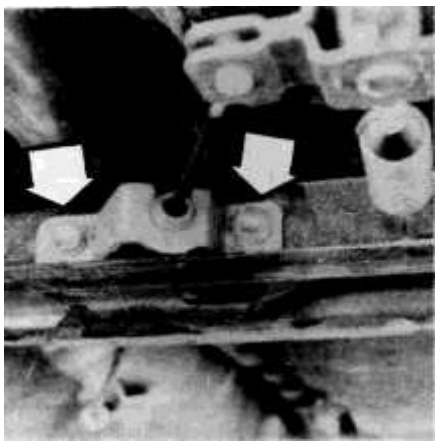
3 Raise the vehicle and support it securely on jackstands.
4 Disconnect the cables from the parking brake cranks on the rear calipers by removing the clevis pins **(see illustration).** Remove the bracket clip and separate the cables from the caliper brackets **(see illustration).**
5 Remove the cable bracket bolts from the rear brackets, one on each side, to free the cables **(see illustration).**
6 Carefully pull the cables through the rear cable guides.
7 Remove the bolts from the front cable guide and push the grommet out of the guide bracket **(see illustrations).**
8 Remove the cable from the equalizer **(see illustration).**
9 Unbolt the middle cable guide and remove the cable.



7.4a Using needle nose pliers, pull the clip from the clevis pin, remove the pin and separate the cable from the parking brake crank

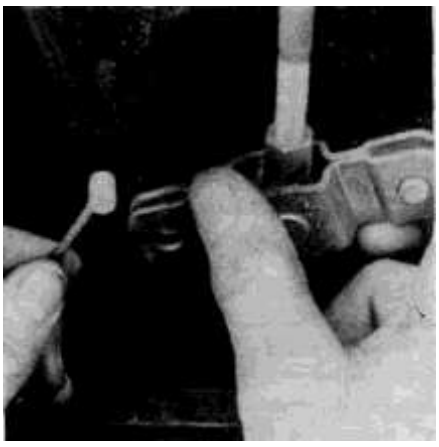
7.4b Pull the bracket clip from the cable and remove the cable from the caliper bracket

7.5 There is a rear bracket on each side of the vehicle, one for each rear wheel. Remove the retaining bolt to remove the bracket

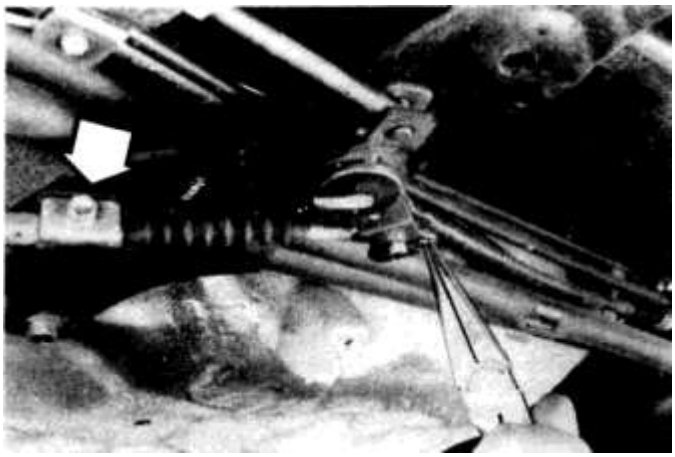


7.7a Remove the two bracket bolts (arrows) from the front cable guide

7.7b Push the grommet out of the guide bracket



7.8 With the cable slack, turn the cable to line it up with the slot in the top of the equalizer. Push the cable up and out to free it



7.10 Using needle nose pliers, pull the clip from the clevis pin and remove the pin. Remove the bolt from the cable bracket (arrow)

Lever to equalizer

10 Remove the clevis pin from the equalizer bellcrank and unbolt the cable bracket **(see illustration).**

11 Take off the console trim panel and the left side console panel (refer to Chapter 11).

12 Unbolt the upper cable bracket and slide the cable from the lever assembly **(see illustration).**

All cables

13 To install the cables, reverse the removal procedure. Apply a thin coat of grease to the portion of the cable that contacts the equalizer.

8 Parking brake adjustment

Refer to illustration 8.4

1 To adjust the cable, pull the parking brake lever all the way up and down two or three times. Release the parking brake lever fully, making sure the indicator light goes off. Pump the brake pedal several times.

2 Raise the vehicle and support it securely on jackstands. Working underneath the vehicle, remove the front protector.

3 Loosen the lock nut and the turnbuckle until there is slack in the cable.

4 Adjust the cable by tightening the turnbuckle until the parking brake crank just begins to move **(see illustration). Note:** *When either parking brake crank is pushed out, the other one should not move. If it does move, the cable is too tight.*

5 Compare the parking brake lever travel to the Specifications. Count the number of clicks until the brake is fully engaged.

6 Before retightening the turnbuckle lock nut, make sure that the rear wheels cannot turn with the parking brake engaged and that they do turn (without dragging) when the brake is disengaged.

7 Tighten the lock nut and check parking brake performance on a steep incline.

9 Parking brake lever — removal and installation

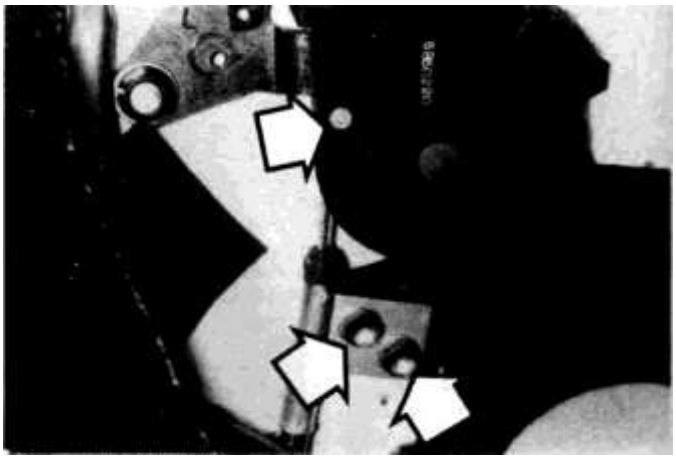
Refer to illustration 9.3

1 Remove the console panel trim and the left side console panel (refer to Chapter 11).

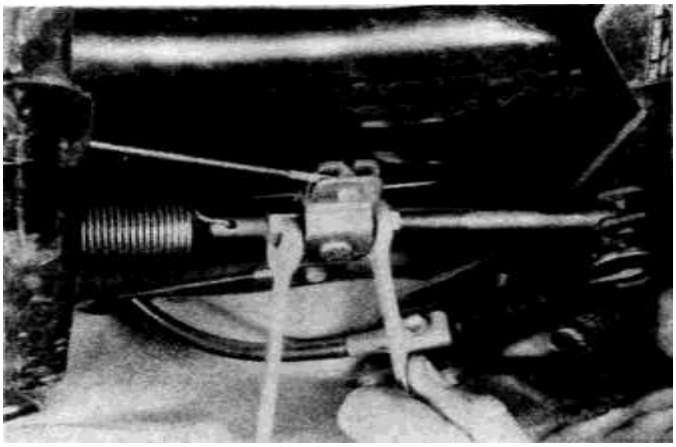
2 Unbolt the cable bracket (see Section 7).

3 Remove the three retaining bolts and remove the lever **(see illustration).**

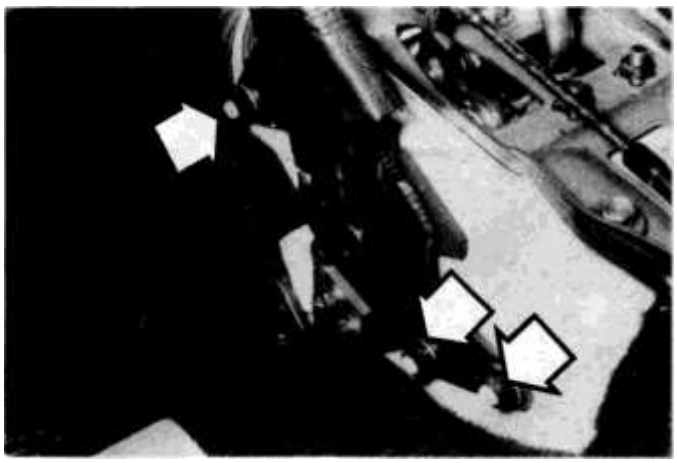
4 Installation is the reverse of removal.



7.12 Remove the two retaining bolts (arrows) and take off the cable bracket. Slide the cable free from the lever (arrow)



8.4 Place a wrench on each side of the adjusting nut, loosen the locknut, then tighten the turnbuckle until the parking brake crank just begins to move



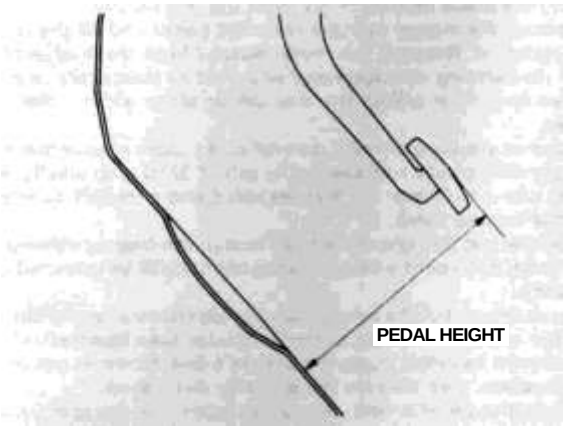
9.3 Take out the three retaining bolts (arrows) to remove the lever

10 Brake pedal — removal, installation and adjustment

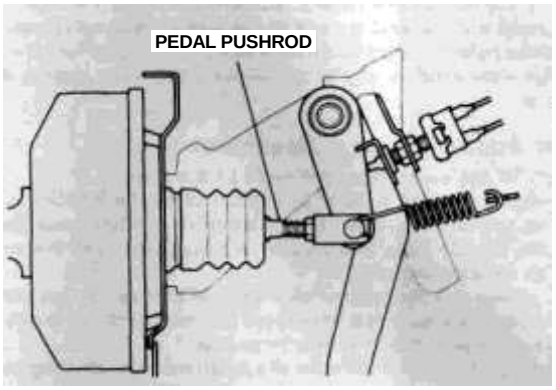
Refer to illustrations 10.6, 10.10, 10.11 and 10.13

Removal and installation

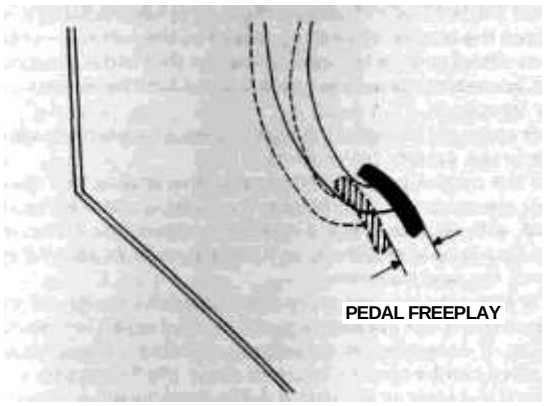
1 Remove the console panel trim, the left side console panel and the



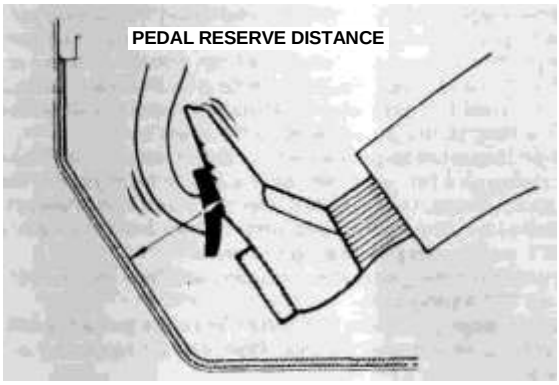
10.6 Pedal height is measured from the floorboard to the top of the pedal



10.10 Loosen the locknut and turn the push rod in the desired direction to set the proper pedal height



10.11 The pedal freeplay is the amount of stroke until the booster air valve is moved by the pedal push rod



10.13 Measure the pedal reserve travel from the floorboard to the top of the pedal while the pedal is held depressed

air conditioning duct (refer to Chapter 11).
2 Disconnect the return spring from the outer groove in the pushrod clevis pin.
3 Withdraw the R-clip and extract the clevis pin.
4 Unscrew the pivot bolt nut, withdraw the bolt and remove the pedal.
5 Install the brake pedal in the reverse order of removal. Lubricate the pivot with grease.

Adjustment

6 The pedal height is measured from the floorboard to the top of the pedal. Compare your measurement to the specifications **(see illustration).**
7 To adjust the pedal height, block the wheels and release the parking brake lever.
8 Loosen the locknut on the stoplight switch and unscrew the switch until it no longer contacts the brake pedal shaft.
9 Depress the pedal a few times to remove any vacuum in the system.
10 Loosen the push rod lock nut and turn the rod in the desired direction to set the pedal **(see illustration).**
11 Check the brake pedal free play **(see illustration).** Press on the pedal with your fingers until initial resistance is felt. Compare the measurement to the specifications.
12 If the free play of the pedal requires adjustment, recheck the pedal height and adjust accordingly.
13 Check brake pedal reserve travel **(see illustration).** Start the engine, depress the brake pedal a few times and then press down hard and hold it.
14 Pedal reserve travel is measured from the floorboard to the top of the pedal while it is being depressed. Compare the measurement to the specifications.
15 If the pedal reserve is less than specified, have the brakes adjusted by your Toyota dealer service department.
16 Readjust the stop light switch so that it is kept fully pushed in when the pedal is not depressed (refer to Section 11).

11 Brake light switch — removal, installation and adjustment

Removal and installation

1 The brake light switch is located on a bracket at the top of the brake pedal. The switch activates the brake lights at the rear of the vehicle whenever the pedal is depressed.
2 Disconnect the negative battery cable and secure it out of the way so that it cannot come back into contact with the battery post.
3 Disconnect the wiring connectors at the brake light switch.
4 Loosen the lock nut and unscrew the switch from the pedal bracket. Install the new switch in the reverse order.

Adjustment

5 Loosen the lock nut, adjust the switch so that the threaded portion lightly contacts the pedal stopper, then tighten the lock nut.
6 Connect the wiring at the switch and the battery. With an assistant, check that the rear brake lights are functioning properly.

12 Brake hoses and lines — inspection and replacement

Inspection

1 About every six months, with the vehicle raised and placed securely on jackstands, the flexible hoses which connect the steel brake lines

with the front and rear brake assemblies should be inspected for cracks, chafing of the outer cover, leaks, blisters and other damage. These are important and vulnerable parts of the brake system and inspection should be complete. A light and mirror will prove helpful for a thorough check. If a hose exhibits any of the above conditions, replace it with a new one.

Flexible (rubber) hose replacement

2 Clean all dirt away from the ends of the hose.

3 To release the lock nuts at both ends of the flexible hoses, hold the nut on the flexible hose steady, loosen the other union nut and remove the flexible hose and washer. If necessary, soak the connections with penetrating oil.

4 Installation is a reversal of the removal procedure, but carefully check that all the securing brackets are in good condition and that the lock nuts are tight. Install a new hose clip.

5 Carefully check to make sure the suspension or steering components do not make contact with the hose. Have an assistant push on the vehicle and also turn the steering wheel lock-to-lock during inspection.

6 Bleed the brake system as described in Section 13.

Metal brake line replacement

7 When replacing brake lines it is important that the proper replacements be purchased. Do not use copper pipe for any brake system connections. Purchase proper brake line from a dealer or brake specialist.

8 Prefabricated brake line, with the tube ends already flared and connectors installed, is available at auto parts stores or dealers. These lines are also bent to the proper shapes if necessary.

9 If prefabricated lengths are not available, obtain the recommended steel tubing and fittings to match the line to be replaced. Determine the correct length by measuring the old brake line (a piece of string can usually be used for this) and cut the new tubing to length, allowing about 1/2-inch extra for flaring the ends.

10 Install the fitting onto the cut tubing and flare the ends of the pipe with an ISO flaring tool.

11 If necessary, carefully bend the line to the proper shape. A tube bender is recommended for this. **Warning:** *Do not crimp or damage the line.*

12 When installing the new line make sure it is well supported in the brackets and has plenty of clearance between moving or hot components.

13 After installation, check the master cylinder fluid level and add fluid as necessary. Bleed the brake system as outlined in the next Section and test the brakes carefully before placing the vehicle into normal operation.

13 Brake system bleeding

Refer to illustration 13.9

Note: *Bleeding the hydraulic system is necessary to remove any air which has entered the system while open during removal and ins tallation of a hose, line, caliper or master cylinder.*

1 It will be necessary to bleed the system at all four brakes if air has entered the system due to low fluid level or if the brake lines have been disconnected at the master cylinder.

2 If a brake line was disconnected only at a wheel, then only that caliper must be bled.

3 If a brake line is disconnected at a fitting located between the master cylinder and any of the brakes, that part of the system served by the disconnected line must be bled.

4 If the rear brakes are being bled, raise the front of the vehicle, which will position the bleeder valve at the 12 o'clock position and prevent air from being trapped in the caliper.

5 Remove any residual vacuum from the brake power booster by applying the brake several times with the engine off.

6 Remove the master cylinder reservoir cover and fill the reservoir with brake fluid. Reinstall the cover. **Note:** *Check the fluid level often during the bleeding operation and add fluid as necessary to prevent the fluid level from falling low enough to allow air into the master cylinder.*

7 Have an assistant on hand, as well as a supply of new brake fluid, an empty clear plastic container, a length of 3/16-inch plastic, rubber or vinyl tubing to fit over the bleeder valve and a wrench to open and close the bleeder valve.

8 Beginning at the right rear wheel, loosen the bleeder valve slightly, then tighten it to a point where it is snug but can still be loosened quickly and easily.

9 Place one end of the tubing over the bleeder valve and submerge the other end in brake fluid in the container **(see illustration).**

10 Have the assistant pump the brakes a few times to get pressure in the system, then hold the pedal firmly depressed.

11 While the pedal is held depressed, open the bleeder valve just enough to allow a flow of fluid to leave the valve. Watch for air bubbles to exit the submerged end of the tube. When the fluid flow slows after a couple of seconds, close the valve and have your assistant release the pedal.

12 Repeat Steps 10 and 11 until no more air is seen leaving the tube, then tighten the bleeder valve and proceed to the left rear wheel, the right front wheel and the left front wheel, in that order, and perform the same procedure. Be sure to check the fluid in the master cylinder reservoir frequently.

13 Never reuse old brake fluid. It contains moisture which will deteriorate the brake system components.

14 Refill the master cylinder with fluid at the end of the operation.

15 Check the operation of the brakes. The pedal should feel solid when depressed, with no sponginess. If necessary, repeat the entire process. **Warning:** *Do not operate the vehicle if you are in doubt about the effectiveness of the brake system.*

16 If any difficulty is experienced in bleeding the hydraulic system, or if an assistant is not available, a pressure bleeding kit is a worthwhile investment. If connected in accordance with the instructions, each bleeder valve can be opened in turn to allow the fluid to be pressure ejected until it is clear of air bubbles without the need to replenish the master cylinder reservoir during the process.

13.9 When bleeding the brakes, a hose is connected to the bleeder valve at the caliper and then submerged in brake fluid. Air will be seen as bubbles in the container or as bubbles inside the tube. All air must be removed before continuing to the next wheel

Chapter 10 Steering and suspension systems

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Specifications

General Data

Strut bar length	360.9 to 361.9 mm (14.206 to 14.248 in)
Wheel bearing play limit	0.05 mm (0.002 in)

Front suspension

Torque specifications	**Nm**	**Ft-lbs**
Steering knuckle-to-strut	142	105
Steering knuckle-to-tie-rod end	49	36
Steering knuckle-to-balljoint	80	59
Stabilizer link-to-stabilizer bar	64	47
Stabilizer bar link-to-strut	64	47
Strut bar-to-lower arm	113	83
Strut bar-to-body	127	94
Stabilizer bar bracket-to-body	19	14
Strut assembly-to-body	31	23
Lower arm-to-balljoint	78	58

Rear suspension

Torque specifications	**Nm**	Ft-lbs
Axle carrier-to-strut	142	105
Axle carrier-to-balljoint	80	59
Suspension support-to-body	31	23
Suspension support-to-strut piston rod	73	54
Strut assembly-to-body	31	23
Lower arm-to-balljoint	91	67
Lower arm-to-body	127	94
Lower arm-to-strut rod	117	86
Strut rod-to-body	113	83
Suspension arm-to-body	87	64
Suspension arm-to-axle carrier	49	36
Tie-rod end-to-axle carrier	49	36
Wheel bearing lock nut	186	137
Brake union bolt	15	11

Steering main shaft

Torque specifications	Nm	Ft-lbs
Steering wheel-to-steering shaft	34	25
Universal joint	35	26
Tilt steering support-to-body	25	19
Upper bracket-to-steering column tube	19	14

Steering gear housing

Torque specifications	Nm	Ft-lbs
Pinion bearing adjusting screw lock nut	113	83
Rack end-to-rack	83	61
Gear housing bracket-to-body	43	32
Tie-rod end-to-knuckle arm	49	36
Center crossmember. .	25	**19**

1 Suspension system — general information

Refer to illustrations 1.1a and 1.1b

The MR2 features front and rear independent suspension, allowing each wheel to compensate for road surface changes without appreciably affecting the other wheels.

Shock absorbing is provided by four MacPherson struts (combination spring, upper suspension arm and shock absorber). The upper ends of the struts are connected to the vehicle with bolts and mounting plates and the lower ends are bolted to the knuckles. The rear control arms are attached to the engine cradle with bolts and rubber bushings. The front control arms are attached to the frame.

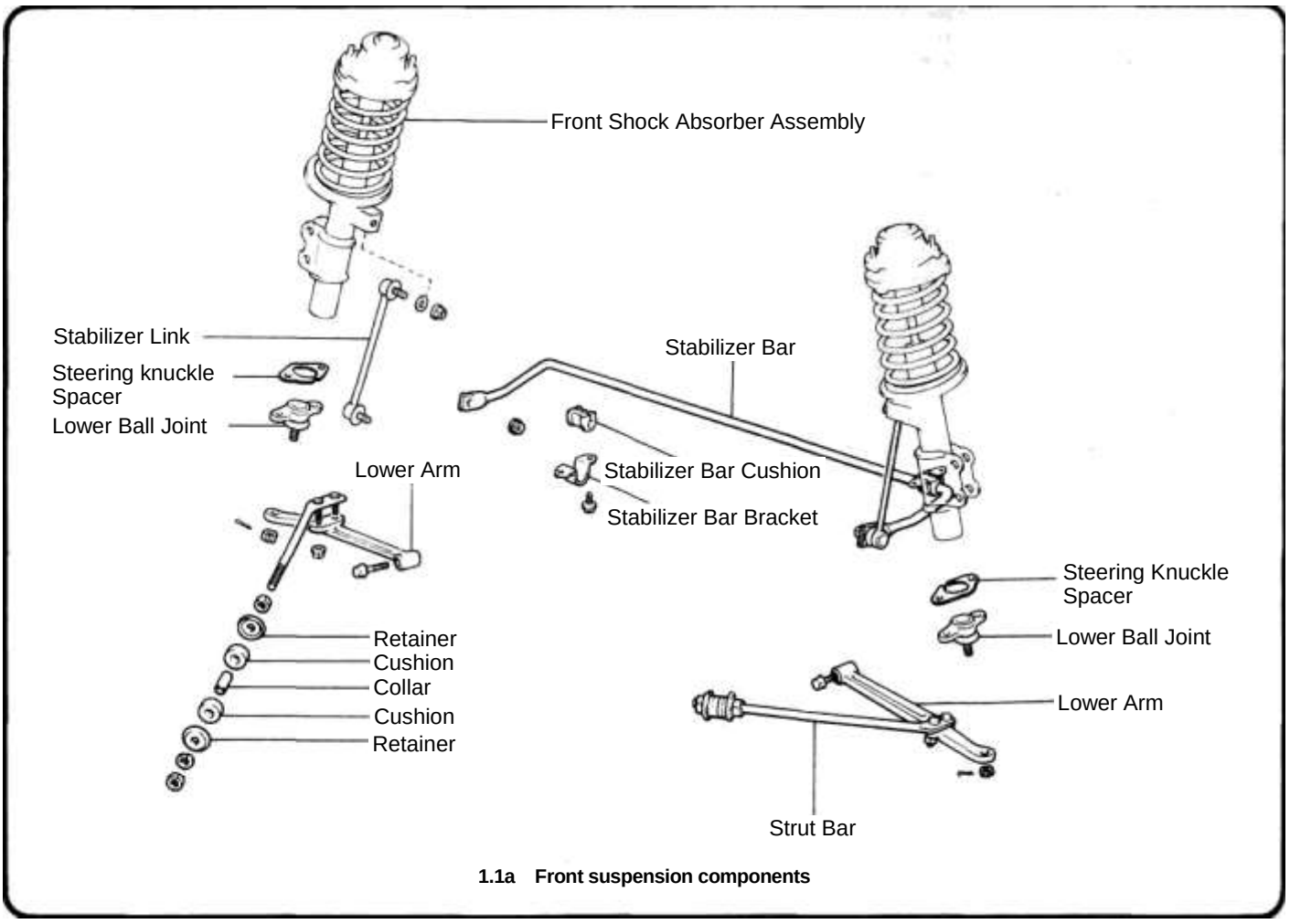
2 Front strut assembly — removal and installation

Refer to illustrations 2.5 and 2.8

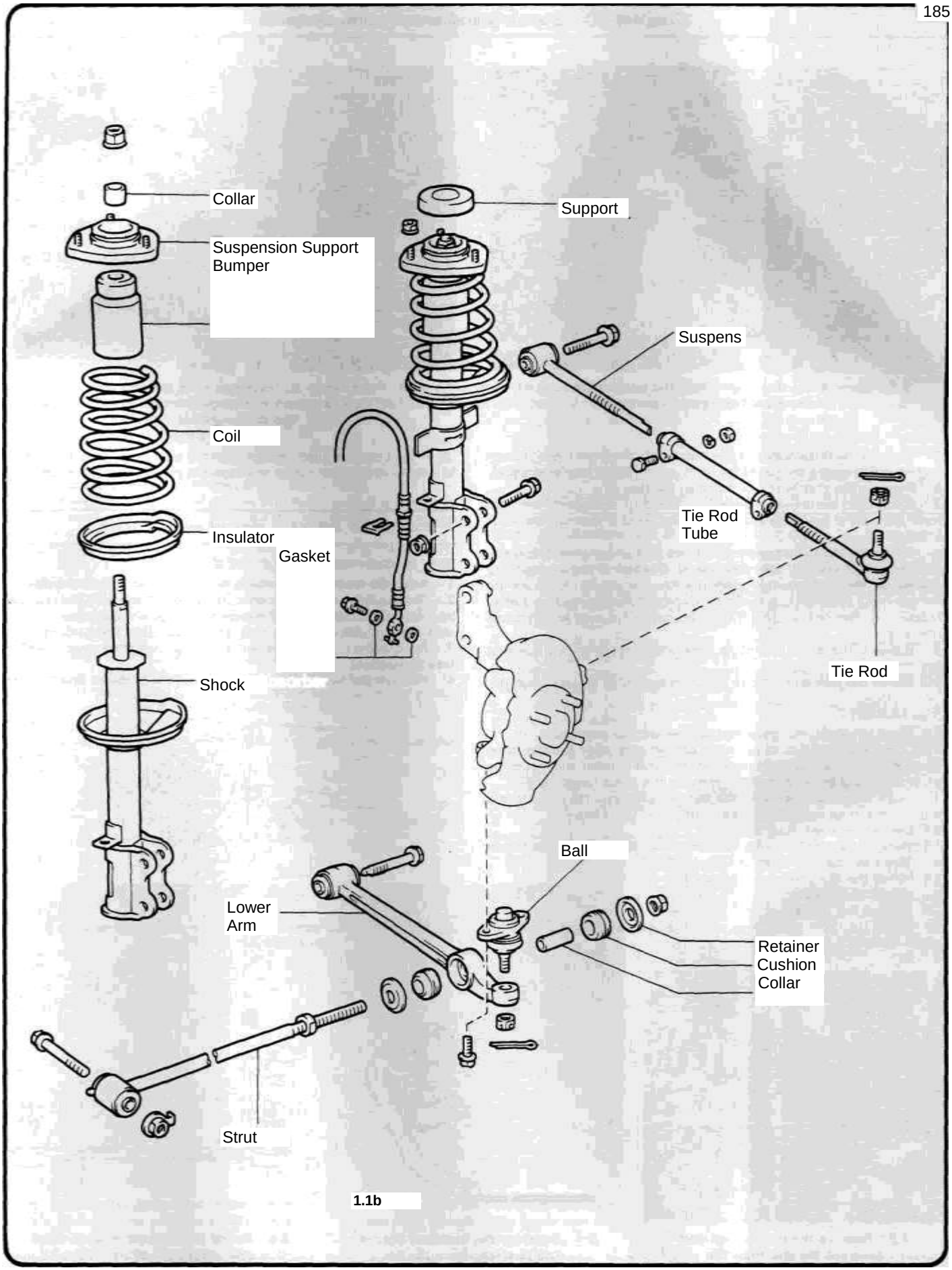
Note: *Although strut damper assemblies don't always reach the end of service life simultaneously, replace both left and right struts at the same time to prevent handling peculiarities and abnormal ride quality.*

Removal

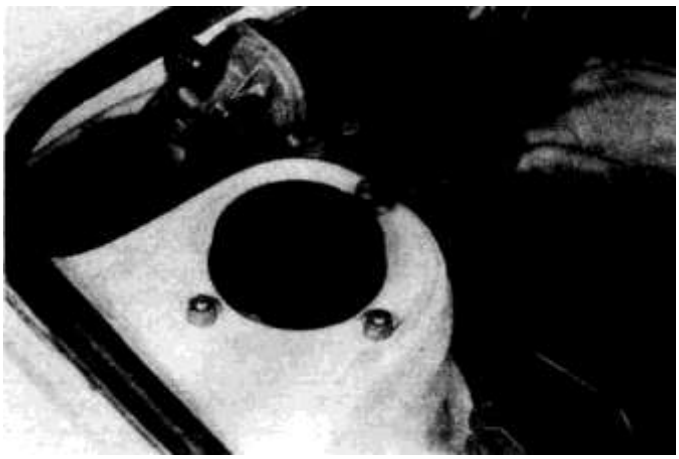
1 Loosen but do not remove the front wheel lug nuts.
2 Raise the front of the vehicle and support it on jackstands.
3 Remove the front wheel.
4 Support the lower control arm with a jack. Do not compress the spring.



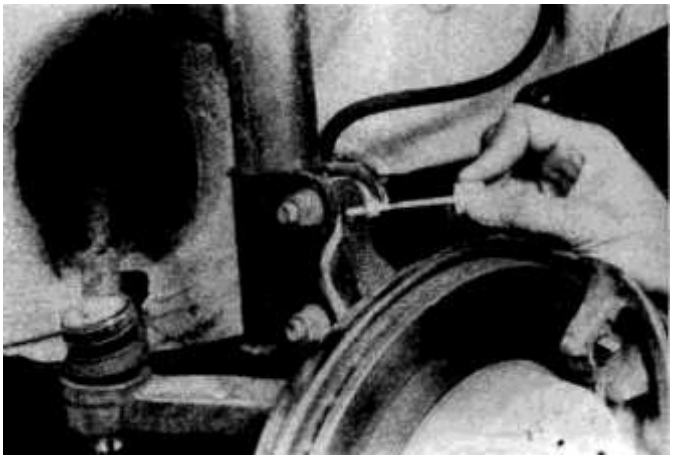
1.1a Front suspension components


Collar
Suspension Support
Bumper
Coil
Insulator
Gasket
Shock
Support
Suspens
Tie Rod
Tube
Tie Rod
Ball
Lower
Arm
Retainer
Cushion
Collar
Strut

1.1b



2.5 Remove the three nuts from the suspension support in the front luggage compartment



2.8 Paint marks on the lower strut bracket and camber adjust cam to assure that proper camber is maintained during reassembly

5 Remove the three nuts and washers inside the front luggage compartment that secure the top of the strut to the vehicle **(see illustration).**
6 Remove the stabilizer link (refer to Section 3).
7 Disconnect the brake hose clip from the strut, remove the line from from the caliper (refer to Chapter 9) and pass it through the strut bracket.
8 Scribe the strut and knuckle to assure that proper camber is maintained upon reassembly **(see illustration). Caution:** *If you are replacing the struts, the new strut dampers will have no scribe marks, so the vehicle must be taken to a dealer or alignment shop immediately after reassembly. Failure to do so will result in uneven tire wear and abnormal handling.*
9 Remove the strut mounting nuts and bolts from the steering knuckle.
10 Lower the jack and remove the strut assembly and spacer plate.

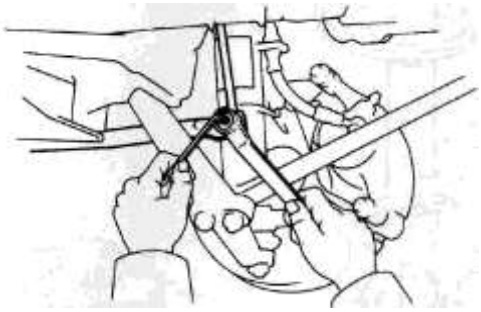
Installation

11 Place the strut assembly and spacer plate in position.
12 Using the floor jack to raise the control arm, align the mounting holes in the knuckle with the holes in the strut bracket and install the strut mounting bolts. Install the nuts on the bolts finger tight.
13 Align the scribe marks on the strut bracket and the knuckle and tighten the strut mounting bolts to the specified torque.
14 Connect the stabilizer link.
15 Install the brake hose clip. Reconnect the brake line to the caliper and bleed the caliper (refer to Chapter 9).
16 Install the tire and wheel assembly.
17 Lower the vehicle.
18 Tighten the wheel lug nuts.
19 Install the three upper strut washers and nuts. Tighten the nuts to the specified torque.
20 If the strut has been replaced with a new one, drive the vehicle to a dealer or alignment shop and have the camber and toe-in adjusted.

3 Stabilizer bar and link — removal and installation

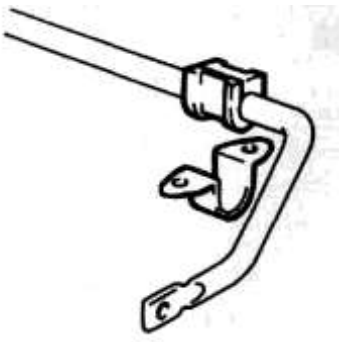
Refer to illustrations 3.2, 3.3, 3.4 and 3.5

1 Raise the front of the vehicle and support it on jackstands.
2 Remove the nut and disconnect the stabilizer link from the stabilizer bar. **Note:** *On 1986and 1987 models, if the balljoint stud turns together with the nut, use a wrench to hold the stud* **(see illustration).**
3 Remove the nut and remove the link from the front strut assembly **(see illustration).**
4 Remove the bolts from the two stabilizer brackets and free the



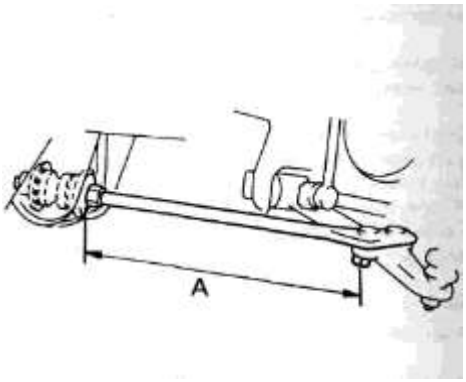
3.2 Use a hex wrench to hold the stud, then remove the nut (1986 and 1987 models)

3.3 Remove the nut (arrow) and separate the link from the strut assembly



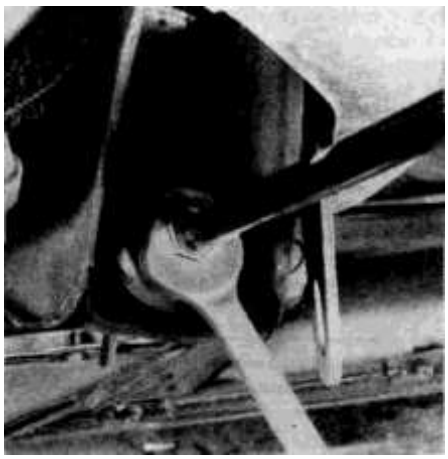
3.4 Separate the stabilizer brackets and cushions from the bar

3.S Rotate the balljoint in all directions. If the movement is not free, replace the stabilizer link



4.2 Measure the distance (A) between the retainer nut and the strut bar-to-lower arm retaining bolt. Note the length for reassembly

4.3 Remove the strut nut to release the front retainer and cushion



4.5 Turn the strut bar adjusting nut until the previous measured length is reached

brackets and stabilizer bar cushions **(see illustration).**
5 Carefully inspect the stabilizer link. Rotate the balljoints in all directions. If the movement is not smooth and free, replace the stabilizer link **(see illustration).**
6 Installation is the reverse of the removal procedure. Be certain to tighten all connections to the specified torque.

4 Front strut bar — removal and installation

Refer to illustration 4.2, 4.3 and 4.5

1 Raise the front of the vehicle and support it on jackstands.
2 Measure the distance from the retainer nut to the strut bar-to-lower arm retaining bolt **(see illustration).** Refer to the Specifications for the approximate length.
3 Remove the nut and remove the front retainer and cushion **(see illustration).**
4 Loosen the adjusting nut, then disconnect the strut bar from the lower arm and separate the lower arm from the strut bar.
5 To install the strut bar reverse the removal procedure. Turn the adjusting nut to adjust the strut bar to the measured length **(see illustration).** Tighten all nuts to the specified torque.

5 Front control arm and balljoint — removal and installation

Refer to illustrations 5.5, 5.6 and 5.7

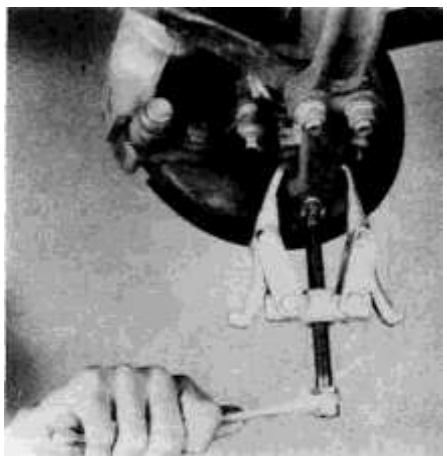
Control arm

Removal

1 Loosen but do not remove the wheel lug nuts.
2 Raise the front of the vehicle and support it on jackstands.
3 Remove the tire and wheel assembly.
4 Remove the cotter pin and loosen the castellated nut, but do not remove it from the lower balljoint stud.
5 Using a two-jaw puller, disconnect the lower arm from the balljoint **(see illustration).** Remove the castle nut.
6 Remove the two nuts and disconnect the strut bar from the lower arm **(see illustration).**
7 Remove the pivot bolt from the lower arm and separate the lower arm from the body **(see illustration).**

Installation

8 To install the lower arm, temporarily fasten the strut bar to the lower arm and the arm to the body.
9 Connect the lower arm to the balljoint, tighten the castle nut to the specified torque and install a new cotter key.



5.5 Loosen the castle nut, keeping it in place to catch the lower arm after it has been separated, then use a two-jaw puller to separate the lower arm from the balljoint

5.6 Remove the two nuts and separate the strut bar from the lower arm

5.7 Take out the pivot bolt and disconnect the lower arm from the body

10 Tighten the strut bar to the lower arm and the arm to the body to the specified torque.
11 Install the tire and wheel assembly. Tighten the wheel lug nuts finger tight. Lower the vehicle and tighten the lug nuts.
12 It's a good idea to have the wheels aligned after reassembling the suspension.

Balljoint removal and installation

13 Once the control arm has been removed, remove the two bolts securing the balljoint to the steering knuckle and separate the balljoint from the knuckle.
14 Install the balljoint by reversing the removal procedure. Tighten the nuts to the specified torque.

6 Front hub and wheel bearing assembly — check, removal and installation

Refer to illustrations 6.7, 6.10, 6.12, 6.13, 6.16 and 6.17 **Note:** *Several special Toyota service tools are called for in this procedure. However, certain standard tools, such as a two-jaw puller and a slide hammer, can be used in their place.*

Front hub removal

1 Loosen but do not remove the wheel lug nuts.
2 Raise the front of the vehicle and secure it on jackstands.
3 Remove the tire and wheel assembly.
4 Remove the caliper mounting bolts and the caliper (Chapter 9).
5 Hang the caliper out of the way with a piece of wire.
6 Remove the brake disc (Chapter 9).
7 Using a dial indicator, check bearing play in the axial direction **(see illustration).** The bearing play limit is 0.05 mm (0.0020 in).
8 Disconnect the stabilizer link (refer to Section 3). When disconnecting the stabilizer link for this procedure, disconnect only the bottom of the link.
9 Remove the cotter pin and nut from the tie-rod end. Remove the two bolts from the steering knuckle and separate the balljoint and the tie-rod end.
10 Using a two-jaw puller, disconnect the tie-rod end from the steering knuckle **(see illustration).**
11 **If** the same hub and bearing assembly is going to be reused, paint marks on the lower strut bracket and the camber adjust cam to aid in reassembly (refer to Section 2), then remove the hub assembly.

Wheel bearing replacement

12 If the bearing check mentioned in Step 7 indicates a play limit greater than specified, replace the bearing **(see illustration).**
13 Line vise jaws with blocks of wood to prevent damaging the assembly and clamp the steering knuckle in the vice. Using a screwdriver and hammer, remove the hub bearing cap and O-ring **(see illustration).**
14 Clamp the axle hub in a vise. Close the vise until it just holds the hub, being careful not to over-tighten the vise. Using a hammer and chisel, loosen the staked part of the nut and remove the locknut. 1 5 Remove the disc brake dust cover. Using a two-jaw puller, remove the axle hub from the steering knuckle.
16 Using a slide hammer, remove the oil seal from the steering knuckle **(see illustration).**
17 Take out the wheel bearing snap ring **(see illustration).**
18 Using a two-jaw puller, remove the hub bearing inner race (outside) from the hub.
19 Install the hub bearing inner race (outside) to the steering knuckle as a guide. Then, using an appropriate size socket, drive out the hub bearing from the steering knuckle.
20 Reassembly of the axle hub is the reverse of this procedure. However, tap a new oil seal into the steering knuckle and coat the oil seal lip with multi-purpose grease.

Front hub installation

21 To install the axle hub, loosely fasten the steering knuckle to the lower arm.
22 Connect the steering knuckle to the lower strut bracket.
23 Insert the bolts and align the match marks on the camber adjusting cam. Tighten the nuts to the specified torque.
24 Connect the tie-rod end to the steering knuckle. Tighten the castle nut to the specified torque and secure it with a new cotter pin.
25 The rest of the installation is the reverse of the removal procedure. Tighten all connections to the specified torque.
26 Replace the wheels and finger tighten the wheel lug nuts, lower the vehicle and tighten the lug nuts.
27 It is advised that the vehicle be driven to a dealer or alignment shop to check the front wheel alignment.

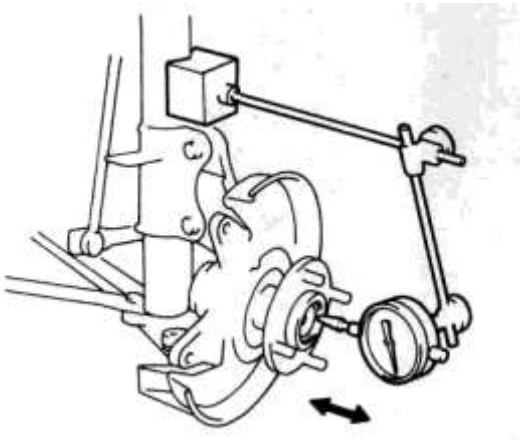
7 Rear strut assembly — removal and installation

Refer to illustrations 7.7 and 7.9

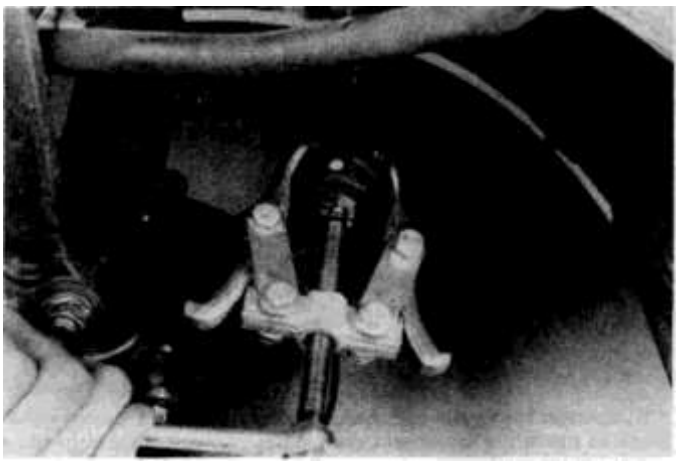
Note: *Although strut damper assemblies don't always reach the end of service life simultaneously, replace both left and right struts at the same time to pre vent handling peculiarities and abnormal ride quality.*

Removal

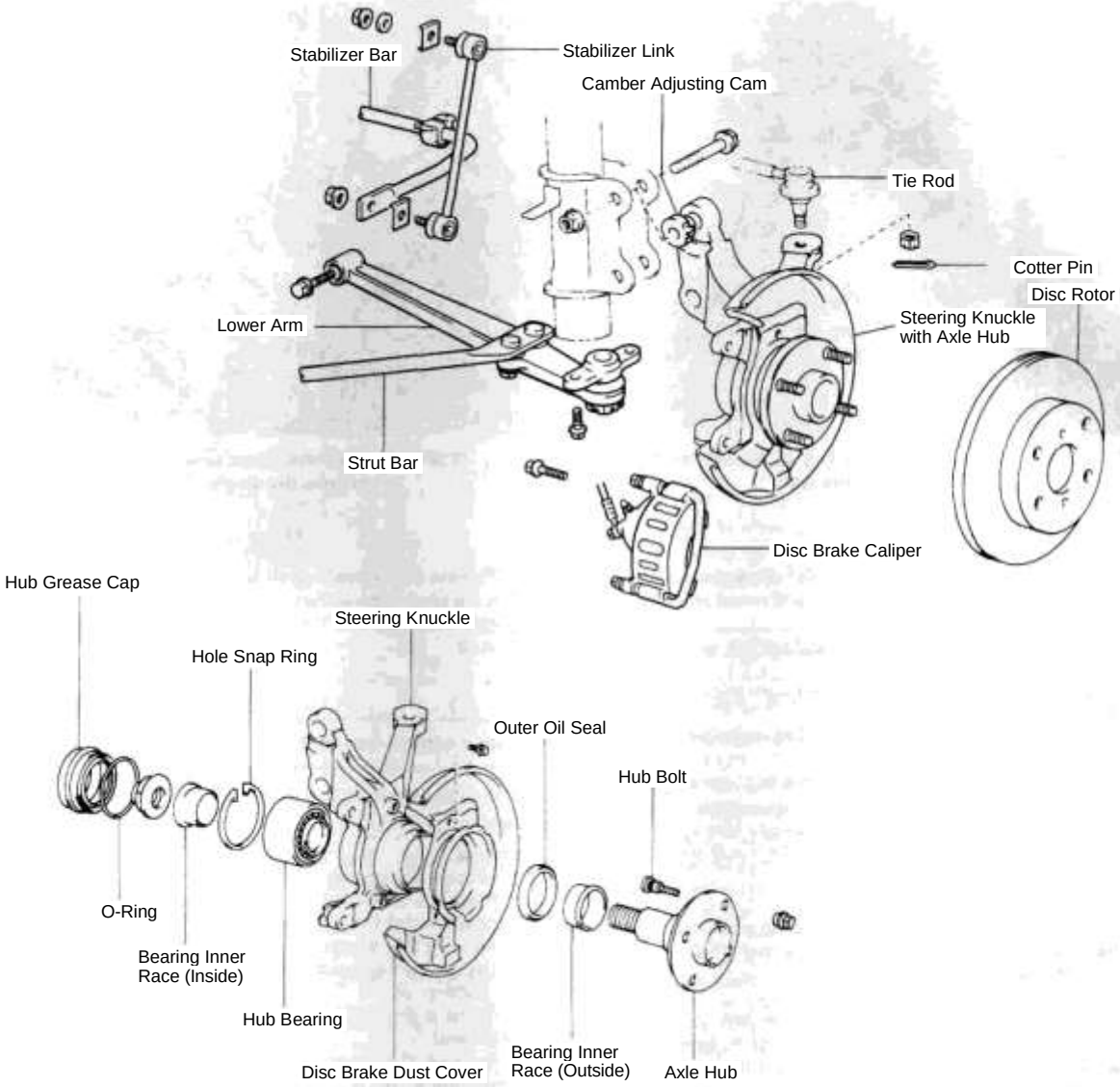
1 Loosen but do not remove the rear wheel lug nuts.
2 Raise the rear of the vehicle and support it on jackstands.
3 Remove the rear wheel.
4 Support the lower control arm with a jack. Do not compress the spring.
5 Disconnect the brake hose clip from the strut, remove the union bolt and two gaskets and disconnect the brake hose. Plug the brake line with a suitable size piece of rubber hose to prevent fluid loss (refer to Chapter 9).
6 Scribe the strut and axle carrier to assure that proper camber adjustment is maintained upon reassembly (see Section 2). **Caution:** ***If*** *you are replacing the struts, the new strut dampers will have no scribe*



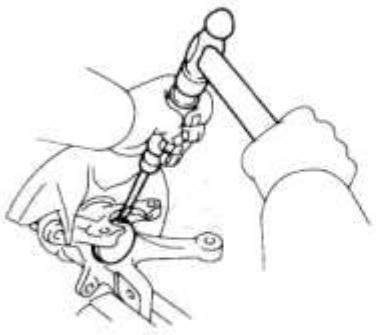
6.7 Place a dial indicator on the axle hub and move the assembly back-and-forth to check the bearing play



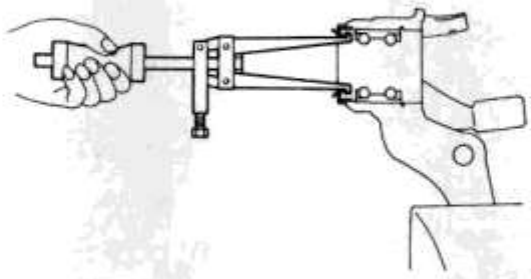
6.10 A two-jaw puller can be used to separate the tie-rod from the steering knuckle



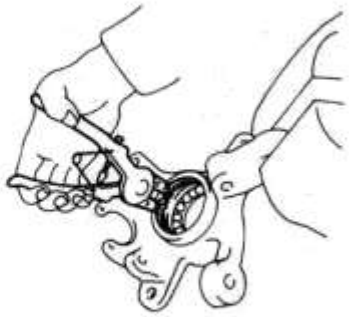
6.12 Front hub components



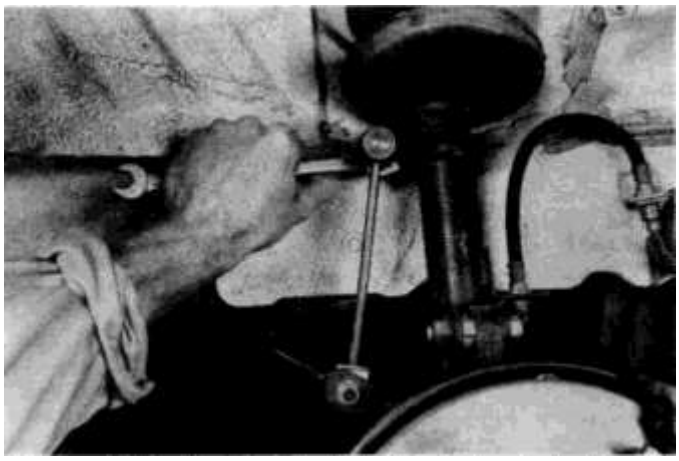
6.13 Clamp the steering knuckle in a vise lined with wood blocks or a soft jaw vise and use a screwdriver and hammer to separate the hub bearing cap and O-ring



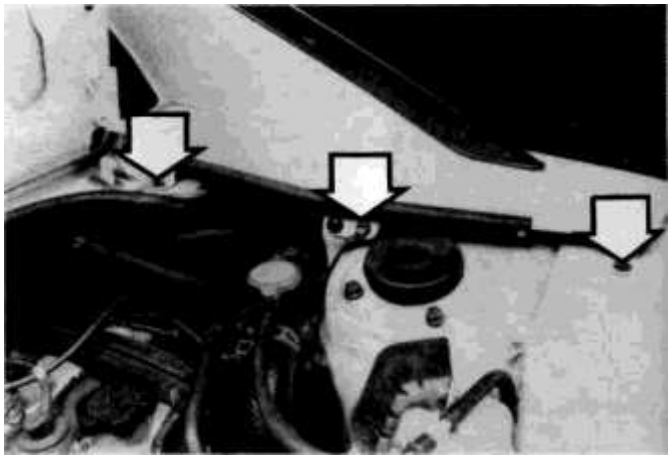
6.16 Use a slide hammer to remove the oil seal from the steering knuckle



6.17 Remove the wheel bearing snap ring



7.7 Disconnect the rear stabilizer link at the top of the strut by removing the nut



7.9 Take out the three retaining screws (arrows) to remove the engine hood side panel

marks, so the vehicle must be taken to a dealer or alignment shop immediately after reassembly. Failure to do so will result in uneven tire wear and abnormal handling.

7 Remove the nut and disconnect the stabilizer link at the top **(see illustration).**

8 Remove the two axle carrier nuts and bolts with the camber adjust cam.

9 Remove the three retaining screws and take out the engine hood side panels **(see illustration).**

10 Remove the three nuts and washers inside the rear engine compartment that secure the top of the strut to the vehicle.

11 Lower the jack and remove the strut assembly and spacer plate. **Caution:** *Cover the driveaxle boot with cloth to avoid damaging it.*

Installation

12 Place the strut assembly and spacer plate in position.

13 Install the three nuts holding the strut damper of the body and tighten them to the specified torque.

14 Install the engine hood side panels.

15 Replace the bolt and reconnect the stabilizer link.

16 Connect the axle carrier to the strut lower bracket. Insert the bolts from the rear side and align the match marks on the camber adjust cam. Tighten the nuts to the specified torque.

17 Install the brake hose and clip to the strut. Replace the union bolt and the two gaskets and tighten it to the specified torque.

18 Bleed the brake line (refer to Chapter 9).

19 Install the tire and wheel assembly.

20 Lower the vehicle.

21 Tighten the wheel lug nuts.

22 If the strut damper has been replaced, drive the vehicle to a dealer or alignment shop and have the camber and toe-in of the rear wheels adjusted.

8 Rear control arm and balljoint — removal and installation

Refer to illustrations 8.6 and 8.7

Control arm

Removal

1 Loosen but do not remove the wheel lug nuts.

2 Raise the rear of the vehicle and support it on jackstands.

3 Remove the tire and wheel assembly.

4 Remove the cotter pin and the nut from the balljoint stud.

5 Using a two-jaw puller, disconnect the lower arm from the balljoint (see Section 5).

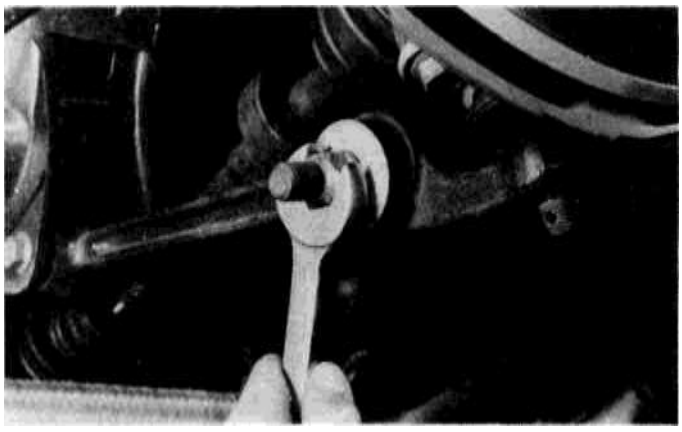
6 Remove the strut rod nut and retainer from the lower arm **(see illustration).**

7 Remove the pivot bolt holding the lower arm to the body and remove the lower arm **(see illustration).**

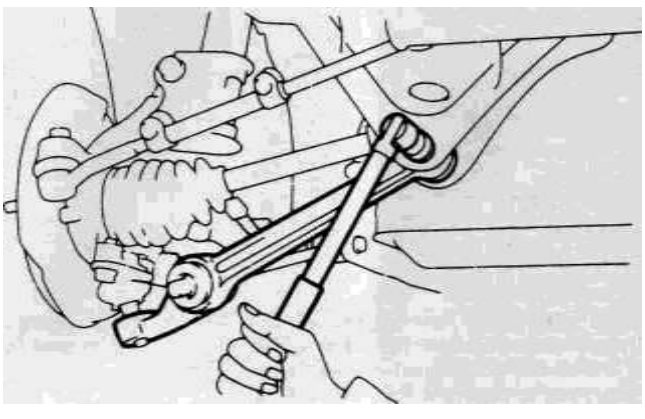
Installation

8 To install the lower arm, temporarily fasten the strut rod to the lower arm and the arm to the body.

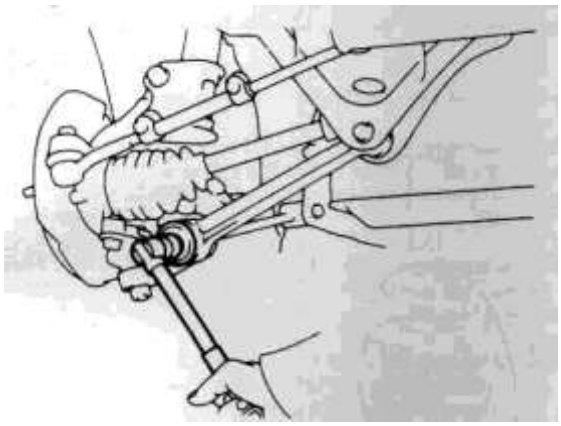
9 Connect the lower arm to the balljoint, tighten the nut to the specified torque and install a new cotter pin.



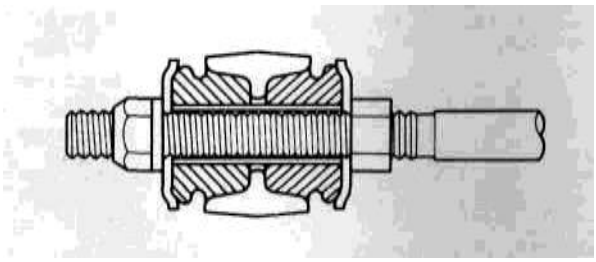
8.6 Remove the strut rod nut and retainer from the lower arm



8.7 Remove the pivot bolt holding the lower arm to the body, then remove the lower arm



9.2 Remove the strut rod nut and retainer



9.6 To install the rod, replace the retainer, collar and cushion on the lower arm side of the rod

10 Tighten the strut rod to the lower arm and the arm to the body to the specified torque.
11 Install the tire and wheel assembly. Tighten the wheel lug nuts finger tight. Lower the vehicle and tighten the lug nuts.
12 It's a good idea to have the wheels aligned after reassembling the suspension.

Balljoint removal and installation

13 Once the control arm has been removed, remove the two bolts securing the balljoint to the rear axle carrier and separate the balljoint from the carrier.
14 Install the balljoint by reversing the procedure. Tighten the nuts to the specified torque.

9 Rear strut rod — removal and installation

Refer to illustrations 9.2, 9.4 and 9.6

1 Raise the rear of the vehicle and support it on jackstands.
2 Remove the strut rod nut and the retainer **(see illustration).**
3 Remove the engine under cover.
4 Remove the strut rod retaining nut and bolt with the cushion (body side) **(see illustration).**
5 Take off the cushion collar and the retainer from the strut rod (lower arm side) and remove the rod.
6 To replace the strut rod, install the retainer, collar and cushion on the rod (lower arm side) **(see illustration).**
7 Temporarily install the strut rod to the lower arm.
8 Temporarily install the strut rod holding bolt and nut with the cushion to the body.
9 Replace the wheels and tighten the wheel lug nuts finger tight.
10 Lower the vehicle and tighten the wheel lug nuts.

9.4 Remove the strut rod holding nut and bolt along with the cushion

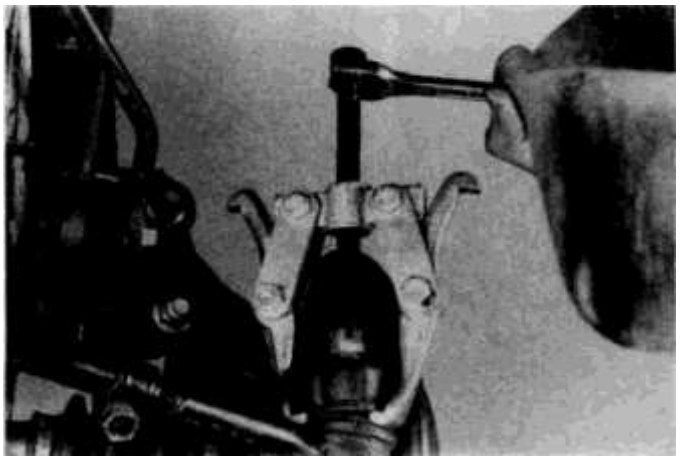
11 Rock the vehicle up and down to settle the suspension. Then, tighten the strut rod holding nuts (lower arm side and body side), to the specified torque.

10 Rear hub and wheel bearing — removal and installation

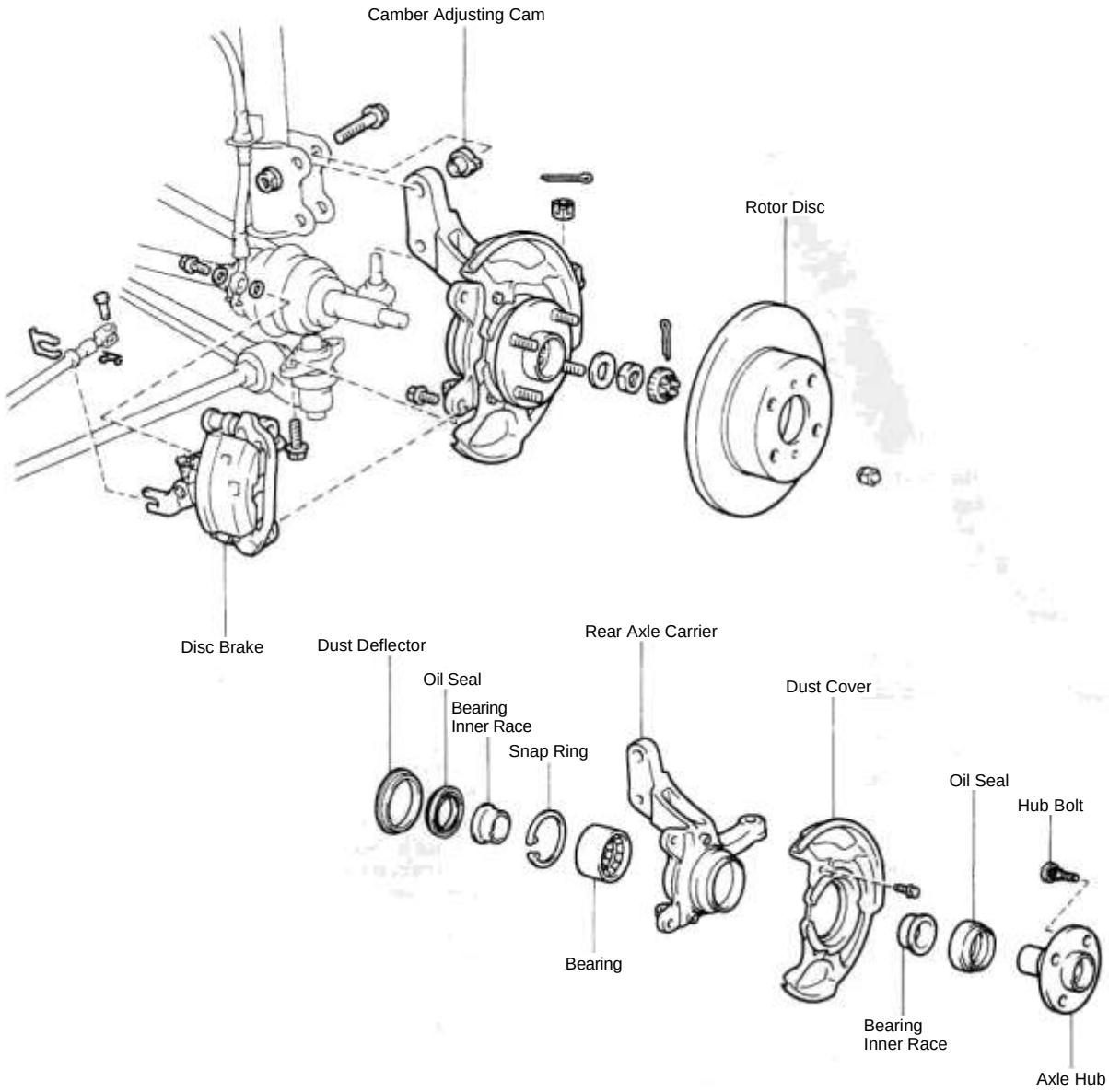
Refer to illustrations 10.9, 10.12, 10.14 and 10.16 **Note:** *Several special Toyota service tools are called for in this procedure. However, certain standard tools, such as a two-jaw puller and a slide hammer, can be used in their place.*

Rear hub removal

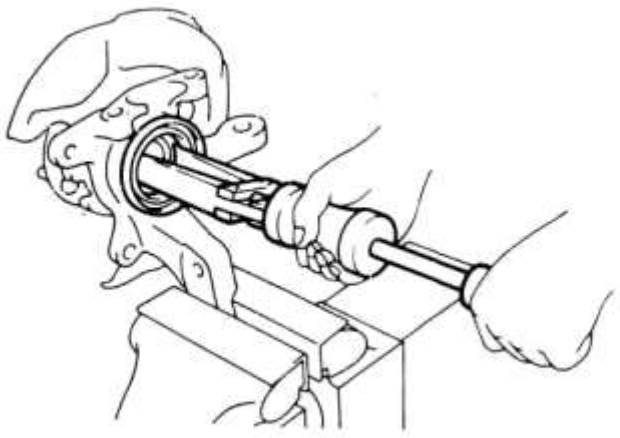
1 Loosen but do not remove the wheel lug nuts.
2 Remove the cotter pin and the bearing lock nut cap. With the parking brake set, remove the bearing lock nut.
3 Raise the rear of the vehicle and secure it on jackstands.
4 Remove the tire and wheel assembly.
5 Remove the caliper mounting bolts and the caliper (Chapter 9).
6 Hang the caliper out of the way with a piece of wire.
7 Remove the brake disc (Chapter 9).
8 Using a dial indicator, check bearing play in the axial direction (refer to Section 6) and compare it to the Specifications.
9 Disconnect the suspension arm. Remove the cotter pin and nut, and using a two-jaw puller, disconnect the tie-rod end from the rear axle carrier **(see illustration).**
10 Disconnect the rear axle carrier from the lower arm.
11 Paint marks on the strut's lower bracket and the camber adjust cam.



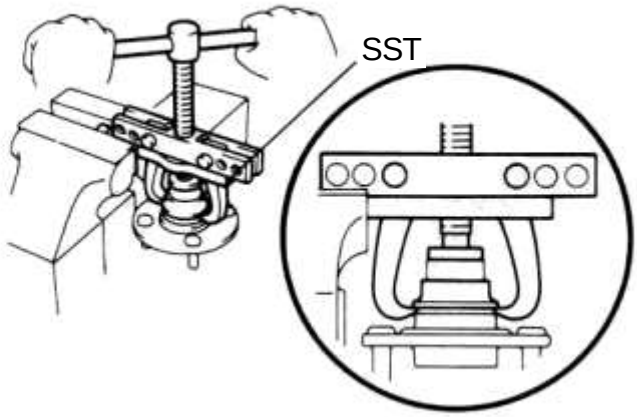
10.9 Using a two-jaw puller, disconnect the tie-rod end from the rear axle carrier



10.12 Rear hub components



10.14 With the axle carrier secured in a vise, use a slide hammer to pull the oil seal from the axle carrier



10.16 Use the two-jaw puller to remove the inner race (outside) from the hub

1 2 Remove the two axle carrier nuts and bolts with the camber adjust cam. Remove the rear axle carrier and hub **(see illustration). Caution:** *Cover the driveaxle boot with cloth to protect it from damage.*

Wheel bearing replacement

13 Remove the three bolts holding the disc brake dust cover to the axle carrier.
14 Place blocks of wood between vise jaws to prevent damaging the assembly and place the rear axle carrier with the hub between the blocks. Using a slide hammer, remove the oil seal from the axle carrier **(see illustration).**
1 5 Remove the bearing snap ring.
16 Using a two-jaw puller, remove the hub from the rear axle carrier. Remove the bearing inner race (inside) from the bearing. Use the puller again and remove the inner race (outside) from the rear axle hub **(see** illustration).
17 Using a slide hammer, remove oil seal from the rear axle carrier.
18 To remove the wheel bearing, first place the bearing inner race (outside) on the bearing, then using a suitable sized socket, drive out the bearing. **Note:** *When replacing the wheel bearing always replace it as an assembly.*
19 To install the new bearing, use a suitable size socket to press the bearing into the rear axle carrier. Drive a new oil seal into the carrier and apply multi-purpose grease to the oil seal lip.
20 Using a suitable sized socket, drive a new outer oil seal into the rear axle carrier. Apply mutli-purpose grease to the oil seal lip.
21 Install the disc brake dust cover and tighten the bolts securely.
22 Apply multi-purpose grease to the oil seal and bearing, and using a suitable size socket press the hub into the rear axle carrier.
23 Using snap ring pliers, install a snap ring into the rear axle carrier.
24 Using the socket, drive a new inner oil seal into the rear axle carrier. Apply multi-purpose grease to the oil seal.

Rear hub installation

25 Installation of the rear hub is the reverse of the removal procedure.
26 Replace the tire and wheel assembly and tighten the wheel lug nuts finger tight, lower the vehicle and tighten the lug nuts.
27 It is advisable at this time to drive the vehicle to a dealer or alignment shop and have the rear wheel alignment checked.

11 Steering system — general information

The MR2 uses a rack and pinion steering system. When the steering wheel is turned, this motion is transferred by the steering column to the intermediate shaft and finally to the pinion gear. The pinion gear teeth mesh with the gear teeth of the rack, so the rack moves right or left in its housing when the pinion is turned. The movement of the rack is transmitted through the inner and outer tie-rods to the steering knuckles, which turn the wheels.

The steering column also houses the ignition switch lock, key warning buzzer and the flashing hazard light switch. The ignition and steering wheel can both be locked to prevent theft when the vehicle is parked.

12 Steering wheel — removal and installation

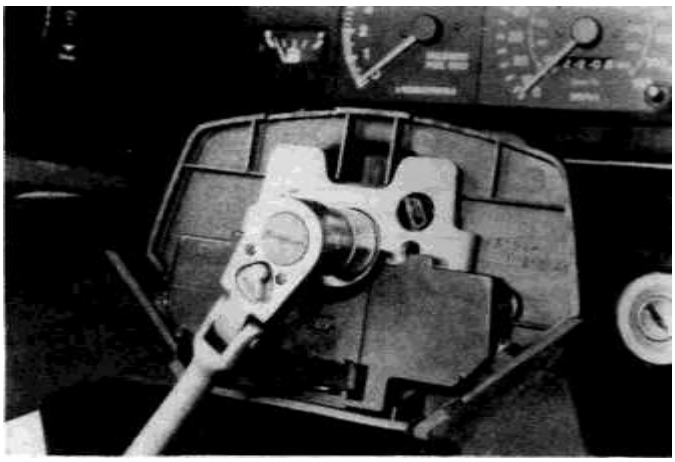
Refer to illustrations 12.3, 12.4 and 12.5

Removal

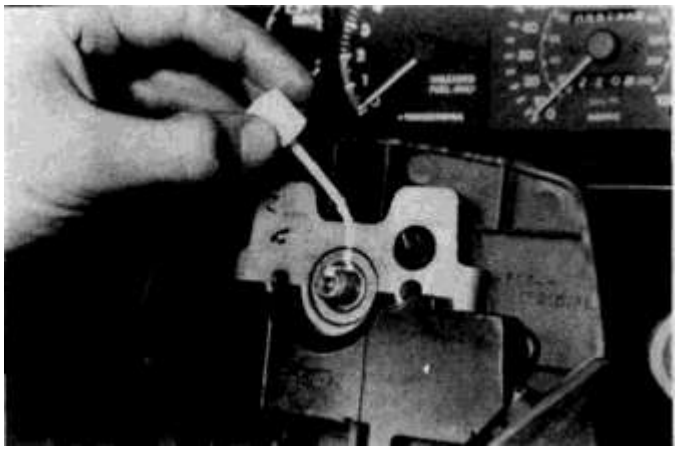
1 Disconnect the negative battery cable.
2 Remove the steering wheel pad. Take out the single retaining screw, located at the bottom of the pad and pull up to free the pad.
3 Remove the steering wheel nut **(see illustration).**
4 Scribe or paint a mark between the steering wheel and the steering column shaft to insure proper reinstallation **(see illustration).**
5 Install a steering wheel puller and remove the steering wheel **(see illustration).**

Installation

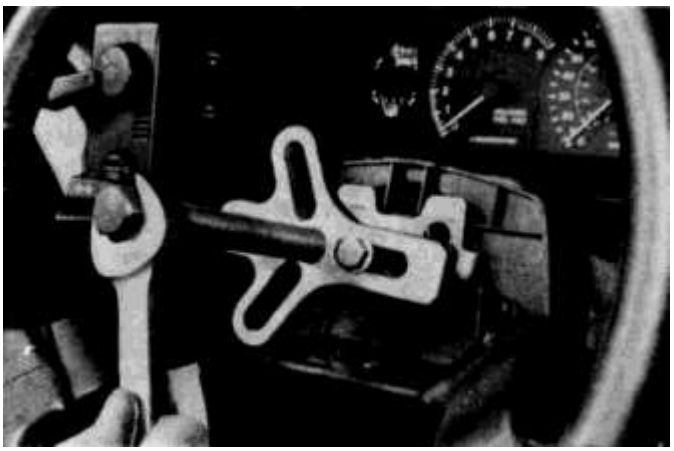
6 Align the mark on the steering wheel with the mark on the steering column shaft.
7 Install the nut and tighten it to the specified torque.
8 Install the steering wheel pad and reconnect the negative battery cable.



12.3 After taking off the steering wheel pad and disconnecting the horn, remove the steering wheel nut



12.4 Paint marks on the steering shaft and the steering wheel to assure proper reinstallation



12.5 Use a steering wheel puller to free the steering wheel from the shaft

13.4 Back off the jam nut. then paint an alignment mark on the tie-rod to assure proper alignment during installation

13 Tie-rod ends — removal and installation

Refer to illustration 13.4

Removal

1 Loosen but do not remove the wheel lug nuts.
2 Raise the front of the vehicle and secure it on jackstands.
3 Remove the front wheel.
4 Back off the jam nut that locks the tie-rod end to the tie-rod, then paint an alignment mark onto the threads to insure that the new tie-rod end is installed to exactly the same thread **(see illustration).**
5 Remove the cotter pin, then loosen and remove the castellated nut from the tie-rod end stud.
6 Install a puller and disconnect the tie-rod end from the knuckle (refer to Section 5), then unscrew the tie-rod end from the tie-rod.

Installation

7 Thread the new tie-rod end onto the tie-rod until it reaches the paint mark. Tighten the jam nut securely.
8 Install the tie-rod end stud through the steering knuckle and tighten the castellated nut to the specified torque. Install a new cotter pin.
9 It is a good idea to have the toe-in adjusted at a dealer service department or alignment shop after the tie-rod is installed.

14 Steering knuckle — removal and installation

1 Loosen the front wheel lug nuts.
2 Raise the front of the vehicle and place it securely on jackstands.
3 Remove the front wheels.
4 Remove the disc brake caliper and the disc (Chapter 9).
5 Disconnect the front lower arm (Section 5).
6 Disconnect the tie-rod end (Section 14).
7 Paint match marks on the lower strut bracket and the camber adjust cam (see Section 2).
8 Remove the two knuckle retaining nuts and bolts along with the camber adjust cam. Separate the knuckle from the strut.
9 To separate the knuckle from the hub assembly, refer to Section 6.
10 To install the knuckle, reverse the removal procedure. Use the match marks to align the lower bracket with the camber adjust cam.
11 Replace the front wheels. Install the wheel lug nuts and tighten them finger tight.
12 Lower the vehicle and tighten the wheel lug nuts.
13 It is advisable at this time to drive the vehicle to a dealer or alignment shop and have the front wheel alignment checked.

15 Rack and pinion assembly — removal and installation

Refer to illustrations 15.7, 15.8 and 15.9

Removal

1 Loosen but do not remove the wheel lug nuts.
2 Raise the vehicle and support it securely on jackstands.
3 Remove the front wheels.
4 Remove the steering shaft universal joint. Place match marks on the main shaft, joint yoke and pinion shaft **(see illustration).**
5 Remove the two bolts from the universal joint. First pull the universal joint from the gear housing, then pull it from the main shaft.
6 Disconnect the tie-rod ends from the steering knuckle (refer to Section 14).
7 Remove the center crossmember **(see illustration).**
8 Remove the rack housing bracket bolts **(see illustration)** and remove the housing assembly.

Installation

9 Align the centers of the column hole cover shield and the pinion shaft **(see illustration).** Install the four bracket bolts and tighten them to the specified torque. **Note:** *Be careful not to damage the rubber boots.*
10 Install the center crossmember and the four bolts and tighten them to the specified torque.
11 Install the tie-rod ends to the knuckle arms, tighten the nuts to the specified torque and install new cotter pins.
12 Align the match marks on the steering shaft, universal joint and pinion shaft. Replace the two bolts and tighten them to the specified torque.
13 Install the front wheels. Tighten the wheel lug nuts finger tight.
14 Lower the vehicle and tighten the wheel lug nuts.
15 It is a good idea to have the front wheels aligned by a dealer or alignment shop after reassembly.

16 Wheel alignment — general information

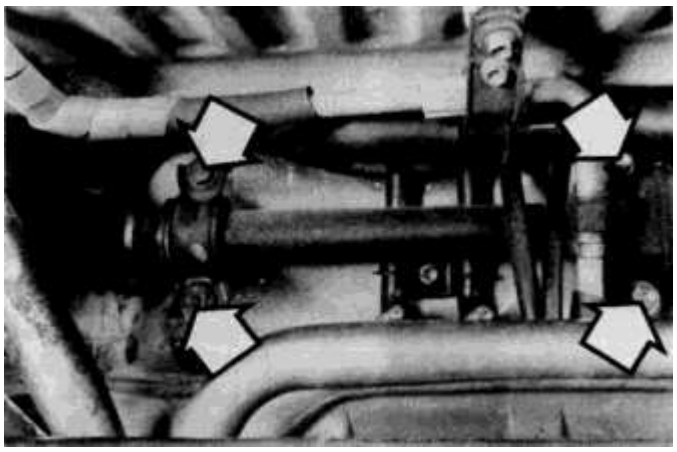
Front wheel alignment refers to the adjustments made to the front suspension and steering components to bring the front wheels into the proper angular relationship with the suspension and the road. Front wheels that are out of proper alignment not only affect steering control, but also increase tire wear.

Rear alignment refers to the angular relationship between the rear wheels, the rear suspension attaching components and the road. Camber and toe-in are the only adjustments required.

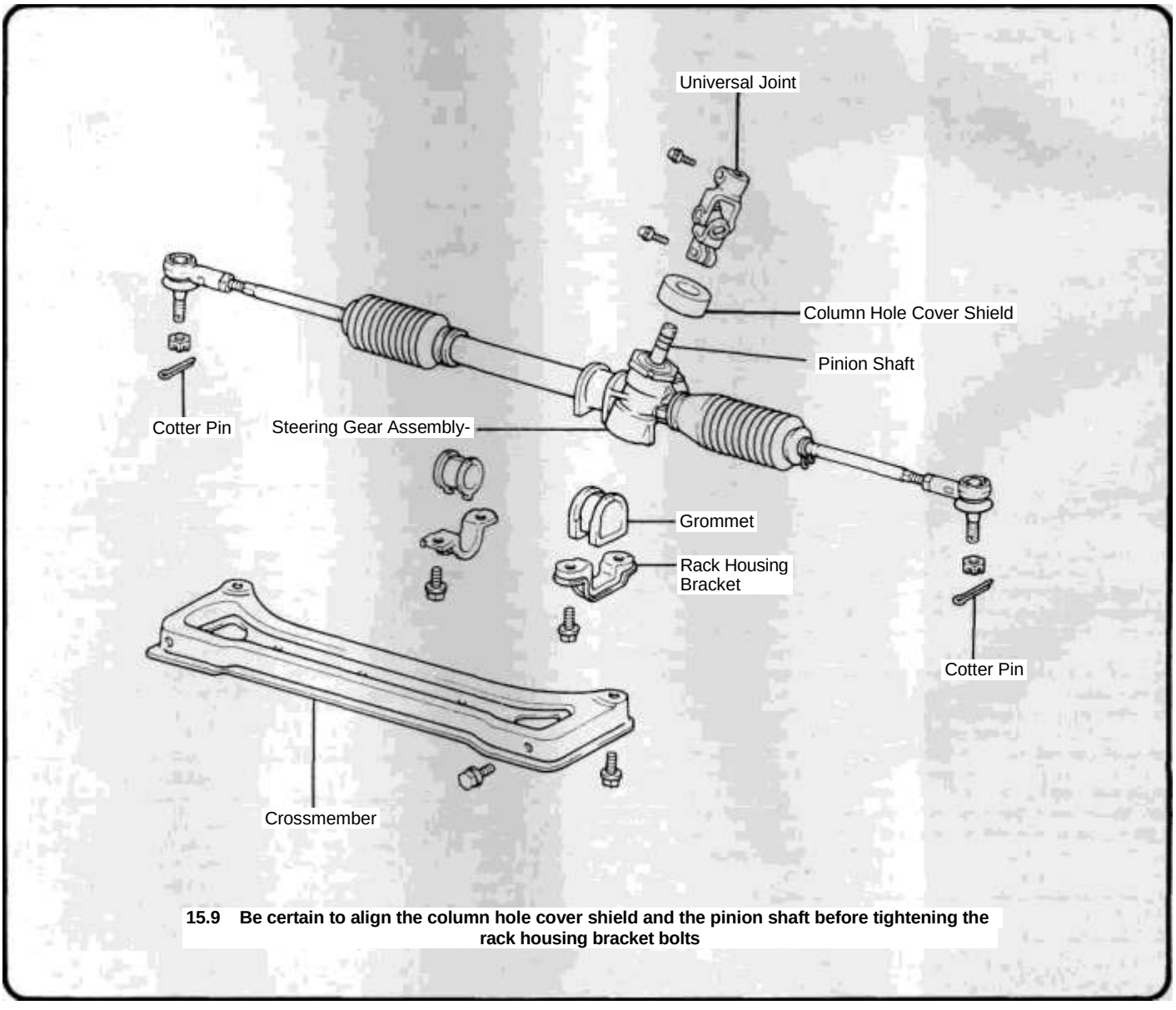
Obtaining the proper wheel alignment is a very exacting process that requires complex and expensive machines to perform the job properly. Therefore, it is advisable to have a properly equipped shop align the wheels immediately after you do any work on the front or rear suspension.

15.4 Paint marks on the steering shaft, joint yoke and pinion shaft to aid reassembly

15.7 Remove the retaining bolts on each side of the crossmember to free it from the body



15.8 Remove the four rack housing bracket bolts (arrows), then remove the housing assembly



15.9 Be certain to align the column hole cover shield and the pinion shaft before tightening the rack housing bracket bolts

17 Wheels and tires — general information

All MR2s are equipped with radial tires. When replacing the tires, make sure that the new ones have the same Tire Performance Criteria (TPC) specification number molded into their sidewalls as the original.

A specific TPC number is assigned to each tire size. This number means that the tire meets Toyota's performance standards for traction, endurance, dimensions, noise, handling, rolling resistance, etc. Tires of the same TPC number will also be the same size, load range and construction as the originals. Other types and/or sizes of tires may affect handling, ride quality, ground clearance, speedometer/odometer calibration and clearance between the tires and the vehicle.

It is recommended that tires be replaced in pairs on the same axle, but if only one tire is being replaced, be sure it is of the same size, structure and tread design as the other.

Wheels must be replaced if they are bent, dented, leak air, have elongated bolt holes, are heavily rusted, out of vertical symmetry or if the lug nuts won't stay tight. Wheel repairs that use welding or peening are not recommended, as this can weaken the metal.

Tire and wheel balance is important in the overall handling, braking and performance of the vehicle . Unbalanced wheels can adversely affect handling and ride characteristics as well as tire life. Whenever a tire is installed on a wheel, the tire and wheel should be balanced by a shop with the proper equipment.

Because the compact spare is designed as a temporary replacement for an out-of-service standard wheel and tire, the compact spare should be used on the vehicle only until the standard wheel and tire can be repaired or replaced. Continuous use of the compact spare at speeds of over 50 mph (80 kph) is not recommended. In addition, the expected tread life of the compact spare is only 3000 miles (4800 kilometers).

Chapter 11 Body

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Specifications

Torque specifications	Nm	Ft-lbs
Seat track-to-body	37	27
Seat adjuster-to-body	37	27
Seat track-to-seat back	13	9
Seat adjuster-to-seat back	37	27
Seat track-to-seat cushion	18	13
Seat adjuster-to-seat cushion	18	13
Seat outer adjuster-to-seat back	37	27

1 General information

The MR2 is of unitized construction, using a floor pan with front and rear frame side rails which support the body components, front and rear suspension systems and other mechanical components.

Certain components are particularly vulnerable to accident damage and can be unbolted and replaced with new ones. Among these parts are the body moldings, bumpers, the hood and trunk lids and all glass.

Only general body maintenance practices and body panel repair procedures within the scope of the average home mechanic are included in this chapter.

2 Body — maintenance

1 The condition of your vehicle's body is very important, because it is on this that the resale value will mainly depend. It is much more difficult to repair a neglected or damaged body than it is to repair mechanical components. The hidden areas of the body, such as the fender wells, the frame and the engine compartment, are equally important, although obviously do not require as frequent attention as the rest of the body.

2 Once a year, or every 12,000 miles, it is a good idea to have the underside of the body and the frame steam cleaned. All traces of dirt and oil will be removed and the underside can then be inspected carefully for rust, damaged brake lines, frayed electrical wiring, damaged cables and other problems. The front suspension components should be greased after completion of this job.

3 At the same time, clean the engine and the engine compartment using either a steam cleaner or a water soluble degreaser.

4 The fender wells should be given particular attention, as undercoating can peel away and stones and dirt thrown up by the tires can cause the paint to chip and flake, allowing rust to set in. If rust is found, clean down to the bare metal and apply an anti-rust paint.

5 The body should be washed once a week (or when dirty). Wet the vehicle thoroughly to soften the dirt, then wash it down with a soft sponge and plenty of clean soapy water. If the surplus dirt is not washed off very carefully, it will in time wear down the paint.

6 Spots of tar or asphalt coating thrown up from the road should be removed with a cloth soaked in solvent.

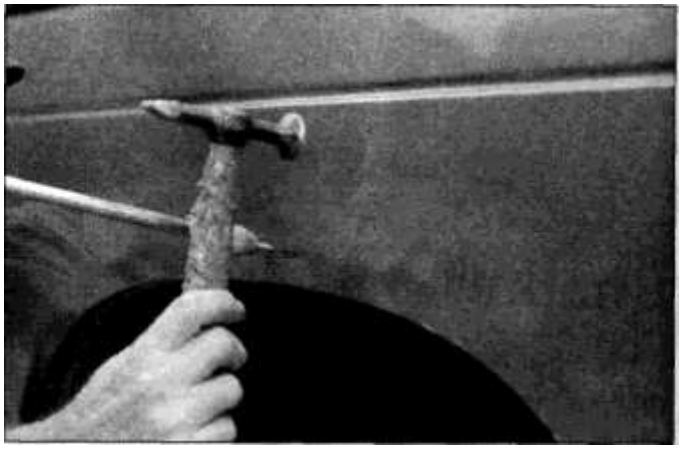
7 Once every six months, give the body and chrome trim a thorough waxing. If a chrome cleaner is used to remove rust from any of the vehicle's plated parts, remember that the cleaner also removes part of the chrome, so use it sparingly.

3 Upholstery and carpets — maintenance

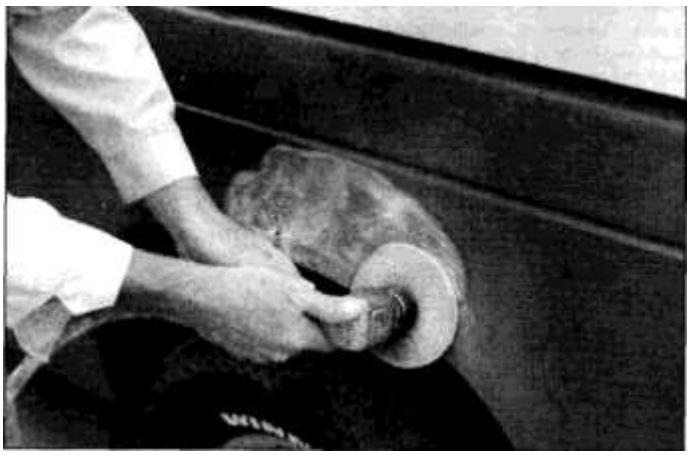
1 Every three months remove the carpets or mats and clean the interior of the vehicle (more frequently if necessary). Vacuum the upholstery and carpets to remove loose dirt and dust.

These photos illustrate a method of repairing simple dents. They are intended to supplement *Body repair - minor damage* in this Chapter and should not be used as the sole instructions for body repair on these vehicles.

1 If you can't access the backside of the body panel to hammer out the dent, pull it out with a slide-hammer-type dent puller. In the deepest portion of the dent or along the crease line, drill or punch hole(s) at least one inch apart...

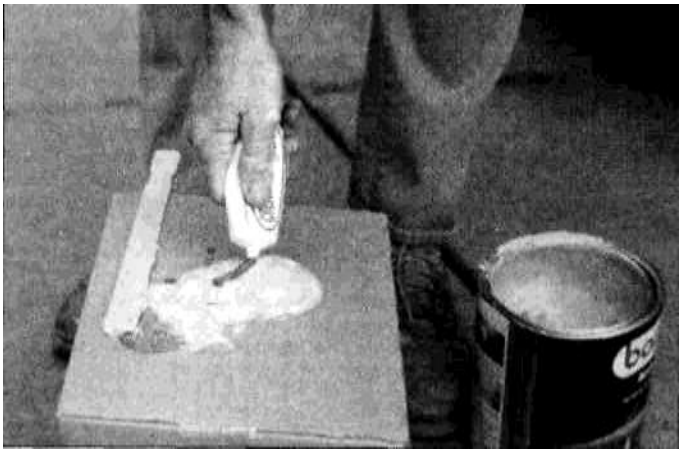


2 ... then screw the slide-hammer into the hole and operate it. Tap with a hammer near the edge of the dent to help 'pop' the metal back to its original shape. When you're finished, the dent area should be close to its original contour and about 1/8-inch below the surface of the surrounding metal

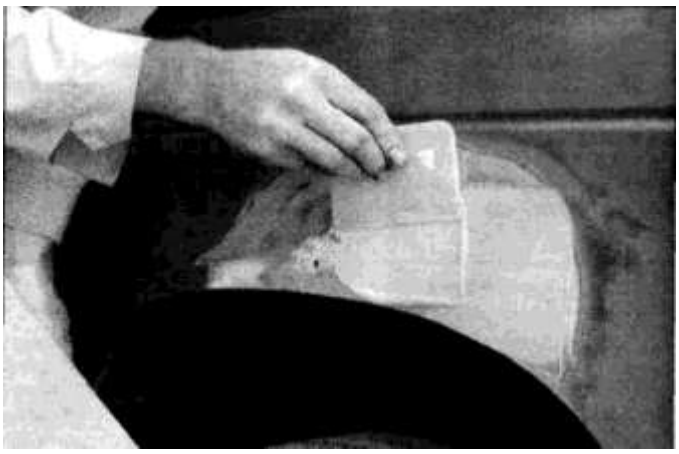


3 Using coarse-grit sandpaper, remove the paint down to the bare metal. Hand sanding works fine, but the disc sander shown here makes the job faster. Use finer (about 320-grit) sandpaper to feather-edge the paint at least One inch around the dent area

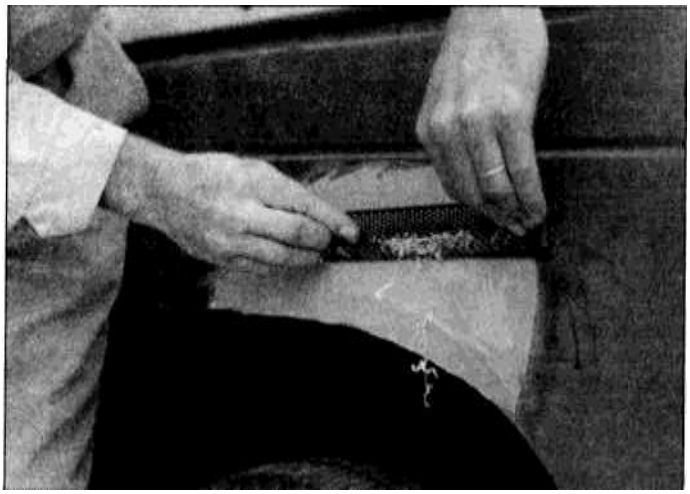
4 When the paint is removed, touch will probably be more helpful than sight for telling if the metal is straight. Hammer down the high spots or raise the low spots as necessary. Clean the repair area with wax/silicone remover



5 Following label instructions, mix up a batch of plastic filler anc hardener. The ratio of filler to hardener is critical, and, if you mix i incorrectly, it will either not cure properly or cure too quickly (you won't have time to file and sand it into shape)

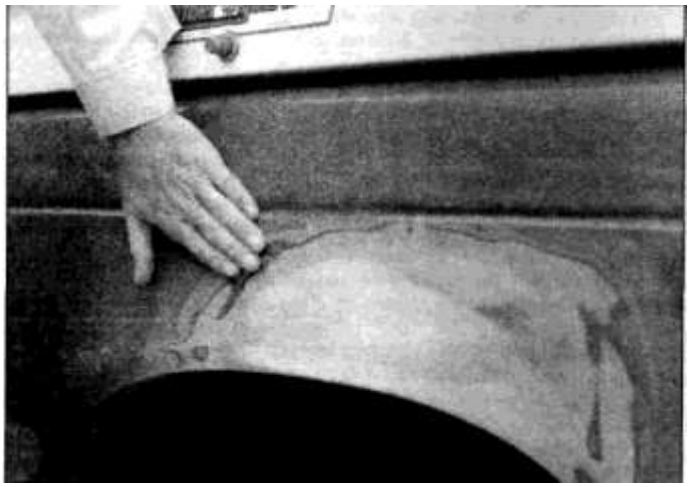


6 Working quickly so the filler doesn't harden, use a plastic applicator to press the body filler firmly into the metal, assuring it bonds completely. Work the filler until it matches the original contour and is slightly above the surrounding metal

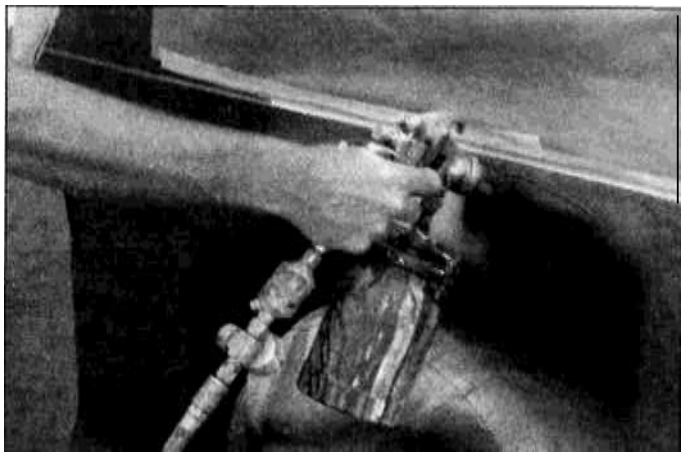


7 Let the filler harden until you can just dent it with your fingernail. Use a body file or Surform tool (shown here) to rough-shape the filler

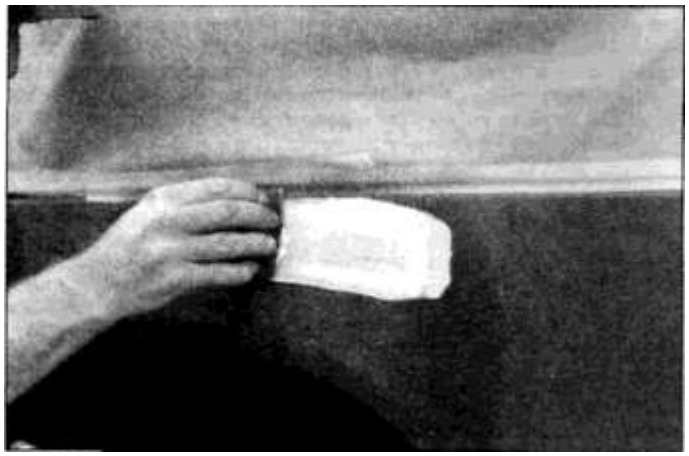
8 Use coarse-grit sandpaper and a sanding board or block to work the filler down until it's smooth and even. Work down to finer grits of sandpaper - always using a board or block - ending up with 360 or 400 grit



9 You shouldn't be able to feel any ridge at the transition from the filler to the bare metal or from the bare metal to the old paint. As soon as the repair is flat and uniform, remove the dust and mask off the adjacent panels or trim pieces



10 Apply several layers of primer to the area. Don't spray the primer on too heavy, so it sags or runs, and make sure each coat is dry before you spray on the next one. A professional-type spray gun is being used here, but aerosol spray primer is available inexpensively from auto parts stores



11 The primer will help reveal imperfections or scratches. Fill these with glazing compound. Follow the label instructions and sand it with 360 or 400-grit sandpaper until it's smooth. Repeat the glazing, sanding and respraying until the primer reveals a perfectly smooth surface

12 Finish sand the primer with very fine sandpaper (400 or 600-grit) to remove the primer overspray. Clean the area with water and allow it to dry. Use a tack rag to remove any dust, then apply the finish coat. Don't attempt to rub out or wax the repair area until the paint has dried completely (at least two weeks)

2 If the upholstery is soiled, apply upholstery cleaner with a damp sponge and wipe it off with a clean, dry cloth.

4 Body repair — minor damage

See photo sequence "Repair of minor scratches"

Repair of minor scratches

1 If the scratch is superficial and does not penetrate to the metal of the body, repair is very simple. Lightly rub the scratched area with a fine rubbing compound to remove loose paint and built up wax. Rinse the area with clean water.

2 Apply touch-up paint to the scratch, using a small brush. Continue to apply thin layers of paint until the surface of the paint in the scratch is level with the surrounding paint. Allow the new paint at least two weeks to harden, then blend it into the surrounding paint by rubbing with a very fine rubbing compound. Finally, apply a coat of wax to the scratch area.

3 If the scratch has penetrated the paint and exposed the metal of the body, causing the metal to rust, a different repair technique is required. Remove all loose rust from the bottom of the scratch with a pocket knife, then apply rust inhibiting paint to prevent the formation of rust in the future. Using a rubber or nylon applicator, coat the scratched area with glaze-type filler. If required, the filler can be mixed with thinner to provide a very thin paste, which is ideal for filling narrow scratches. Before the glaze filler in the scratch hardens, wrap a piece of smooth cotton cloth around the tip of a finger. Dip the cloth in thinner and then quickly wipe it along the surface of the scratch. This will ensure that the surface of the filler is slightly hollow. The scratch can now be painted over as described earlier in this section.

Repair of dents

4 When repairing dents, the first job is to pull the dent out until the affected area is as close as possible to its original shape. There is no point in trying to restore the original shape completely as the metal in the damaged area will have stretched on impact and cannot be restored to its original contours. It is better to bring the level of the dent up to a point which is about 1/8-inch below the level of the surrounding metal. In cases where the dent is very shallow, it is not worth trying to pull it out at all.

5 If the back side of the dent is accessible, it can be hammered out gently from behind using a soft-face hammer. While doing this, hold a block of wood firmly against the opposite side of the metal to absorb the hammer blows and prevent the metal from being stretched.

6 If the dent is in a section of the body which has double layers, or some other factor makes it inaccessible from behind, a different technique is required. Drill several small holes through the metal inside the damaged area, particularly in the deeper sections. Screw long, self tapping screws into the holes just enough for them to get a good grip in the metal. Now the dent can be pulled out by pulling on the protruding heads of the screws with locking pliers.

7 The next stage of repair is the removal of paint from the damaged area and from an inch or so of the surrounding metal. This is easily done with a wire brush or sanding disk in a drill motor, although it can be done just as effectively by hand with sandpaper. To complete the preparation for filling, score the surface of the bare metal with a screwdriver or the tang of a file or drill small holes in the affected area. This will provide a good grip for the filler material. To complete the repair, see the Section on filling and painting.

Repair of rust holes or gashes

8 Remove all paint from the affected area and from an inch or so of the surrounding metal using a sanding disk or wire brush mounted in a drill motor. If these are not available, a few sheets of sandpaper will do the job just as effectively.

9 With the paint removed, you will be able to determine the severity of the corrosion and decide whether to replace the whole panel, if possible, or repair the affected area. New body panels are not as expensive as most people think and it is often quicker to install a new panel than to repair large areas of rust.

10 Remove all trim pieces from the affected area except those which will act as a guide to the original shape of the damaged body, such as headlight shells, etc. Using metal snips or a hacksaw blade, remove all loose metal and any other metal that is badly affected by rust. Hammer the edges of the hole inward to create a slight depression for the filler material.

11 Wire brush the affected area to remove the powdery rust from the surface of the metal. If the back of the rusted area is accessible, treat it with rust inhibiting paint.

12 Before filling is done, block the hole in some way. This can be done with sheet metal riveted or screwed into place, or by stuffing the hole with wire mesh.

13 Once the hole is blocked off, the affected area can be filled and painted. See the following subsection on filling and painting.

Filling and painting

14 Many types of body fillers are available, but generally speaking, body repair kits which contain filler paste and a tube of resin hardener are best for this type of repair work. A wide, flexible plastic or nylon applicator will be necessary for imparting a smooth and contoured finish to the surface of the filler material. Mix up a small amount of filler on a clean piece of wood or cardboard (use the hardener sparingly). Follow the manufacturer's instructions on the package, otherwise the filler will set incorrectly.

15 Using the applicator, apply the filler paste to the prepared area. Draw the applicator across the surface of the filler to achieve the desired contour and to level the filler surface. As soon as a contour that approximates the original one is achieved, stop working the paste. If you continue, the paste will begin to stick to the applicator. Continue to add thin layers of paste at 20-minute intervals until the level of the filler is just above the surrounding metal.

16 Once the filler has hardened, the excess can be removed with a body file. From then on, progressively finer grades of sandpaper should be used, starting with a 180-grit paper and finishing with 600-grit wet-or-dry paper. Always wrap the sandpaper around a flat rubber or wooden block, otherwise the surface of the filler will not be completely flat. During the sanding of the filler surface, the wet-or-dry paper should be periodically rinsed in water. This will ensure that a very smooth finish is produced in the final stage.

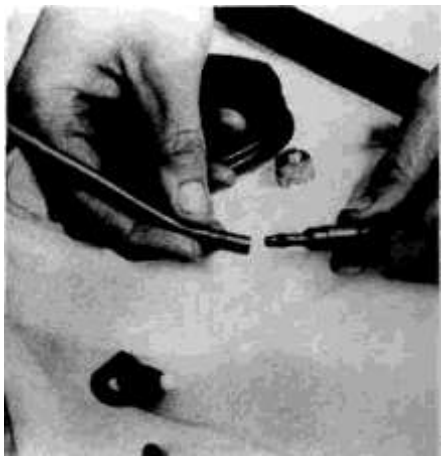
17 At this point, the repair area should be surrounded by a ring of bare metal, which in turn should be encircled by the finely feathered edge of good paint. Rinse the repair area with clean water until all of the dust produced by the sanding operation is gone.

18 Spray the entire area with a light coat of primer. This will reveal any imperfections in the surface of the filler. Repair the imperfections with fresh filler paste or glaze filler and once more smooth the surface with sandpaper. Repeat this spray-and-repair procedure until you are satisfied that the surface of the filler and the feathered edge of the paint are perfect. Rinse the area with clean water and allow it to dry completely.

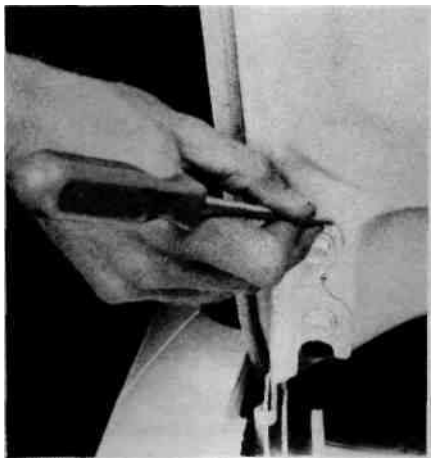
19 The repair area is now ready for painting. Spray painting must be carried out in a warm, dry, windless and dust free atmosphere. These conditions can be created if you have access to a large indoor work area, but if you are forced to work in the open, you will have to pick the day very carefully. If you are working indoors, dousing the floor in the work area with water will help settle the dust which would otherwise be in the air. If the repair area is confined to one body panel, mask off the surrounding panels. This will help minimize the effects of a slight mismatch in paint color. Trim pieces such as chrome strips, door handles, etc., will also need to be masked off or removed. Use masking tape and several thicknesses of newspaper for the masking operations.

20 Before spraying, shake the paint can thoroughly, then spray a test area until the spray painting technique is mastered. Cover the repair area with a thick coat of primer. The thickness should be built up using several thin layers of primer rather than one thick one. Using 600-grit wet-or-dry sandpaper, rub down the surface of the primer until it is very smooth. While doing this, the work area should be thoroughly rinsed with water and the wet-or-dry sandpaper periodically rinsed as wall. Allow the primer to dry before spraying additional coats.

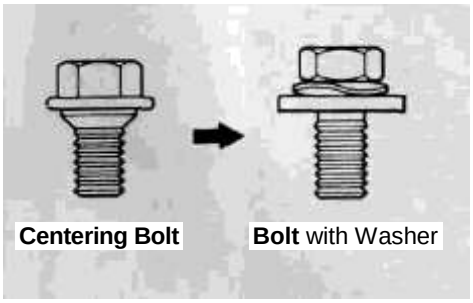
21 Spray on the top coat, again building up the thickness by using several thin layers of paint. Begin spraying in the center of the repair area and then, using a circular motion, work out until the whole repair area and about two inches of the surrounding original paint is covered. Remove all masking material 10 to 15 minutes after spraying on the final coat of paint. Allow the new paint at least two weeks to harden, then use a very fine rubbing compound to blend the edges of the new paint into the existing paint. Finally, apply a coat of wax.



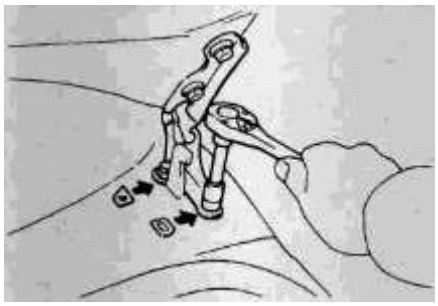
7.1 Pull the windshield washer line apart at the reservoir



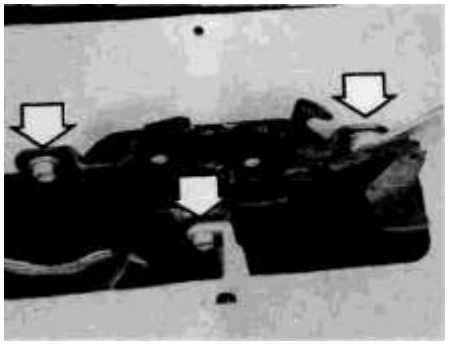
7.2 Placing alignment marks along the compartment lid hinge upper flange will aid in aligning the lid during installation



7.7 Substitute bolts with washers for the centering bolts in the front compartment lid to make possible lid adjustment



7.9 Adjust the rear edge of the lid by increasing or decreasing the number of shims used



8.1 After scribing alignment marks around the latch, remove the three retaining bolts (arrows) and the latch

7.8 To adjust the front edge of the lid up or down, turn the cushions

5 Body repair — major damage

1 Major damage must be repaired by an auto body shop specifically equipped to perform unibody repairs. These shops have available the specialized equipment required to do the job properly.
2 If the damage is extensive, the underbody must be checked for proper alignment or the vehicle's handling characteristics may be adversely affected and other components may wear at an accelerated rate.
3 Due to the fact that all of the major body components (hood, fenders, etc.) are separate and replaceable units, any seriously damaged components should be replaced rather than repaired. Sometimes these components can be found in a wrecking yard that specializes in used vehicle components, often at considerable savings over the cost of new parts.

6 Hinges and locks — maintenance

Once every 3000 miles, or every three months, the door and hood hinges and locks should be given a few drops of light oil or lock lubricant. The door striker plates can be given a thin coat of grease to reduce wear and ensure free movement.

7 Front compartment lid — removal, installation and adjustment

Refer to illustrations 7.1, 7.2, 7.7, 7.8 and 7.9

Removal

1 Disconnect the windshield washer line at the washer reservoir **(see illustration).**
2 Scribe or paint alignment marks along the edges of the front compartment lid hinge upper flange **(see illustration)** and remove the hinge-to-lid mounting bolts.
3 Remove the front compartment lid.

Installation

4 Place the front compartment lid in position.
5 Align the marks made at removal, replace the upper hinge-to-lid mounting bolts and tighten them.
6 Reconnect the windshield washer line.

Adjustment

1 Adjust the lid in the forward/rearward and left/right directions by loosening the lid side hinge bolts and shifting the lid in the desired direction. **Note:** *Since centering bolts are used as the lid hinge original equipment retaining bolts, the lid can not be adjusted with them in place. Substitute bolts with washers for the centering bolts to alter the lid position* **(see illustration).**
8 Adjust the front edge of the lid up or down by turning the cushions **(see illustration).**
9 Adjust the rear edge of the lid up or down by increasing or decreasing the number of shims on the hinge-to-body mounting bolts **(see illustration).**

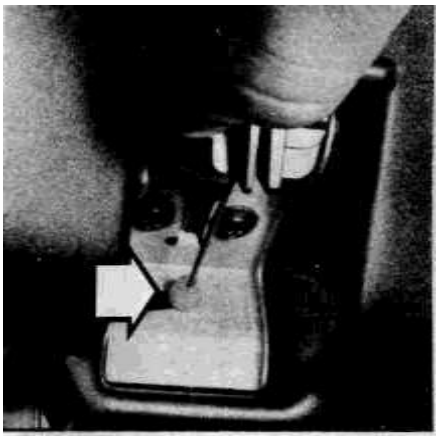
8 Latch and cable — removal, installation and adjustment

Refer to illustrations 8.1, 8.5, 8.6a and 8.6b
Note: *Latches do not need to be removed in any of these procedures to replace the cables.*

Front compartment

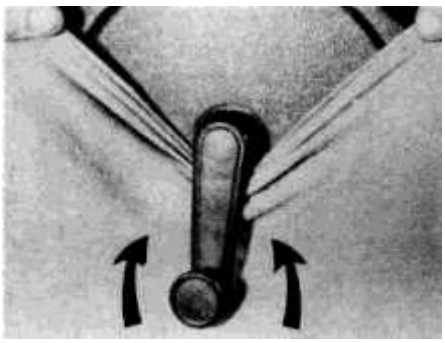
1 Scribe or paint marks around the latch, then remove the three latch retaining bolts and the latch **(see illustration).**

8.5 Pull the cable loose from the two plastic clips



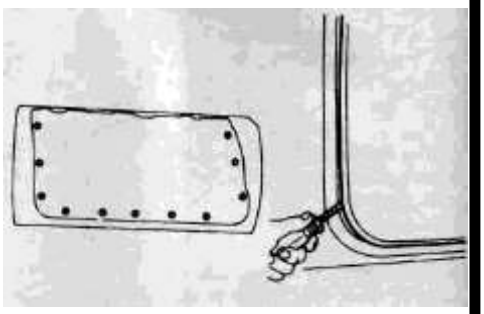
8.6a Slide the cable casing free from the carrier (arrow)

8.6b Using the slack in the cable, slip the cable end out of the lid release lever



9.1 Pull a cloth back and forth under the regulator handle to remove the snap ring

9.3 Pry out the plastic covers and remove the three trim panel retaining screws



9.4 Tape the tip of a screwdriver, insert it between the retainers and the panel, and pop the panel loose

2 Pry the latch cable free from the latch assembly.
3 To replace the cable, loosen the front wheel lug nuts on the driver's side, raise the vehicle and support it on jackstands. Remove the lug nuts and the wheel.
4 Remove the screws and take out the inner fender panel.
5 Pull the cable free from the plastic clips **(see illustration).**
6 Disconnect the the cable casing from the dash panel carrier **(see illustration),** then the cable end from the lever **(see illustration).**
7 Pull both ends of the cable into the wheel well to remove it.
8 Installation of a new cable is the reverse of the removal procedure.

Engine compartment

9 Begin the procedure by following steps 1 and 2 above.
10 Remove the battery (refer to Chapter 1).
11 Free the cable from the plastic clip.
1 2 Remove the latch release lever bezel.
1 3 Disconnect the cable casing from the firewall.
14 Disconnect the cable from the latch release lever.
15 Feed the cable through the firewall into the engine compartment and remove it.
16 Installation is the reverse of the removal procedure.

Rear luggage compartment

17 Remove the compartment front and rear trim panel by undoing the plastic pop fasteners.
18 Using a screwdriver, separate the lock cylinder rod from the lock cylinder.
19 Remove the two retaining bolts to remove the latch.
20 Separate the cable from the latch.
21 Work the cable into the engine compartment.
22 Remove the pop fasteners from the carpet pads, located behind the seats and pull the pads up to reveal the cable, then pull the cable into cab.
23 Disconnect the cable from the release latch.
24 Replace the cable by reversing the removal procedure.

9 Door trim panel — removal and installation

Refer to illustrations 9.1, 9.3 and 9.4

Removal

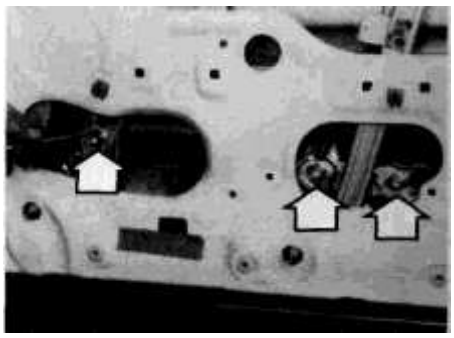
1 Feed a piece of cloth in behind the window crank and slide it back and forth to remove the ring snap ring from behind the handle **(see illustration).**
2 Remove the screw from the inside door handle bezel and take out the bezel.
3 Pry out the plastic screw covers and remove the three retaining screws from the trim panel **(see illustration).**
4 Tape the tip of a screwdriver, then insert it between the the retainers and the door trim to pry the panel loose **(see illustration). Note:** *On vehicles equipped with power windows, pry the bottom of portion of the panel free first and reach in to disconnect the the power window connector.*

Installation

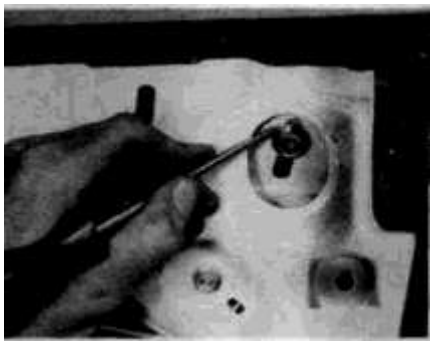
5 Place the door trim panel in position against the door and push on it around the edges until all the pop fasteners are seated into the door.
6 The rest of the installation is the reverse of the removal procedure.

10 Door window glass — removal, installation and adjustment

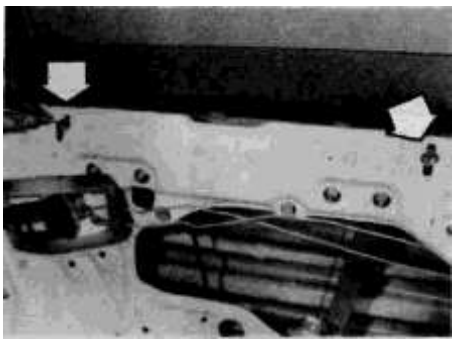
Refer to illustrations 10.2, 10.3 and 10.4 **1** Remove the door trim panel (Section 9).



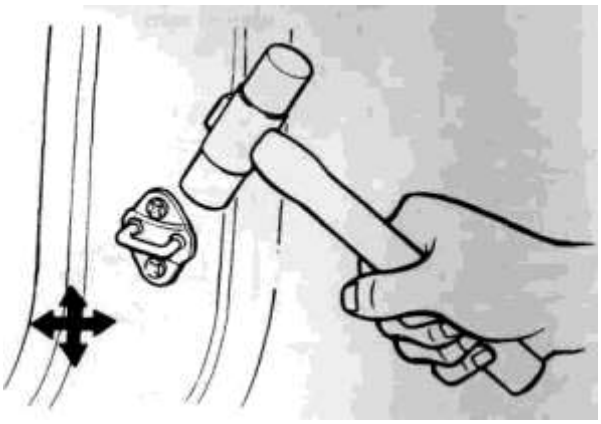
10.2 Visible through the door access opening are the two window-to-regulator nuts and one bolt (arrows). Scribe or paint alignment marks and remove them



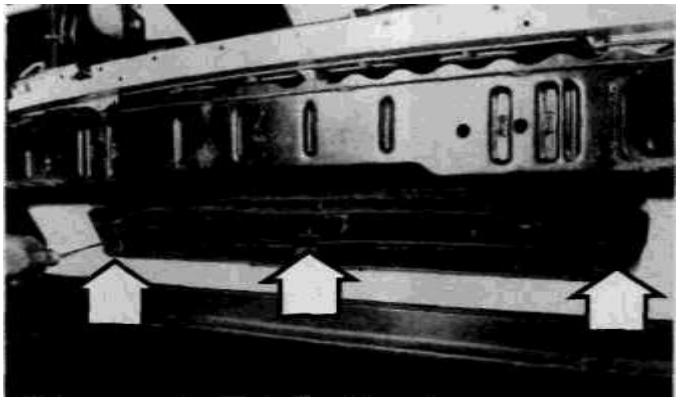
10.3 The guide bolts are located on either end of the door. Mark them for proper alignment during installation, then remove them



10.4 Mark the two upper window stop retaining bolts (arrows) and remove them



11.1 Adjust the door latch striker by loosening the retaining bolts and tapping the striker in the desired direction



14.6 Take out the three grille retaining screws (arrows) and remove the grille

2 Scribe or paint marks on the two window-to-regulator nuts and the single bolt and remove them **(see illustration).**
3 Scribe or paint marks on the upper window guide bolts and remove them **(see illustration).**
4 Repeat the marks around the two upper window stops **(see illustration)** and remove them.
5 Carefully work the window out of the door.
6 Installation is the reverse of the removal procedure. **Note:** *During installation make certain the front window guide is inserted into front run channel of the regulator.*

11 Door latch striker — adjustment

Refer to illustration 11.1

1 The door lock striker position can be adjusted by loosening the retaining bolts then, using a soft faced hammer, tapping the striker to adjust it **(see illustration).**
2 When the striker is correctly adjusted the door should close securely and align with the adjacent panels.

12 Door latch — removal and installation

1 Remove the door panel (see Section 9).
2 Remove window glass (refer to Section 10).
3 Reach in through the door access opening and disconnect the four lock rods from the latch.
4 Remove the three latch retaining screws.
5 Pull the latch out through the door access opening.
6 Reverse the procedure for installation.

13 Door lock cylinder — removal and installation

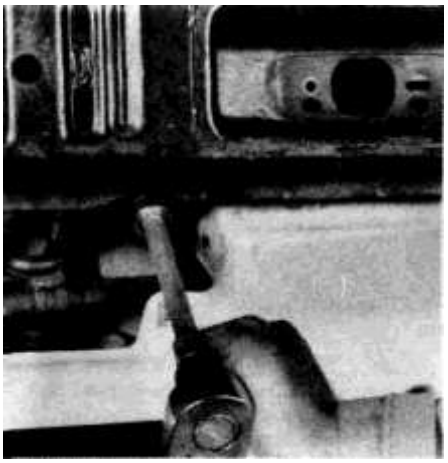
1 Remove the door panel (Section 9).
2 Remove the window glass (Section 10).
3 Reaching in through the door access opening, disconnect the lock rods from the lock.
4 Remove the fasteners holding the door handle from inside the access opening (on vehicles equipped with electric locks, disconnect the connectors at this time), then remove the handle and lock cylinder.
5 Reverse the steps to replace the handle and door lock cylinder assembly.

14 Front bumper — removal and installation

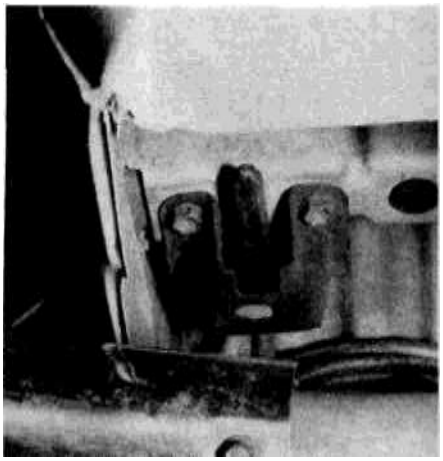
Refer to illustrations 14.6, 14.7a and 14.7b

1 Raise the headlights by turning them on, then disconnect the negative battery cable.
2 Remove the headlight (see Chapter 12).
3 Remove the two retaining screws on each parking light/turn signal, disconnect the connector and take out the light.
4 Take out the nine screws from the bottom bumper cover and the 16 nuts along the top of the cover.
5 Remove the two trim pieces on top of either end of the cover.
6 Remove the three screws holding the lower grille and remove the grille **(see illustration).**

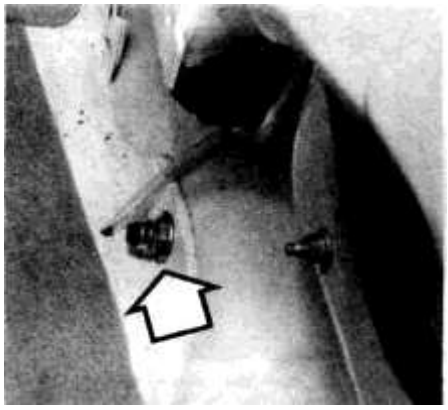
14.7a Remove the two upper bumper bar retaining bolts, one on each end . . .



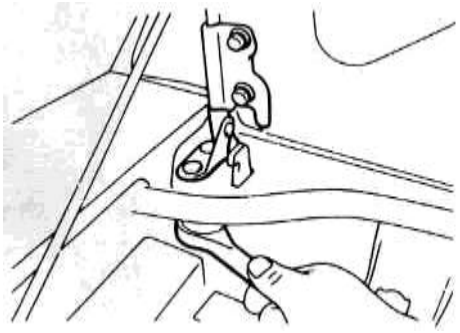
14.7b . . . and the two lower bolts on each end



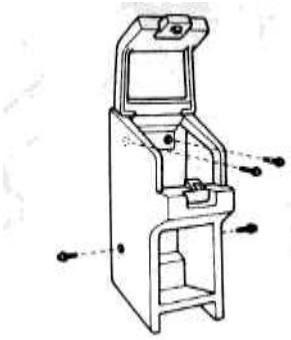
15.1 Remove the lower bumper support bolts



15.2 The upper support nuts (arrow) are located inside the rear luggage compartment



16.5 Loosen the side hinge bolts and move the lid in the desired direction



17.2a Remove the four retaining screws and lift the rear console box out

7 Remove the four bolts holding the bumper bar to the body and remove the bumper bar **(see illustrations).**

15 Rear bumper — removal and installation

Refer to illustrations 15.1 and 15.2

1 Remove the two lower support bolts **(see illustration).**
2 Remove the two upper support nuts, located in the rear luggage compartment **(see illustration)** and remove the bumper.
3 To remove the bumper cover, take off the top row of nuts and the bottom row of bolts.
4 Installation is the reverse of the removal procedure.

16 Engine compartment lid — removal, installation and adjustment

Refer to illustration 16.5

Removal

1 Scribe or paint alignment marks along the edges of the engine compartment lid hinge upper flange (refer to Section 7) and remove the hinge-to-lid mounting bolts.
2 Remove the engine compartment lid.

Installation

3 Place the engine compartment lid in position.
4 Align the marks made earlier, replace the upper hinge-to-lid mounting bolts and tighten them.

Adjustment

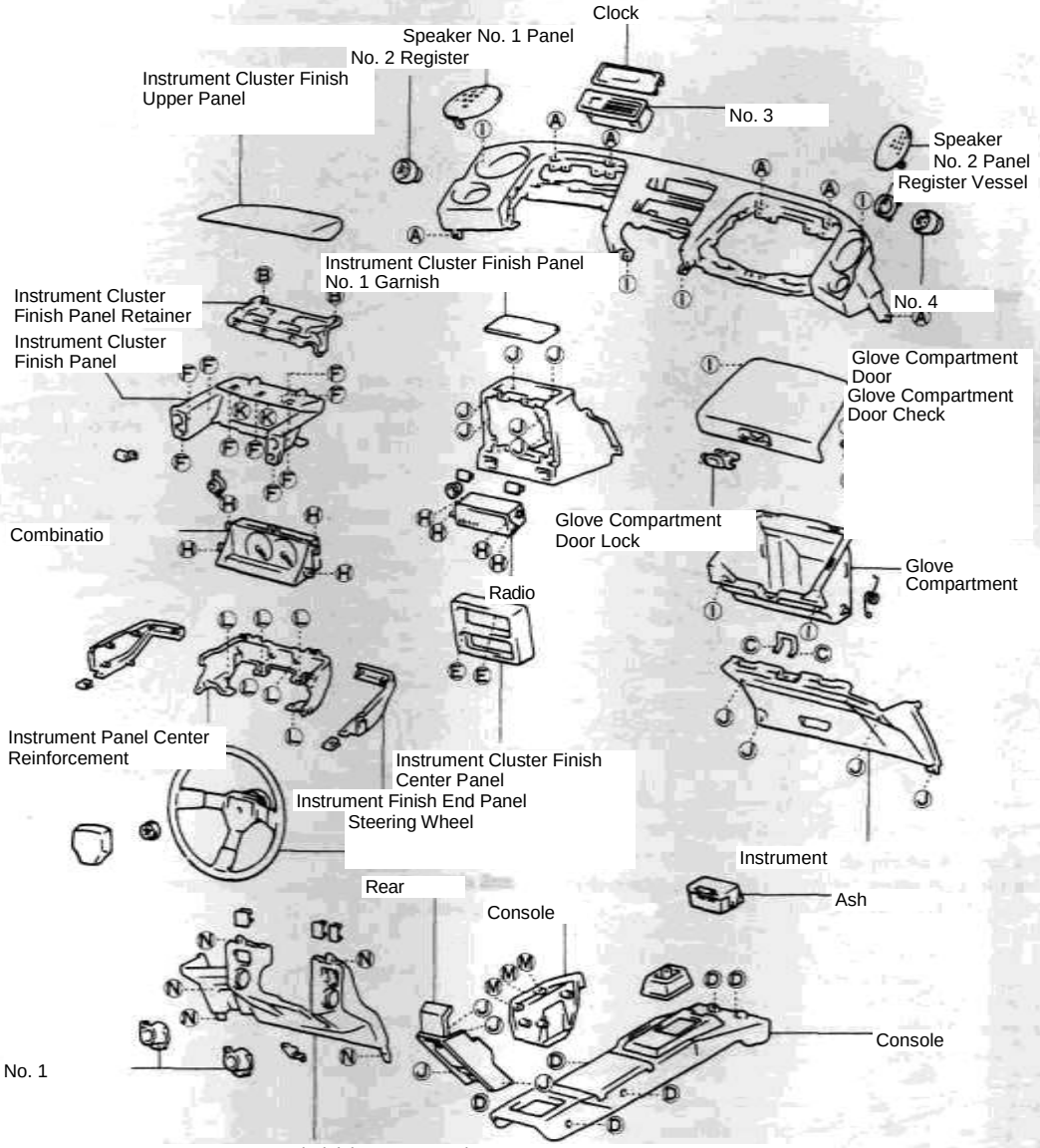
5 Adjust the lid in the forward/rearward and left/right directions by loosening the lid side hinge bolts and shifting the lid in the desired direction **(see illustration).**
6 Adjust the rear edge of the lid up or down by turning the cushions (see Section 7).
7 Adjust the front edge of the lid up or down by increasing or decreasing the number of shims on the hinge-to-body mounting bolts (see Section 7).

17 Console, glove compartment and instrument panel — removal and installation

Refer to illustrations 17.2a, 17.2b, 17.2c, 17.3, 17.5, 17.6, 17.9, 17.11, 17.13, 17.15 and 17.16

Console box removal

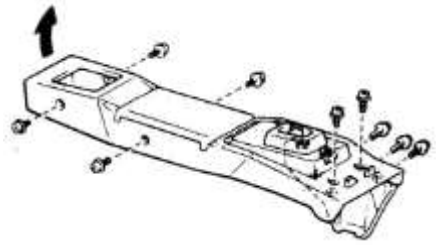
1 Disconnect the negative battery terminal.
2 Remove the rear console box by removing four screws **(see illustration). Note:** *Use the accompanying exploded view and code key **(see illustrations)** to determine proper fastener size during the removal and installation procedures.*



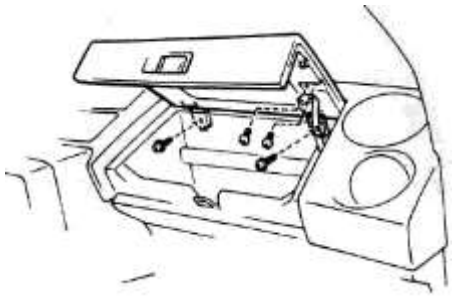
17.2b Instrument panel components and fastener codes

Code	Shape	Code	Shape	Code	Shape
A	ϕ 6 L=16	F	ϕ 5 L=12	K	ϕ 5.22 L=20
B	ϕ 6	G	ϕ 5 L=8	L	ϕ 6 L=16
C	ϕ 5.22 L=12	H	ϕ 5 L=18	M	ϕ 6 L=14
D	ϕ 5.22 L=14	I	ϕ 5.22 L=14	N	ϕ 5.22 L=16
E	ϕ 5.22 L=12	J	ϕ 5.22 L=16	—	—

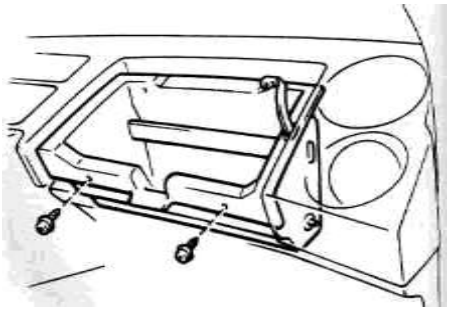
17.2c



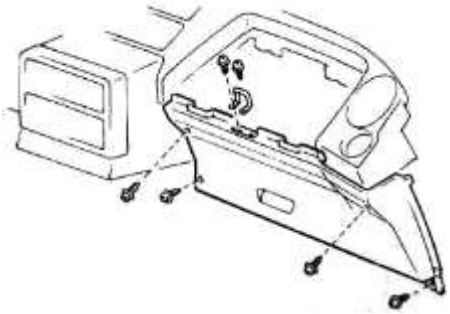
17.3 Take out the retaining screws, lift up the back of the console (arrow) and pull the console up and away



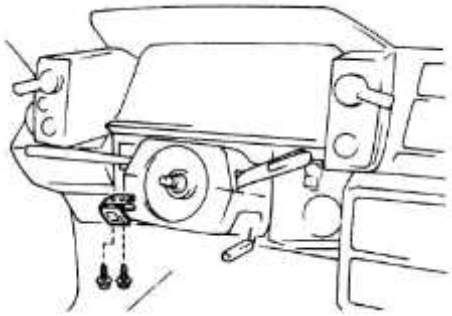
17.5 Remove the two door arm retaining screws, the two door check retaining screws and the door



17.6 Remove the glove compartment retaining screws and lift out the compartment

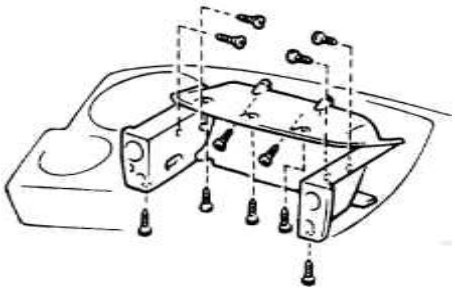


17.9 Remove the four retaining screws to take off the lower dash panel

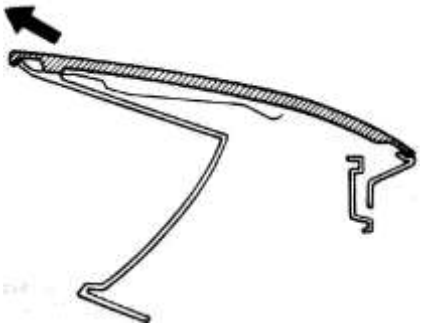


17.11 Remove the front luggage compartment release lever by taking out the two retaining screws

17.13 Take out the two retaining screws and pull out the lower part of the panel

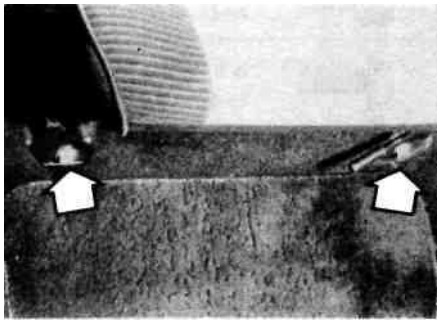


17.15 Retaining screw locations for the instrument cluster upper panel

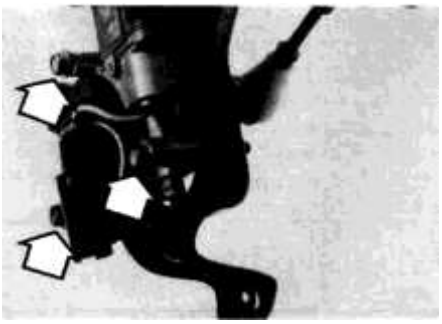


17.16 Pull up at a slight angle to remove the panel

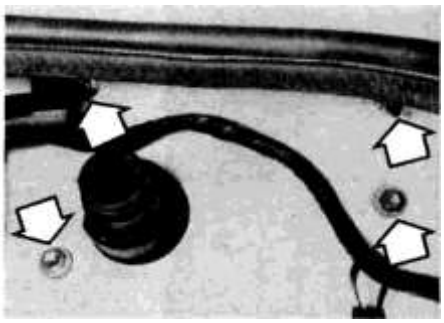
18.2 Move the seat all the way forward to remove the two rear bolts (arrows)



18.4 Push back the seat to reveal the front bolts (arrows)



19.4 Remove the three motor retaining bolts (arrows) to free the assembly frame



19.5 Remove the two upper nuts and the two lower bolts (arrows) from inside the front luggage compartment

3 Take out the ashtray. Remove the nine screws, and with the back of the console raised, pull the console free **(see illustration).**

Glove compartment and dash panel removal

4 Take out the two compartment door arm retaining screws.
5 Remove the two door check retaining screws and the door **(see illustration).**
6 Remove the glove compartment **(see illustration).**
7 Remove the screw from the front of the scuff plate.
8 Take out the cowl side trim board.
9 Remove the four screws and take out the dash panel **(see illustration).**

Instrument panel removal

10 To remove the instrument panel lower finish panel, remove the screw from the front of the scuff plate.
11 Remove the cowl side trim board, then remove the two screws from the front luggage compartment release lever and remove it **(see illustration).**
12 Take out the five retaining screws, lower the panel, disconnect the connectors from the mirror control switch and remove the panel.
13 To remove the instrument center panel, take out the two retaining screws **(see illustration).**
14 Pull out the lower side of the finish panel first to remove the panel.
1 5 To remove the instrument cluster upper finish panel, take out the eleven screws **(see illustration).**
16 Remove the panel by pulling in a diagonally upward direction **(see illustration).**

Installation

17 To install the components, reverse the removal sequence.

18 Seats — removal and installation

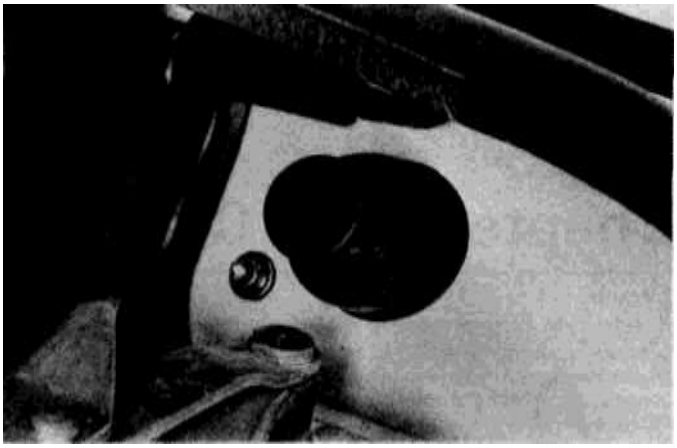
Refer to illustrations 18.2 and 18.4

1 Slide the seat all the way forward.
2 Remove the two rear mounting bolts **(see illustration).**
3 Slide the seat all the way to the rear.
4 Remove the two front mounting bolts **(see illustration).**
5 Lift out the seat.
6 Installation is the reverse of the removal procedure.

19 Headlight door assembly — removal, installation and adjustment

Refer to illustrations 19.4 and 19.5

1 Raise the headlights then disconnect the negative battery cable.
2 Remove the headlight bezel (refer to Chapter 12).
3 Disconnect the headlight motor connector.
4 Remove the three headlight motor retaining bolts from the assembly frame **(see illustration)** and the single bracket-to-body bolt.
5 Take out the two bolts and the two nuts on the back of the headlight door assembly, inside the front luggage compartment **(see illustration).**
6 Carefully remove the assembly.
7 Installation is the reverse of the removal procedure.



20.1 Turn the manually operated crank clockwise to raise the headlight door

20 Headlight door — emergency (manual) operation

Refer to illustration 20.1

In the event that the headlight door should fail to open when the headlights are turned on, a manually operated crank assembly can be used to raise the door **(see illustration).**

21 Windshield and stationary glass — replacement

The windshield and stationary window glass on all models is sealed in place with a special butyl compound. Removal of the existing sealant requires the use of an electric knife specially made for the operation and glass replacement is a complex operation.

In view of this, it is not recommended that stationary glass removal be attempted by the home mechanic. If replacement is necessary due to breakage or leakage, the work should be referred to your dealer or a qualified glass or body shop.

22 Weatherstripping — maintenance and replacement

1 The weatherstripping should be kept clean and free of contaminants such as gasoline or oil. Spray the weatherstripping periodically with silicone lubricant to reduce abrasion, wear and cracking.
2 The weatherstripping is retained to the doors by adhesive above the vehicle beltline and by clips below it.
3 To remove the weatherstripping, release the plastic clip at the bottom of the door. Work your way around the circumference of the door and carefully pull the weatherstripping free.
4 Clean the channel of any residual adhesive or weatherstripping which would interfere with the installation of the new weatherstripping.
5 Apply a thin coat of a suitable adhesive to the upper portion of the door and install the new weatherstripping, making sure to push it fully into the channel, and secure the clips.

Chapter 12 Chassis electrical system

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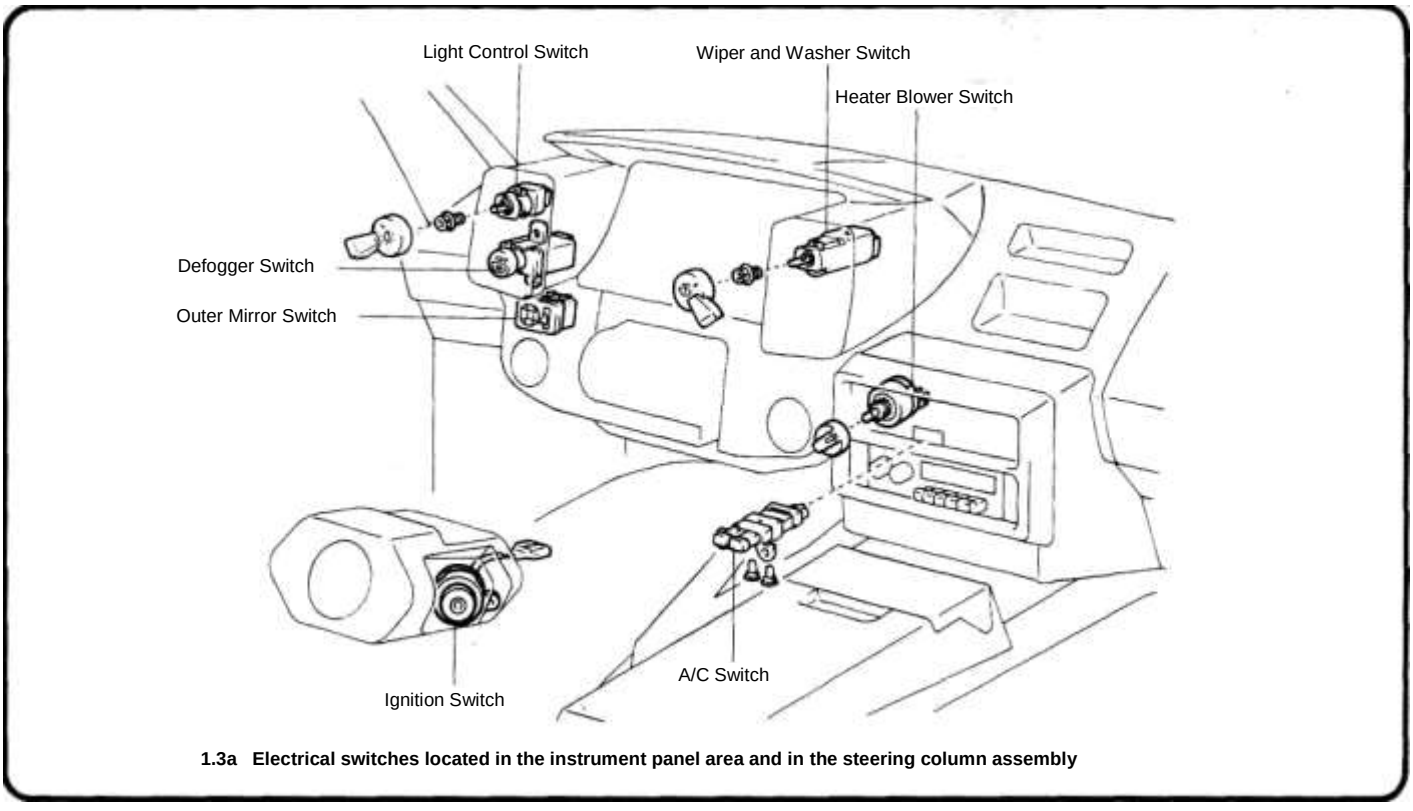
1 General information

Refer to illustrations 1.3a, 1.3b and 1.3c

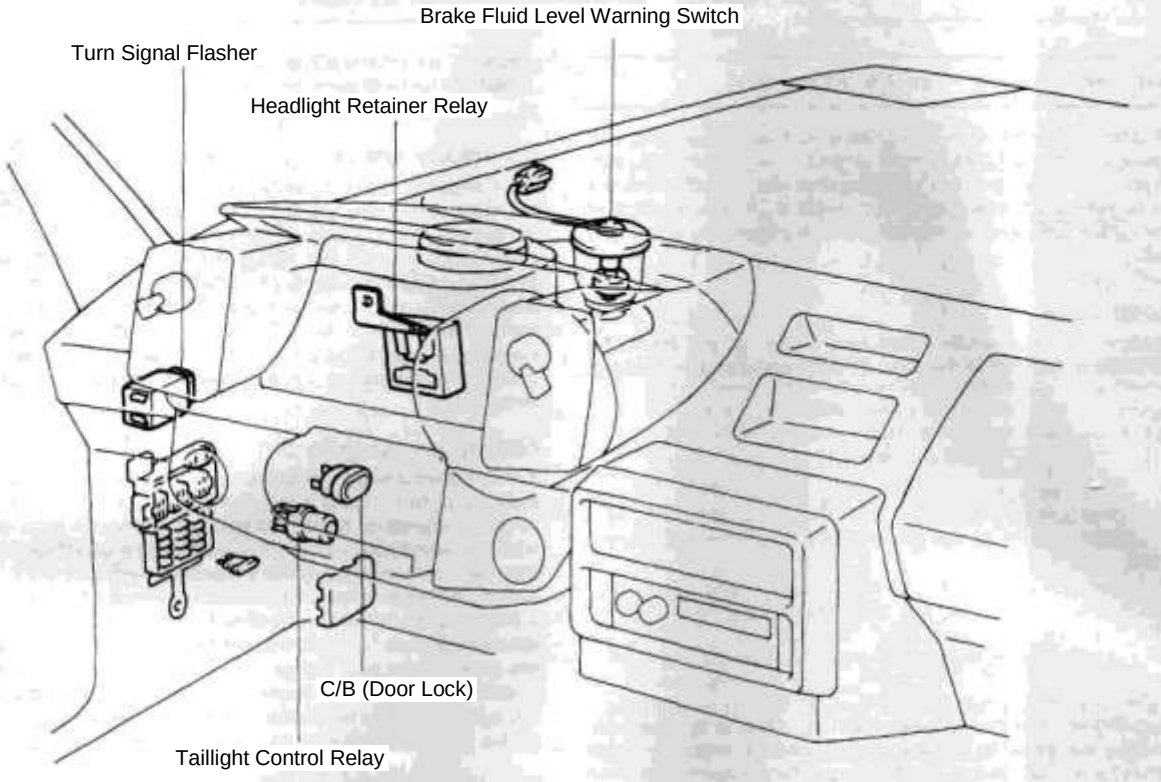
Warning: *To prevent electrical shorts, fires and personal injury, always disconnect the cable from the negative terminal of the battery before checking, repairing or replacing electrical system components.*

The chassis electrical system of this vehicle is a 12-volt, negative ground type. Power for the lights and all electrical accessories is supplied by a lead/acid-type battery which is charged by the alternator.

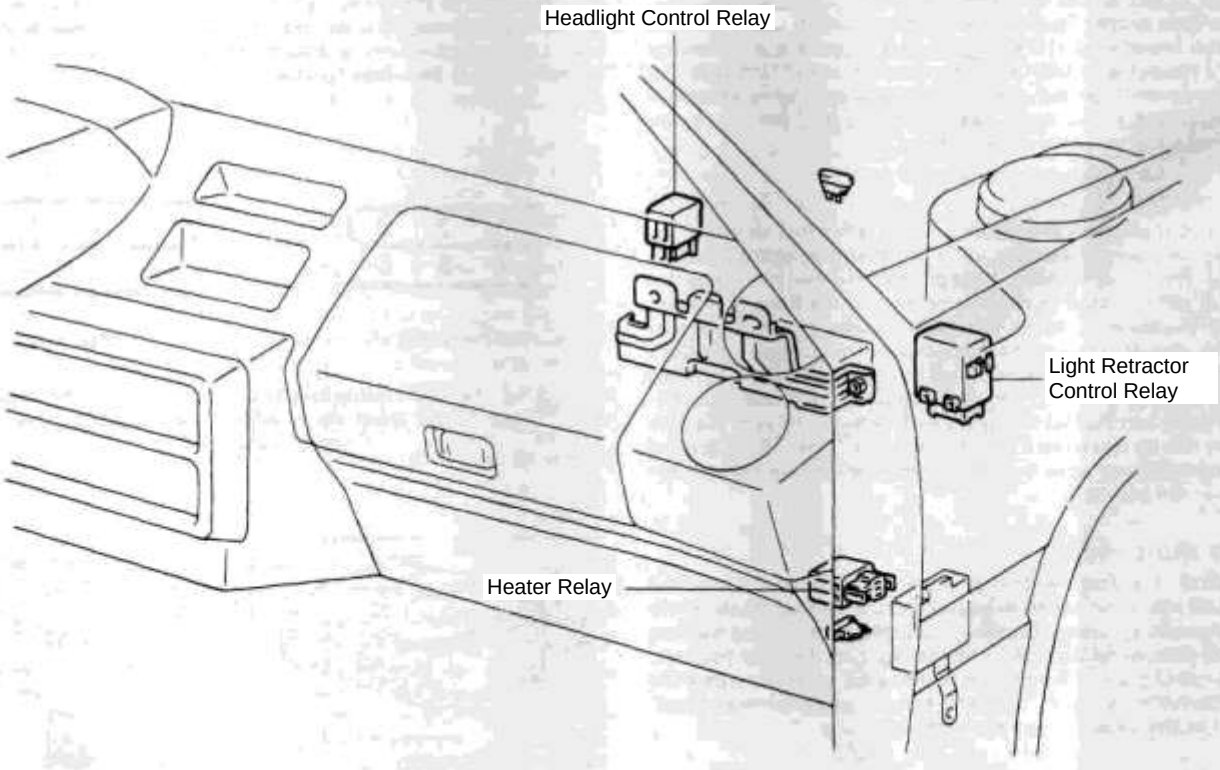
This chapter covers repair and service procedures for various chassis (non-engine related) electrical components. These devices are located throughout the vehicle **(see illustrations).** For further information on the battery, alternator, distributor and starter motor, refer to Chapter 5.



1.3a Electrical switches located in the instrument panel area and in the steering column assembly



1.3b Electrical switches, flashers and relays located in the area of the instrument panel



1.3c Relays located adjacent to the heater, inside the right dashboard area

2 Electrical troubleshooting — general information

A typical electrical circuit consists of an electrical component, any switches, relays, motors, fuses, fusible links or circuit breakers, etc. related to that component and the wiring and connectors that link the component to both the battery and the chassis. To help you pinpoint an electrical circuit problem, wiring diagrams are included at the end of this book.

Wiring color code

When referring to the wiring diagrams, refer to the following alphabetical code to determine the color of the wires you are checking:

B Black
BR Brown
G Green
GR Gray
L Light blue
LG Light green
O Orange
P Pink
R Red
V Violet
W White
Y Yellow

Before tackling any troublesome electrical circuit, first study the appropriate wiring diagrams to get a complete understanding of what makes up that individual circuit. Trouble spots, for instance, can often be isolated by noting if other components related to that circuit are operating properly. If several components or circuits fail at one time, chances are the problem is in a fuse or ground connection because several circuits are often routed through the same fuse and ground connections.

Electrical problems usually stem from simple causes such as loose or corroded connectors, a blown fuse, a melted fusible link or a bad relay. Visually inspect the condition of all fuses, wires and connectors in a problem circuit before troubleshooting it.

The basic tools needed for electrical troubleshooting include a circuit tester, a high impedance (10 K-ohm) digital voltmeter, a continuity tester and a jumper wire with an inline circuit breaker for bypassing electrical components. Before attempting to locate or define a problem with electrical test instruments, use the wiring diagrams to decide where to make the necessary connections.

Voltage checks

Perform a voltage check first when a circuit is not functioning properly. Connect one lead of a circuit tester to either the negative battery terminal or a known good ground. Connect the other lead to a connector in the circuit being tested, preferably nearest to the battery or fuse. If the bulb of the tester lights up, voltage is present, which means that the part of the circuit between the connector and the battery is problem free. Continue checking the rest of the circuit in the same fashion. When you reach a point at which no voltage is present, the problem lies between that point and the last test point with voltage. Most of the time the problem can be traced to a loose connection. **Note:** *Keep in mind that some circuits receive voltage only when the ignition key is in the accessory or run position.*

Finding a short circuit

One method of finding shorts in a circuit is to remove the fuse and connect a test light or voltmeter in its place to the fuse terminals. There should be no voltage present in the circuit. Move the wiring harness from side-to-side while watching the test light. If the bulb goes on, there is a short to ground somewhere in that area, probably where the insulation has rubbed through. The same test can be performed on each component in the circuit, even a switch.

Ground check

Perform a ground test to check whether a component is properly grounded. Disconnect the battery and connect one lead of a self-powered test light, known as a *continuity tester,* to a known good ground. Connect the other lead to the wire or ground connection being tested. If the bulb goes on, the ground is good. If the bulb does not go on, the ground is not good.

Continuity check

A continuity check determines if there are any breaks in a circuit — if it is conducting electricity properly. With the circuit off (no power in the circuit), a self-powered continuity tester can be used to check the circuit. Connect the test leads to both ends of the circuit (or to the power end and a good ground), and if the test light comes on the circuit is passing current properly. If the light doesn't come on, there is a break somewhere in the circuit. The same procedure can be used to test a switch, by connecting the continuity tester to the power in and power out sides of the switch. With the switch turned on, the test light should come on.

Finding an open circuit

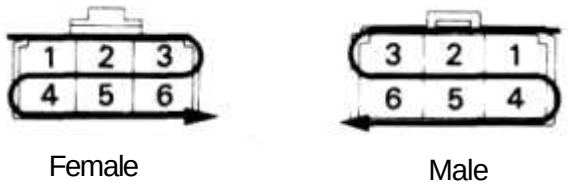
When diagnosing for possible open circuits it is often difficult to locate them by sight because Oxidation or terminal misalignment are hidden by the connectors. Merely wiggling a connector on a sensor or in the wiring harness may correct the open circuit condition. Remember this if an open circuit is indicated when troubleshooting a circuit. Intermittent problems may also be caused by oxidized or loose connections.

Electrical troubleshooting is simple if you keep in mind that all electrical circuits are basically electricity running from the battery, through the wires, switches, relays, fuses and fusible links to each electrical component (light bulb, motor, etc.) and back to ground, from which it is passed back to the battery. Any electrical problem is an interruption in the flow of electricity to and from the battery.

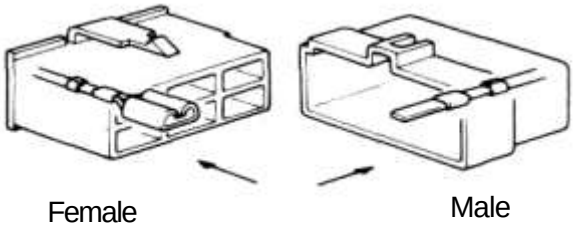
3 Connectors — general information

Refer to illustrations 3.1a, 3.1b, 3.2a and 3.2b

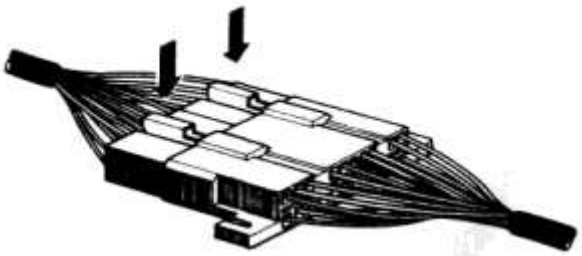
When unplugging the two halves of an electrical connector, pull on the connectors themselves, not the wires. Once they're unplugged, note that the pins of the female connector are numbered in order from the upper left to the lower right and the pins of the male connector are numbered from the upper right to the lower left **(see illustration).** Male connectors are easily distinguished from females by the shape of their internal pins **(see illustration).**



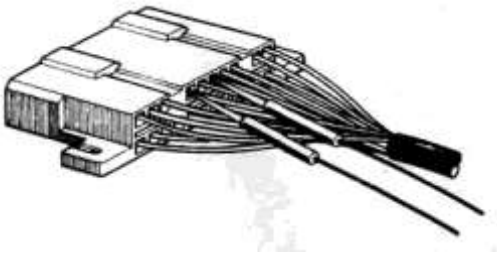
3.1a Female connectors are numbered from the upper left to the lower right, while male connectors are just the opposite



3.1b When a connector is unplugged, the easiest way to distinguish a male from a female half is to look at the terminal pins, which are shaped differently



3.2a To separate the two halves of a connector, release the lock levers (arrows) by pushing down on them and pull the connectors apart



3.2b When checking the continuity or voltage with a circuit tester, inserting the test probe into the receptacle may open the fitting to the connector and cause a poor contact — instead, insert the test probe from the wire harness side

Checking bulkhead type connectors

To unplug bulkhead type connectors, push the lock levers and pull out **(see illustration).** When checking continuity or voltage with a circuit tester, insertion of the test probe into the receptacle may open the fitting to the connector and result in poor contact. Instead, insert the test probe from the wire harness side of the connector **(see illustration).**

4 Fuses — general information

The electrical circuits of this vehicle are protected by a combination of fuses, fusible links and circuit breakers. The three main fuse panels are located in the right rear corner of the front luggage compartment, the left front corner of the engine compartment and above the left side kick panel beneath the left end of the dashboard.

Each fuse protects one or more circuits. The protected circuit is identified on the face of the fuse panel cover above each fuse. The fuse block is fitted with miniaturized fuses because their compact dimensions and convenient blade-type terminal design allow fingertip removal and installation.

If an electrical component fails, always check the fuse first. A blown fuse, which is nothing more than a broken element, is easily identified through the clear plastic body. Visually inspect the element for evidence of damage. If a continuity check is called for, the blade terminal tips are exposed in the fuse body.

Remove and insert fuses straight in and out without twisting. Twisting could force the terminals open too far, resulting in a bad connection.

Be sure to replace blown fuses with the correct type and amp rating. Fuses of different ratings are physically interchangeable, but replacing a fuse with one of a higher or lower value than specified is not recommended. Each electrical circuit needs a specific amount of protection. The amperage value of each fuse is molded into the fuse body. **Caution:** *Always turn off all electrical components and the ignition switch before replacing a fuse. Never bypass a fuse with pieces of metal or foil. Serious damage to the electrical system could result.*

If the replacement fuse immediately fails, do not replace it again until the cause of the problem is isolated and corrected. In most cases, this will be a short circuit in the wiring caused by a broken or deteriorated wire.

5 Fusible links — general information

Some circuits are protected by fusible links. These links are used in circuits which are not ordinarily fused, such as the ignition circuit.

Although the fusible links appear to be a heavier gauge than the wire they are protecting, the appearance is due to the thick insulation. All fusible links are four wire gauges *smaller* than the wire they are designed to protect. The location of the fusible links on your particular vehicle may be determined by referring to the wiring diagrams at the end of this chapter.

Fusible links cannot be repaired, but a new link of the same size wire can be put in its place. The procedure is as follows:

a) Disconnect the negative cable at the battery.
b) Disconnect the fusible link from the wiring harness.
c) Cut the damaged fusible link out of the wiring just behind the connector.
d) Strip the insulation back approximately 1/2-inch.
e) Position the connector on the new fusible link and crimp it into place.
f) Use rosin core solder at each end of the new link to obtain a good solder joint.
g) Use plenty of electrical tape around the soldered joint. No wires should be exposed.
h) Connect the battery ground cable. Test the circuit for proper operation.

6 Circuit breakers — general information

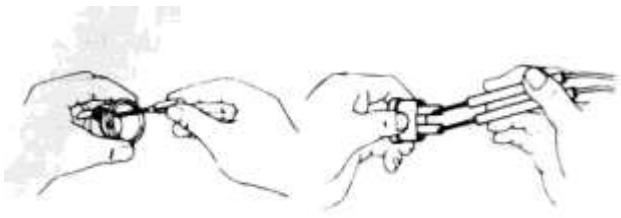
Refer to illustration 6.2

Circuit breakers protect accessories such as power windows, power door locks, the rear window defogger and the headlights. Some circuit breakers are located in the fuse box. Refer to the wiring diagrams at the end of this book for the location of the circuit breakers located elsewhere on this vehicle.

Resetting circuit breakers

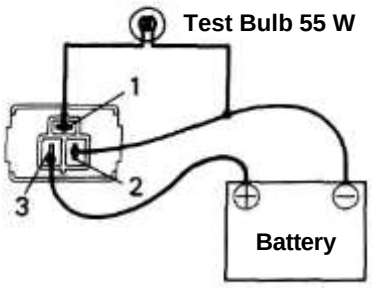
Because a circuit breaker resets itself automatically, an electrical overload in a circuit breaker protected system will cause the circuit to fail momentarily, then come back on. If the circuit does not come back on, check it immediately.

a) Remove the fuse panel cover.
b) Remove the circuit breaker.
c) Insert the needle into the reset hole and push it **(see illustration).**
d) Using an ohmmeter, verify that there is continuity between both terminals of the circuit breaker. If there is no continuity, replace the circuit breaker.
e) Install the circuit breaker. If it continues to cut out, a short circuit is indicated. Troubleshoot the appropriate circuit (refer to wiring diagrams at the back of this book) or have the system checked out by a professional mechanic.
f) Install the fuse panel cover.

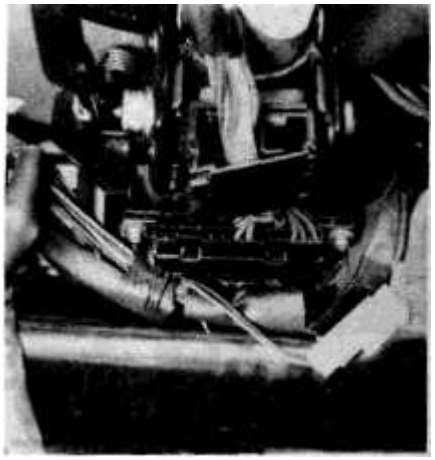


6.2 To reset a circuit breaker, insert the needle into the reset hole and push it, then, using an ohmmeter. verify that there is continuity between both terminals of the circuit breaker

7.1 To remove the turn signal/hazard flasher detach it from the spade connector on top, pull it down and unplug it from the electrical connector



7.2 To test the turn signal/hazard flasher relay, attach the negative terminal of the battery to terminal 2 of the flasher electrical connector and the positive terminal to terminal 3, hook up a 55W light bulb between terminals 1 and 2 and apply battery voltage — the light should flash on and off



7.4 The turn signal/dimmer/hazard flasher connector is located at the base of the steering column

7 Turn signal/hazard flasher relay and turn signal/hazard flasher/dimmer switch — check and replacement

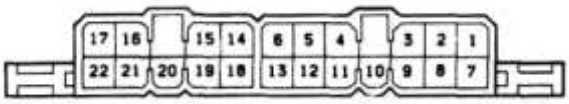
Refer to illustrations 7.1, 7.2, 7.4, 7.5a, 7.5b, 7.7, 7.10, 7.12, 7.15, 7.16, 7.17, 7.18 and 7.20

Turn signal/hazard flasher relay check

1 The turn signal/hazard flasher relay is located under the left side of the dashboard, above the fuse panel **(see illustration).**

2 To check it, remove the relay and connect the positive lead from the battery to terminal 3. Connect the negative lead to terminal 2 . Connect a 55W bulb between terminals 1 and 2 and verify that the bulb flashes on and off **(see illustration).** If the flasher relay does not perform as described, replace it.

3 The flasher relay can also be checked by observing its control of the turn signal lights themselves. The turn signal lights should flash 75 to 95 times per minute. If one of the front or rear turn signal lights has an open circuit, the number of flashes will be more than 120 times per minute. If one of the side turn signal lights has an open circuit, the number of flashes will increase by about 10 flashes per minute. If the flasher relay fails to perform in accordance with these guidelines, replace it.



7.5a Refer to this terminal number guide when checking the continuity of the turn signal/hazard flasher switch or the dimmer switch at the large electrical connector at the bottom of the steering column

Switch position \ Terminal (Wire color)		9 TL (G-B)	3 TB (G-W)	8 TR (G-Y)	2 B1 (G-L)	7 F (G)	1 B2 (G-O)
Turn Signal	L	○—○			○—○		
	N				○—○		
	R		○—○		○—○		
Hazard	ON	○—○	○—○	○—○		○—○	

7.5b Use this table to check continuity between the terminals of the turn signal/hazard flasher/dimmer switch

Turn signal/hazard flasher switch check

4 The turn signal/hazard flasher switch is located in the steering column assembly (the hazard flasher switch protrudes through the top of the steering column cover). Though the switch assembly itself can be checked without actually removing it, the switch electrical connector **(see illustration),** which is mounted at the lower end of the steering column, must be unscrewed (two screws) and unplugged.

5 To check the turn signal/hazard flasher switch, use an ohmmeter to check continuity between the connector terminals **(see illustrations).** If continuity is not as specified, replace the flasher switch.

Headlight dimmer switch check

6 The headlight dimmer switch is also located inside the steering column assembly, right next to the turn signal/hazard flasher switch. The dimmer switch itself does not have to be removed for checking, but the electrical connector, which it shares with the turn signal/hazard flasher switch, must be unscrewed and unplugged (refer to illustration for Step 4).

7 To check the dimmer switch, use an ohmmeter to check the continuity between switch terminals **(see illustration).**

8 If continuity is not as specified, replace the switch.

Turn signal/hazard flasher or headlight dimmer switch replacement

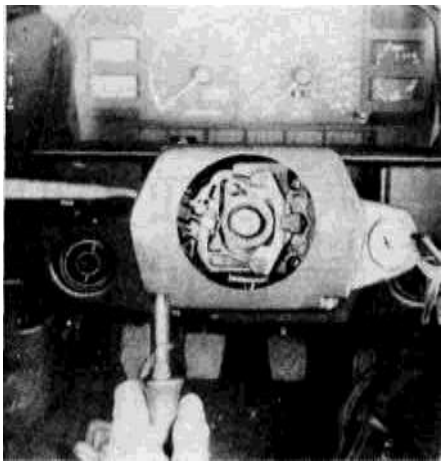
9 Remove the steering wheel (Chapter 10).

10 Remove the six screws (all in the lower cover) that hold the upper and lower steering column cover halves together **(see illustration).** Remove the upper and lower cover halves from the column assembly and set them aside.

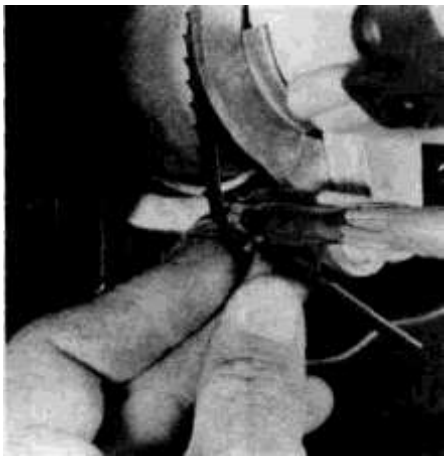
11 Remove the lower dash panel (Chapter 10).

Switch position \ Terminal (Wire color)	13 ED (W-B)	6 HL (R-G)	5 HU (R-Y)	12 HF (R-W)
Flash	○		○	○
Low Beam	○—○			
High Beam	○		○	

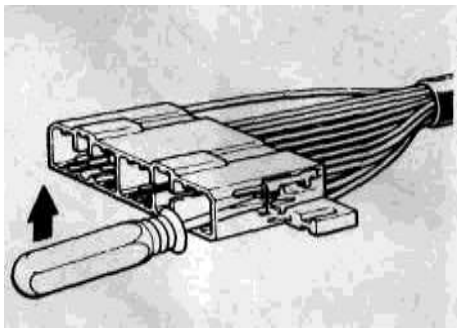
7.7 Use this table to check continuity between the terminals of the headlight dimmer switch



7.10 Remove the six screws that hold the upper and lower steering column assembly cover halves together, split the covers and remove them from the steering column assembly



7.12 Remove the cable tie that secures the turn signal/hazard flasher and headlight dimmer switch wire harnesses to the steering column

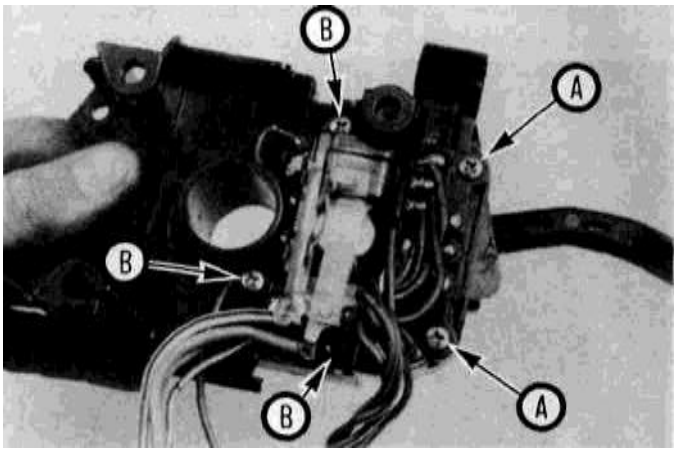


7.15 From the open end of the electrical connector, insert a miniature screwdriver between the locking lugs and the terminal of each wire you are disconnecting

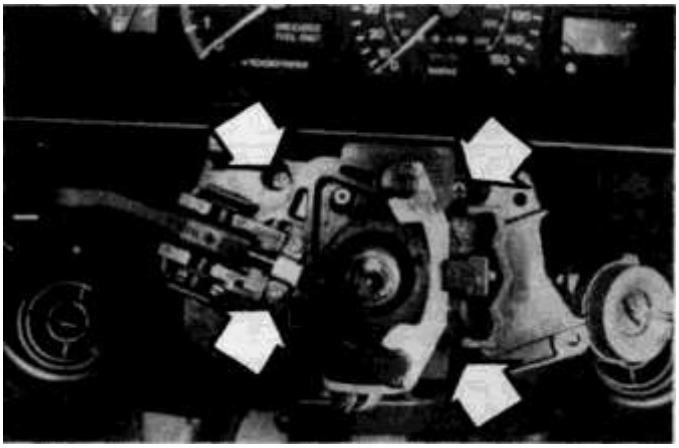
12 Disconnect the cable tie that secures the turn signal/hazard flasher and dimmer switch wire harness to the steering column **(see** illustration).
13 Remove the turn signal/hazard flasher and dimmer switch wire harness electrical connector retaining screws if you have not already done so.
14 Unplug the wire harness electrical connector.
15 From the open side of the connector, insert a miniature screwdriver between the locking lugs and terminal you intend to remove **(see illustration).**
16 Pry up the locking lugs with the screwdriver **(see illustration)** and pull the terminal out from the rear.

1 7 Remove the four turn signal/hazard flasher and dimmer switch assembly mounting screws **(see illustration).** Remove the switch assembly from the steering column.
18 Flip the switch assembly over so that you are looking at its backside. If you are replacing the headlight dimmer switch, remove the three switch mounting screws. If you are replacing the turn signal/hazard flasher switch, remove the two switch mounting screws **(see illustration).**
19 Installation is the reverse of removal.
20 Be sure to push in the terminals of the wire harness for the switch you are replacing until each one is securely locked in the connector lug **(see illustration).** Pull on each wire to verify that it is locked.

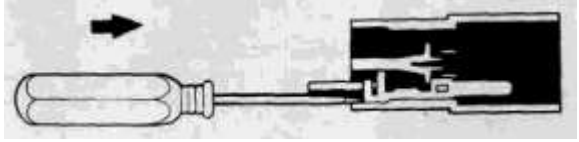
7.16 Pry up the locking lugs with the screwdriver and pull the terminal out from the rear



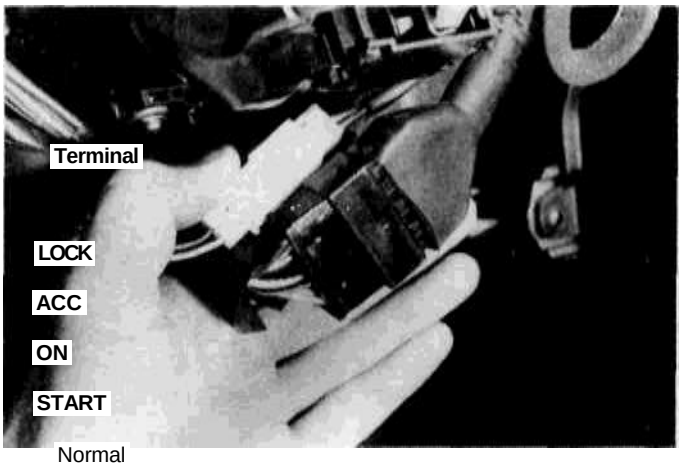
7.18 To remove the turn signal/hazard flasher switch, remove the A screws; to remove the headlight dimmer switch, remove the B screws

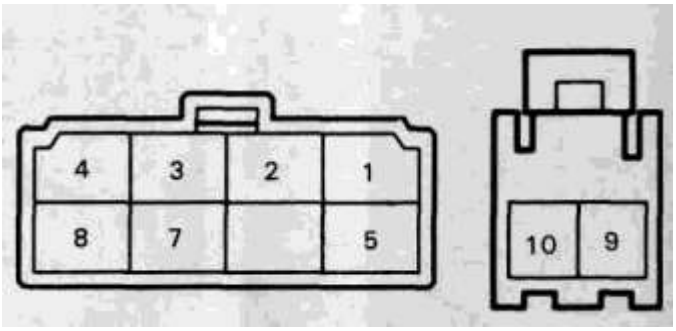


7.17 Remove the four mounting screws (arrows) and remove the turn signal/hazard flasher and headlight dimmer switch assembly

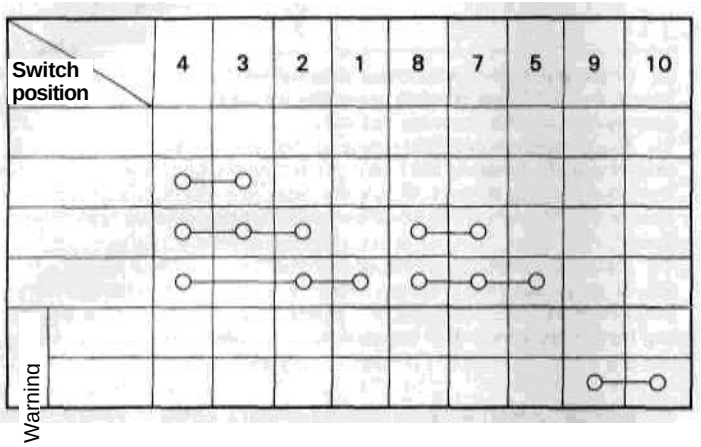


7.20 Be sure to push in the terminals of the wire harness for the switch you are replacing until they are locked into place by the connector lugs





8.3a Refer to this terminal number guide when checking the ignition switch or the warning buzzer



8.2 The ignition switch electrical connector (large dark) and the warning buzzer connector (small white) are located beneath the forward end of the steering column assembly

8.3b Refer to this table when checking the continuity of the ignition switch or the warning buzzer

8.7 Remove this retaining screw to remove the ignition switch/key lock cylinder

8 Ignition switch and key lock cylinder — check and replacement

Refer to illustrations 8.2, 8.3a, 8.3b and 8.7

Check

1 The ignition switch and key lock cylinder is located in the right side of the steering column assembly.

2 To check it, locate the large plastic electrical connector adjacent to the turn signal/hazard flasher/dimmer switch connector at the bottom of the steering column assembly **(see illustration).** The smaller connector is for the warning buzzer that is activated when the key is turned on.

3 To check the ignition switch and the warning buzzer, use an ohmmeter to check the continuity between the indicated terminals of their electrical connectors **(see illustrations).** If the continuity of the ignition switch or the buzzer is not as specified, replace the ignition switch.

Replacement

4 Remove the steering wheel (Chapter 10).

5 Remove the six screws from the lower steering column assembly cover half and remove both the upper and lower covers from the steering column assembly.

6 Remove the lower dash panel (Chapter 10).

7 Remove the ignition key lock cylinder retaining screw **(see illustration).**

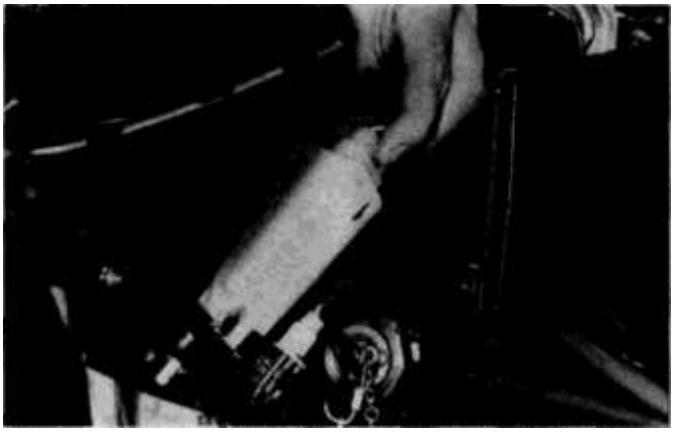
8 Remove the ignition key lock cylinder.

9 Installation is the reverse of removal.

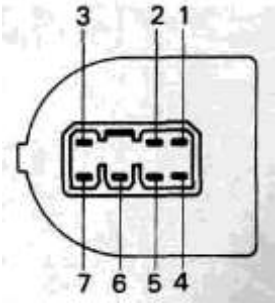
9 Windshield wiper and washer switch — check and replacement

Refer to illustrations 9.2, 9.3a, 9.3b, 9.4, 9.5 and 9.7

1 The windshield wiper and washer switch is located inside the right pod of the instrument cluster finish panel. Before you can check it,



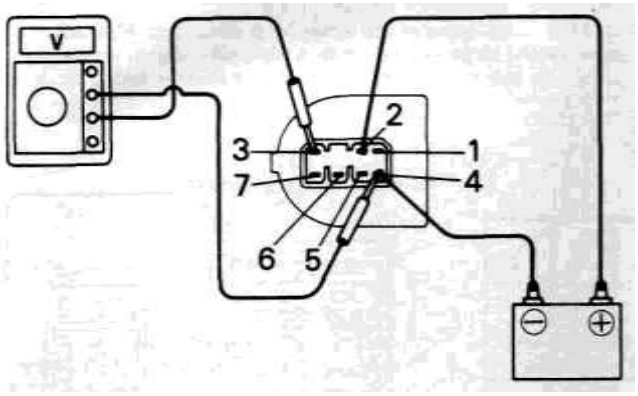
9.2 Unplug the electrical connector on the back of the windshield wiper and washer switch housing



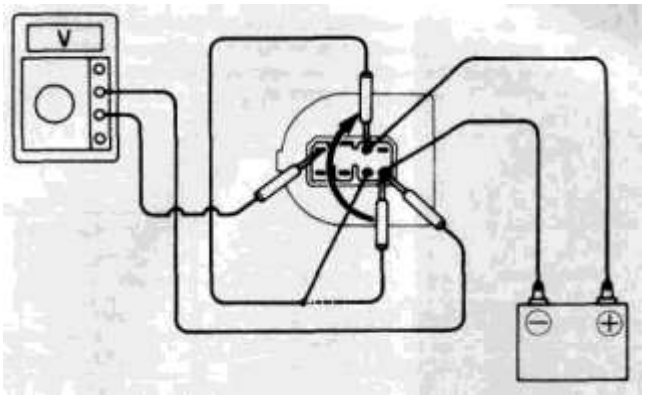
9.3a This is what the terminal looks like after you have unplugged the electrical connector to the windshield wiper and washer switch housing

Switch position \ Terminal	2 +B	1 +2	3 +1	5 +S	4 E	7 W
MIST	○	—	○			
OFF			○	○		
INT			○	○		
LO	○	—	○			
HI	○	○				
Washer					○	○

9.3b Refer to this table when checking the windshield wiper and washer switch for continuity



9.4 To check the operation of the windshield wiper switch's intermittent mode, connect the positive lead from the battery to terminal 2 and connect the negative lead to terminal 4, then connect the positive lead from the voltmeter to terminal 3 and connect the negative lead to terminal 4 — when the wiper switch is turned to the INT position, the meter needle should indicate battery voltage



9.5 After connecting a probe to terminal 4, connect it to terminal 2. Then immediately connect it to terminal 4 again and verify that the tester needle indicates zero volts for three to five seconds before returning to its original position — if the switch does not operate as described, . replace it

you must first disconnect the finish panel from the dash panel (refer to Chapter 11) and pull the finish panel far enough from the dash panel so that you can reach the electrical connector and unplug it.

Switch continuity check

2 To check the windshield wiper and washer switch, unplug the electrical connector from the backside of the switch housing **(see illustration).**

3 Using an ohmmeter, check the switch continuity between terminals **(see illustrations).** If continuity is not as specified, replace the switch.

Switch operation check (intermittent mode only)

4 Connect the positive lead from the battery to terminal 2 and connect the negative lead from the battery to terminal 4. Connect the positive lead from the voltmeter to terminal 3 and connect the negative lead from the voltmeter to terminal **4 (see illustration).** Turn the wiper switch to the intermittent (INT) position and verify that the meter needle indicates battery voltage.

5 After first connecting a probe to terminal 4, connect it to terminal 2. Then immediately connect it to terminal 4 again and verify that the tester needle indicates 0 volts for 3 to 5 seconds before returning to its original position **(see illustration).** If the switch does not operate as described, replace it.

Replacement

6 Remove the switch knob by pulling it straight off.

7 Remove the locknut **(see illustration)** and remove the windshield wiper and washer switch housing.

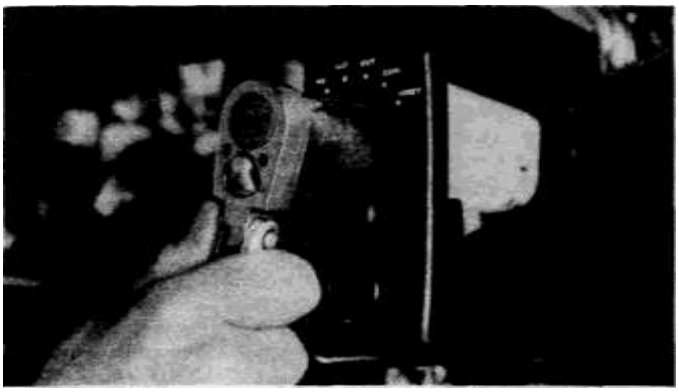
8 Installation is the reverse of removal.

10 Headlight control switch and rheostat — check and replacement

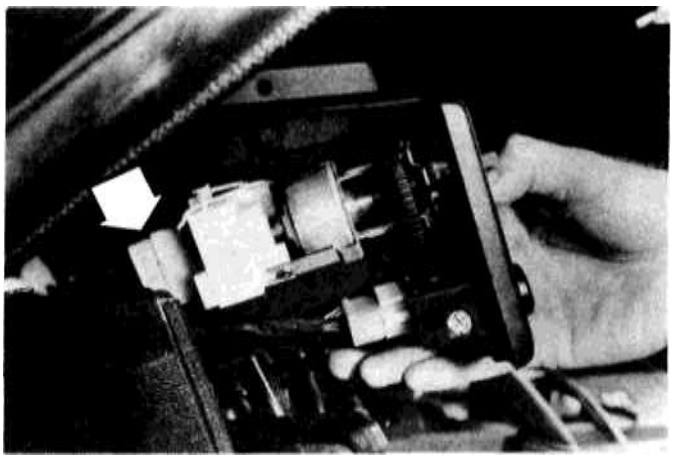
Refer to illustrations 10.3, 10.4, 10.5a, 10.5b and 10.6

Removal

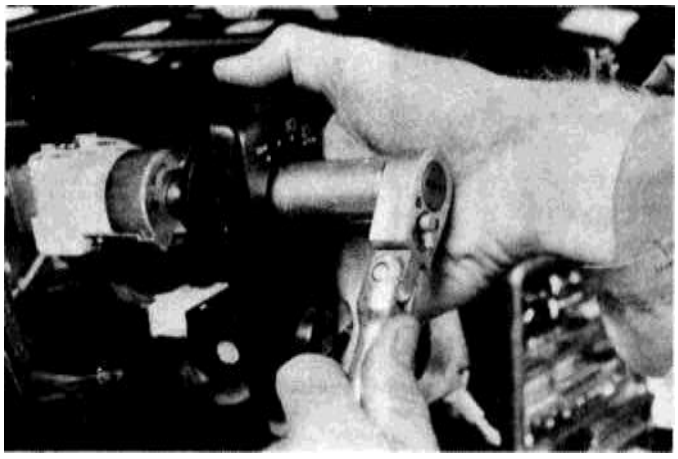
1 The headlight control switch and rheostat are located in the left pod of the instrument cluster finish panel.



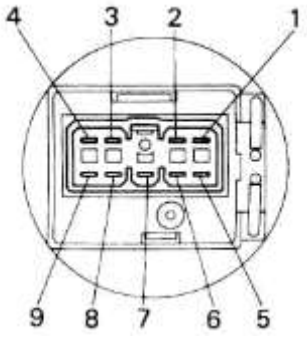
9.7 To replace the windshield wiper and washer switch housing, first remove the knob, then remove the large locknut with a deep, six-point socket of the correct size



10.3 To check the headlight control switch and rheostat, you must first separate the instrument cluster finish panel from the dash panel, unplug the electrical connector **(arrow) . . .**



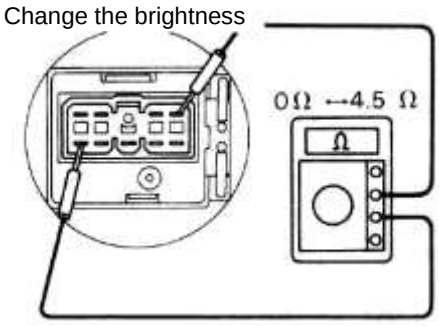
10.4 . . . remove the knob by pulling it straight off, remove the large locknut with a six-point, deep socket and remove the switch housing from the cluster finish panel



10.5a Use this terminal number guide when checking the continuity or operation of the headlight control switch or rheostat

Switch position \ Terminal	9	8	4	7
OFF				
TAIL	○—○			
HEAD	○—○	○—○	○—○	
HOLD	○—○			○—○

10.5b Refer to this table when checking the continuity of the headlight control switch — if the continuity of the switch is not as specified, replace the switch



10.6 To check the operation of the light control rheostat, gradually change the brightness of the rheostat from maximum to minimum and verify that the resistance between terminals 1 and 9 increases from 0 to 4.5 ohms — if it doesn't, replace the switch

2 To check the switch or rheostat, first disconnect the instrument cluster finish panel from the dash panel and pull it out so that you can reach the electrical connector (refer to Chapter 11).
3 Disconnect the headlight control switch electrical connector **(see** illustration).
4 Remove the large locknut **(see illustration)** and remove the switch.

Check

5 To check the light control switch, use an ohmmeter to check the switch continuity between terminals **(see illustrations).** If continuity is not as specified, replace the switch.
6 To check the operation of the light control rheostat, use an ohmmeter to measure the resistance between terminals 1 and 9 as you gradually change the brightness of the rheostat from maximum to minimum **(see illustration).** It should increase from 0 to 4.5 ohms. If it doesn't, replace the switch.
7 Installation is the reverse of removal.

11 Headlight retractor control relay and motor — check and replacement

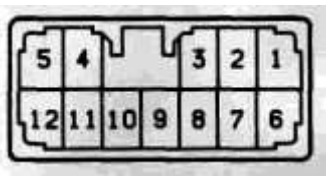
Refer to illustrations 11.1, 11,2, 11.3a, 11.3b, 11.4, 11.5, 11.6, 11.13, 11.15 and 11.16

Headlight retractor control relay

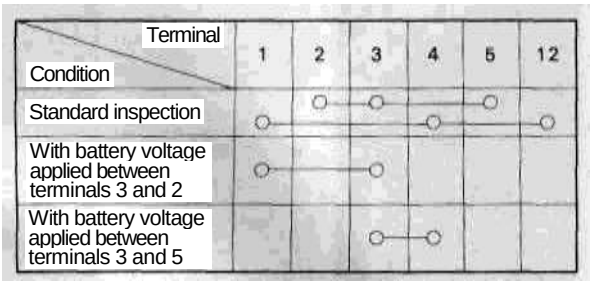
1 The headlight retractor control relay is located in the right rear corner of the front luggage compartment, next to the windshield wiper motor **(see illustration).**

11.1 The headlight retractor control relay is located in the right rear corner of the front luggage compartment

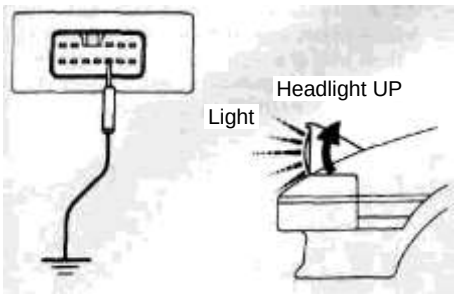
11.2 To remove the headlight retractor control relay, slide it straight up and detach it from the spade connector (arrow), then unplug the electrical connector



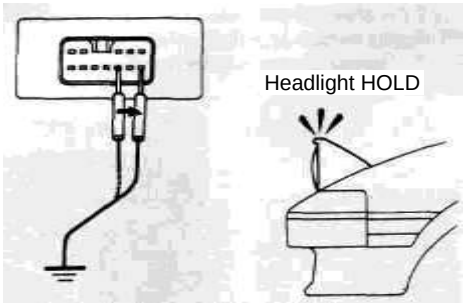
11.3a Use this terminal number guide when checking the headlight retractor control relay



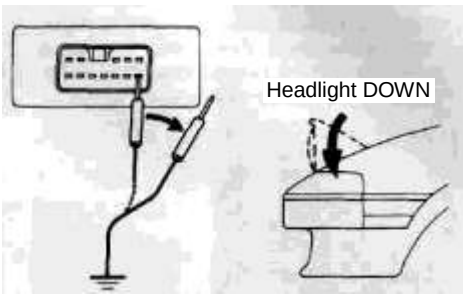
11.3b Refer to this table when checking the continuity between terminals of the headlight retractor control relay



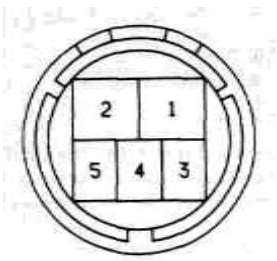
11.4 With the light control switch off, the connector plugged into the retractor relay and terminal 8 grounded, raise the headlights with the lights on



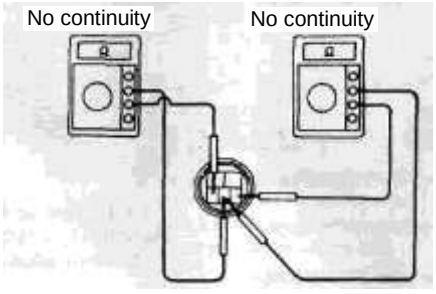
11.5 Quickly ground terminal 6 — the light should go out but the headlight should remain up



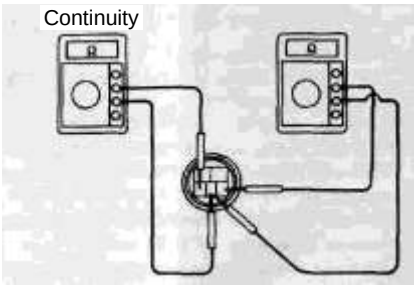
11.6 Take terminal 6 off ground and the headlights should flip down — if the headlights do not perform as described, replace the retractor relay



11.13 Use this terminal number guide when checking the headlight retractor motor



11.15 To check the diode continuity of the motor, move the lights to any position except the uppermost or lowermost positions and connect the ohmmeter positive lead to terminal 4 and the negative lead to terminal 5, then connect the ohmmeter positive lead to terminal 4 and the negative lead to terminal 3 — there should be no continuity for either check

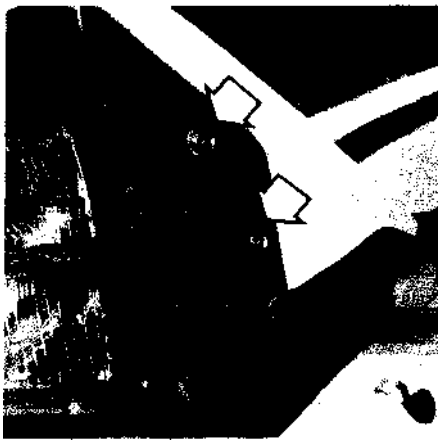


11.16 Now reverse the ohmmeter test leads and repeat the two tests described in Fig. 11.15 — this time there should be continuity for both checks — if the motor fails any of these four checks, replace it

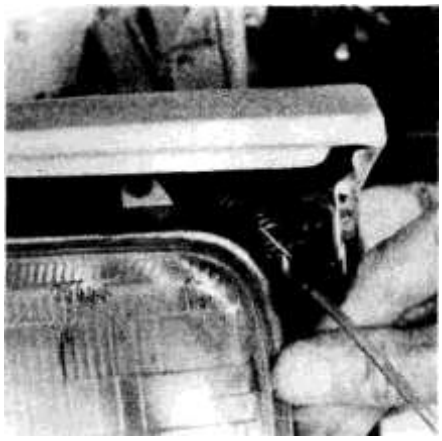
2 To check the retractor control relay, remove and unplug it **(see illustration).**
3 Use an ohmmeter to check relay continuity between terminals **(see illustrations).** If continuity is not as specified, replace the relay.
4 To check relay operation, with the light control switch off, the connector plugged in and terminal 8 grounded, raise the headlights with the lights on **(see illustration).**
5 Quickly ground terminal 6. The light will go out, but the headlight will remain up **(see illustration).**
6 When terminal 6 is taken off ground, the headlights will flip down **(see illustration).**
7 If the light retractor control relay does not operate as described, replace it.

Headlight retractor motor check

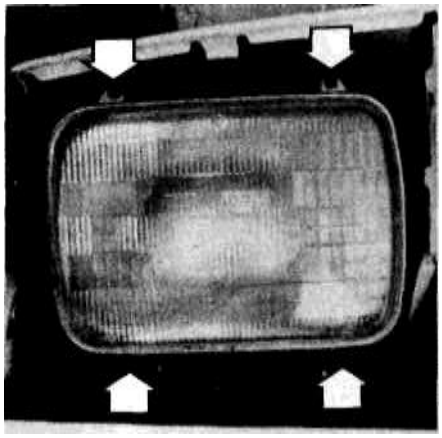
8 Turn the headlights on.
9 Pull the headlight retractor control relay (Section 11).
10 Turn the headlights off.
11 Remove the headlight trim piece (see Section 12).
12 Unplug the electrical connector from the retractor motor.
13 The retractor motor is difficult to check when it's installed in the vehicle, but the second of the two following checks must be done with the motor installed because it can't be done any other way. Refer to the accompanying terminal number guide and make sure that you are probing the correct terminals **(see illustration).**
14 To check motor operation, connect the positive lead from the battery to terminal 2 and connect the negative led to terminal 1. Verify that the motor runs. If it doesn't, replace it.
1 5 To check diode continuity of the motor, move the headlights to any position except the uppermost or lowermost positions. Connect the ohmmeter positive lead to terminal 4 and the negative lead to terminal 5. There should be continuity. Connect the ohmmeter lead to to terminal 4 and the negative lead to terminal 3. There should be continuity **(see illustration).** If there is no continuity, replace the motor assembly.
16 Reverse the test leads of the ohmmeter and repeat the above two checks **(see illustration).** There should be no continuity for either check. If there is, replace the motor assembly.



12.4 To remove this piece of headlight trim, unscrew both of these screws (arrows) and the two on the other side of the trim piece in the same place



12.5 Using a suitable tool such as this hook, detach the spring from the left upper comer of the headlight



12.6 Remove the four bezel retaining screws (arrows) and the chrome bezel, then pull the light out far enough to **reach around behind it and unplug the electrical connector**

Headlight retractor motor replacement

17 Remove the retractor crank arm-to-shaft nut and pull off the crank arm.
18 Remove the three motor mounting bolts.
19 Remove the motor.
20 Installation is the reverse of removal.

12 Headlights — removal and installation

Refer to illustrations 12.4, 12.5 and 12.6

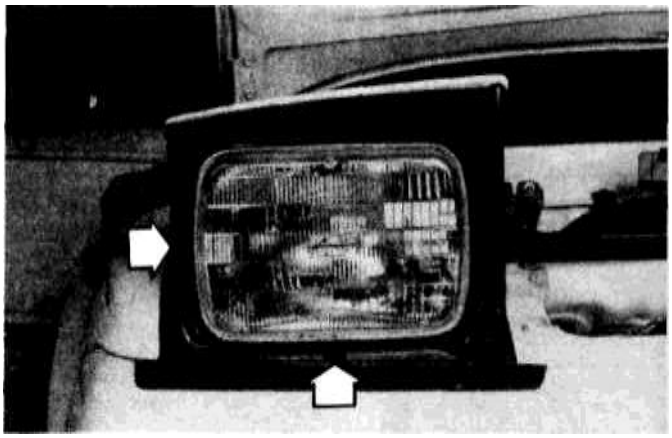
1 Turn the headlights on.
2 Unplug the electrical connector from the headlight retractor control relay (see Section 11).
3 Turn the headlights off. With the retractor control relay disconnected, the lights will remain in the up position.
4 Remove the headlight trim piece screws and the trim piece **(see illustration).**
5 Pull the headlight toward you and disconnect the spring in the upper left corner **(see illustration).**
6 Remove the four headlamp bezel retaining screws **(see illustration).**
7 Pull the headlight out and unplug the connector.
8 Remove the headlight.
9 Installation is the reverse of removal.
10 Be sure to adjust the headlights (see next Section).

13 Headlights — adjustment

Refer to illustration 13.1

Note: *It is important that the headlights be aimed correctly. If adjusted incorrectly they could blind the driver of an oncoming car and cause a serious accident or seriously reduce your ability to see the road. The headlights should be checked for proper aim every 12 months and any time a new sealed beam headlight is installed or front end body work is performed. It should be emphasized that the following procedure is only an interim step which will provide temporary adjustment until the headlights can be adjusted by a properly equipped shop.*

1 Headlights have two spring loaded adjusting screws, one on the top controlling up-and-down movement and one on the side controlling left-and-right movement **(see illustration).**
2 There are several methods of adjusting the headlights. The simplest method requires a blank wall 25 feet in front of the vehicle and a level floor.
3 Position masking tape vertically on the wall in reference to the vehicle centerline and the centerlines of both headlights.
4 Position a horizontal tape line in reference to the centerline of all the headlights. **Note:** *It may be easier to position the tape on the wall with the vehicle parked only a few inches away.*



13.1 The spring loaded screw on the right side of the headlight controls vertical adjustment and the one on the bottom edge controls horizontal adjustment (arrows)

5 Adjustment should be made with the vehicle sitting level, the gas tank half-full and no unusually heavy load in the vehicle.
6 Starting with the low beam adjustment, position the high intensity zone so it is two inches below the horizontal line and two inches to the right of the headlight vertical line. Adjustment is made by turning the top adjusting screw *clockwise* to raise the beam and *counterclockwise* to lower the beam. The adjusting screw on the side should be used in the same manner to move the beam left or right.
7 With the high beams on, the high intensity zone should be vertically centered with the exact center just below the horizontal line. **Note:** *It may not be possible to position the headlight aim exactly for both high and low beams. If a compromise must be used, keep in mind that the low beams are the most used and have the greatest effect on driver safety.*
8 Have the headlights adjusted by a dealer service department at the earliest opportunity.

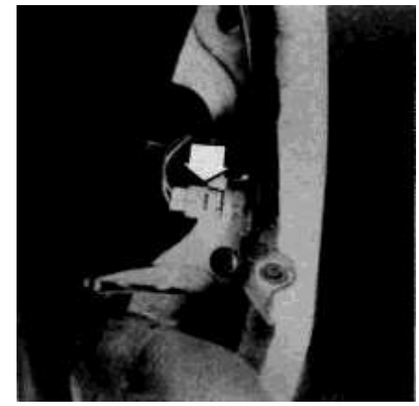
14 Headlight doors — emergency manual operation

Refer to illustrations 14.2 and 14.3

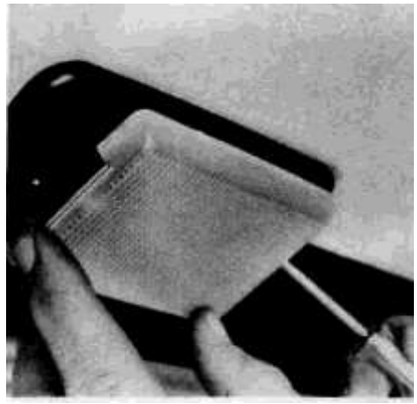
1 Each headlight door is raised and lowered by its own retractor motor. If a headlight retractor motor malfunctions, turn the ignition and headlight switches Off and pull out the 30A "RTR MTR" fuse (located in junction block No. 5 in the right rear corner of the front luggage compartment) to prevent the headlight from suddenly retract-

14.2 Remove the cover from the headlight emergency manual operation knob

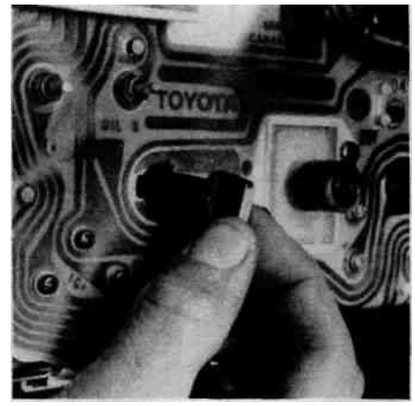
14.3 Turn the knob clockwise until the headlight is fully extended



15.5 To remove the front sidemarker light bulb grasp the bulb holder (arrow), turn it counterclockwise and pull the bulb straight out of the holder



15.9 To replace the dome light, pry off the plastic lens with a small screwdriver



15.13 To replace an instrument panel bulb, remove the instrument panel, rotate the bulb holder counterclockwise and pull the bulb straight out

15.17 To remove a rear sidemarker bulb rotate the bulb holder counterclockwise and pull the bulb straight out

ing or extending and causing injury.
2 Remove the cover from the manual operation knob next to the inoperative headlight **(see illustration).**
3 Turn the knob clockwise **(see illustration)** until the headlight is fully extended.
4 After the headlights are extended, turn on the light switch and check to see whether the lights come on.
5 When manually retracting the headlight, make sure that the door matches the contours of the body.
6 Check the headlight retractor control relay and motor (Section 11) as soon as possible.

15 Bulb replacement

Refer to illustrations 15.5, 15.9, 15.13, 15.17 and 15.21 **Warning:** *Always disconnect the cable from the negative terminal of the battery before replacing a bulb.*

Front turn signal

1 Remove the two Phillips screws and the lens.
2 Turn the bulb counterclockwise about an eighth of a turn.
3 Pull the bulb straight out.
4 Installation is the reverse of removal.

Front sidemarker

5 Remove the two front inner fender panel-to-outer fender screws and pull back the panel far enough to reach the backside of the side-marker light bulb holder **(see illustration).**
6 Rotate the bulb holder counterclockwise and remove it from the sidemarker assembly.
7 Pull the bulb straight out of the bulb holder.
8 Installation is the reverse of removal.

Dome light

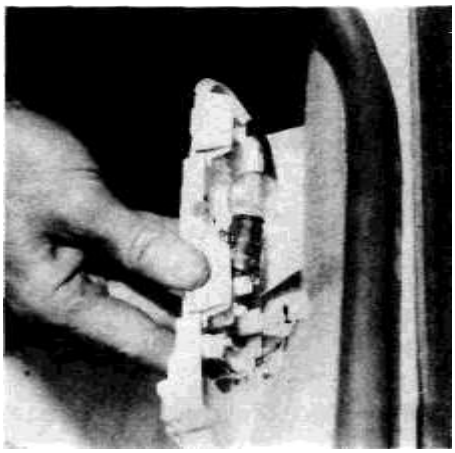
9 Pry the plastic lens cover off with a small screwdriver **(see illustration).**
10 Remove the bulb from the dome light assembly.
11 Installation is the reverse of removal.

Instrument panel

12 To remove an instrument panel bulb, you must first remove the instrument panel (see Section 18).
13 Rotate the bulb holder counterclockwise **(see illustration).**
14 Pull the bulb straight out of the bulb holder.
15 Installation is the reverse of removal.

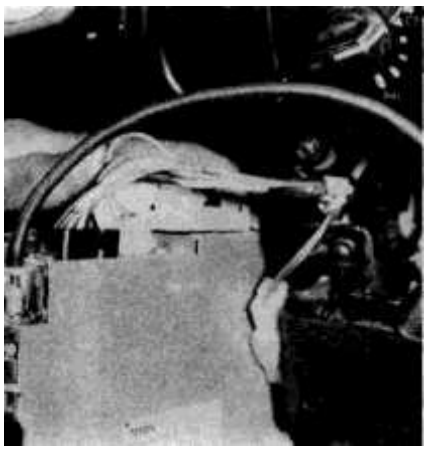
Rear sidemarker

16 Open the rear luggage compartment lid, peel back the carpeting and lift up the particle board cover.
1 7 Rotate the bulb holder **(see illustration)** counterclockwise and pull it from the sidemarker assembly.
18 Pull the bulb straight out of the bulb holder.
19 Installation is the reverse of removal.



15.21 To remove a brake, backup or turn signal bulb depress the two tabs on the top of the plastic taillight assembly housing and tilt it forward far enough to remove the burned out bulb

16.3 These two screws (arrows) and the other two on the left side of the radio must be removed before the radio can be pulled out of the dash



16.4 Disconnect the antenna cable and the electrical connectors from the back of the radio

16.6 Gently pry the speaker covers from the dash with a small screwdriver

16.7 Remove the two speaker mounting screws, pull the speaker out of the dash, unplug the electrical connector and remove the speaker

Rear brake, turn signal and backup lights

20 Open the rear luggage compartment lid.
21 Push down on the two tabs on the top edge of the plastic tail light housing, pivot the assembly forward **(see illustration)** and lift up on it.
22 Remove the burned out brake, turn signal or backup bulb.
23 Installation is the reverse of removal.

16 Radio and speakers — removal and installation

Refer to illustrations 16.3, 16.4, 16.6 and 16.7

Radio

1 Disconnect the cable from the negative terminal of the battery.
2 Remove the instrument cluster finish center panel (refer to Chapter 11).
3 Remove the four radio mounting screws **(see illustration)** and pull the radio out of the dash.
4 Disconnect the radio antenna cable and unplug the electrical connectors **(see illustration),** then remove the radio.
5 Installation is the reverse of removal.

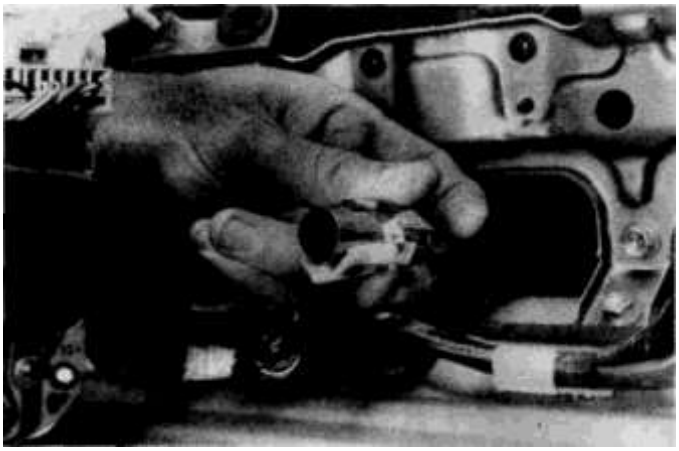
Speakers

6 Pry up the speaker panel **(see illustration).**
7 Remove the four speaker screws, pull out the speaker, unplug the connector and remove the speaker **(see illustration).** 8 Installation is the reverse of removal.

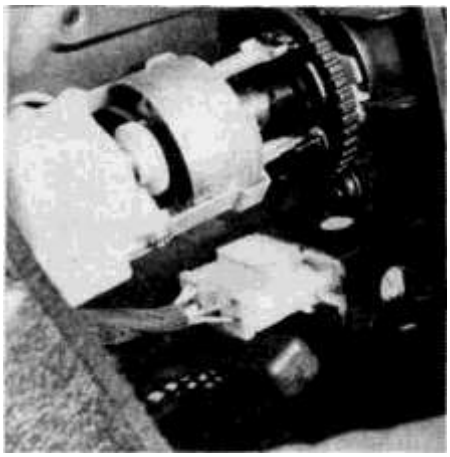
17 Radio antenna — removal and installation

1 Disconnect the cable from the negative terminal of the battery.
2 Remove the left side kick panel and the instrument panel lower finish panel (Chapter 11). These panels must be removed so that you can guide the old antenna cable out and the new antenna cable in.
3 Remove the radio and disconnect the antenna cable from the back of the radio (see Section 16).
4 Attach a section of wire to the radio end of the cable.
5 Remove the two antenna flange mounting screws from the left side of the roof.
6 Pull the antenna and cable from the vehicle.
7 Detach the old cable from the wire.
8 Attach the new cable to the wire and thread it back through the dash to the radio.
9 Detach the wire from the new cable and attach the cable to the radio.
10 Install the radio (Section 16).
11 Install the instrument panel lower finish panel and the left side kick panel (refer to Chapter 11).
12 Install the two antenna flange mounting screws and tighten them securely.

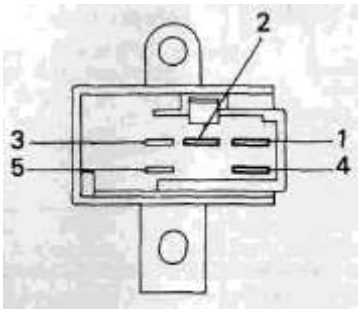
18.2 To disconnect the instrument panel from the instrument panel center reinforcement, remove the four mounting screws (arrows)



18.3 Before removing the instrument panel from the vehicle you must disconnect the speedometer cable



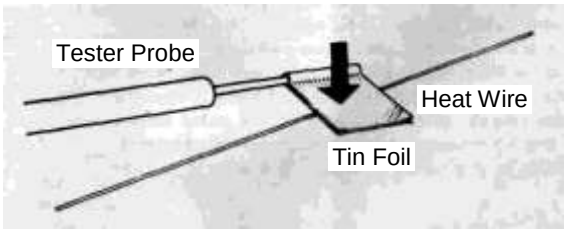
19.3 To check (or replace) the rear window defogger switch, unplug the electrical connector, unscrew the switch and remove it from the instrument cluster finish panel



19.5a Use this terminal number guide when checking the rear window defogger switch

Switch position \ Terminal	1	2	4
OFF			
ON			

19.5b Refer to this table when checking the continuity of the rear window defogger switch



19.8 When measuring the voltage of the rear window defogger grids, wind a piece of aluminum foil around the negative probe of the voltmeter and press the foil against the wire with your finger (arrow)

18 Instrument panel — removal and installation

Refer to illustrations 18.2 and 18.3

1 Remove the instrument cluster finish upper panel and the panel retainer (refer to Chapter 11).
2 Remove the four instrument panel screws **(see illustration).**
3 Disconnect the speedometer cable **(see illustration).**
4 Unplug the electrical connectors and remove the instrument panel.
5 Installation is the reverse of removal.

19 Rear window defogger and switch — check and repair

Refer to illustrations 19.3, 19.5a, 19.5b, 19.8, 19.9, 19.10, 19.12 and 19.14

Rear window defogger switch check and replacement

1 The rear window defogger switch is located in the left pod of the instrument cluster finish panel.
2 To check the switch, you must first remove the instrument cluster finish panel (refer to Chapter 11).
3 Pull the instrument cluster finish panel out from the dash and unplug the electrical connector from the defogger switch **(see illustration).**
4 Unscrew and remove the defogger switch.
5 Using an ohmmeter, check the continuity between the defogger switch terminals **(see illustrations).** If continuity is not as specified, replace it.
6 Installation is the reverse of removal.

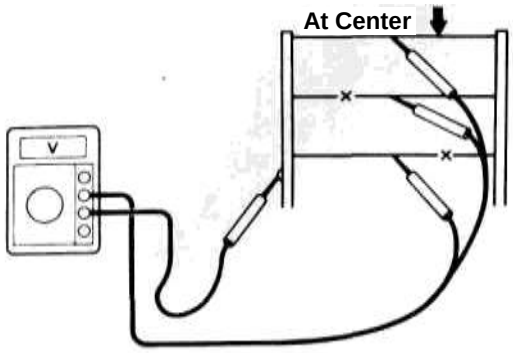
Rear window defogger check

Caution: *Use a soft, dry cloth when cleaning the glass and wipe it in the direction of the wire. Take care not to damage the wires. Do not use detergents or glass cleaners with abrasive ingredients.*

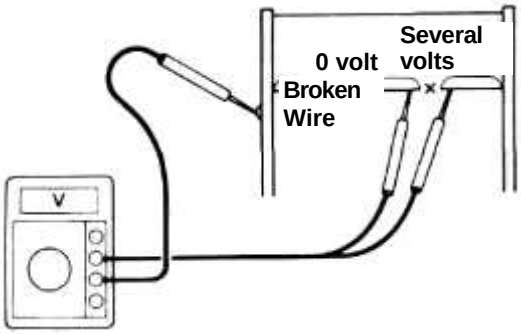
7 Turn the ignition and defogger switches to On.
8 When measuring voltage during the next two tests, wind a piece of aluminum foil around the tip of the voltmeter negative probe and press the foil against the wire with your finger **(see illustration).**

9 Check the voltage at the center of each heat wire **(see illustration).** If the voltage is 5V, the wire is okay (there is no break). If the voltage is 10V, the wire is broken between the center of the wire and the positive end of the wire. If there is no voltage reading, the wire is broken between the center of the wire and ground.

10 To find the breakage point, place the voltmeter positive lead against the defogger positive terminal. Place the voltmeter negative lead with the foil strip against the heat wire at the positive terminal end and slide it toward the negative terminal end. The point where the voltmeter deflects from zero to several volts is the point at which the heat wire is broken **(see illustration). Note:** *If the heat wire is not broken, the voltmeter will indicate no voltage at the positive end of the heat wire but gradually increase to about 12V as the meter probe is moved to the other end.*



19.9 To determine if a **wire has broken, check the voltage at the center of each wire — if the voltage is 5V, the wire is unbroken; if the voltage is 10V, the wire is broken between the center of the wire and the positive end; if the voltage is 0V, the wire is broken between the center of the wire and ground**



19.10 To find the breakage point, place the voltmeter positive lead against the defogger positive terminal, place the voltmeter negative lead with the foil strip against the heat wire at the positive terminal end and slide it toward the negative terminal end — the point where the voltmeter deflects from zero to several volts is the point at which the wire is broken

Rear window defogger repair

11 Clean the broken wire tips with white gasoline.

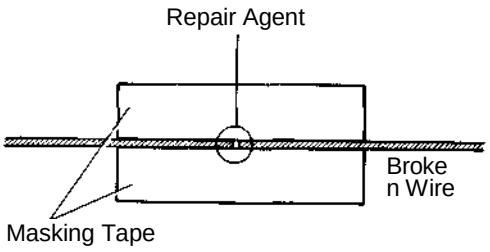
12 Place masking tape along both sides of the wire to be repaired **(see illustration).**

13 Thoroughly mix the repair agent (Dupont paste No. 4817, available at your Toyota dealer).

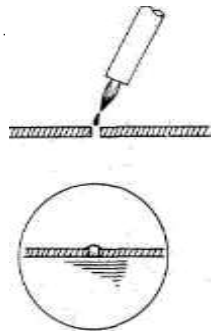
14 Using a fine tip brush, apply a small amount to the wire **(see illustration).**

15 After a few minutes, remove the masking tape.

16 Allow the repair to cure for at least 24 hours.



19.12 Place masking tape along both sides if the wire to be repaired



19.14 Using a fine tip brush, apply a small amount of repair material to the wire, remove the masking tape after a few minutes and allow the repair to cure for at least 24 hours

20 Heater electrical components — check and replacement

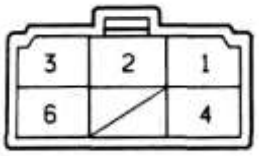
Refer to illustrations 20.3, 20.5, 20.6a, 20.6b, 20.10,20.11, 20.12 and 20.14

Heater blower switch

1 The heater blower switch is located behind the left end of the heater control panel on the dashboard.

20.3 To remove the heater/air conditioner control panel, remove the four screws (arrows)

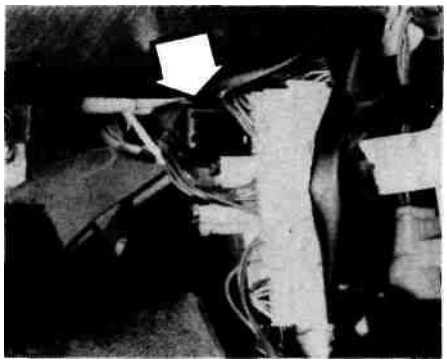
20.5 To remove the heater blower switch from the heater/air conditioner control panel, remove the knob then remove the large locknut



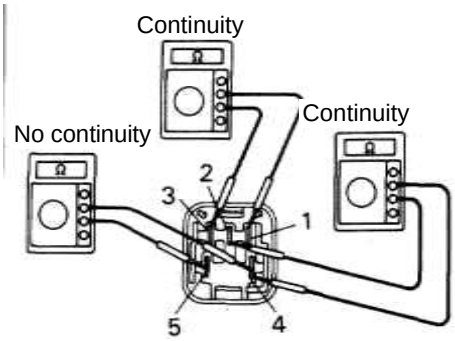
20.6a Use this terminal number guide when checking the heater blower switch

20.6b Refer to this table when checking the terminals of the heater blower switch for continuity

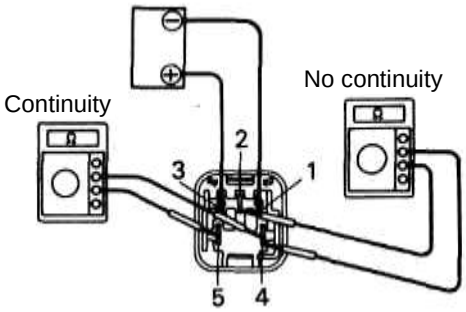
Switch position \ Terminal	6	4	1	2	3
OFF					
LO	○	○			
II	○	○	○		
III	○	○		○	
HI	○	○			○



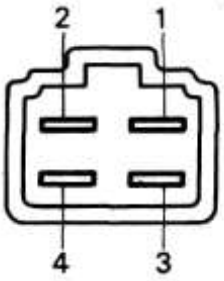
20.10 The heater relay (arrow) is behind the right kick panel



20.11 To check the heater relay, verify that there is continuity between terminals 1 and 3 and between terminals 2 and 5, but not between terminals 4 and 5 — if continuity is not as specified, replace the relay



20.12 To check the operation of the heater relay, apply battery voltage to terminals 1 and 3 and verify that there is continuity between terminals 4 and 5 but not between terminals 2 and 4 — if the relay does not operate as specified, replace it



20.14 To check the heater blower resistor, verify that there is continuity between terminals 1 and 2, 1 and 3 and 1 and 4 — if continuity is not as specified, replace the heater blower resistor

2 Remove the instrument cluster finish center panel (refer to Chapter 11).
3 Remove the four heater/air conditioner control panel mounting screws **(see illustration).**
4 Pull the panel out far enough to unplug the electrical connector from the back of the heater blower switch.
5 Remove the large locknut **(see illustration)** and remove the heater blower switch.
6 Check the heater blower switch for continuity **(see illustrations).** If continuity is not as specified, replace the switch.
7 Installation is the reverse of removal.

Heater relay

8 The heater relay is located under the right part of the dashboard.
9 Remove the instrument panel under cover and the right kick panel (refer to Chapter 11).
10 Remove the relay **(see illustration).**
11 Using an ohmmeter, check that there is continuity between terminals 1 and 3 and between terminals 2 and 5, but not between terminals 4 and 5 **(see illustration).** If continuity is not as specified, replace the relay.
12 To check relay operation, apply battery voltage across terminals 1 and 3. Using an ohmmeter, verify that there is continuity between terminals 4 and 5 but not between terminals 2 and 4 **(see illustration).** If the relay does not operate as described, replace it.

Heater blower resistor

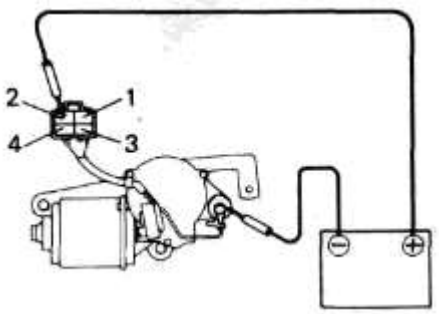
13 The heater blower resistor is located adjacent to the heater relay.
14 Using an ohmmeter, verify that there is resistor continuity between terminals 1 and 2 and between terminals 1 and 3, but not between terminals 1 and 4 **(see illustration).** If continuity is not as specified, replace the heater blower resistor.

21 Windshield wiper motor — test and replacement

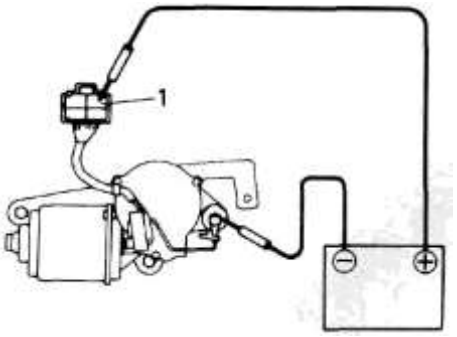
Refer to illustrations 21.2, 21.3, 21.5, 21.6, 21.11, 21.12a, 21.12b and 21.13

Test

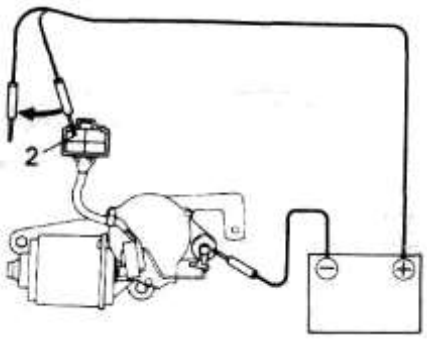
1 The windshield wiper motor is located at the right rear corner of the front luggage compartment. To check the motor, you must unplug the electrical connector.
2 Connect the positive lead from the battery to terminal 2. Connect the negative lead to the motor body **(see illustration).** Verify that the motor operates at low speed.



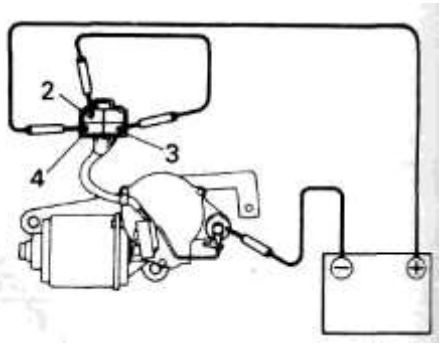
21.2 To check the low speed operation of the windshield wiper motor, unplug the electrical connector from the motor, connect the positive lead from the battery to terminal 2, connect the negative lead to the motor body and verify that the motor operates at low speed



21.3 To check the high speed operation of the windshield wiper motor, connect the positive lead from the battery to terminal 1, connect the negative lead to the motor body and verify that the motor operates at high speed

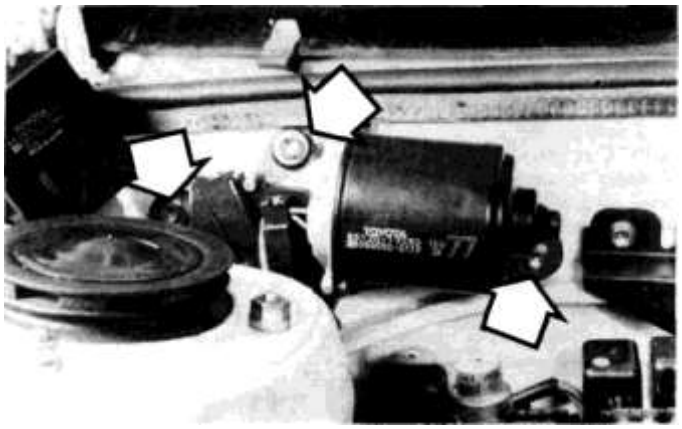


21.5 To verify that the motor stops at the stopping position after operation, run the motor at low speed (see illustration 21.2), then stop motor operation anywhere except the stop position by disconnecting terminal 2 . . .



21.6 ... then connect terminals 2 and 3, connect the positive lead from the battery to terminal 4 and verify that the motor stops running at the stop position

3 Connect the positive lead from the battery to terminal 1. Connect the negative lead to the motor body **(see illustration).** Verify that the motor operates at high speed.
4 If the motor fails either of the above tests, replace it.
5 Operate the motor at low speed. Stop the motor anywhere except the Stop position by disconnecting terminal 2 **(see illustration).**

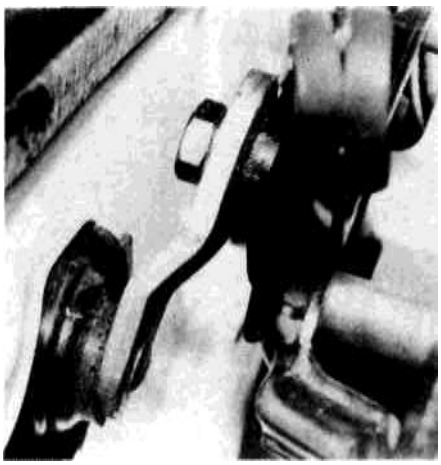


21.11 To remove the windshield wiper motor, remove the three mounting bolts (arrows)

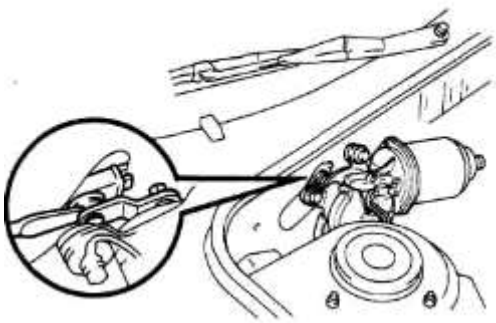
6 Connect terminals 2 and 3. Connect the positive lead from the battery to terminal 4 **(see illustration).** Verify that the motor stops running at the stop position after the motor operates again.
7 If the motor fails the above test, replace it.

Replacement

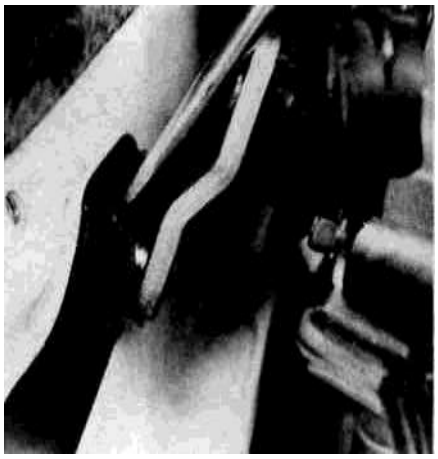
8 Turn the ignition switch to On, turn the wiper switch to low and, when the wiper arm is in the "up" position, turn the ignition switch to Off. **Note:** *If the motor is not operational, ignore this Step and proceed to the next one.*
9 Unplug the connector from the wiper motor.
10 Disconnect the headlight retractor relay from the wiper bracket (refer to Section 11 if necessary).
11 Remove the three wiper motor mounting bolts **(see illustration).**
12 Lower the wiper arm by hand until it stops **(see illustration).** Hook the wiper link hook onto the dash panel service hole to prevent the link from moving while it is disconnected from the motor **(see illustration).**
13 Using a screwdriver, disconnect the motor arm from the wiper link **(see illustration).**
14 Connect the wiper motor to the wiper link. Be sure to rotate the motor crank 180° from the auto-stop position (new motors come with the crank already rotated).
15 Move the wiper arm to the up position by hand.
16 Install the wiper mounting bolts and tighten them securely.
17 Plug in the wiper motor electrical connector.
18 Install the light retractor control relay.



21.12a Lower the wiper arm until it stops . . .

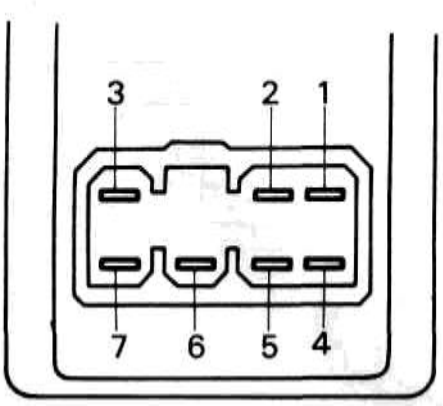


21.12b ... then hook the wiper link hook onto the edge of the dash panel service hole



21.13 Using a screwdriver, disconnect the motor arm from the wiper link

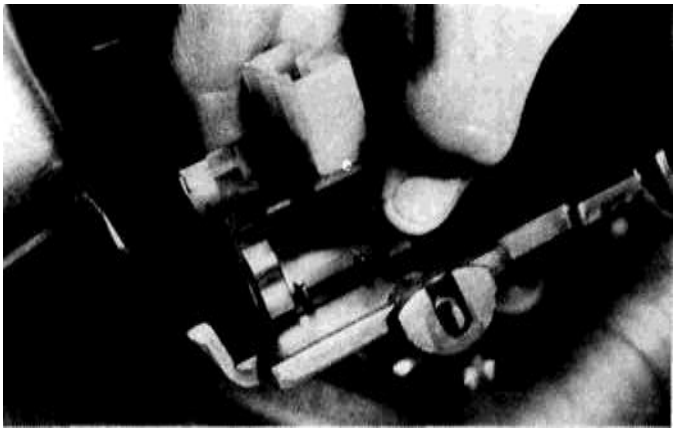
26.3 To check the remote control mirror switch, detach the instrument cluster finish panel from the dash and pull it down far enough to unplug the electrical connector from the switch



26.4a Use this terminal number guide when checking the remote control mirror switch

Mirror	Left				Right			
Switch position \ Terminal	7	6	1	2	3	2	1	5	4
UP	○		○	○	○	○	○		○
DOWN	○		○	○	○	○	○		○
LEFT		○	○	○	○	○	○	○	
RIGHT		○	○	○	○	○	○	○	

26.4b Refer to this table when checking continuity between the terminals of the remote control mirror switch



26.5 To remove the remote control mirror switch, depress the tabs on top and bottom of the switch housing

22 Horn — removal and installation

1 Disconnect the cable from the negative terminal of the battery.
2 The horn is located at the left front corner of the luggage compartment, just behind the radiator air bleeder valve.
3 Unplug the horn electrical connector.
4 Remove the horn mounting bolt.
5 Remove the horn.
6 Installation is the reverse of removal.

23 Cruise control — general information

Because of system complexity, special diagnostic equipment needed and safety considerations, the cruise control system should be serviced only by trained professionals.

24 Power door lock system — general information

Because of the difficulty involved in gaining access to the remote door lock motor, replacement of this component is best left to a trained professional.

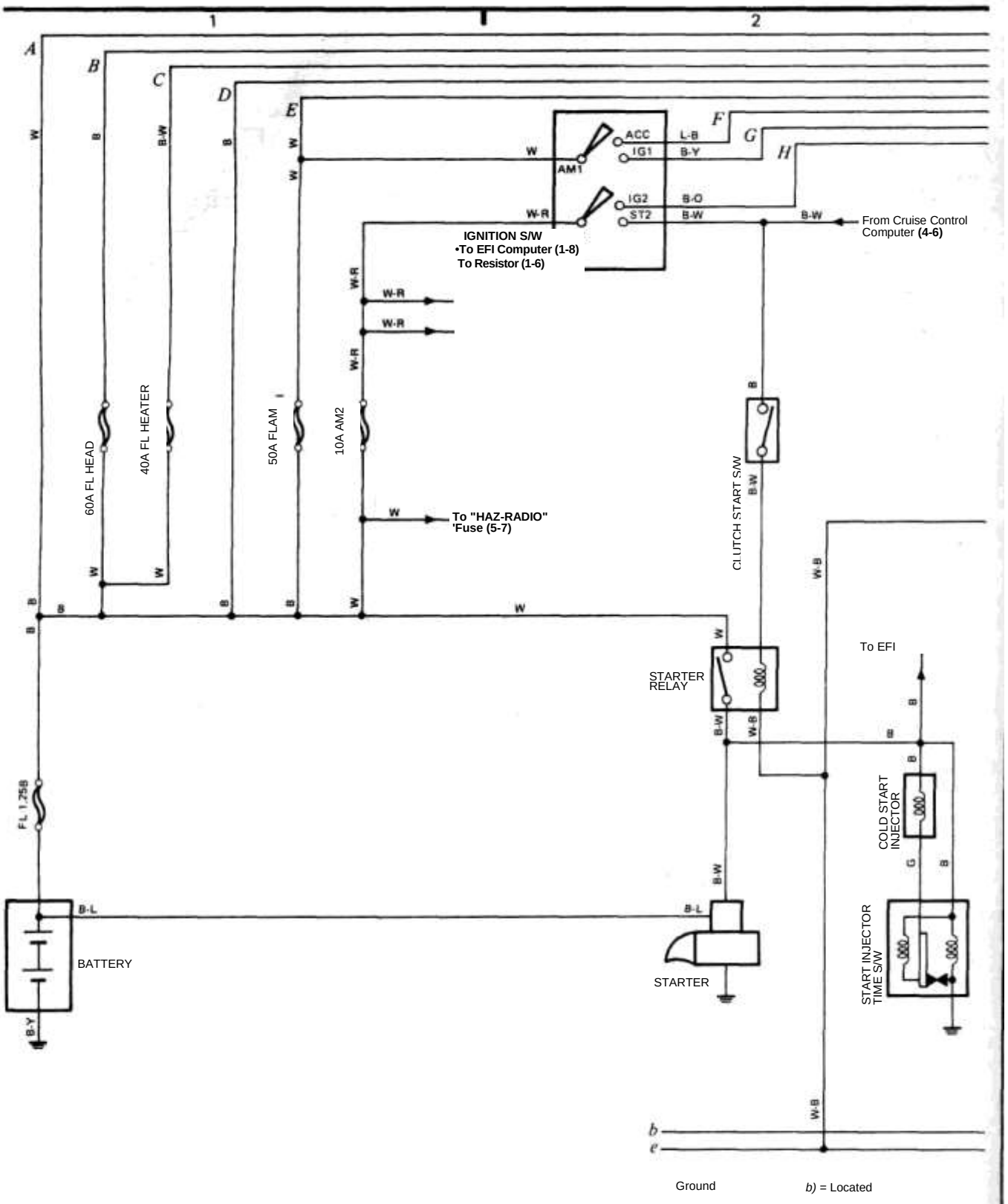
25 Power windows — general information

Because of the difficulty involved in gaining access to the power window motor, replacement of this component should be done by a dealer service department.

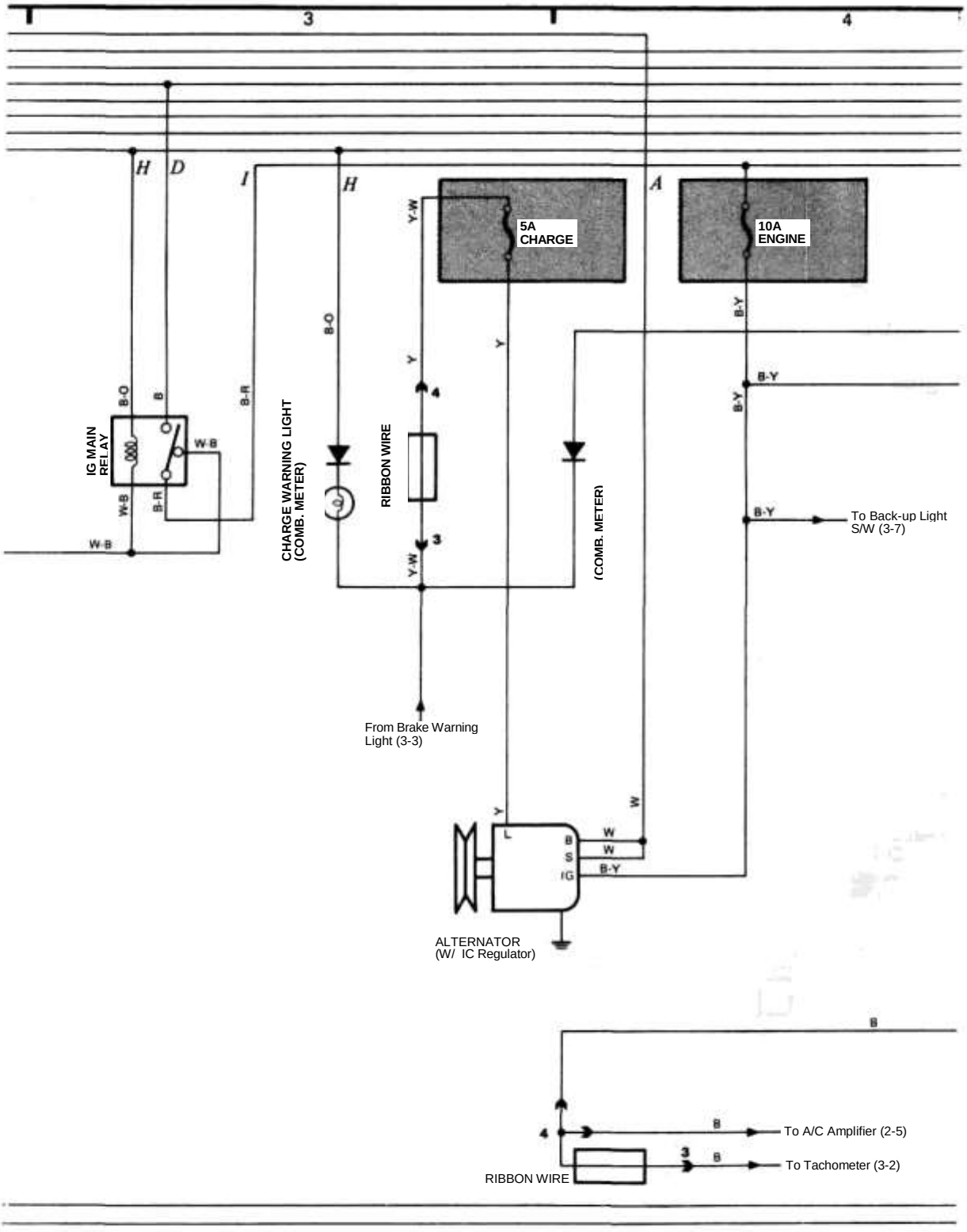
26 Remote control mirror switch — check and replacement

Refer to illustrations 26.3, 26.4a, 26.4b and 26.5

1 The remote control mirror switch is located in the left side of the instrument cluster finish panel, just to the left of the steering column.
2 To check or replace the switch, you must first remove the instrument cluster finish panel (refer to Chapter 11).
3 Pull down the instrument cluster finish panel far enough to unplug the electrical connector from the switch **(see illustration)**
4 Using an ohmmeter, check the switch continuity between terminals **(see illustrations).** If continuity is not as specified, replace the switch.
5 To replace the switch, push in the tabs on the top and bottom of the switch housing and pull it from the back of the instrument cluster finish panel **(see illustration).**
6 Installation is the reverse of removal.

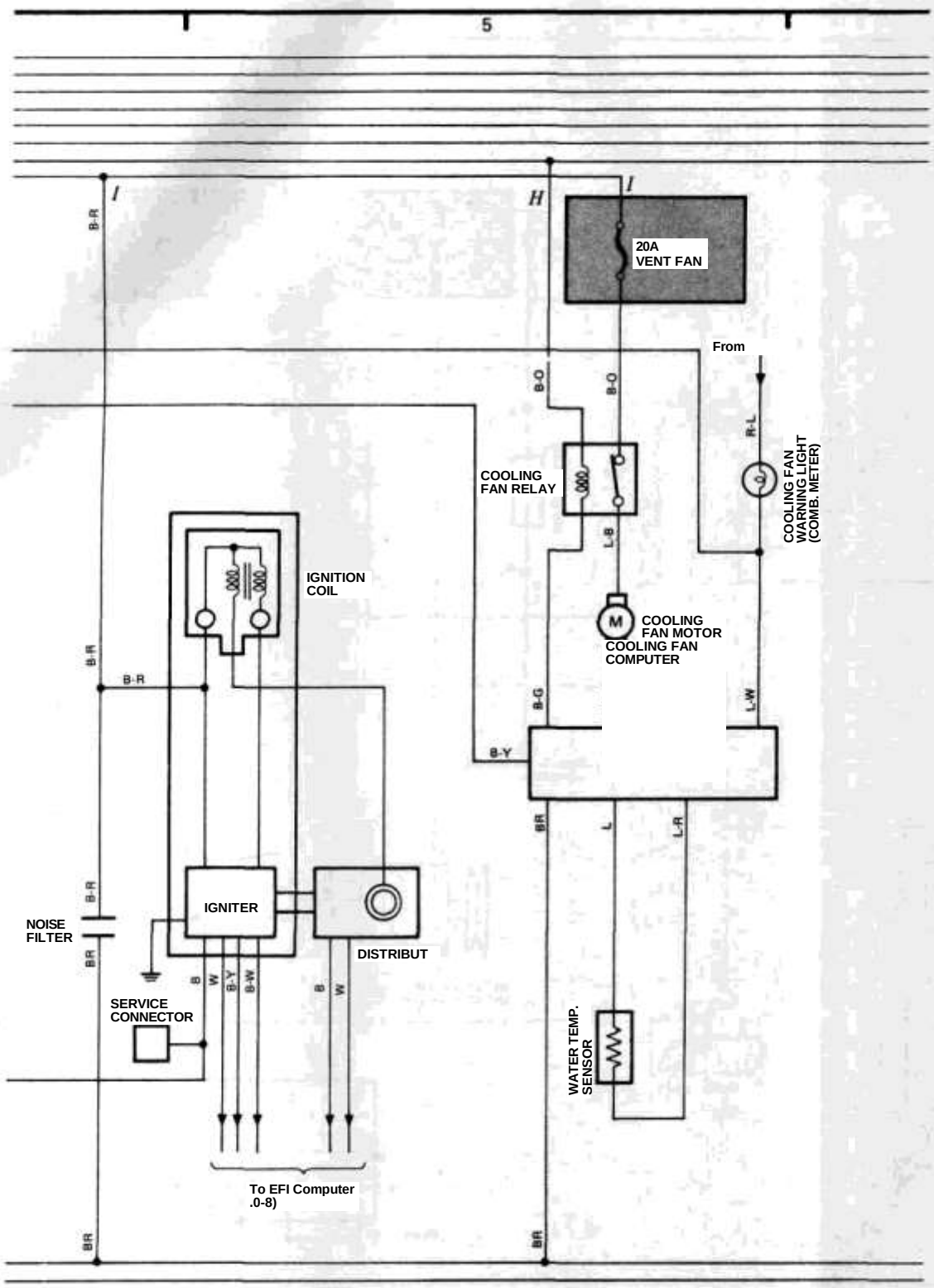

1
2
A
B
C
D
E
F
G
H
ACC
IG1
IG2
ST2
AM1
L-B
B-Y
B-O
B-W
W
W-R
IGNITION S/W
•To EFI Computer (1-8)
To Resistor (1-6)
From Cruise Control Computer (4-6)
60A FL HEAD
40A FL HEATER
50A FL-AM1
10A AM2
To "HAZ-RADIO" 'Fuse (5-7)
CLUTCH START S/W
STARTER RELAY
To EFI
COLD START INJECTOR
START INJECTOR TIME S/W
FL 1.25B
BATTERY
STARTER
B-L
B-Y
W-B
G
b
e
Ground
b) = Located

The



6 = Located on center of back panel

The charging system circuit


5
I
H
I
B-R
20A
VENT FAN
From
B-O
B-O
R-L
COOLING
FAN RELAY
COOLING FAN
WARNING LIGHT
(COMB. METER)
L-B
IGNITION
COIL
M
COOLING
FAN MOTOR
COOLING FAN
COMPUTER
B-R
B-R
B-G
L-W
B-Y
BR
L
L-R
B-R
IGNITER
NOISE
FILTER
BR
DISTRIBUT
B
W
B-Y
B-W
B
W
SERVICE
CONNECTOR
WATER TEMP.
SENSOR
To EFI Computer
.0-8)
BR
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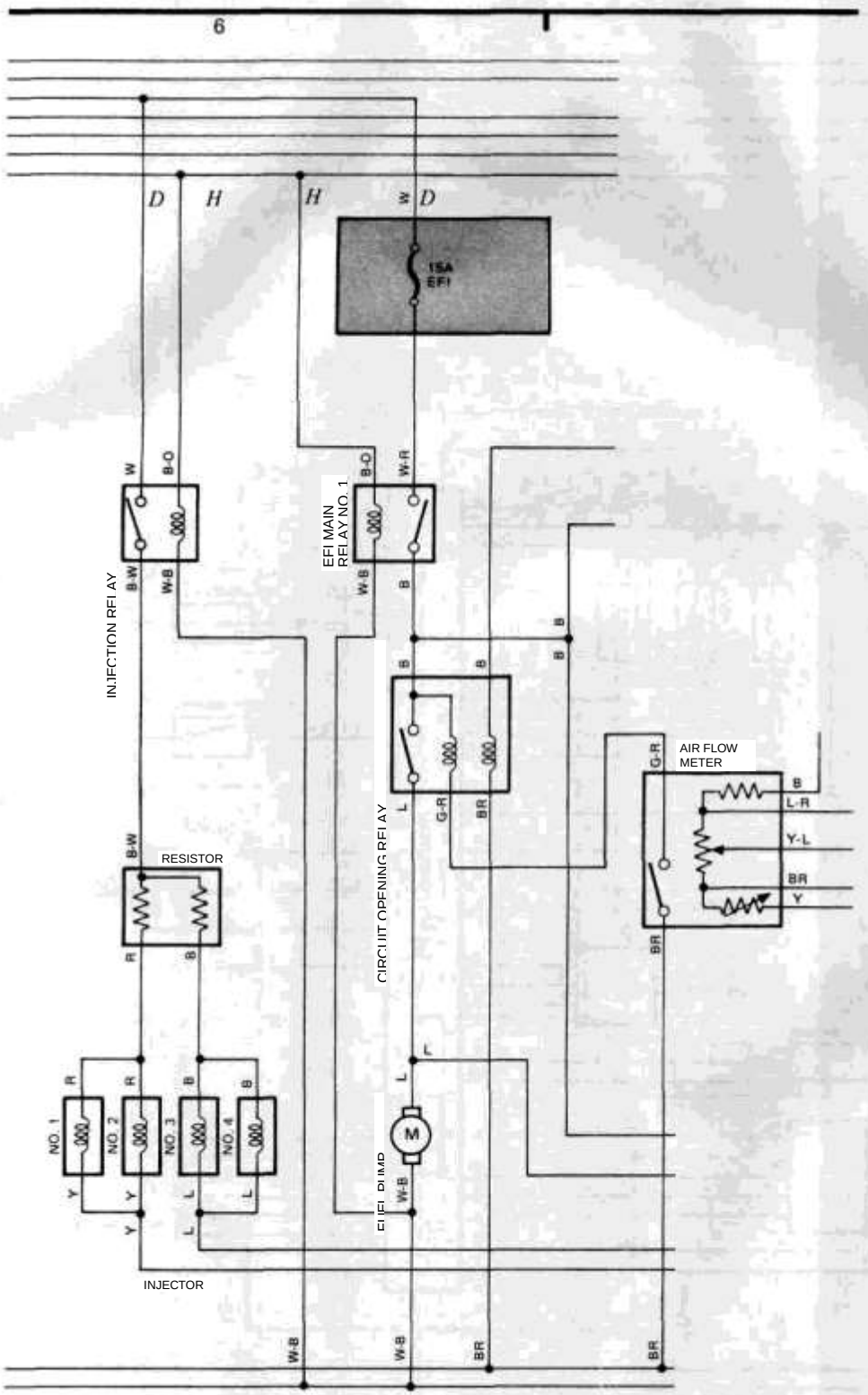
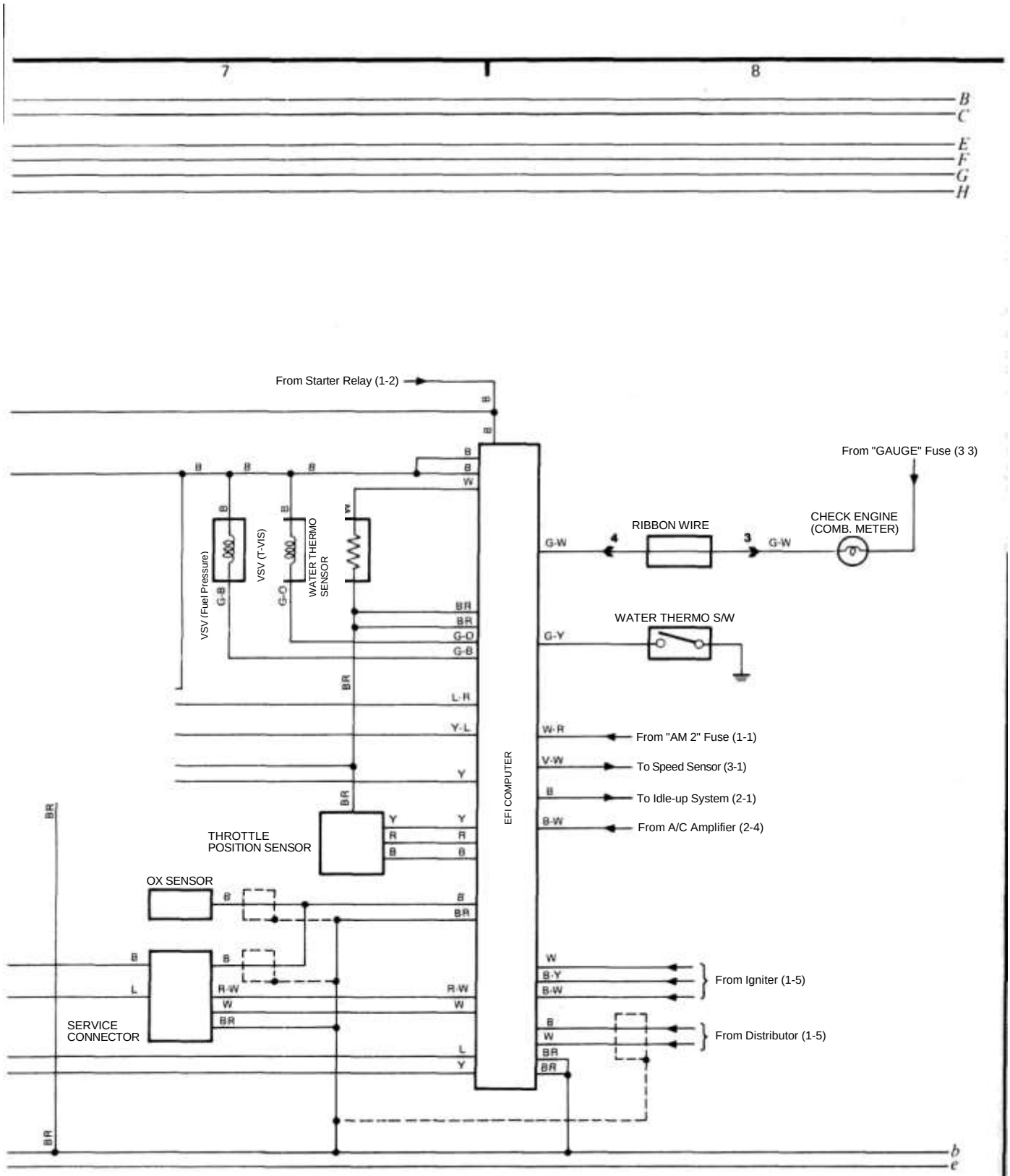
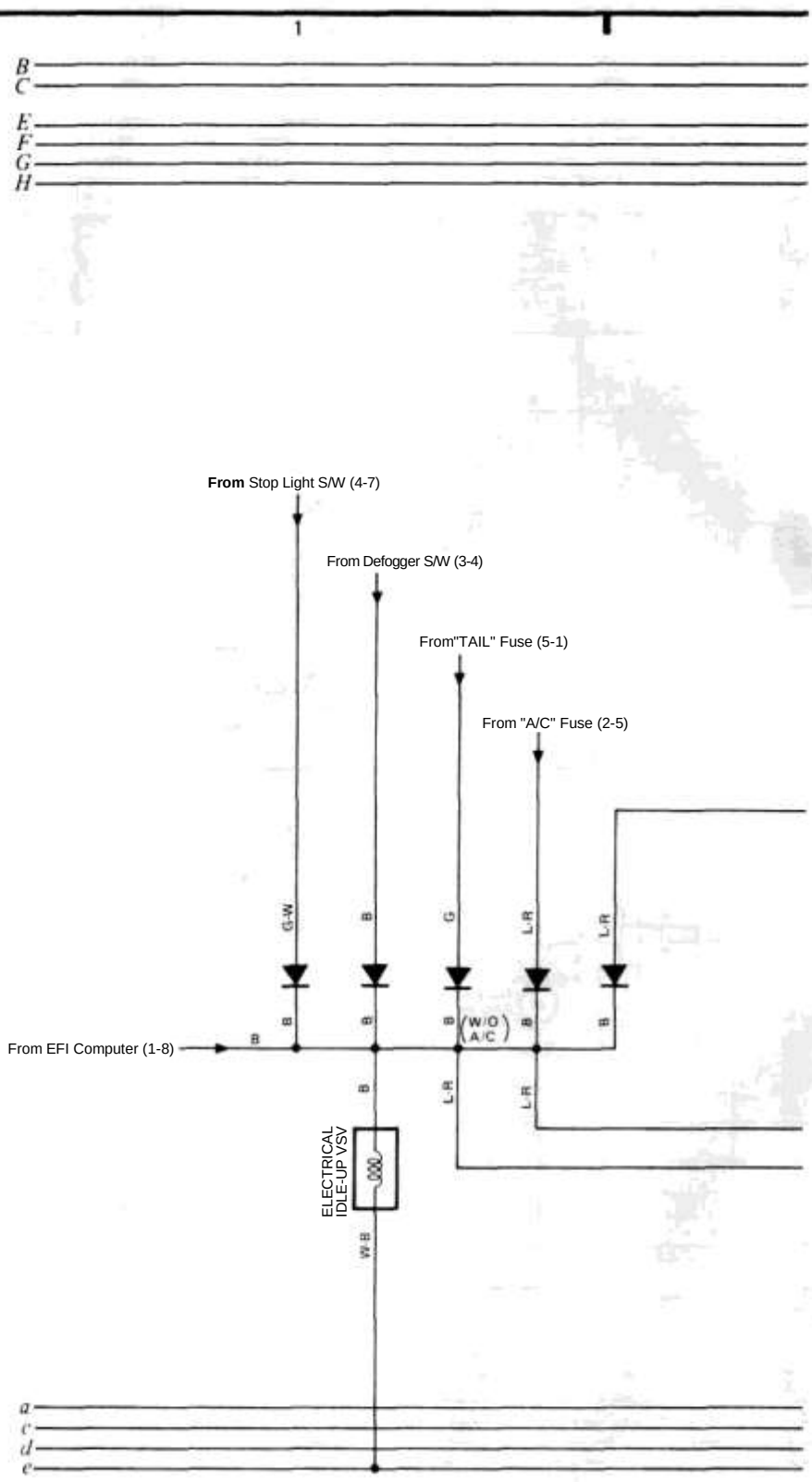
The



The electronic fuel injection system circuit

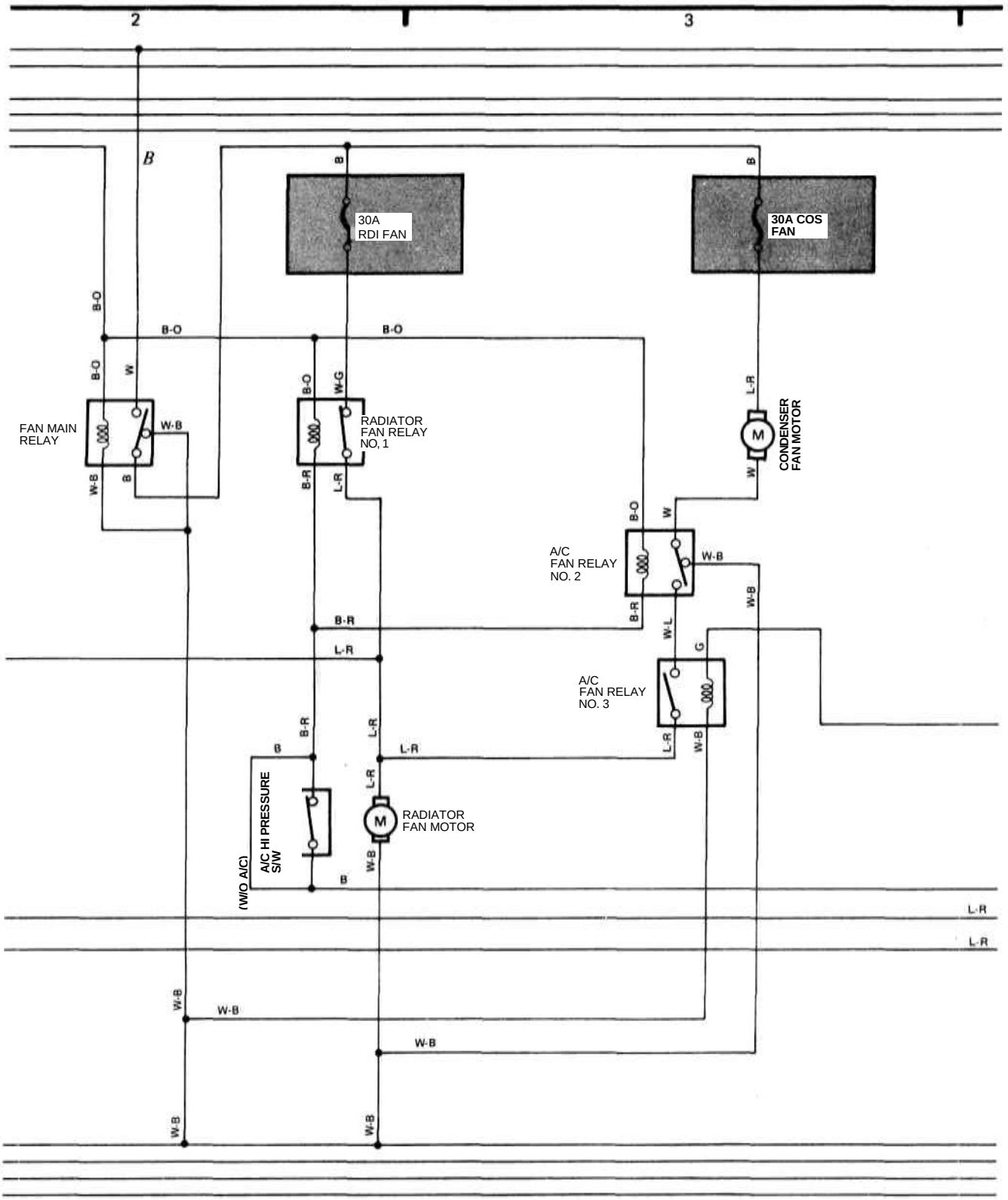


The electronic fuel injection system circuit (continued)



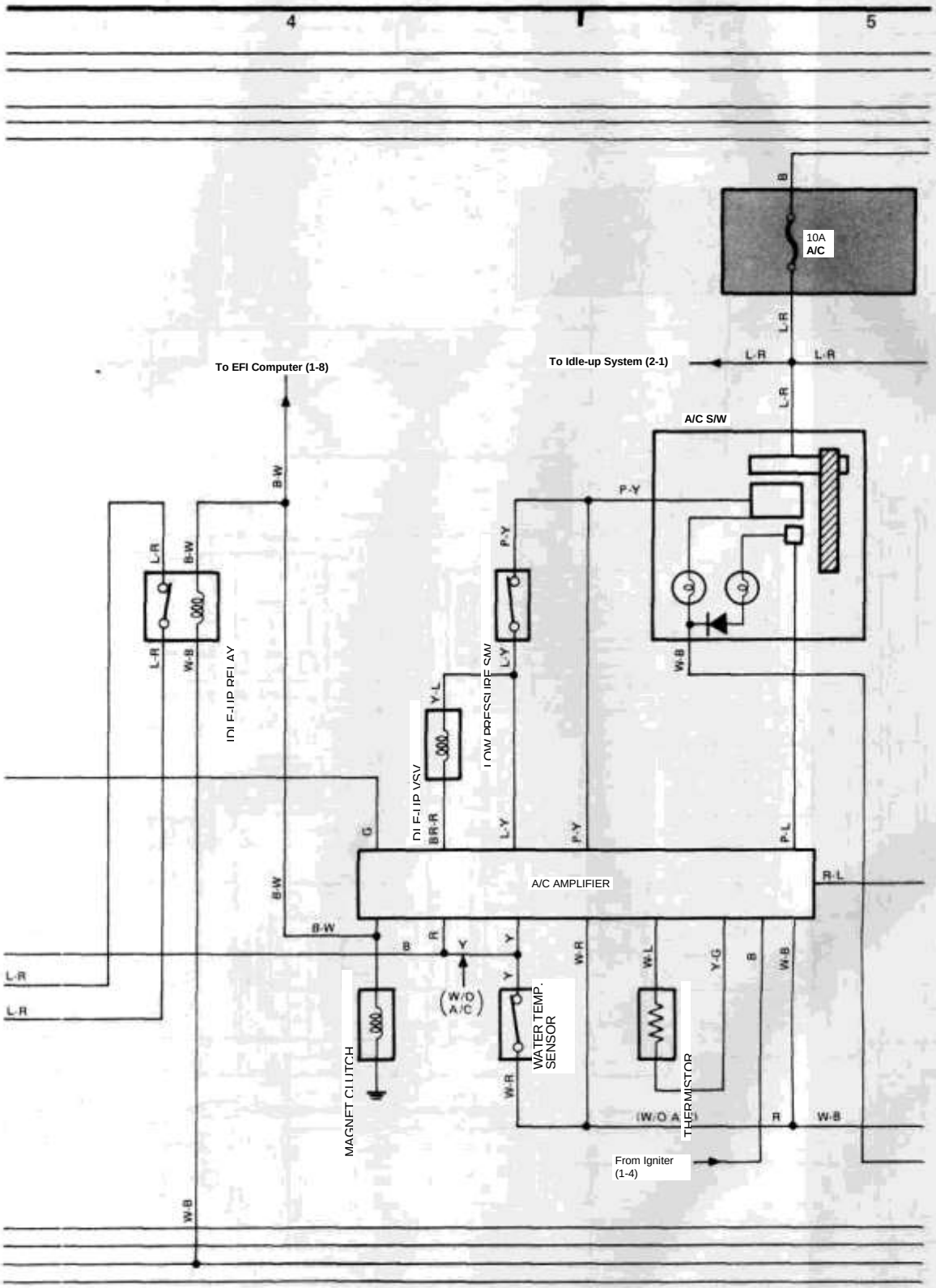
Ground points *α* = Located in right front fender *C* = Located under right front pillar

The idle-up circuit

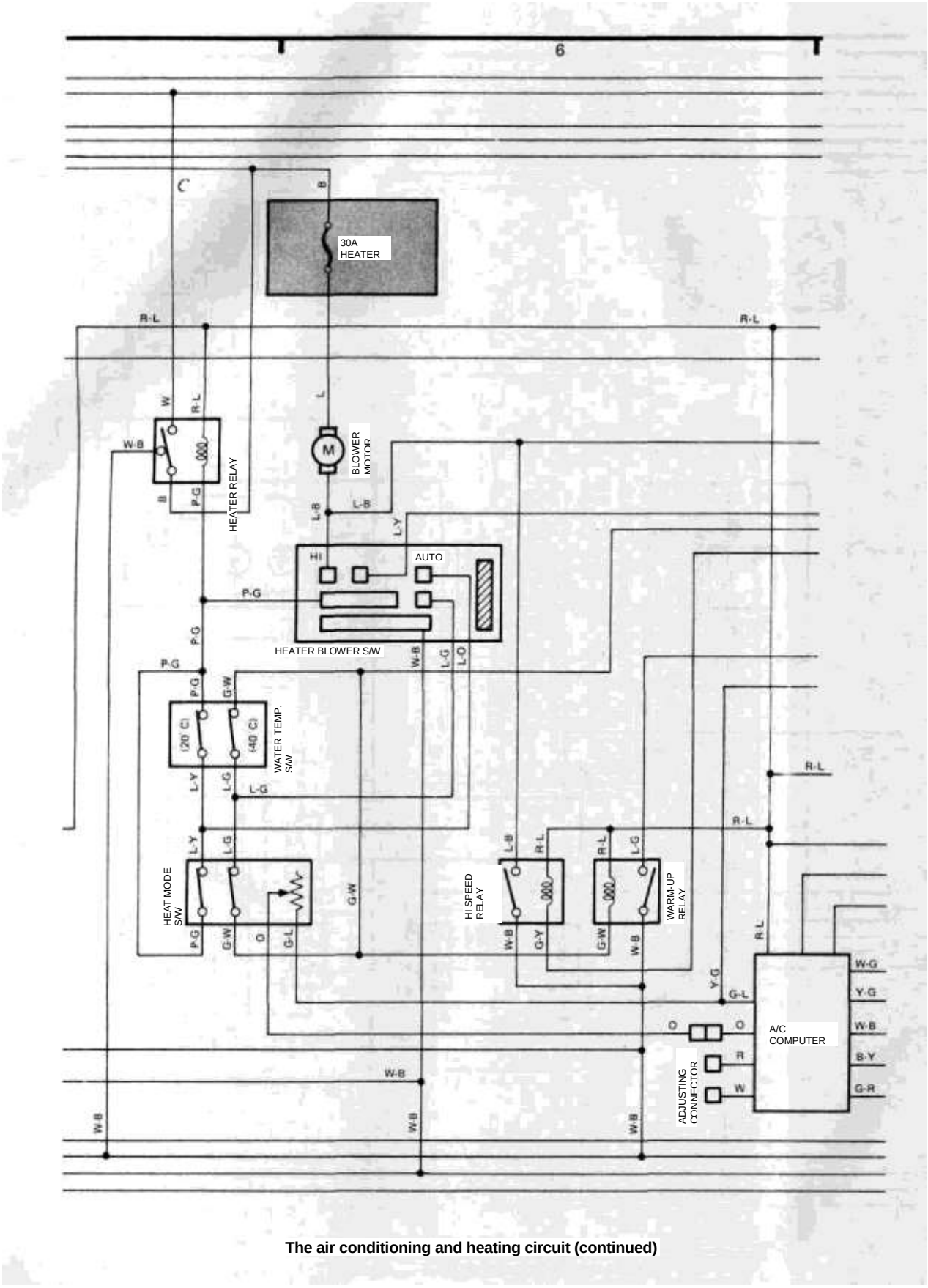


d = Located under left front pillar e = Located on center of back panel

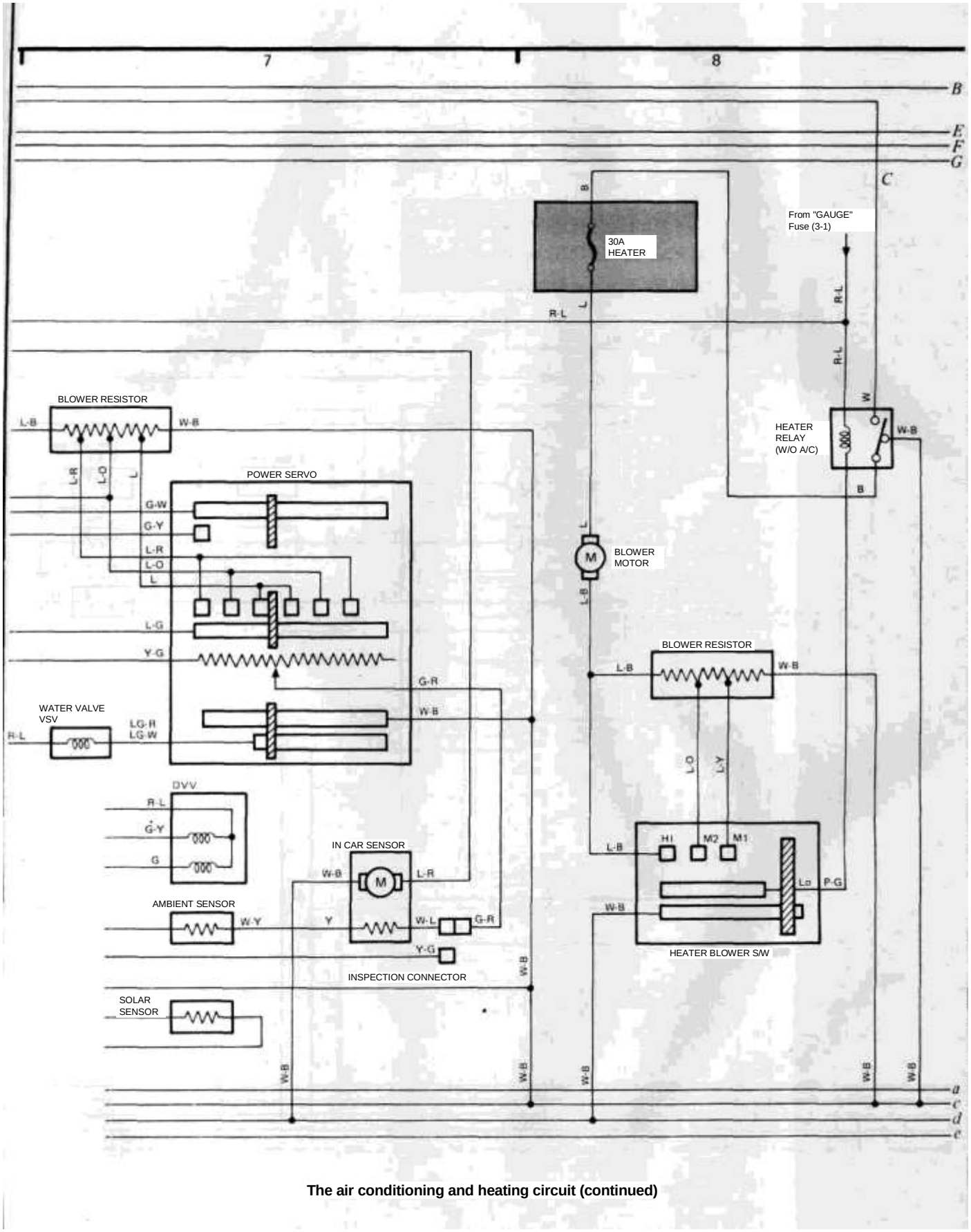
The radiator and A/C condenser fan circuit



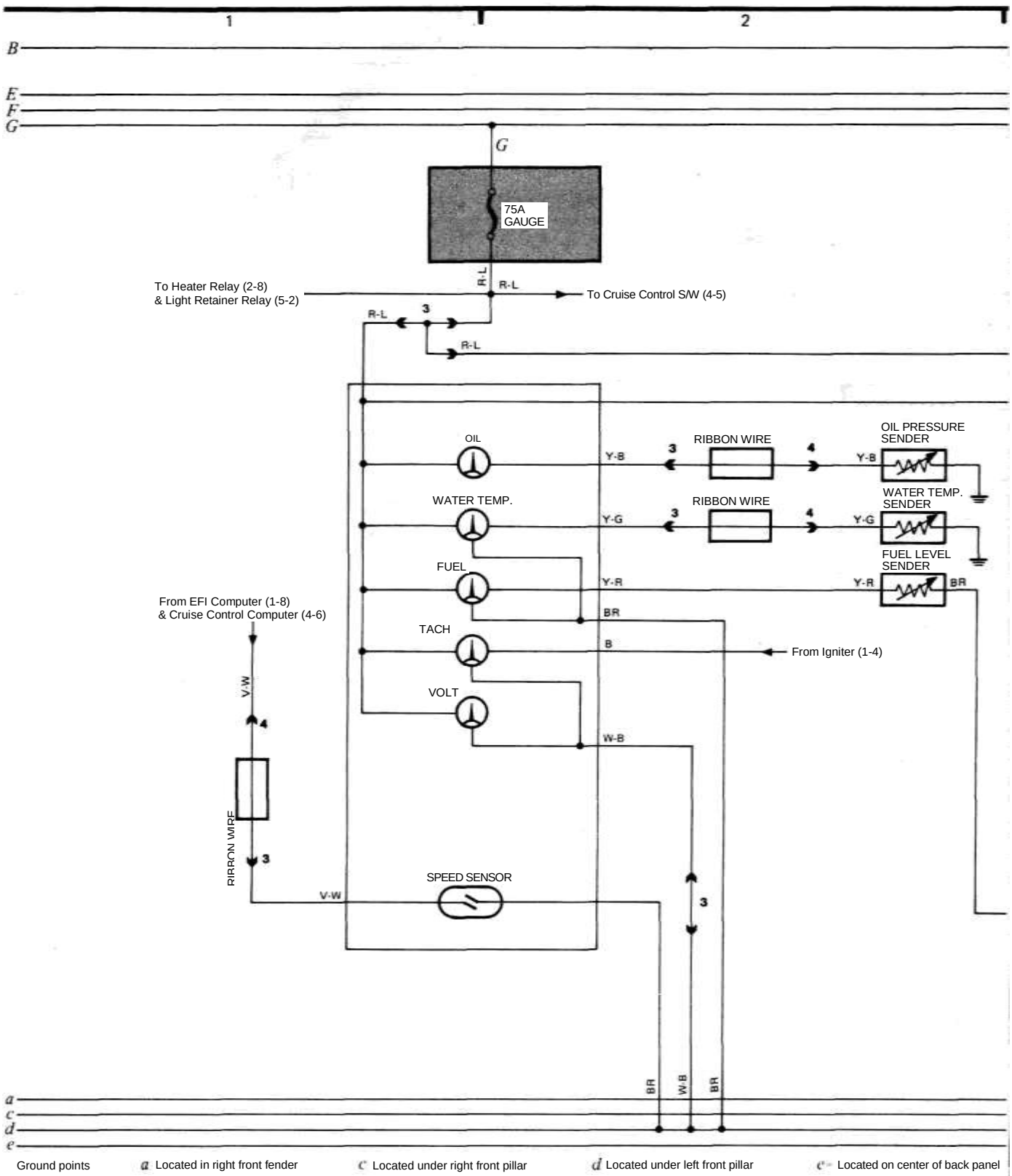
The air conditioning and heating circuit



The air conditioning and heating circuit (continued)

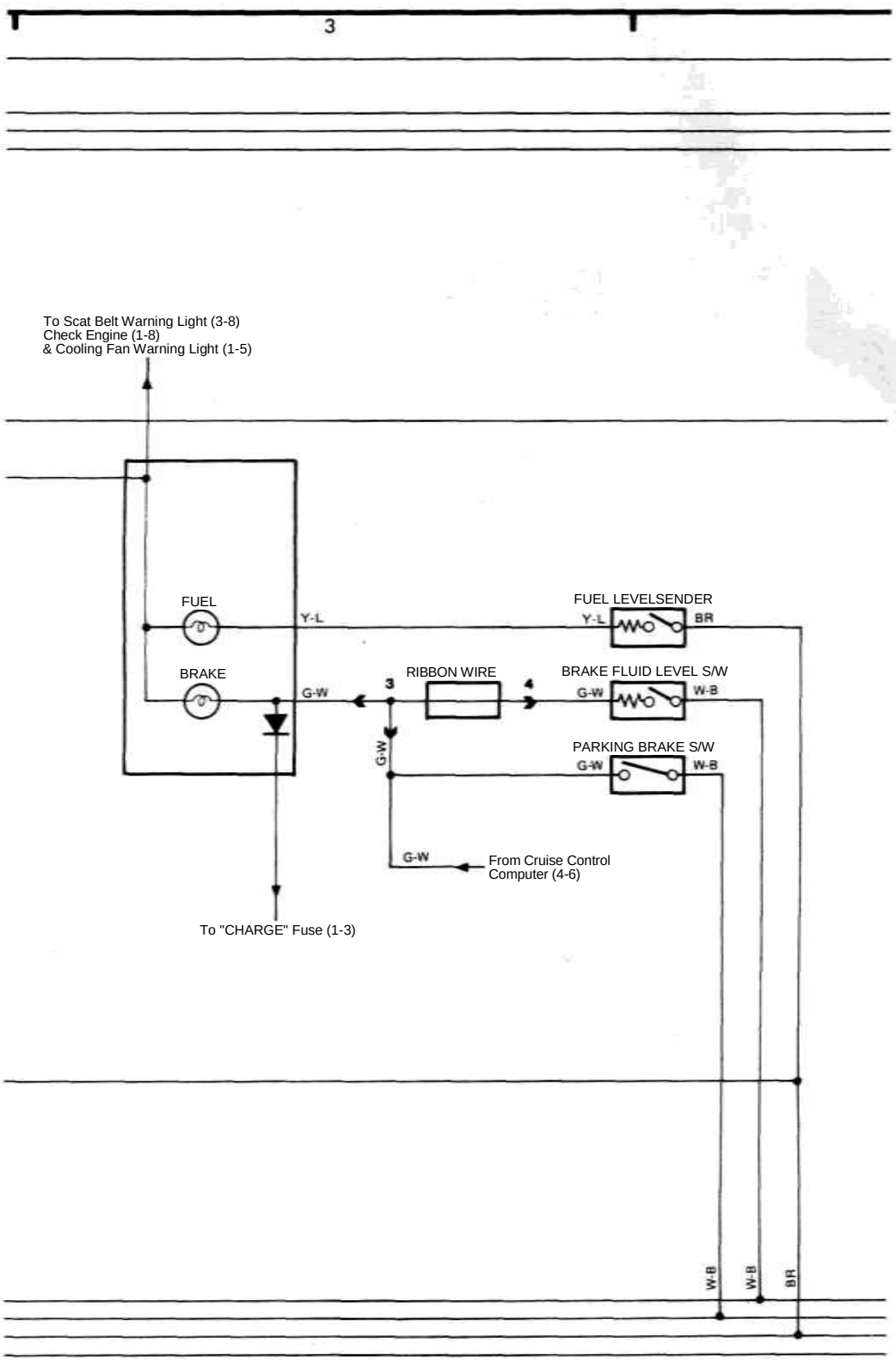


The air conditioning and heating circuit (continued)

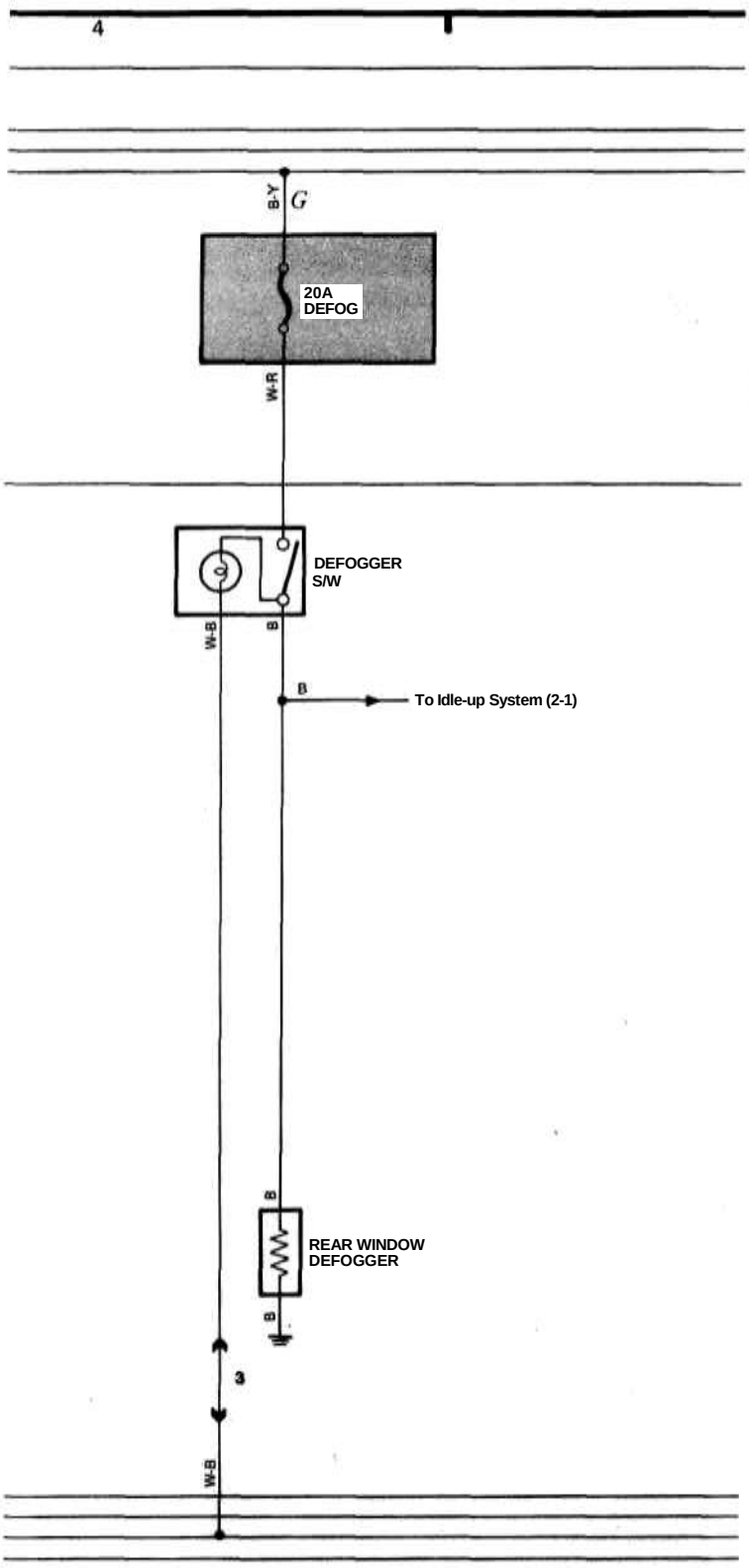


Ground points *a* Located in right front fender *c* Located under right front pillar *d* Located under left front pillar *e* Located on center of back panel

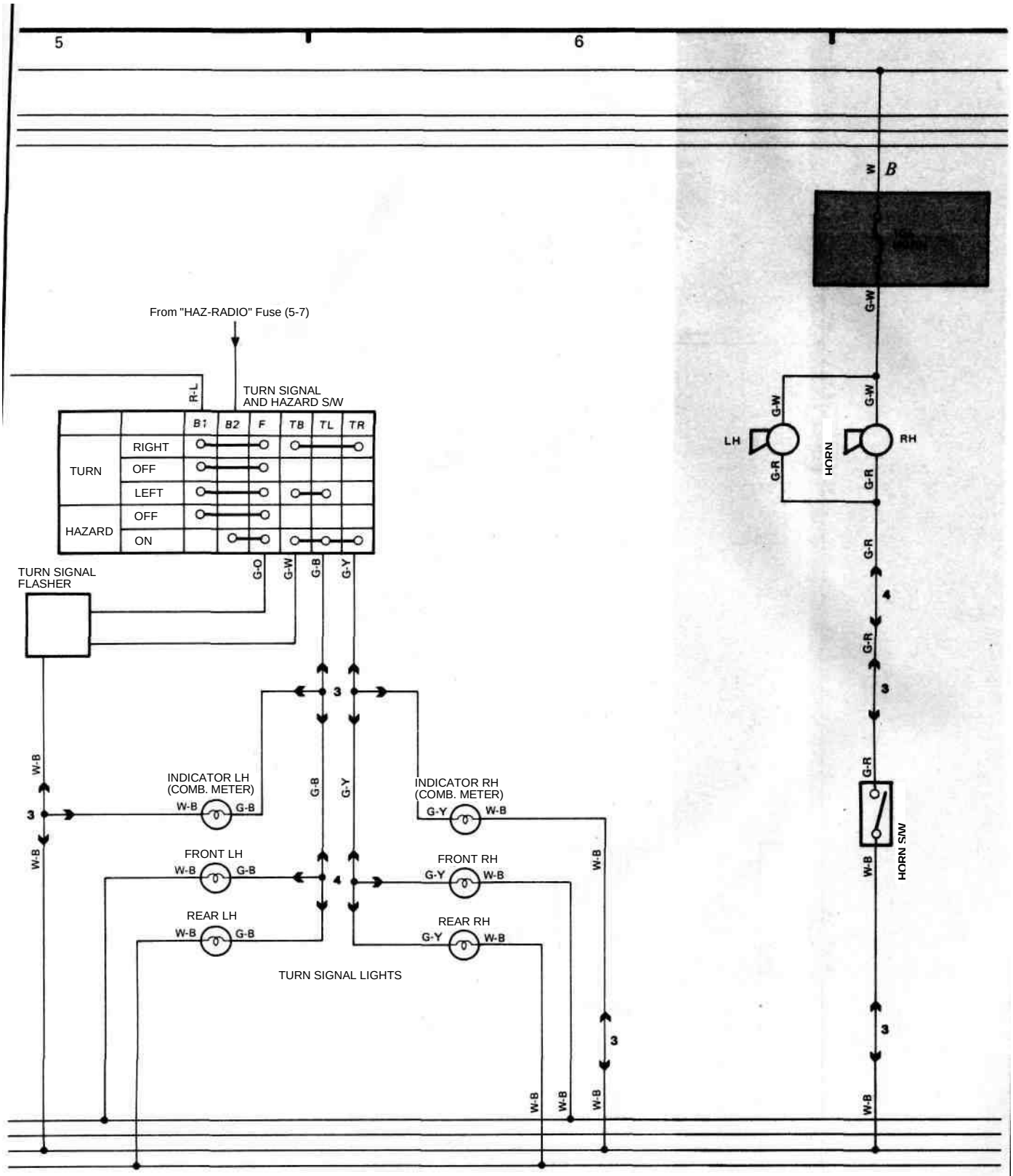
Instrument panel circuit



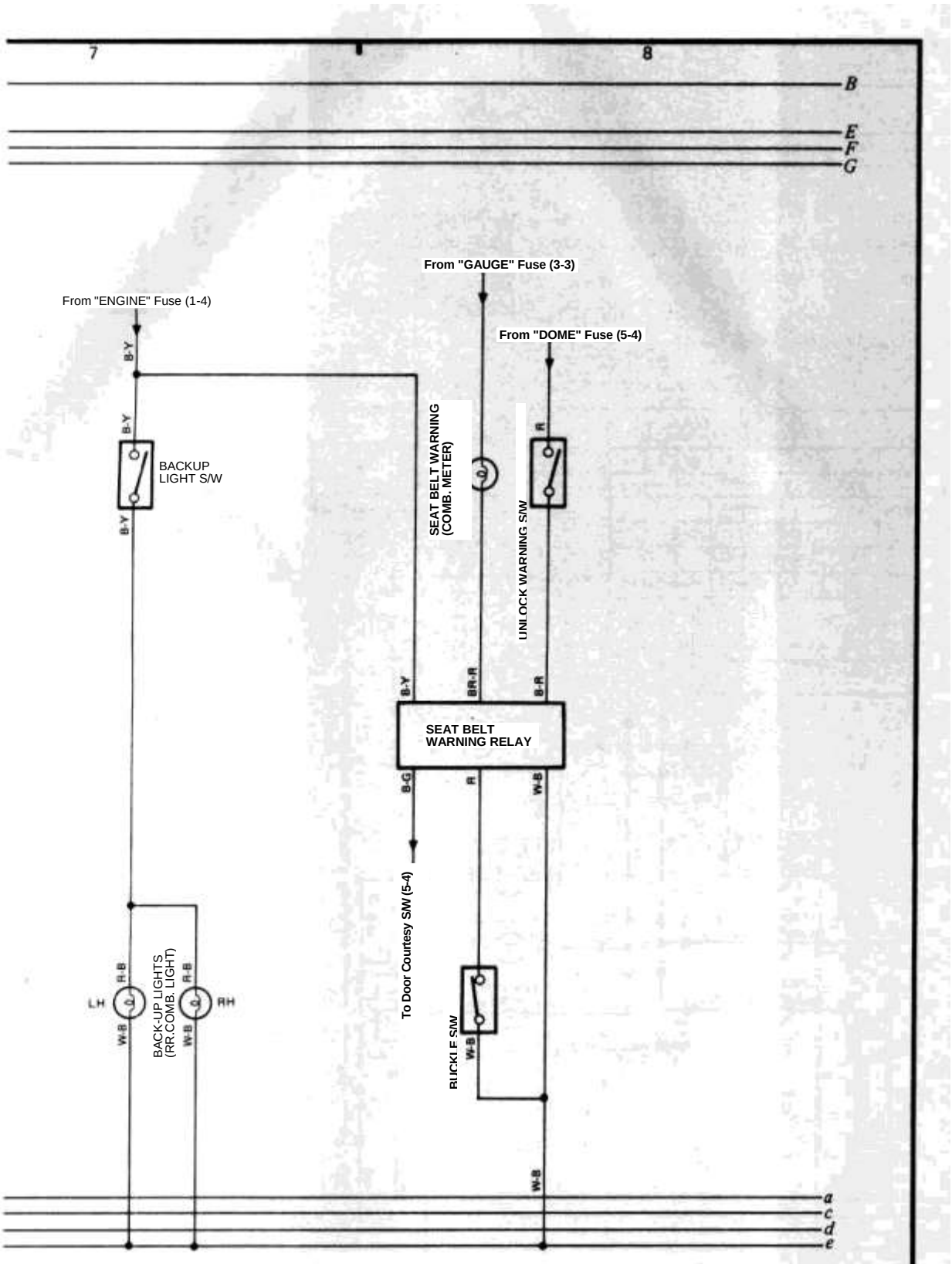
Instrument panel circuit (continued)



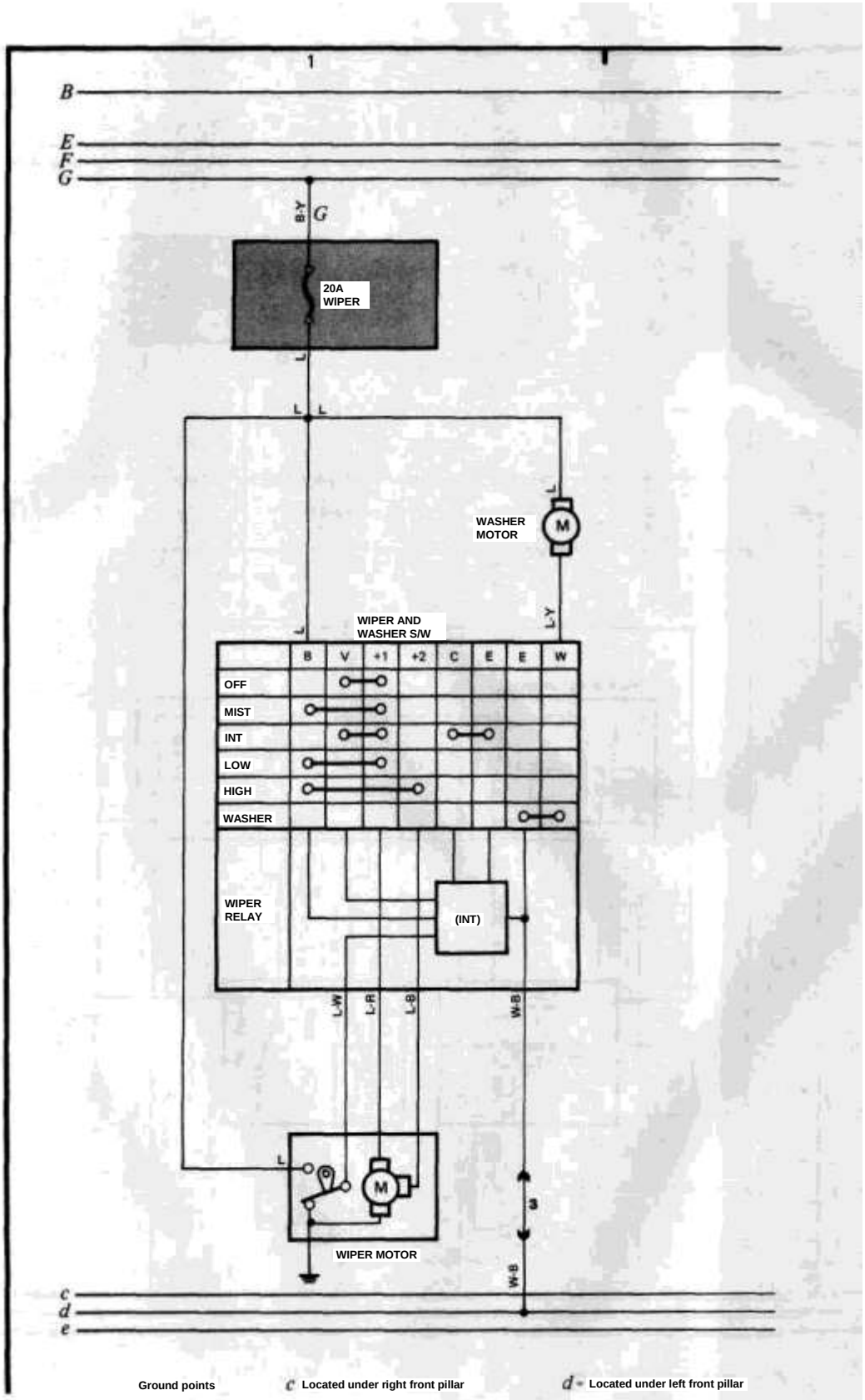
Rear window defogger circuit



Turn signal and hazard flasher circuit

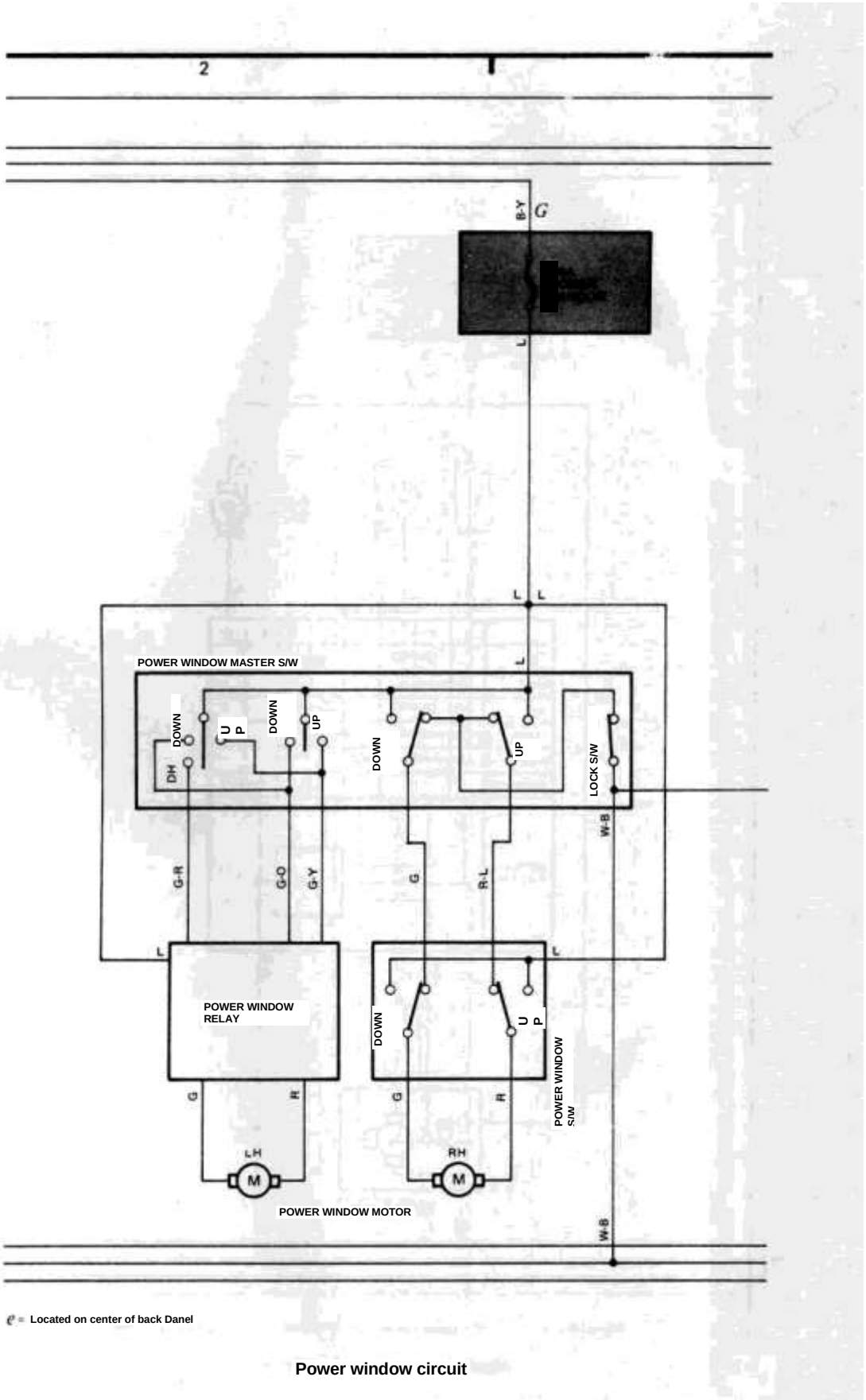


Seat belt warning circuit



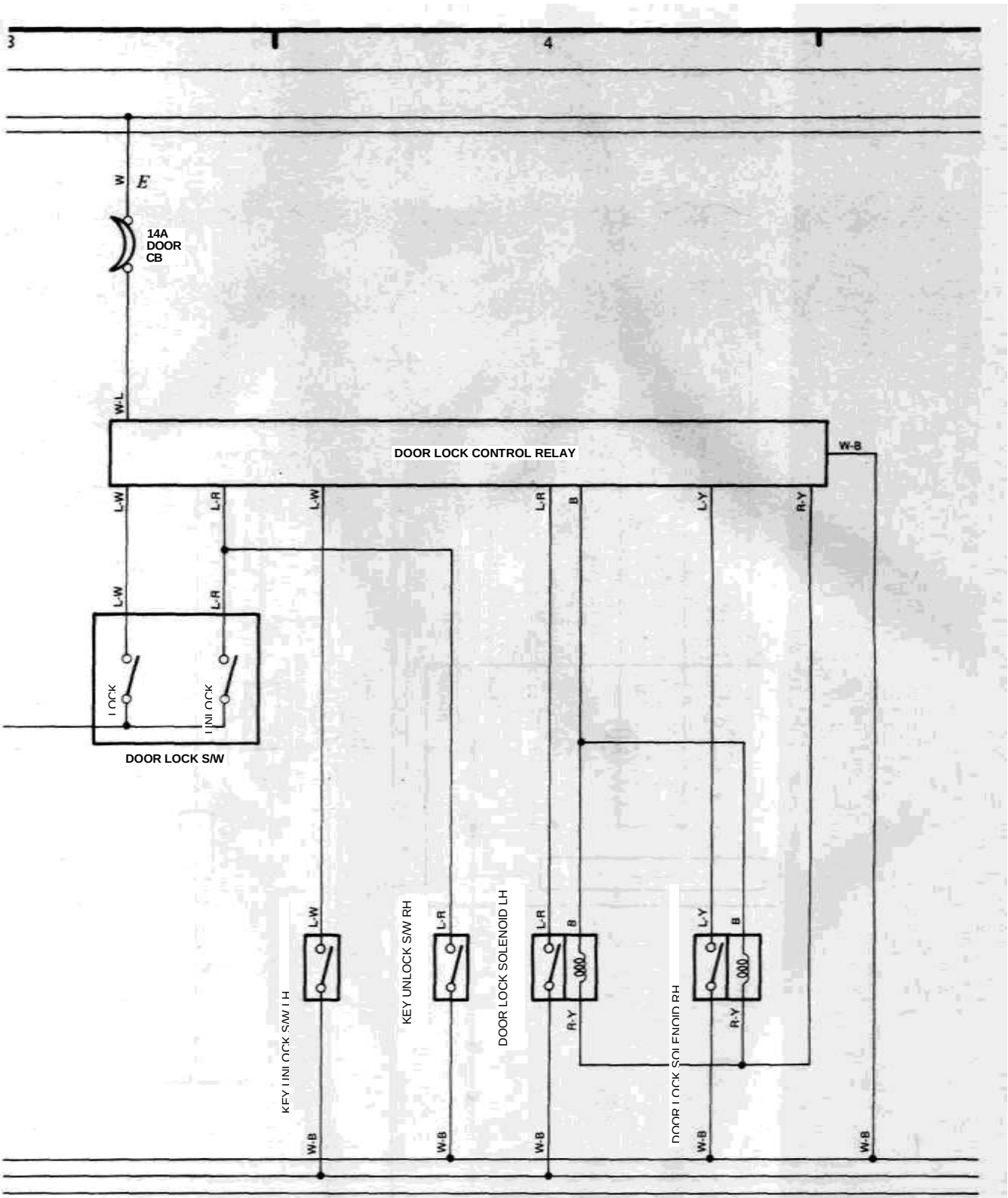
Ground points c Located under right front pillar d Located under left front pillar

Wiper and washer motor circuit

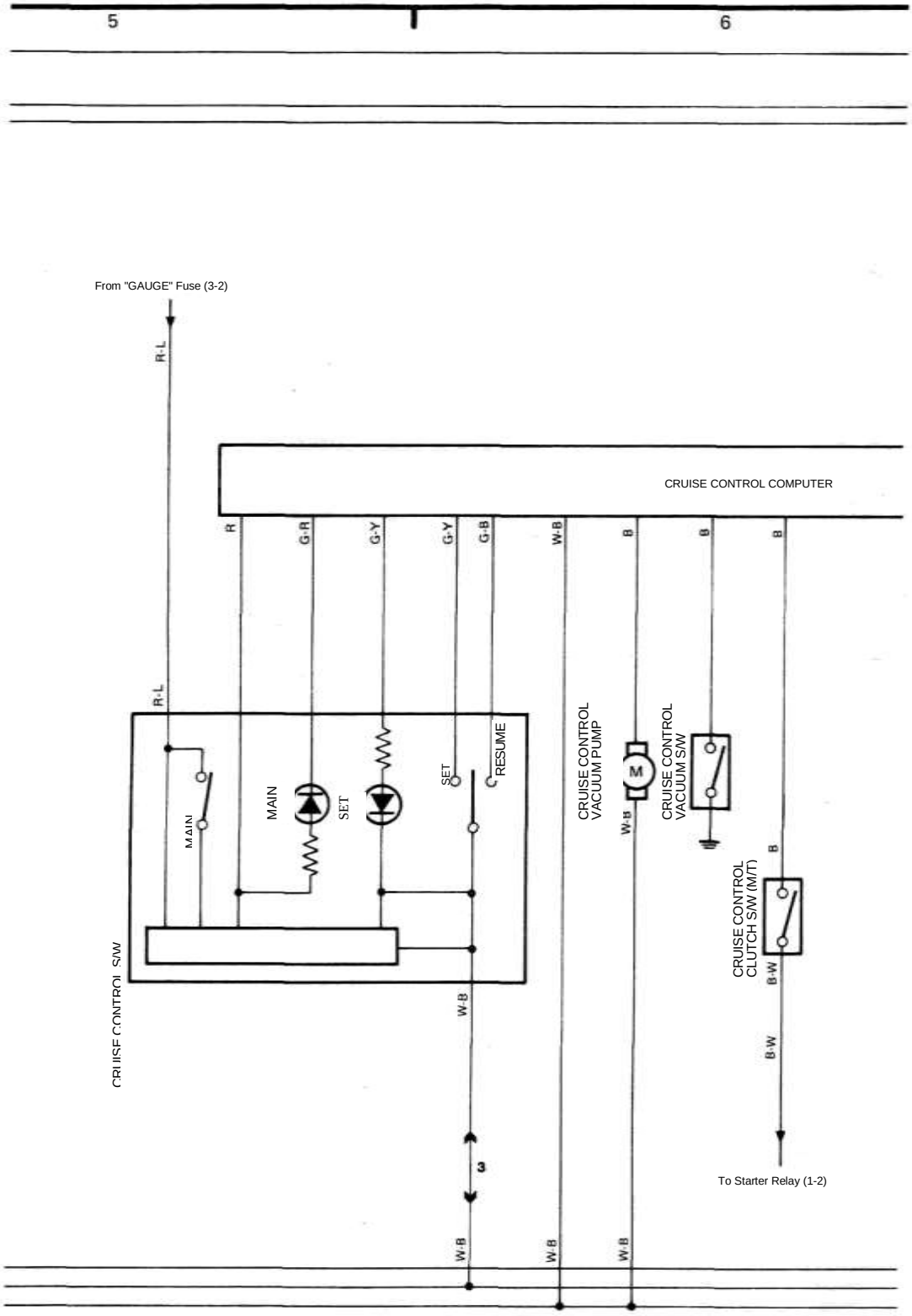


* = Located on center of back Danel

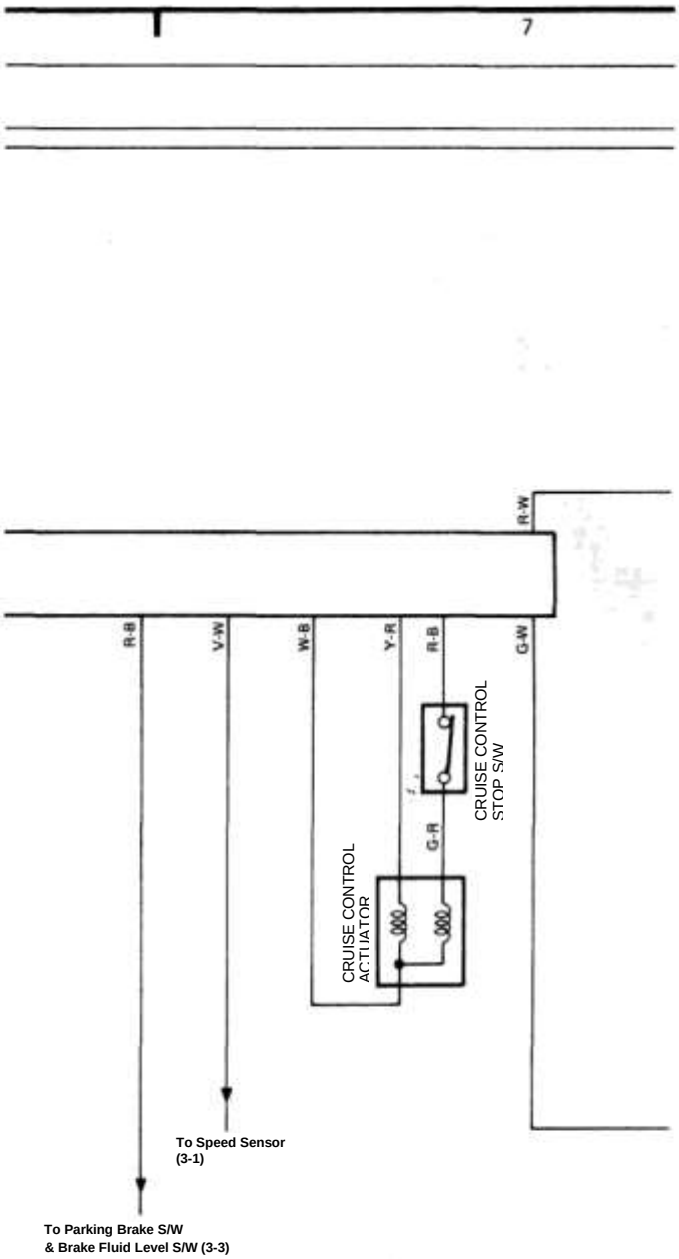
Power window circuit



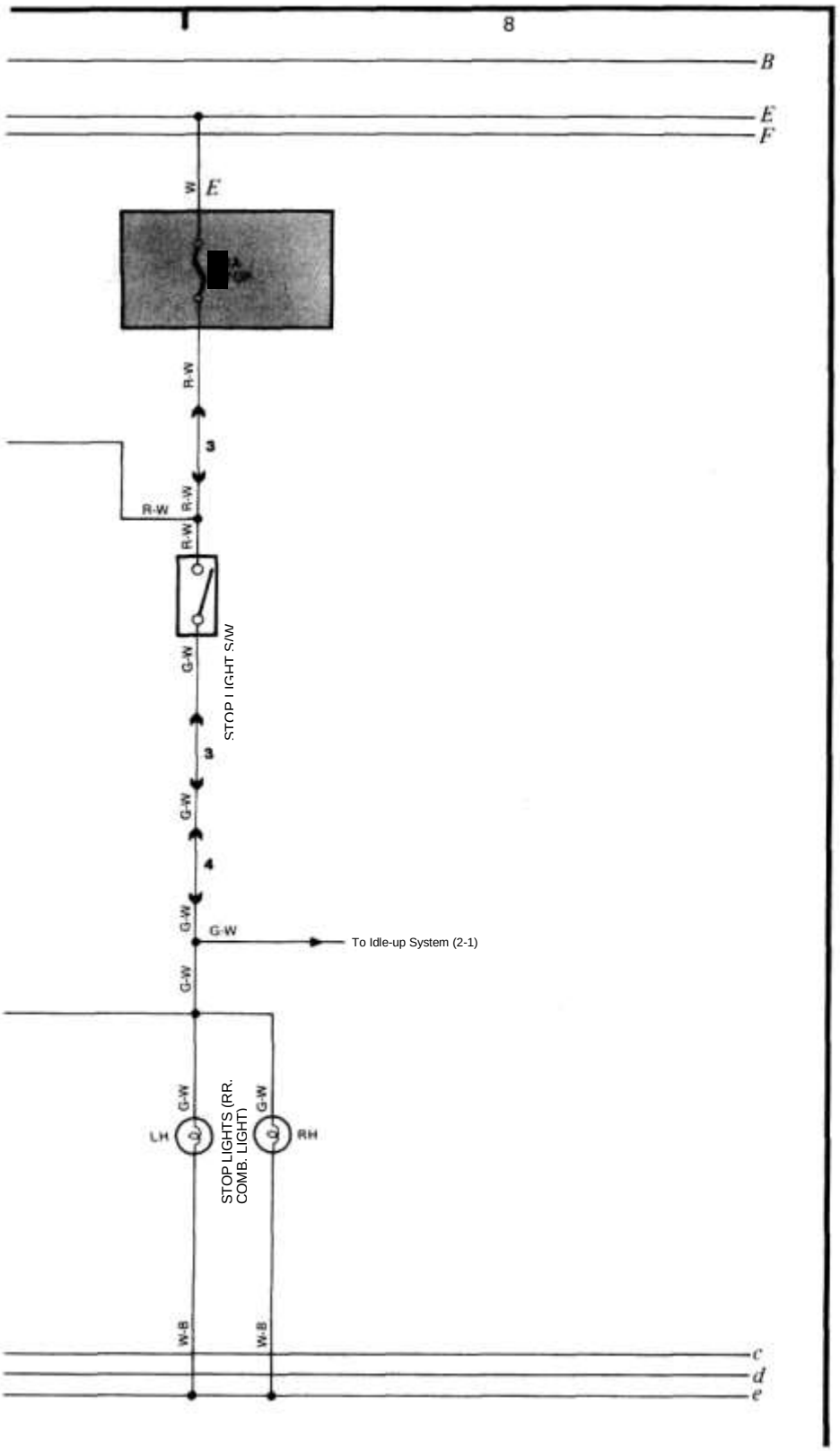
Power door lock circuit



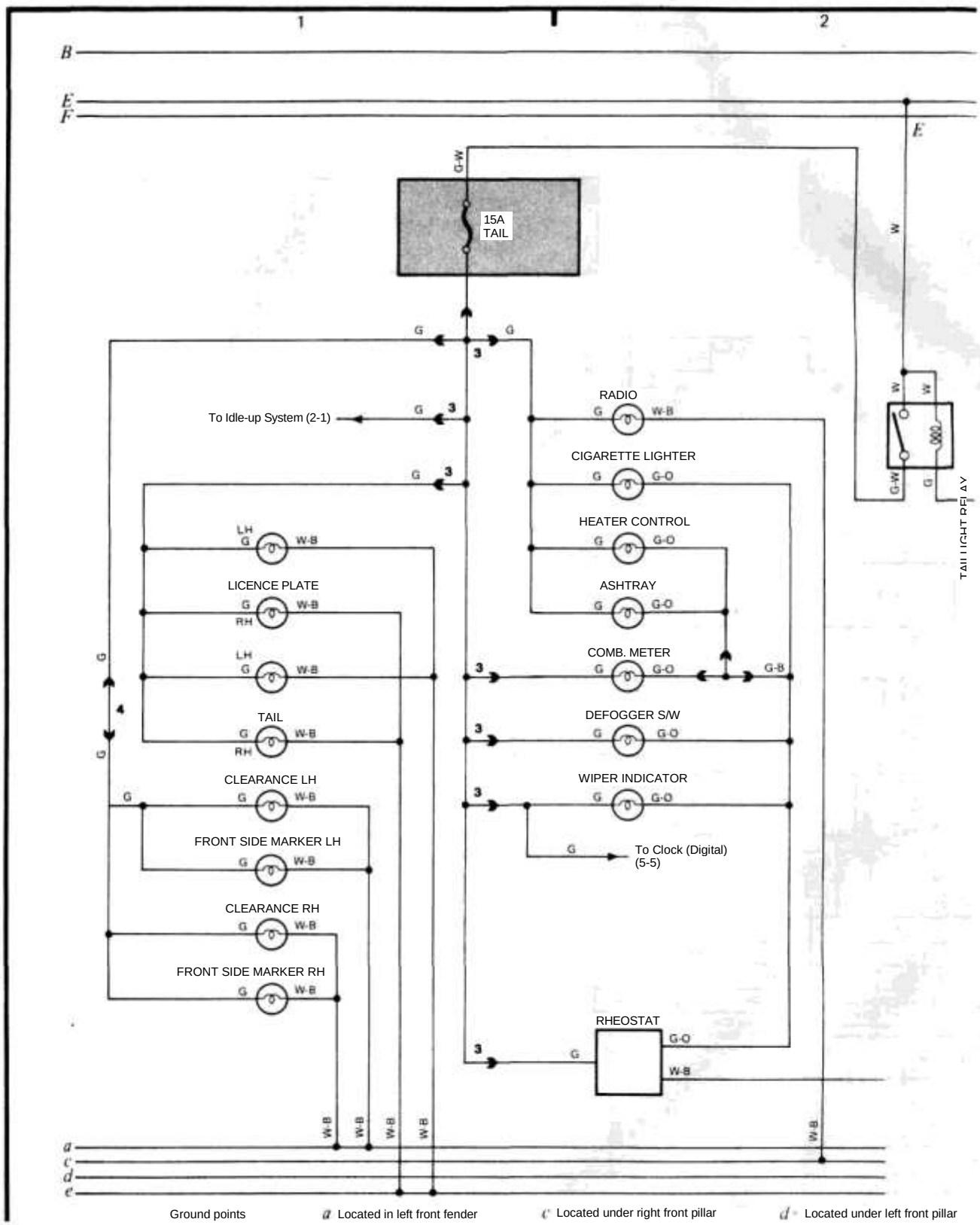
Cruise control circuit



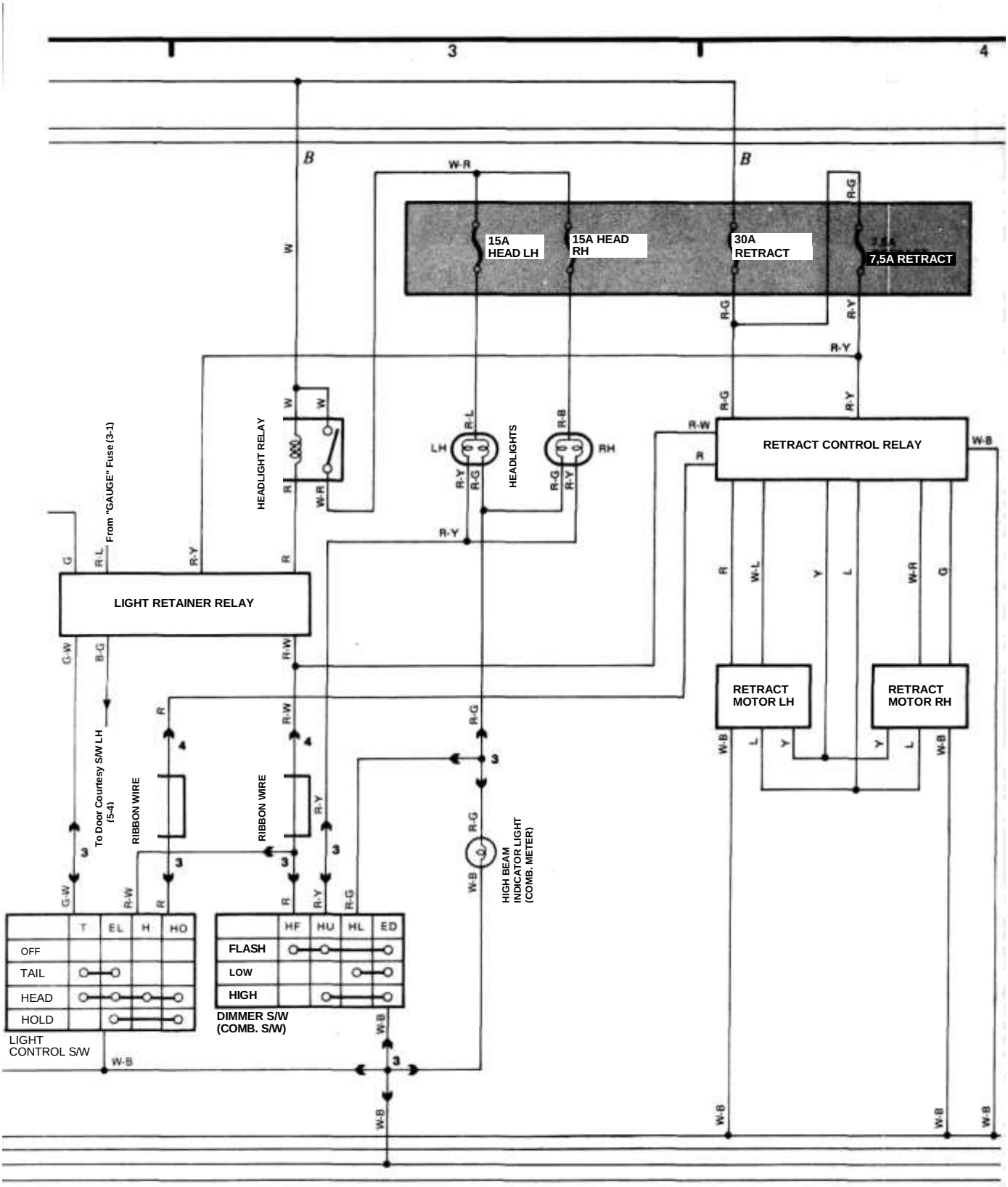
Cruise control circuit (continued)



Stop light circuit

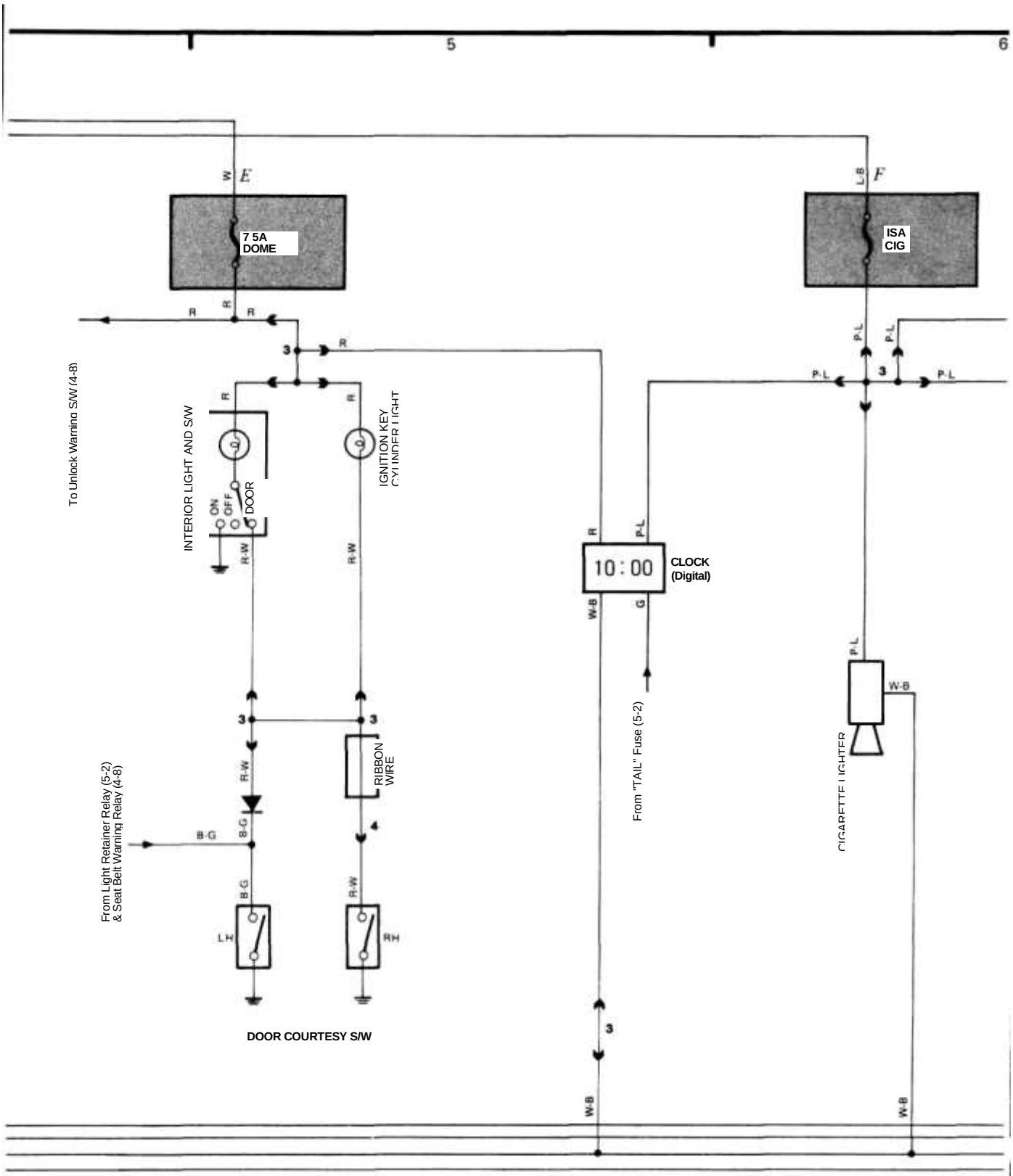


Taillight and instrument illumination circuit

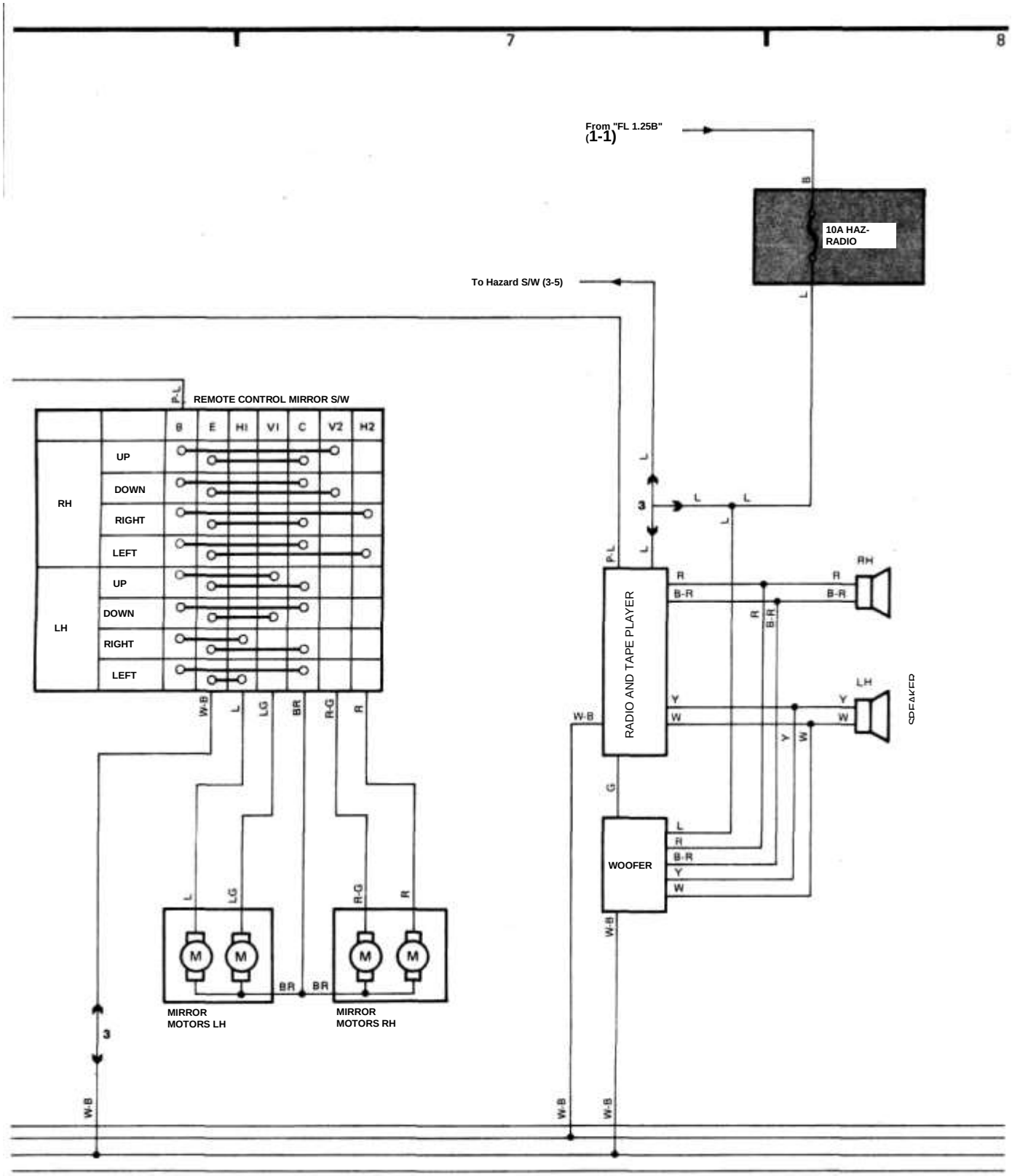


℄ = Located on center of back panel

Headlight circuit



Interior light, clock and cigarette circuit



Remote control mirrors and radio circuit

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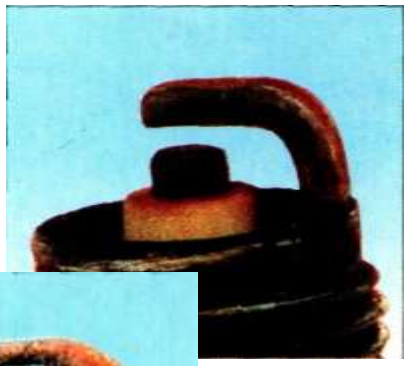
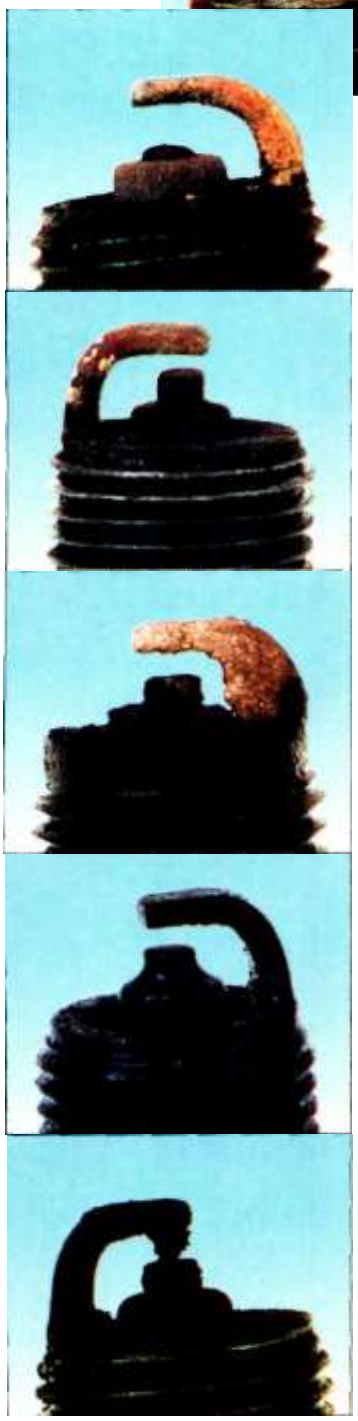
Common spark plug conditions



NORMAL

Symptoms: Brown to grayish-tan color and slight electrode wear. Correct heat range for engine and operating conditions.
Recommendation: When new spark plugs are installed, replace with plugs of the same heat range.



WORN

Symptoms: Rounded electrodes with a small amount of deposits on the firing end. Normal color. Causes hard starting in damp or cold weather and poor fuel economy. ***Recommendation:*** Plugs have been left in the engine too long. Replace with new plugs of the same heat range. Follow the recommended maintenance schedule.

CARBON DEPOSITS

Symptoms: Dry sooty deposits indicate a rich mixture or weak ignition. Causes misfiring, hard starting and hesitation.
Recommendation: Make sure the plug has the correct heat range. Check for a clogged air filter or problem in the fuel system or engine management system. Also check for ignition system problems.

ASH DEPOSITS

Symptoms: Light brown deposits encrusted on the side or center electrodes or both. Derived from oil and/or fuel additives. Excessive amounts may mask the spark, causing misfiring and hesitation during acceleration. ***Recommendation:*** If excessive deposits accumulate over a short time or low mileage, install new valve guide seals to prevent seepage of oil into the combustion chambers. Also try changing gasoline brands.

OIL DEPOSITS

Symptoms: Oily coating caused by poor oil control. Oil is leaking past worn valve guides or piston rings into the combustion chamber. Causes hard starting, misfiring and hesitation.
Recommendation: Correct the mechanical condition with necessary repairs and install new plugs.

GAP BRIDGING

Symptoms: Combustion deposits lodge between the electrodes. Heavy deposits accumulate and bridge the electrode gap. The plug ceases to fire, resulting in a dead cylinder.
Recommendation: Locate the faulty plug and remove the deposits from between the electrodes.

TOO HOT

Symptoms: Blistered, white insulator, eroded electrode and absence of deposits. Results in shortened plug life.
Recommendation: Check for the correct plug heat range, over-advanced ignition timing, lean fuel mixture, intake manifold vacuum leaks, sticking valves and insufficient engine cooling.

PREIGNITION

Symptoms: Melted electrodes. Insulators are white, but may be dirty due to misfiring or flying debris in the combustion chamber. Can lead to engine damage. ***Recommendation:*** Check for the correct plug heat range, over-advanced ignition timing, lean fuel mixture, insufficient engine cooling and lack of lubrication.

HIGH SPEED GLAZING

Symptoms: Insulator has yellowish, glazed appearance. Indicates that combustion chamber temperatures have risen suddenly during hard acceleration. Normal deposits melt to form a conductive coating. Causes misfiring at high speeds. ***Recommendation:*** Install new plugs. Consider using a colder plug if driving habits warrant.

DETONATION

Symptoms: Insulators may be cracked or chipped. Improper gap setting techniques can also result in a fractured insulator tip. Can lead to piston damage. ***Recommendation:*** Make sure the fuel anti-knock values meet engine requirements. Use care when set-ting the gaps on new plugs. Avoid lugging the engine.

MECHANICAL DAMAGE

Symptoms: May be caused by a foreign object in the combustion chamber or the piston striking an incorrect reach (too long) plug. Causes a dead cylinder and could result in piston damage. ***Recommendation:*** Repair the mechanical damage. Remove the foreign object from the engine and/or install the correct reach plug.

Models covered by this manual:

All Toyota MR2 models, five-speed manual and four-speed automatic transaxles

1985 thru 1987

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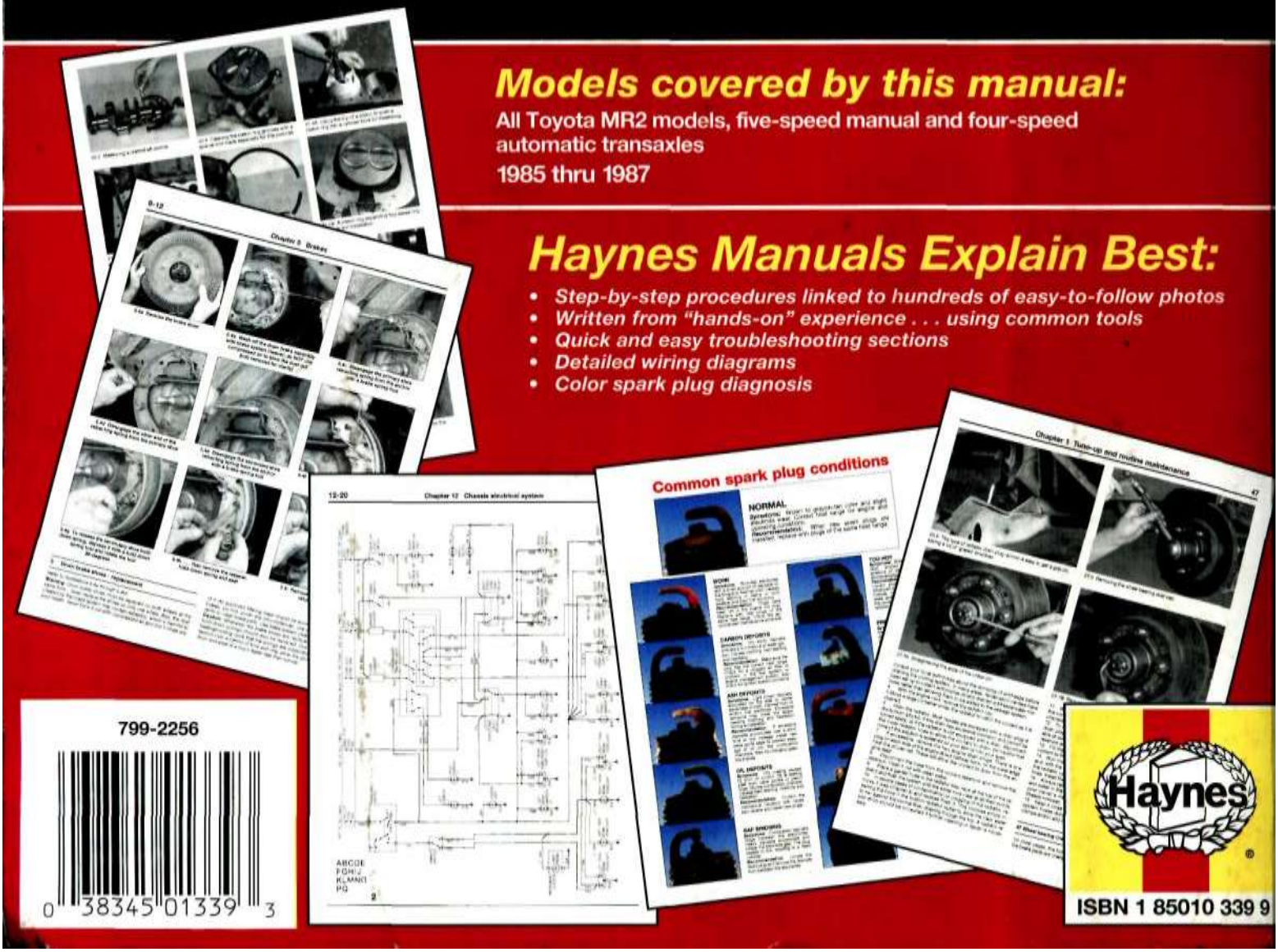
- *Color spark plug diagnosis*



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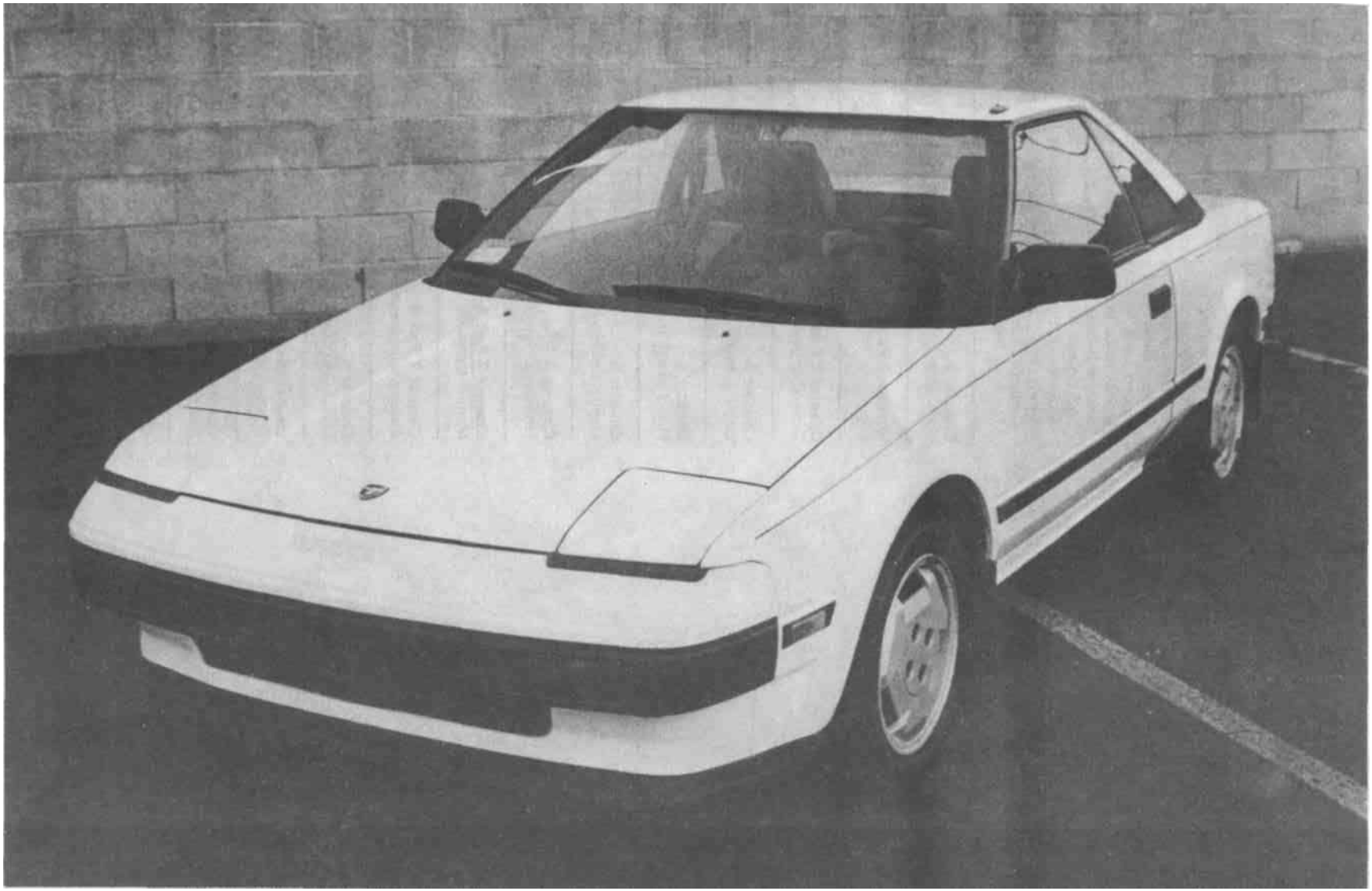

1985 Tovota MR2

1986 Toyota MR2 with optional spoiler package